



# Onsite Program Guide & Exhibitor Information

Exhibitor  
Guide  
INCLUDED!



# M&M 2016

## MICROSCOPY & MICROANALYSIS

July 24-28, 2016 • Columbus, Ohio



<http://microscopy.org/MandM/2016>

Hitachi strives to provide comprehensive solutions to support your success, not only from inside the lab, but beyond, by providing high-value, innovative, robust, and ergonomic products. Visit Hitachi at M&M 2016 to see our latest technology demonstrating our commitment to you and the advancement of microscopy.

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VP-SEM, FE-SEM & FIB



TEM & STEM



Atmospheric SEM



Tabletop SEM



Atomic Force Microscopy



Sample Preparation

# Table of Contents



|                                                                                                                     |         |
|---------------------------------------------------------------------------------------------------------------------|---------|
| Future Meeting Dates.....                                                                                           | 4       |
| Welcome from the Society Presidents .....                                                                           | 5       |
| 2016 Sponsors .....                                                                                                 | 6       |
| Essential Meeting Information .....                                                                                 | 7-8     |
| Columbus Convention Center.....                                                                                     | 9       |
| Hotel & City Map & Information .....                                                                                | 10      |
| Social Events .....                                                                                                 | 11      |
| Ancillary Meetings & Social Events Schedule .....                                                                   | 12-13   |
| Microscopy Society of America (MSA) .....                                                                           | 14-20   |
| MSA Council & Appointed Officers .....                                                                              | 14      |
| MSA Fellows .....                                                                                                   | 15      |
| MSA Distinguished Scientist Awards .....                                                                            | 16      |
| MSA Major Society Awards .....                                                                                      | 17-19   |
| MSA Sustaining Members .....                                                                                        | 20      |
| MSA MegaBooth .....                                                                                                 | 21      |
| Microanalysis Society (MAS) .....                                                                                   | 22-26   |
| MAS Officers .....                                                                                                  | 22      |
| MAS Major Society Awards .....                                                                                      | 23-25   |
| MAS Sustaining Members .....                                                                                        | 26      |
| M&M Meeting Awards.....                                                                                             | 27      |
| International Metallographic Society (IMS) .....                                                                    | 28-31   |
| IMS Leadership .....                                                                                                | 28      |
| IMS Awards .....                                                                                                    | 29-31   |
| Week At-A-Glance .....                                                                                              | 32-39   |
| Welcome from the Program Chairs .....                                                                               | 40      |
| Plenary Session: Beyond the Limits of Microscopy:<br>Revealing the Unseeable through Hollywood Visual Effects ..... | 41-42   |
| Plenary Session: Materials for the 21st Century .....                                                               | 43-44   |
| Sunday Short Courses.....                                                                                           | 45      |
| Pre-Meeting Congresses .....                                                                                        | 46      |
| Analytical Sciences Symposia .....                                                                                  | 47-50   |
| Biological Sciences Symposia .....                                                                                  | 51-52   |
| Physical Sciences Symposia .....                                                                                    | 53-55   |
| Technologists' Forum Symposia .....                                                                                 | 56      |
| Tutorials .....                                                                                                     | 57      |
| Special Educational Opportunities .....                                                                             | 58      |
| Scientific Program .....                                                                                            | 59-130  |
| Monday, August 3 .....                                                                                              | 59-67   |
| Tuesday, August 4 .....                                                                                             | 68-91   |
| Wednesday, August 5 .....                                                                                           | 92-113  |
| Thursday, August 6 .....                                                                                            | 114-130 |
| Author Index .....                                                                                                  | 131-147 |
| Exhibitor Directory .....                                                                                           | 148-160 |
| Product and Services Index .....                                                                                    | 161-167 |
| Exhibitor List by Booth .....                                                                                       | 168     |
| Exhibitor List by Name.....                                                                                         | 169     |
| Exhibit Hall Diagram .....                                                                                          | 170-171 |
| 2017 Save-the-Date .....                                                                                            | 174     |

# Future Meeting Dates



August 5-9, 2018  
BALTIMORE, MD



August 4-8, 2019  
PORTLAND, OR



July 24-28, 2020  
MILWAUKEE, WI



August 1-5, 2021  
PITTSBURGH, PA



Download the  
**Microscopy & Microanalysis**  
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- Receive alerts
- Learn about exhibitors
- Schedule your agenda
- View maps & floor plans
- Connect with colleagues & friends
- Join in on social media with #MM16Ohio
- And much, much more!



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**SEARCH:** The App Store or Google Play for "M&M Annual Meeting"



SCAN:



**For All Other Device Types** (including BlackBerry, Windows, and all other web browser-enabled devices): While on your smartphone, point your mobile browser to [l.core-apps.com/mm\\_meetings](http://l.core-apps.com/mm_meetings) to be directed to the proper download version for your phone.

Should you have any questions, please contact [support@core-apps.com](mailto:support@core-apps.com)

# Welcome from the Society Presidents

## Dear Fellow Microscopists, Microanalysts, Students, Colleagues, and Friends:

On behalf of our respective societies, we are excited to welcome you to Columbus, Ohio for Microscopy & Microanalysis 2016! The state capital of Ohio, and home to the Ohio State University, Columbus is a vibrant, bustling city with great restaurants, fun nightspots, an up-and-coming culinary scene, and a great family-friendly place to visit.



We look forward to another exciting and informative M&M meeting in 2016. The Program Committee has created a wonderfully diverse program that illustrates our members' diverse fields of work.

The technical program commences Monday morning with two plenary lectures. One will be given by Prof. Mark Miodownik, University College London Professor of Materials and Society and a well-known BBC presenter of programs on materials science and engineering, whose talk is entitled *Materials for the 21st Century*. The other plenary speaker, Drew Berry, is a biomedical animator with a background in cell biology and microscopy, whose work has been exhibited at storied art venues including the Guggenheim Museum, MoMA, the Royal Institute of Great Britain, and the University of Geneva. His talk is entitled *Beyond the Limits of Microscopy: Revealing the Unseeable through Hollywood Visual Effects*.

Between the two presentations, we will honor the winners of our major society and meeting awards. The exhibit floor showcases the latest state-of-the-art microscopy-related equipment. The ever-popular free vendor tutorials are again available. The meeting also features the traditional Sunday Short Courses, Physical Sciences and Biological Sciences Tutorials, as well as two Pre-Meeting Congresses: *Exploiting the Diffractive Properties of Electrons for Solving Materials Problems*, organized by the Electron Crystallography and Automated Mapping Methods FIG, and *Essentials of Atom Probe Tomography*, organized by the Atom Probe FIG.

Participating at M&M 2016 gives you the opportunity to stay abreast of new technologies, learn new techniques, see the latest instrumentation, and most importantly, network with colleagues and make new connections. Have a wonderful week and we hope to see you next year in St. Louis, Missouri!



Mike Marko  
PRESIDENT  
*Microscopy Society  
of America*



Thomas F. Kelly  
PRESIDENT  
*Microanalysis Society*



Jaret J. Frafjord  
PRESIDENT  
*International  
Metallographic Society*



## Accessibility

If you require special accommodation in order to participate fully in the meeting, please ask to speak with the meeting manager, or email [MeetingManager@microscopy.org](mailto:MeetingManager@microscopy.org). Requests made after July 1 or onsite at the meeting will be accommodated as much as possible.

## Awards

Major Society Awards for the three societies, along with M&M Meeting Awards, will be presented at the Plenary Session immediately following the first Keynote presentation (Monday morning). Other IMS Awards are presented at the IMS Awards Banquet on Wednesday evening (ticket purchase required). For detailed listings of all awards, criteria, and award winners, please visit <http://microscopy.org/MandM/2016/>.

## Cancellation and Refund Policy

Refund requests received prior to July 15, 2016 will be honored less a \$60 administrative fee. No refunds will be issued for cancellations (for any reason) received on or after July 15, 2016 and no refunds will be issued onsite in Columbus, Ohio.

## Food for Purchase

Inexpensive, portable breakfast and snack items are available for purchase in the convention center on the ground level (7:30 am – 10:30 am). Lunch concessions are available for purchase inside the exhibit hall during lunch hours (11:00 am–2:00 pm).

## Columbus & Regional Visitor Information

Stop by the Experience Columbus booth, located inside the convention center, to pick up local information including maps, dining guides, and tour info. Located on the main level of the Greater Columbus Convention Center across from the Exhibit Hall entrance, it's staffed during the meeting and stocked with visitor information on Columbus and surrounding areas.

## Internet & E-mail

Free wireless internet is available for M&M attendees in the Greater Columbus Convention Center. Find a comfortable spot to check your email and surf the web at the Internet Café (located next to the MSA MegaBooth) inside the M&M exhibit hall during exhibit hours. For more information on the MegaBooth, see page 21.

## Job & Resume Postings/ Placement Office

*See MSA MegaBooth info on Page 21.*

Post your company's or department's job listing, peruse posted resumes for that perfect job candidate, or post your own resume. Take advantage of thousands of microscopists and over 100 microscopy companies all gathered in one place! Go to the MSA MegaBooth in the Exhibit Hall for details.

## M&M 2017 – Meeting & City Information

Stop by for advance information on the M&M 2017 Meeting in St. Louis, MO! The 2017 booth is staffed with a St. Louis representative, and located in the main registration area. It's the 75<sup>th</sup> anniversary of the Microscopy Society of America and the 50<sup>th</sup> anniversary of the Microanalysis Society, and big things are planned! We hope you can make it!

## MSA MegaBooth [BOOTH # 914]

*See complete details on Page 21.*

Check out all that MSA has to offer its members and M&M attendees: seating area to check your email, book display from scientific publishers, and updated information on the Certification Board. Register for the popular Vendor Tutorials, sign up for MSA Membership, check out recent editions of *Microscopy Today*, learn about Project MICRO, and get information on becoming a Certified Technologist.

## Phone Numbers & Information

- **Greater Columbus Convention Center**  
MAIN: (800) 626-0241  
SECURITY: (614) 827-2547
- **Exhibitor Services**  
(614) 827-2548; [https://www.columbusconventions.com/iebms/coe/coe\\_p1\\_all.aspx?oc=C4&cc=coetest](https://www.columbusconventions.com/iebms/coe/coe_p1_all.aspx?oc=C4&cc=coetest)
- **OhioHealth Urgent Care**  
(614) 437-0278; <http://www.ohiohealthuc.com/ucgrandview/>

## Proceedings

Conference Proceedings are distributed at Registration. All Full Meeting registrations include a copy of the proceedings on digital medium. Hard-copy proceedings are available for purchase through Cambridge University Press (allow several weeks for delivery). Inquire at the Registration Desk or email: [MMProceedings@cambridge.org](mailto:MMProceedings@cambridge.org)

## Society Booths

MAS and IMS each has a membership and information booth located in the main registration foyer on the 1<sup>st</sup> level outside the exhibit hall entrance. Sign up for membership, get information on Society events at or after the M&M Meeting, and find out all that the joining societies have to offer.

## Smoking Policy

M&M 2016 is a smoke-free meeting. If you wish to smoke, you will need to go to designated outdoor areas.

## Tote Bags

All non-Exhibitor Meeting Registrants are entitled to a meeting tote bag. Bags are distributed in the registration area.

## Volunteer Room

The volunteer & student bursary office is in the Hall D Front Show Office on the 1<sup>st</sup> level. Check in here for volunteer assignments and sign-outs.

## Greater Columbus Convention Center (GCCC)

Pick up your badge and materials at the Registration desk according to the schedule below. The Sunday Social starts at 6:30 pm in the Regency Ballroom, which is at the attached Hyatt Regency Columbus Hotel.

### Registration Hours:

|                    |                   |
|--------------------|-------------------|
| Friday, July 22    | 1:00 pm – 6:00 pm |
| Saturday, July 23  | 8:00 am – 6:00 pm |
| Sunday, July 24    | 7:00 am – 7:30 pm |
| Monday, July 25    | 7:00 am – 6:00 pm |
| Tuesday, July 26   | 7:30 am – 5:00 pm |
| Wednesday, July 27 | 7:30 am – 5:00 pm |
| Thursday, July 28  | 7:30 am – 3:00 pm |

### Speaker and Awardee Reimbursement Desk

is located at Registration and will be open Sunday – Thursday during the meeting. Stop by at your convenience to submit your form and receipts.

### Commercial Exhibition Hours:

|                    |                    |
|--------------------|--------------------|
| Monday, July 25    | 12:00 pm – 5:30 pm |
| Tuesday, July 26   | 10:00 am – 5:30 pm |
| Wednesday, July 27 | 10:00 am – 5:30 pm |
| Thursday, July 28  | 10:00 am – 2:00 pm |

## Vendor Tutorials

### MONDAY, JULY 25

5:45 pm - 6:45 pm

### TUESDAY, JULY 26

5:45 pm - 6:45 pm

### WEDNESDAY, JULY 27

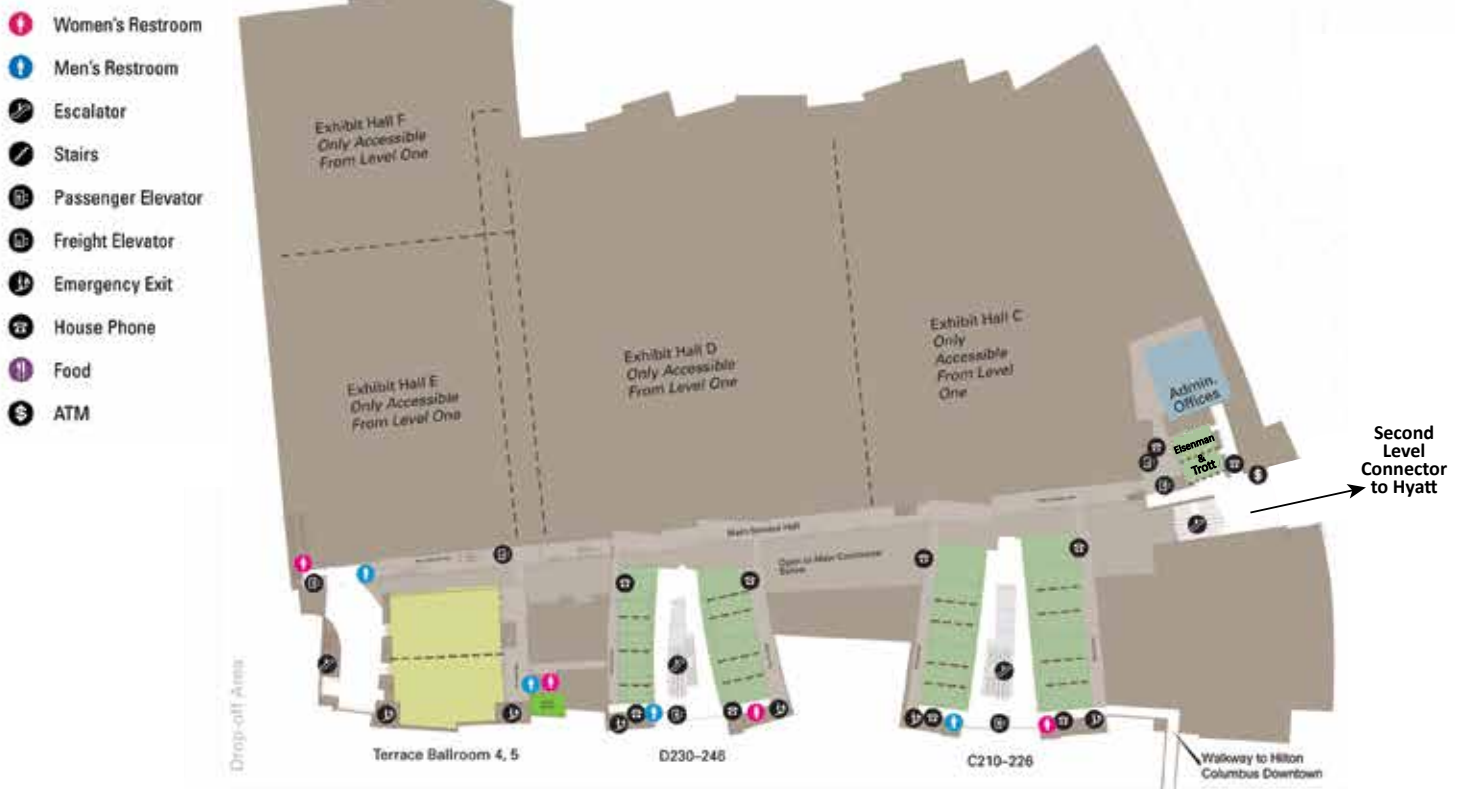
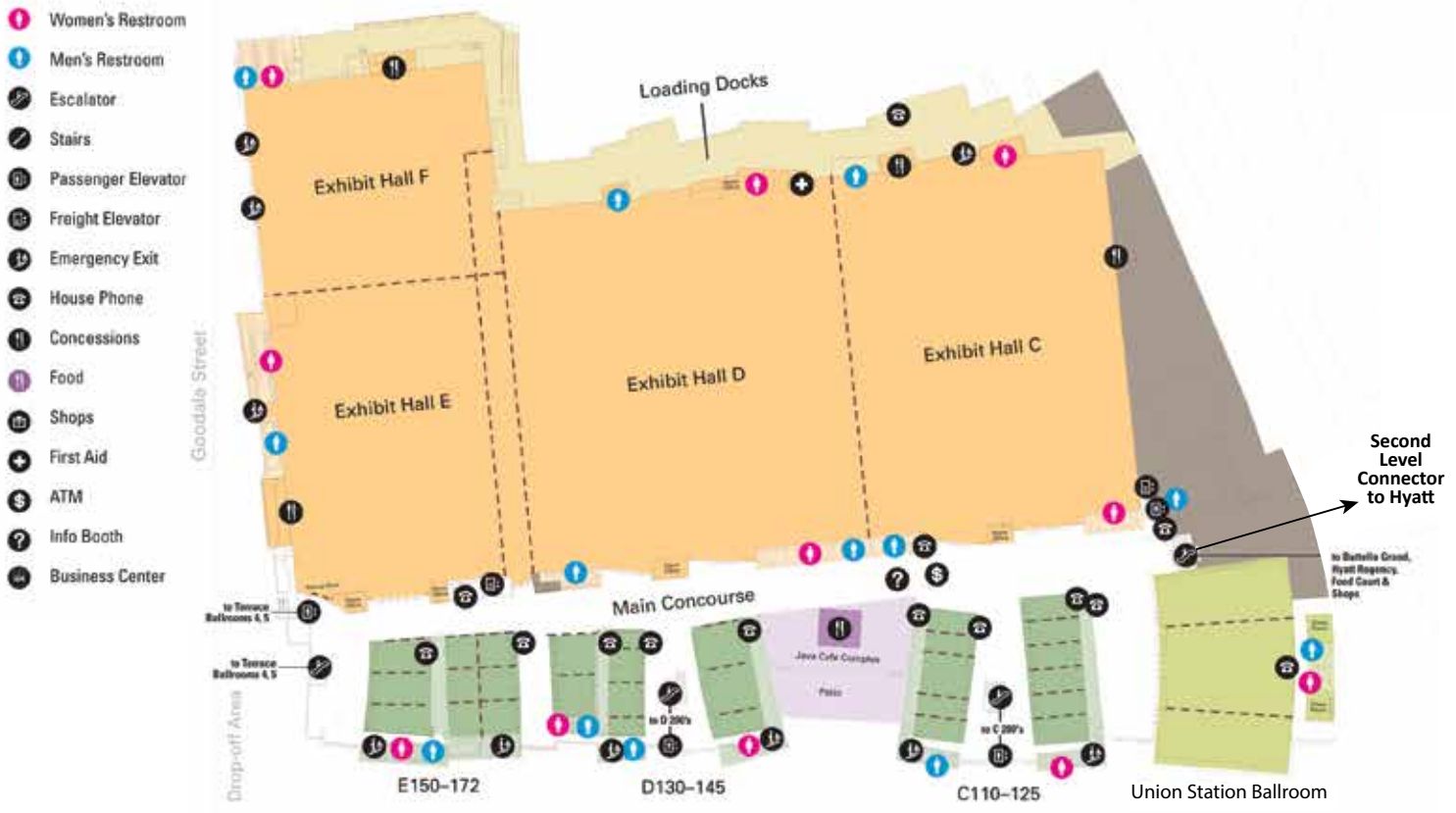
5:45 pm - 6:45 pm

Attendees may register for Vendor Tutorials at the MSA MegaBooth inside the Exhibit hall beginning on Monday, July 25. All Vendor Tutorial participants are required to sign up in advance. First come, first served. Availability is not guaranteed.



# Columbus Convention Center

Unless indicated otherwise, all official conference events are being held at the Greater Columbus Convention Center, which is located in downtown Columbus.



# Hotel & City Map & Information



1. Crowne Plaza | 33 E. Nationwide Blvd.
2. Drury Inn & Suites Convention Center | 88 E. Nationwide Blvd.
3. Hampton Inn & Suites | 501 N. High St.
4. Hilton Columbus Downtown | 401 N. High St.
5. Hyatt Regency Columbus | 350 N. High St.
6. Red Roof Inn Plus | 111 E. Nationwide Blvd.
7. Renaissance Columbus Downtown Hotel | 50 N. Third St.
8. Residence Inn by Marriott | 36 E. Gay St.

## Getting To & Around Columbus

The Port Columbus International Airport is located only 7 miles (10-15 minutes by car) from downtown Columbus. The airport features free Wi-Fi, guest services information and assistance center, and several restaurants, stores, and personal-services outlets. Visit <http://flycolumbus.com/> for detailed information about the airport.

## CAR/VAN/SHUTTLE:

<http://flycolumbus.com/to-from-port-columbus/> for detailed information on taxi service, limousine service, and scheduled shuttle service fees and schedules.

## MORE COLUMBUS TRAVEL INFO:

For detailed attraction, tour, dining and travel information for visitors, visit Experience Columbus at [www.experiencecolumbus.com](http://www.experiencecolumbus.com)

## MAS Social Event



*For MAS Members only!*

WEDNESDAY, JULY 27, 2016  
6:30 PM – 8:30 PM

Attention MAS Members! Stop by the MAS booth in the registration area to make sure your membership is up to date, and pick up your ticket to the MAS social event on Wednesday evening, immediately following the MAS Business Meeting. (Location of the Social will be printed on the ticket.)

## IMS Icebreaker



*All are welcome!*

MONDAY, JULY 25, 2016  
7:00 PM – 9:00 PM

*Hilton Columbus Downtown  
Gallerie's Lamp Area*

The IMS Icebreaker welcomes all M&M attendees! Stop by for appetizers and a beverage, and to network with members of the International Metallographic Society.

## IMS Awards Banquet



WEDNESDAY, JULY 27, 2016  
6:30 PM – 9:00 PM

*Martini's Restaurant*

Don't forget to purchase your IMS Banquet ticket (available online when you register for the meeting, or onsite at the Registration desk – subject to availability)! Inquire at the IMS booth in the registration area for additional information on the IMS Awards Banquet on Wednesday evening.

## M&M 2016 Sunday Evening Social Event

SUNDAY, JULY 24, 2016 6:30 PM – 9:00 PM

*Hyatt Regency Columbus Hotel – Regency Ballroom, 2nd Level*

One ticket is included with most registrations (see M&M 2016 website "Registration Information" for details). **ADDITIONAL TICKETS: \$75 each.**

*\*Please note: Onsite availability of tickets is not guaranteed. Register for the meeting, and, if needed, purchase extra tickets for family/guests early to be sure that they're able to attend.*

The 2016 welcome reception at the Hyatt Regency Columbus Hotel (attached to the Greater Columbus Convention Center) is a great way to kick off your M&M 2016 experience! Relaxed and informal, the event will feature a buffet supper with a Midwest-inspired menu, and some locally brewed beverages. (Non-alcoholic cold drinks will also be available.)

After the reception, head to the trendy Short North area just outside of the Convention Center to check out some of Columbus' newest pubs and other "watering holes".



# Ancillary Meetings & Social Events Schedule

*As of June 25. Please check with your committee chair/liaison to confirm.*

**All events held at the Greater Columbus Convention Center unless otherwise noted.**

## Friday, July 22, 2016

|             | TIME              | ROOM           |
|-------------|-------------------|----------------|
| MSA Council | 8:30 AM – 5:00 PM | Hyatt – Marion |

## Saturday, July 23, 2016

|             | TIME              | ROOM           |
|-------------|-------------------|----------------|
| MSA Council | 8:30 AM – 5:00 PM | Hyatt – Marion |

## Sunday, July 24, 2016

|                                 | TIME              | ROOM                     |
|---------------------------------|-------------------|--------------------------|
| IMS Board of Directors          | 8:30 AM – 5:00 PM | E161-A                   |
| IMS Poster Judging              | 8:30 AM – 5:00 PM | E160-A                   |
| MAS Council                     | 9:00 AM – 5:00 PM | Hyatt–Marion             |
| <i>Microscopy Today</i> Editors | 1:00 PM – 2:45 PM | Eisenman & Trott         |
| Sunday Evening Social Event     | 6:30 PM – 9:00 PM | Hyatt – Regency Ballroom |

## Monday, July 25, 2016

|                                                                          | TIME               | ROOM             |
|--------------------------------------------------------------------------|--------------------|------------------|
| MSA Awards & Fellows Committees                                          | 7:15 AM – 8:15 AM  | Eisenman & Trott |
| Technologists' Forum Board                                               | 7:15 AM – 8:15 AM  | C125             |
| <i>MaM</i> Editorial Board                                               | 7:15 AM – 8:15 AM  | C223             |
| FOM FIG: Instrumentation Grant Writing Roundtable Lunch                  | 12:00 PM – 1:30 PM | C226             |
| MAS Meal with a Mentor                                                   | 12:15 PM – 1:15 PM | Eisenman & Trott |
| FIG: Diagnostic Microscopy                                               | 12:15 PM – 1:15 PM | C125             |
| FIG: Focused Ion Beam                                                    | 12:15 PM – 1:15 PM | C221             |
| FIG: Atom Probe Field Ion Microscopy                                     | 12:15 PM – 1:15 PM | C222             |
| FIG: MicroAnalytical Standards                                           | 12:15 PM – 1:15 PM | C220             |
| IMS General Members' Meeting                                             | 2:30 PM – 3:00 PM  | C123-124         |
| Technologists' Forum Business Meeting                                    | 3:30 PM – 4:30 PM  | C125             |
| MSA-CUP Book Series Advisory Board Meeting                               | 4:15 PM – 5:15 PM  | C221             |
| Student Mixer                                                            | 5:30 PM – 7:00 PM  | C110-112         |
| Vendor Tutorials ( <i>Sign Up at MSA MegaBooth inside Exhibit Hall</i> ) | 5:45 PM – 6:45 PM  | Exhibit Hall CD  |
| IMS Icebreaker                                                           | 7:00 PM – 9:00 PM  | Offsite          |

As of June 25. Please check with your committee chair/liaison to confirm.

All events held at the Greater Columbus Convention Center unless otherwise noted.

## Tuesday, July 26, 2016

|                                                                                     | TIME                | ROOM             |
|-------------------------------------------------------------------------------------|---------------------|------------------|
| <i>Metallography, Microstructure and Analysis</i> Editorial Board Meeting           | 7:00 AM – 8:15 AM   | C222             |
| Joint Breakfast: MSA Local Affiliated Societies + MAS Affiliated Regional Societies | 7:15 AM – 8:15 AM   | Eisenman & Trott |
| <i>Microscopy Today</i> Editorial Board Meeting                                     | 7:15 AM – 8:15 AM   | E162-A           |
| M&M 2017 - Program Planning Meeting                                                 | 10:00 AM – 11:00 AM | E161-A           |
| FIG: Facilities Operation & Management (FOM)                                        | 12:15 PM – 1:15 PM  | Eisenman & Trott |
| MSA Distinguished Scientist Awardee Lectures                                        | 12:15 PM – 1:15 PM  | C121-122         |
| MSA Standards Committee                                                             | 12:15 PM – 1:15 PM  | C211             |
| FIG: Cryo-Preparation                                                               | 12:15 PM – 1:15 PM  | C161-A           |
| FIG: Electron Crystallography                                                       | 12:15 PM – 1:15 PM  | C223             |
| FIG: Electron Microscopy in Liquids and Gases                                       | 12:15 PM – 1:15 PM  | E162-A&B         |
| Professional Development Session ( <i>lunch provided to first 60 participants</i> ) | 12:15 PM – 1:15 PM  | C226             |
| FIG: 3D EM in the Biological Sciences                                               | 3:00 PM – 4:00 PM   | C111             |
| FIG Business Meeting                                                                | 3:30 PM – 4:30 PM   | E162-A           |
| MSA Education Committee Meeting ( <i>Combined</i> )                                 | 3:30 PM – 4:30 PM   | E161-A           |
| FIG: Aberration Correction EM                                                       | 5:15 PM – 6:15 PM   | C211             |
| Symposium Organizers – Appreciation Event                                           | 5:30 PM – 6:30 PM   | Eisenman & Trott |
| Post-Doctoral Researchers' Reception                                                | 5:30 PM – 6:30 PM   | C222             |
| Vendor Tutorials ( <i>Sign up at MSA MegaBooth inside Exhibit Hall</i> )            | 5:45 PM – 6:45 PM   | Exhibit Hall     |
| Presidents' Reception ( <i>Invitation Only</i> )                                    | 6:30 PM – 8:30 PM   | Offsite          |

## Wednesday, July 27, 2016

|                                                                          | TIME               | ROOM         |
|--------------------------------------------------------------------------|--------------------|--------------|
| MSA Certification Board                                                  | 7:15 AM – 8:15 AM  | Trott        |
| MSA Membership Committee                                                 | 7:15 AM – 8:15 AM  | Eisenman     |
| MAS - ANSI Meeting                                                       | 12:15 PM – 1:15 PM | Trott        |
| MSA Members Meeting                                                      | 12:15 PM – 1:15 PM | C123-125     |
| FIG: Pharmaceuticals                                                     | 12:15 PM – 1:15 PM | Eisenman     |
| MAS Business Meeting                                                     | 5:15 PM – 6:15 PM  | C111-112     |
| Vendor Tutorials ( <i>Sign up at MSA MegaBooth inside Exhibit Hall</i> ) | 5:45 PM – 6:45 PM  | Exhibit Hall |
| IMS Awards Banquet — <i>Visit IMS Booth for Details</i>                  | 6:30 PM            | Offsite      |
| MAS Members Social — <i>Visit MAS Booth for Details</i>                  | 6:30 PM            | Offsite      |

## Thursday, July 28, 2016

|                                | TIME                | ROOM             |
|--------------------------------|---------------------|------------------|
| M&M Sustaining Members Meeting | 8:30 AM – 10:00 AM  | Eisenman & Trott |
| MSA Student Committee Meeting  | 10:00 AM – 11:00 AM | C212             |
| M&M 2016 Wrap-Up & Debrief     | 5:30 PM – 6:30 PM   | Eisenman & Trott |

## 2016 COUNCIL – OFFICERS & DIRECTORS

|                                              |                      |
|----------------------------------------------|----------------------|
| <b>President</b>                             | Michael Marko        |
| <b>Past President</b>                        | John Mansfield       |
| <b>President Elect</b>                       | Ian Anderson         |
| <b>Secretary</b>                             | Pamela Lloyd         |
| <b>Treasurer</b>                             | Peter Crozier        |
| <b>Director</b>                              | Esther Bullitt       |
| <b>Director (Local Affiliated Societies)</b> | Beverly Maleeff      |
| <b>Director</b>                              | Andreas Holzenburg   |
| <b>Director</b>                              | Luisa Amelia Dempere |
| <b>Director</b>                              | Paul Voyles          |
| <b>Director</b>                              | Paul Kotula          |
| <b>Director</b>                              | Teresa Ruiz          |

## APPOINTED OFFICERS

|                                              |                               |
|----------------------------------------------|-------------------------------|
| <b>Archives</b>                              | Michael Marko                 |
| <b>Awards Committee Chair</b>                | Christine A. Brantner         |
| <b>Bylaws</b>                                | John F. Mansfield             |
| <b>Certification Board Chair</b>             | Edward P. Calomeni            |
| <b>Educational Outreach Committee Chairs</b> | Dave Becker<br>Alyssa Waldron |
| <b>Educational Resources Chair</b>           | Liz Wright                    |
| <b>Fellows Chair</b>                         | Ian Anderson                  |
| <b>Finance</b>                               | Peter Crozier                 |
| <b>Information Technology</b>                | Nestor Zaluzec                |
| <b>Membership Committee Chair</b>            | Jeffrey Lengyel               |
| <b>Nominating Committee Chair</b>            | John Mansfield                |
| <b>Placement Office</b>                      | David Tomlin                  |
| <b>Publications Liaison</b>                  | Michael Marko                 |
| <b>Sustaining Members Chair</b>              | Noel T. (Tom) Nuhfer          |
| <b>Student Committee Chair</b>               | James Kilcrease               |
| <b>Technologist's Forum</b>                  | Caroline A. Miller            |

## FOCUSED INTEREST GROUPS

|                                                                  |                                    |
|------------------------------------------------------------------|------------------------------------|
| <b>Focused Interest Group Chairs</b>                             | Andy Vogt                          |
| <b>3D Electron Microscopy in the Biological Sciences</b>         | Teresa Ruiz<br>Michael Radermacher |
| <b>Aberration-Corrected Electron Microscopy</b>                  | Paul Voyles                        |
| <b>Atom Probe Field Ion Microscopy</b>                           | Arun Devaraj                       |
| <b>Cryo-preparation</b>                                          | Kim Rensing                        |
| <b>Diagnostic Microscopy</b>                                     | Jon Charlesworth                   |
| <b>Electron Crystallography and Automated Mapping Techniques</b> | Jorg Wiezorek, PhD                 |
| <b>Electron Microscopy in Liquids and Gas (EMLG)</b>             | Renu Sharma, PhD                   |
| <b>Facilities Operation &amp; Management (FOM)</b>               | Christine Brantner                 |
| <b>Focused Ion Beam</b>                                          | Nicholas Antoniou                  |
| <b>Pharmaceuticals</b>                                           | Joseph Neilly                      |
| <b>MicroAnalytic Standards FIG</b>                               | Julien Allaz                       |

## PUBLICATIONS

|                                                     |                                          |
|-----------------------------------------------------|------------------------------------------|
| <b>Microscopy and Microanalysis Editor in Chief</b> | Robert L. Price                          |
| <b>Onsite Program Guide Editors</b>                 | Richard L. Martens<br>Richard E. Edelman |
| <b>M&amp;M 2016 Proceedings Editor</b>              | Gail J. Celio                            |
| <b>Microscopy Today Editor</b>                      | Charles E. Lyman                         |

## M&M ANNUAL MEETING PROGRAM CHAIRS

|                     |                  |
|---------------------|------------------|
| <b>M&amp;M 2016</b> | Joseph Michael   |
| <b>M&amp;M 2017</b> | Jay Potts        |
| <b>M&amp;M 2018</b> | Yoosuf Picard    |
| <b>M&amp;M 2019</b> | Alice Dohnalkova |

## SOCIETY & MEETING MANAGEMENT

|                                            |                                                     |
|--------------------------------------------|-----------------------------------------------------|
| <b>Association Management</b>              | Drohan Management Group                             |
| <b>Managing Director</b>                   | Robert Dziuban                                      |
| <b>Meeting Management</b>                  | Conference Managers                                 |
| <b>Meeting &amp; Registration Managers</b> | Nicole Guy<br>Kristen Strickland<br>Corey Siembieda |
| <b>Exhibition Management</b>               | Corcoran Expositions, Inc.                          |
| <b>Exhibits &amp; Sponsorship Managers</b> | Doreen Bonnema<br>Mary Michalik                     |

## MSA PAST PRESIDENTS

|         |                      |      |                     |      |                       |
|---------|----------------------|------|---------------------|------|-----------------------|
| 1942    | G.L. Clark           | 1967 | Joseph J. Comer     | 1992 | Patricia Calarco      |
| 1943-44 | R. Bowling Barnes    | 1968 | John H. Luft        | 1993 | Michael Issacson      |
| 1945    | James Hillier        | 1969 | W.C. Bigelow        | 1994 | Robert Cardell        |
| 1946    | David Harker         | 1970 | Russell Steere      | 1995 | Terence E. Mitchell   |
| 1947    | William G. Kinsinger | 1971 | Robert M. Fisher    | 1996 | Margret Ann Goldstein |
| 1948    | Perry C. Smith       | 1972 | Daniel C. Pease     | 1997 | C. Barry Carter       |
| 1949    | F.O. Schmitt         | 1973 | Benjamin Siegel     | 1998 | Ralph M. Albrecht     |
| 1950    | Ralph W.G. Wyckoff   | 1974 | Russell J. Barrnett | 1999 | David Joy             |
| 1951    | Robley C. Williams   | 1975 | Gareth Thomas       | 2000 | Kenneth Downing       |
| 1952    | R.D. Heidenreich     | 1976 | Etienne de Harven   | 2001 | Ron Anderson          |
| 1953    | Cecil E. Hall        | 1977 | T.E. Everhart       | 2002 | Stanley L. Erlandsen  |
| 1954    | Robert G. Picard     | 1978 | Myron Ledbetter     | 2003 | Alwyn Eades           |
| 1955    | Thomas F. Anderson   | 1979 | John Silcox         | 2004 | Sara Miller           |
| 1956    | William L. Grube     | 1980 | Michael Beer        | 2005 | M. Grace Burke        |
| 1957    | John H.L. Watson     | 1981 | John Hren           | 2006 | W. Gray (Jay) Jerome  |
| 1958    | Max Swerdlow         | 1982 | Lee Peachey         | 2007 | Michael O'Keefe       |
| 1959    | John H. Reisner      | 1983 | David Wittry        | 2008 | William T. Gunning    |
| 1960    | D. Gordon Sharp      | 1984 | J. David Robertson  | 2009 | David J. Smith        |
| 1961    | D. Maxwell Teague    | 1985 | Dale Johnson        | 2010 | David W. Piston       |
| 1962    | Keith R. Porter      | 1986 | Robert M. Glaeser   | 2011 | Nestor Zaluzec        |
| 1963    | Charles Schwartz     | 1987 | Linn W. Hobbs       | 2012 | Janet Woodward        |
| 1964    | Sidney S. Breese     | 1988 | Jean Paul Revel     | 2013 | Ernest Hall           |
| 1965    | Virgil G. Peck       | 1989 | Ray Carpenter       | 2014 | Jeanette Killius      |
| 1966    | Walter Frajola       | 1990 | Keith R. Porter     | 2015 | John F. Mansfield     |
|         |                      | 1991 | Charles Lyman       |      |                       |

## 2016

Helmut Gnaegi  
Ernest L. Hall  
David Mastronarde  
Stuart McKernan  
Renu Sharma  
George Smith  
Kenneth Taylor  
James E. Wittig

## 2015

Rafal Dunin-Borkowski  
E. Ann Ellis  
Miguel Jose-Yacamán  
Kent McDonald  
Stanley Platek  
Michael Postek  
Susanne Stemmer  
Michael Treacy

## 2014

Gianluigi Botton  
Abhaya Datye  
Marijia Gajdardziska-Josifovska  
Lucille A. Giannuzzi  
Thomas Kelly  
John Mansfield  
Martha McCartney  
Xiaoqing Pan  
David Piston  
Wah Chiu  
David J. Smith

## 2013

Timothy Baker  
Nigel Browning  
Hamish Fraser  
David C. Muller  
Michael Radermacher  
David J. Smith  
Eric Stach  
David DeRosier

## 2012

Uli Dahmen  
Ann Goldstein  
Moon Kim  
William J. Landis  
Jingyue Liu  
Beverly Maleeff  
Bob Price  
Frances Ross  
David Seidman  
Debra Sherman  
Nan Yao

## 2011

Ueli Aebi  
Phil Batson  
Patricia Calarco-Isaacson  
Peter A. Crozier  
Alwyn Eades  
Brendan J. Griffin  
William T. Gunning, III  
W. Gray Jerome  
Richard D. Leapman  
Hannes Lichte  
Charles E. Lyman  
Michael A. O'Keefe  
George Perry  
Robert B. Simmons  
Janet H. Woodward

## 2010

Ralph M. Albrecht  
Lawrence F. Allard  
Kenneth H. Downing  
Joseph I. Goldstein  
Michael Isaacson  
Michael K. Miller  
George Pappas  
Stephen J. Pennycook  
John P. Petrali  
Zhong L. Wang  
David B. Williams

## 2009 (Inaugural Class)

|                        |                    |
|------------------------|--------------------|
| Marc Adrian            | Kenneth C.A. Smith |
| Ron Anderson           | Avril V. Somlyo    |
| James Bentley          | John C.H. Spence   |
| Mary Grace Burke       | Alasdair Steven    |
| Ray W. Carpenter       | Peter R. Swann     |
| C. Barry Carter        | Gareth Thomas      |
| Albert V. Crewe        | Kiyoteru Tokuyasu  |
| Marc De Graef          | Nigel Unwin        |
| Vinayak P. Dravid      | Joseph S. Wall     |
| Jacques Dubochet       | Oliver Wells       |
| Patrick Echlin         | Michael J. Whelan  |
| Raymond F. Egerton     | Nestor J. Zaluzec  |
| Marilyn G. Farquhar    | Elmar Zeitler      |
| Don W. Fawcett         | Yimei Zhu          |
| Joachim Frank          |                    |
| Robert M. Glaeser      |                    |
| Audrey M. Glauert      |                    |
| Raymond Kenneth Hart   |                    |
| Hatsujiro Hashimoto    |                    |
| Richard Henderson      |                    |
| Sir Peter B. Hirsch    |                    |
| Archibald Howie        |                    |
| Hugh E. Huxley         |                    |
| Takeo Ichinokawa       |                    |
| Sumio Iijima           |                    |
| Shinya Inoue           |                    |
| David C. Joy           |                    |
| Morris J. Karnovsky    |                    |
| Aaron Klug             |                    |
| Ondrej L. Krivanek     |                    |
| Myron C. Ledbetter     |                    |
| Dennis McMullan        |                    |
| Joseph Richard Michael |                    |
| Sara Elizabeth Miller  |                    |
| Terrence E. Mitchell   |                    |
| Thomas Mulvey          |                    |
| Dale E. Newbury        |                    |
| Gertrude Rempfer       |                    |
| Jean-Paul Revel        |                    |
| Harald Rose            |                    |
| F.O. Schmitt           |                    |
| Caroline Schooley      |                    |
| Ryuichi Shimizu        |                    |
| John Silcox            |                    |
| Robert Sinclair        |                    |
| S. J. Singer           |                    |
| Fritiof Sjostrand      |                    |

## PHYSICAL SCIENCES (2016)

### George Smith

George Smith began his academic career in the Oxford University Metallurgy and Chemistry Departments. He received his Bachelors degree in Metallurgy in 1965, and his Doctorate in Chemistry in 1968. He was particularly interested in the study of the relationship between the local chemistry, microstructure, and properties of materials. He realised that insight was needed at the atomic level, and decided that field ion microscopy and (later) atom probe microanalysis would provide the most direct and incisive way to obtain the required information.



George built up and led the Oxford research group that developed novel atom probe techniques for the direct observation of solid materials in three dimensions on the atomic scale. For this work, he was awarded the Beilby Medal and Prize (1985), the Rosenhain Medal (1991) the Acta Materialia Gold Medal (2005), and the Institute of Materials Platinum Medal (2006). In 1996, he was elected to Fellowships of the Royal Society, the U.K. Institute of Materials Minerals and Mining, and the Institute of Physics. In 2003, he was elected to a Fellowship of the Royal Society for Chemistry. Together with Oxford colleagues, he also founded a spin-out company, Kindbrisk Ltd., later re-named Oxford Nanoscience Ltd., which was the first commercial producer of three-dimensional atom probe systems. The company won several national and international technology awards, and is now part of Cemea Instruments Inc.

George is the author or co-author of two books and over 400 scientific papers. He has published extensively on the subjects of phase transformations and microstructural stability in a wide range of metals and alloys. He has also worked on the phase stability of compound semiconductor nanostructures, and on the effects of environmental exposure on the atomic-scale structure and surface composition of platinum alloy catalysts. In recent years, he has focussed on the long-term safety and stability of the materials used in the pressure vessels and fuel cladding for current-generation nuclear reactors, and the development of new materials for future nuclear fusion energy systems.

From 2000-2005, George served as Head of the Department of Materials at Oxford University. He gave the Hatfield Lecture at the University of Sheffield in 2011, and the Hume Rothery Lecture at the University of Oxford in 2014. His current research interests are centred on the irradiation response of plasma-facing materials for fusion reactors, and on the durability of supported nanoparticulate catalysts for use in clean energy systems.

## BIOLOGICAL SCIENCES (2016)

### Kenneth Downing

Kenneth Downing received his BS and PhD from Cornell University. He worked at the Institute for Cell Biology at the ETH in Zurich before moving to the Lawrence Berkeley National Laboratory, where he is currently a Senior Scientist.



He began his career in electron microscopy as a grad student and has from the beginning been involved in development and application of techniques for obtaining high resolution data from biological macromolecules. He developed spot-scan imaging, along with focus correction for tilted specimens, which is of particular value in electron crystallography, as well as a decelerator-based CCD camera for intermediate voltage electron microscopes. He has over the years studied several types of DNA condensates along with various protein structures. He was involved in the solution of the first protein structure obtained by electron crystallography, bacteriorhodopsin. His group then solved the structure of tubulin and obtained the first sub-nm resolution structures of microtubules and kinase motors on microtubules. He has studied larger structures by electron tomography, including tubulin-based structures of the eukaryotic axoneme and a number of features in bacteria. Most recently he has been studying the structure of microtentacles, microtubule-based projections from cancer cells, as well as nanostructures of polymers with applications in batteries and fuel cells.

Dr. Downing served as MSA President in 2000 and was named a Fellow in 2010. He is a co-author of the text "Electron Crystallography of Biological Macromolecules", along with R. M. Glaeser, W. Chiu, J. Frank and D. DeRosier, all of whom have now been awarded the DSA.

|      | BIOLOGICAL SCIENCES | PHYSICAL SCIENCES    |
|------|---------------------|----------------------|
| 1975 | Keith Porter        | Robert Heidenreich   |
| 1976 | L.L. Marton         | Albert Crewe         |
| 1977 | Robley C. Williams  | James Hillier        |
| 1978 | Thomas Anderson     | Vernon E. Cosslett   |
| 1979 | Daniel C. Pease     | John M. Cowley       |
| 1980 | George E. Palade    | Gareth Thomas        |
| 1981 | Sanford L. Palay    | Vladimir K. Zworykin |
| 1982 | Richard M. Eakin    | Benjamin M. Siegel   |
| 1983 | Hans Ris            | Otto Scherzer        |
| 1984 | Cecil E. Hall       | Sir Charles Oatley   |
| 1985 | Gaston Dupouy       | Ernst Ruska          |
| 1986 | F. O. Schmitt       | Peter Hirsch         |
| 1987 | Marilyn G. Farquhar | Jan B. LePoole       |
| 1988 | Morris J. Karnovsky | Hatsujiro Hashimoto  |
| 1989 | Don W. Fawcett      | Elmar Zeitler        |
| 1990 | Audrey M. Glauret   | Gertrude F. Rempfer  |
| 1991 | Hugh E. Huxley      | Archie Howie         |
| 1992 | Fritiof Sjöstrand   | Oliver C. Wells      |
| 1993 | Jean-Paul Revel     | Kenneth C.A. Smith   |
| 1994 | Andrew P. Somlyo    | Dennis McMullan      |

|      | BIOLOGICAL SCIENCES | PHYSICAL SCIENCES   |
|------|---------------------|---------------------|
| 1995 | Shinya Inoue        | David B. Wittry     |
| 1996 | Myron C. Ledbetter  | John Silcox         |
| 1997 | S. J. Singer        | Peter R. Swann      |
| 1998 | Avril V. Somlyo     | Michael J. Whelan   |
| 1999 | Sir Aaron Klug      | Takeo Ichinokawa    |
| 2000 | K. Tokuyasu         | S. Amelinckx        |
| 2001 | Patrick Echlin      | Thomas Mulvey       |
| 2002 | Marc Adrian         | Ryuichi Shimizu     |
| 2003 | Joachim Frank       | Harald Rose         |
| 2004 | Robert M. Glaeser   | Raymond F. Egerton  |
| 2005 | Richard Henderson   | Sumio Iijima        |
| 2006 | Joseph S. Wall      | John C.H. Spence    |
| 2007 | Nigel Unwin         | Terence E. Mitchell |
| 2008 | Alasdair Steven     | Ondrej L. Krivanek  |
| 2009 | Jacques Dubochet    | Robert Sinclair     |
| 2010 | George Papas        | Michael Isaacson    |
| 2011 | Ueli Aepli          | Hannes Lichte       |
| 2012 | Timothy Baker       | Ulrich Dahmen       |
| 2013 | David DeRosier      | C. Barry Carter     |
| 2014 | Wah Chiu            | David J. Smith      |
| 2015 | Peter Hawkes        | Michael Davidson    |

# Major Society Awards

## BURTON MEDAL AWARD (2016)

### Miaofang Chi (2016)

#### Oak Ridge National Laboratory, Oak Ridge

Miaofang Chi received her Ph.D. in Materials Science and Engineering from University of California, Davis in 2008, and M.S. from Shanghai Institute of Ceramics, Chinese Academy of Sciences in 2003. She currently is a research staff member at the Center for Nanophase Materials Sciences (CNMS) at Oak Ridge National Laboratory (ORNL). Prior to joining ORNL in 2008, she was a visiting scholar at the National Center for Electron Microscopy at Lawrence Berkeley National Laboratory (2004-2006) and was a research fellow at Lawrence Livermore National Laboratory (2006-2008). She has extensive research experience in the development and application of novel electron microscopy techniques for energy materials, and has over 120 peer-reviewed journal publications with more than 4500 citations. She was awarded the Lawrence Graduate Research Fellowship in 2006, the Distinguished Scholar Award by the Microanalysis Society in 2007, and twice the significant event awards at ORNL (2014, 2016). In 2015, she received the ORNL Director's Award for Outstanding Individual Accomplishment in Science and Technology and the ORNL's Early Career Research Award.



## ALBERT CREWE AWARD (2016)

### Ryo Ishikawa

Ryo Ishikawa received his PhD degree (2011) in Materials Science and Engineering from the University of Tokyo in Japan. During his PhD research at the University of Tokyo, he started atomic-scale structure characterization in luminescent materials by using STEM imaging and spectroscopy. In 2012, he joined the STEM group at Oak Ridge National Laboratory and continued his research on single dopant analysis in nitrides, including the identification of the three-dimensional location of a single dopant combining with single-electron-sensitive quantitative microscopy and tracking a single atom during bulk diffusion. Currently, he is an Assistant Professor in the Institute of Engineering Innovation at the University of Tokyo, and he is working on the development of atomic-scale three-dimensional imaging by STEM.



| YEAR | RECIPIENT                 |
|------|---------------------------|
| 1975 | James Lake                |
| 1976 | Michael S. Isaacson       |
| 1977 | David C. Joy              |
| 1978 | Robert Sinclair           |
| 1979 | Norton B. Gilula          |
| 1980 | John C.H. Spence          |
| 1981 | Barbara J. Panessa-Warren |
| 1982 | Nestor J. Zaluzec         |
| 1983 | Ronald Gronsky            |
| 1984 | David B. Williams         |
| 1985 | Richard D. Leapman        |
| 1986 | J. Murray Gibson          |
| 1987 | Ron A. Milligan           |
| 1988 | A.D. Romig, Jr.           |
| 1989 | Laurence D. Marks         |
| 1990 | W. Mason Skiff            |
| 1991 | Joseph R. Michael         |
| 1992 | Kannan M. Krishnan        |
| 1993 | Joseph A.N. Zasadzinski   |
| 1994 | Jan M. Chabala            |
| 1995 | Joanna L. Batstone        |
| 1996 | Vinayak P. Dravid         |
| 1997 | P.M. Ajayan               |
| 1998 | Ian M. Anderson           |
| 1999 | Zhong Lin Wang            |
| 2000 | Eva Nogales               |
| 2001 | Jian Min Zuo              |
| 2002 | Nigel D. Browning         |
| 2003 | Frances M. Ross           |
| 2004 | Z. Hong Zhou              |
| 2005 | David J. Larson           |
| 2006 | David A. Muller           |
| 2007 | Peter D. Nellist          |
| 2008 | Steven J. Ludtke          |
| 2009 | Eric Stach                |
| 2010 | Sergei V. Kalinin         |
| 2011 | Radostin Danev            |
| 2012 | David Ginger              |
| 2013 | John L. Rubinstein        |
| 2014 | Maria Varela              |
| 2015 | Andrew Minor              |

| YEAR | RECIPIENT               |
|------|-------------------------|
| 2012 | Wu Zhou                 |
| 2013 | Lena Fitting-Kourkoutis |
| 2014 | Jinwoo Hwang            |
| 2015 | Meng Gu                 |

## MORTON D. MASER DISTINGUISHED SERVICE AWARD (2016)

### Amanda Lawrence

Amanda Lawrence first joined MSA in 2005 and quickly became actively involved in the society's student bursary/volunteer program. Amanda's service mindedness, proactive nature, demeanor, work ethic, and attention to detail was noticed and resulted in her leading the coordination of and having the majority of responsibility for the volunteer/bursary program by 2009. Amanda is also a long-time active member of the Southeastern Microscopy Society (SEMS), her local MSA affiliate society. She serves on the Membership Committee and Executive Council (2008-2009; 2013-2016), and has been a critical part of the Local Arrangement Committee for a number of annual meetings. Service work has always been an integral part of Amanda's life. She was active in local Girl Scouts for many years, serving both as troop leader, service unit newsletter editor, and adult trainer along with coordinating day long multi-troop badge events.

Amanda got her start in electron microscopy in the late 1970s while working at Louisiana State University on the biology of sweet potato diseases. Because of her electron microscopy expertise, she was recruited into the insect pathology program at Mississippi State University in 1985 and in 2004 she became a full-time member of MSU's Institute for Imaging and Analytical Technologies (I2AT; known as the Electron Microscopy Center until 2010). The I2AT is a University-level research center and core facility which serves the larger community with microscopy and analytical technologies and expertise while meeting University missions in research, teaching and service. In addition to Amanda's role as research associate, she serves as I2AT's Outreach Coordinator, increasing awareness of microscopy and analytical technologies in diverse K-12, university and industrial arenas.



## GEORGE PALADE AWARD (2016)

### Dmitry Lyumkis

Dmitry obtained his PhD at The Scripps Research Institute in La Jolla, CA, where he spearheaded numerous methodological developments in single-particle cryo-electron microscopy (cryoEM) and applied them to the analysis of biological macromolecules. He became particularly interested in the rapidly evolving field of HIV structural biology and led the efforts behind the first high-resolution structural characterization of the complete HIV glycoprotein envelope trimer (at the time, this was one of the remaining "structures of desire" among structural biologists). The resulting model revealed mechanistic details about how the HIV virus enters human cells. It also explained how broadly neutralizing antibodies recognize their epitopes, and why quaternary constraints prevent some non-neutralizing antibodies from binding the trimer. Crucially, the model represents a platform for the ongoing design of novel vaccine candidates to combat the AIDS virus.



This work prompted him to become more broadly interested in the intricate molecular relationships between pathogen and host interactions. He went on to the Salk Research Institute where he became interested in the later phases of the retroviral lifecycle, especially the process of irreversible viral integration into the host genome, which defines a point-of-no-return in establishing permanent infection within the host. Dmitry recently characterized a novel form of a retroviral integration complex, which was completely unexpected from earlier X-ray structures of similar complexes from different retroviruses. He is now very actively trying to understand how HIV integration complexes assemble and function. Given the historical difficulty of their purification and analysis, Dmitry suspects that the HIV complexes will be structurally complex, heterogeneous, and metastable, a characteristic that is, at least in theory, ideally suited for studying using single-particle cryoEM techniques. To grapple with such complexities, Dmitry continues to be involved in methodological developments in cryoEM, as he believes that methodologies and applications are fundamentally intertwined and complement one another to gain deeper insight into one's system of interest.

### YEAR RECIPIENT

|      |                        |
|------|------------------------|
| 1992 | Ronald Anderson        |
|      | G. W. Bailey           |
|      | Frances Ball           |
|      | Blair Bowers           |
|      | Deborah Clayton        |
|      | Joseph Harb            |
|      | Kenneth Lawless        |
|      | Morton D Maser         |
|      | Caroline Schooley      |
|      | John H.L. Watson       |
| 1993 | E. Laurence Thurston   |
| 1994 | Richard Crang          |
| 1995 | Raymond K. Hart        |
| 1996 | José Mascorro          |
| 1997 | William T. Gunning III |
| 1998 | Nestor J. Zaluzec      |
| 1999 | Charles Lyman          |

|      |                      |
|------|----------------------|
| 2000 | Barbara A. Reine     |
|      | Hildegard H. Crowley |
| 2002 | Beverly Maleeff      |
| 2003 | M. Grace Burke       |
| 2004 | Ralph Albrecht       |
| 2005 | W. Gray (Jay) Jerome |
| 2006 | Jeanette Killius     |
| 2007 | Robert L. Price      |
| 2008 | Stuart McKernan      |
| 2010 | Pamela Lloyd         |
| 2011 | Janet Woodward       |
| 2012 | Gina Sosinsky        |
| 2013 | Caroline Miller      |
| 2014 | Mike Marko           |
| 2015 | JoAn Hudson          |

### YEAR RECIPIENT

|      |                           |
|------|---------------------------|
| 2012 | Gabriel Lander            |
| 2013 | Peng Ge                   |
| 2014 | Ricardo Guerrero-Ferreira |
| 2015 | Alexey Amunts             |

## HILDEGARD H. CROWLEY OUTSTANDING TECHNOLOGIST AWARD FOR BIOLOGICAL SCIENCES (2016)

### Frank Macaluso

Frank Macaluso received his Bachelor of Science Degree in Biology from Long Island University Brooklyn Center. He did graduate studies in Marine Biology and Electron Microscopy at Florida Atlantic University in Boca Raton, completing his Master of Science Degree in Cell Biology at Fordham University. He has been involved in biological microscopy in a core facility environment since 1978 at the Albert Einstein College of Medicine, Bronx, New York.

He became Director of the Analytical Ultrastructure Center in 1991 and was appointed Associate in Cell Biology. He was instrumental in the programmatic and physical merger of two core microscope facilities, the Analytical Ultrastructure Center and the Image Analysis Facility, to form the Analytical Imaging Facility (AIF) in 1995. The AIF provides state of the art methods in modern light and electron microscopy imaging to biomedical scientists with all levels of expertise. Frank was named Director of Electron Microscopy upon the establishment of this new comprehensive microscopy facility and in 2003 he was also appointed Administrative Director. He is currently Senior Associate in Anatomy and Structural Biology.

His broad technical base makes him especially suited to coordinating and supplying technical advice to a wide variety of research projects. Frank has a proven track record of identifying new imaging technology required to meet the scientific needs of the Einstein research community, establishing that technology within the AIF and making that technology immediately available to the entire Einstein research community.



## CHUCK FIORI OUTSTANDING TECHNOLOGIST AWARD FOR PHYSICAL SCIENCES

### 2016—No Recipient

| YEAR | RECIPIENT           |
|------|---------------------|
| 1993 | Ben O. Spurlock     |
| 1994 | Bernard J. Kestel   |
| 1995 | Kai Chien           |
| 1996 | David W. Ackland    |
| 1997 | John P. Benedict    |
|      | Stanley J. Klepeis  |
| 1998 | Charles J. Echer    |
|      | Hilton H. Molehauer |
| 1999 | John C. Wheatley    |
|      | John M. Basgen      |
| 2000 | Nancy Crise Smith   |
| 2001 | Conrad G. Bremer    |
| 2002 | José A. Mascorro    |
| 2003 | Edward A. Ryan      |
| 2004 | Mark C. Reuter      |
| 2005 | Chris Nelson        |
|      | John J. Bozzola     |
| 2007 | Thomas Deerinck     |
| 2009 | Lynne Gignac        |
|      | Mary Morphew        |
| 2010 | E. Ann Ellis        |
| 2011 | Robert Grassucci    |
| 2012 | Kunio Nagashima     |
| 2013 | Robyn Roth          |
|      | K. Shawn Reeves     |
| 2014 | Hong Yi             |
|      | Eddy Garcia-Meitin  |
| 2015 | Norman Olson        |
|      | Masahiro Kawasaki   |

*(as of June 25, 2016)*

|                                           |                                          |
|-------------------------------------------|------------------------------------------|
| Advanced MicroBeam, Inc.                  | IXRF Systems, Inc.                       |
| Advanced Microscopy Techniques            | JEOL USA, Inc.                           |
| American Institute of Physics             | Ladd Research Industries                 |
| Angstrom Scientific, Inc.                 | Lehigh Microscopy School                 |
| Applied Physics Technologies, Inc.        | Leica Microsystems, Inc.                 |
| AYO Technologies Inc.                     | Mager Scientific, Inc.                   |
| Birla Carbon Company                      | Materials Analytical Services            |
| Boeckeler Instruments, Inc.               | MAS, LLC                                 |
| Bruker Nano Analytics                     | Micro Star Technologies                  |
| CAMECA Instruments Inc.                   | Micron, Inc.                             |
| Carl Zeiss Microscopy, LLC                | NION Company                             |
| Carnegie Mellon University                | Olympus Soft Imaging Solutions           |
| Denton Vacuum LLC                         | Oregon Physics LLC                       |
| Diatome U.S.                              | Oxford Instruments                       |
| Direct Electron, LP                       | Pace Technologies                        |
| Duniway Stockroom Corp.                   | Portland State University                |
| E.A. Fischione Instruments, Inc.          | Protochips, Inc.                         |
| EDAX Inc.                                 | PulseTor LLC                             |
| Electron Microscopy Sciences              | Scientific Instrumentation Services, Inc |
| EMSIS                                     | SEMTECH Solutions, Inc.                  |
| EXpressLO LLC                             | SGX Sensortech (MA) Ltd                  |
| FEI Company                               | South Bay Technology, Inc.               |
| Gatan Inc.                                | SPI Supplies/Structure Probe, Inc.       |
| HGST                                      | Technical Sales Solutions, LLC           |
| Hitachi High Technologies America         | Ted Pella, Inc.                          |
| HREM Research Inc                         | TESCAN USA                               |
| Hummingbird Precision Machine Co.         | ThermoFisher Scientific Inc.             |
| ibss Group, Inc.                          | Tousimis Research Corporation            |
| Integrated Dynamics Engineering, Inc.     | XEI Scientific, Inc.                     |
| International Centre for Diffraction Data |                                          |



# MSA MegaBooth in the **M&M 2016** Exhibit Hall

*Open during all  
exhibit hall hours*

The **MSA MEGABOOTH** showcases all that MSA membership has to offer. If you are currently a member, stop by to catch up on all the new society developments. Member information available at Regular, Sustaining (corporate), and Student levels.

Sign up for **VENDOR TUTORIALS** here! These popular sessions are presented on Monday, Tuesday, and Wednesday evenings after the exhibit hall has closed for the day. Don't miss out – advance registration is required!

The **INTERNET CAFÉ** and **PHONE CHARGING STATION** are open to all meeting attendees during all exhibit hall hours. **Bring Your Own Device!** Lots of places to sit and rest your feet for a few minutes while you charge your mobile phone, check your email, put the finishing touches on your talk, or collaborate with colleagues.

The **TECHNOLOGISTS' FORUM** (TF): Attention Technologists! Stop by to find out how you can grow and develop your skills, your professional career, and your network by joining the Forum!

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**EDUCATIONAL OUTREACH** – Includes MSA's educational outreach program. Browse the materials and find out how to start an outreach program in your local area. Get details on the special programming at the M&M meeting for educators and kids of all ages.

Be sure to see the new and updated **Project MICRO** display and information!

**For more information, visit <http://microscopy.org>**

Established 1968

## MAS 2016 COUNCIL – OFFICERS

### EXECUTIVE COUNCIL

|                        |                   |
|------------------------|-------------------|
| <b>President</b>       | Thomas F. Kelly   |
| <b>President-Elect</b> | Masashi Watanabe  |
| <b>Secretary</b>       | Heather A. Lowers |
| <b>Treasurer</b>       | Daniel T. Kremser |

### DIRECTORS

Brendan Foran  
Keana Scott  
Yoosuf Picard  
Katherine Crispin  
Julie Chouinard  
Vin Smentkowski  
Sihar Hihath (Student Liaison)

### COMMITTEE CHAIRS

|                                                          |                       |
|----------------------------------------------------------|-----------------------|
| <b>Archivist</b>                                         | John H. Fournelle     |
| <b>Affiliated Regional Societies &amp; Tour Speakers</b> | Kerry Siebein         |
| <b>Awards Committee</b>                                  | Nicholas W.M. Ritchie |
| <b>Computer Activities</b>                               | Nicholas W.M. Ritchie |
| <b>Corporate Liaison</b>                                 | Vernon E. Robertson   |
| <b>Education</b>                                         | Inga Holl Musselman   |
| <b>Finance</b>                                           | Joseph R. Michael     |
| <b>International Liaison</b>                             | Paul K. Carpenter     |
| <b>M&amp;M 2016 Co-Chair</b>                             | Brian Gorman          |
| <b>M&amp;M 2017 Co-Chair</b>                             | Katherine L. Crispin  |
| <b>Membership Services</b>                               | Karen E. Wright       |
| <b>MicroNews Editor</b>                                  | Assel Aitkaliyeva     |
| <b>Microscopy and Microanalysis Editorial Board</b>      | Masashi Watanabe      |
| <b>Nominations</b>                                       | Masashi Watanabe      |
| <b>Social Media</b>                                      | Katherine L. Crispin  |
| <b>Strategic Planning</b>                                | Rhonda Stroud         |
| <b>Sustaining Membership</b>                             | Lucille Giannuzzi     |
| <b>Topical Conferences</b>                               | Paul K. Carpenter     |

## PAST PRESIDENTS

|         |                 |
|---------|-----------------|
| 1968    | L.S. Birks      |
| 1969    | K.F.J. Heinrich |
| 1970    | R.E. Ogilvie    |
| 1971    | A.A. Chodos     |
| 1972    | K. Keil         |
| 1973    | D.R. Beaman     |
| 1974    | P. Lublin       |
| 1975    | J.E. Colby      |
| 1976    | E. Lifshin      |
| 1977    | J.I. Goldstein  |
| 1978    | J.D. Brown      |
| 1979    | D.F. Kyser      |
| 1980    | O.C. Wells      |
| 1981    | J.R. Coleman    |
| 1982    | R.L. Myklebust  |
| 1983    | R. Bolon        |
| 1984    | D.C. Joy        |
| 1985    | D.E. Newbury    |
| 1986    | C.G. Cleaver    |
| 1987    | C.E. Fiori      |
| 1988    | W.F. Chambers   |
| 1989    | D.B. Wittry     |
| 1990    | A.D. Romig, Jr  |
| 1991    | J.T. Armstrong  |
| 1992    | D.B. Williams   |
| 1993    | T.G. Huber      |
| 1994    | J.A. Small      |
| 1995    | J.J. McCarthy   |
| 1996    | D.E. Johnson    |
| 1997    | J.R. Michael    |
| 1998    | R.B. Marinenko  |
| 1999    | J.J. Friel      |
| 2000    | C.E. Lyman      |
| 2001    | R.W. Linton     |
| 2002    | G.P. Meeker     |
| 2003    | E.S. Etz        |
| 2004    | P.K. Carpenter  |
| 2005    | I.H. Musselman  |
| 2006    | R. Gauvin       |
| 2007    | P.G. Kotula     |
| 2008    | I.M. Anderson   |
| 2009    | C. Johnson      |
| 2010    | E.P. Vicenzi    |
| 2011    | J.H.J. Scott    |
| 2012    | J.F. Mansfield  |
| 2013-14 | K.L. Bunker     |

## DUNCUMB AWARD FOR EXCELLENCE IN MICROANALYSIS

### David Muller

David Muller is a professor of Applied and Engineering Physics at Cornell University, and the co-director of the Kavli Institute at Cornell for Nanoscale Science. He is a graduate of the University of Sydney, received a PhD from Cornell University and worked as a member of the technical staff at Bell Labs for six years before returning as faculty to Cornell. His current research interests include developing the hardware and algorithms for high-speed pixelated detectors, and the atomic-scale control and characterization of matter for applications in energy storage and conversion.



Historically his work has focused on the development of scanning transmission electron microscopy and spectroscopy as quantitative tools for atomic-resolution materials analysis, and its application to unraveling connections between electronic-structure changes on the atomic scale and the macroscopic behavior of materials, including identifying physical limits to transistor scaling by the first direct observation of interface phases in gate oxides, and the structure of dopant complexes. He has developed quantitative imaging and characterization methods to explore the chemistry, electronic structure and bonding inside objects as diverse as fuel cells, batteries, transistors, and two-dimensional superconductors. To help others adopt these new methods, he has also worked on the underlying challenges to turn a one-time science experiment into a wide-spread and routinely useful technique. As aberration-correctors correct aberrations and not instabilities, he has made a science of room design and environmental remediation to people setting up microscopy laboratories, improved and simplified the tripod polishing specimen preparation method to the point where a beginning student can be trained in the method in a few afternoons. His group has developed freely available software and web resources for EELS and tomographic analysis that have over 3,000 downloads to date.

David is a fellow of both the American Physical Society and the Microscopy Society of America. He was named one of the top 100 young innovators in 2003 by Tech Review Magazine, is the recipient of the MSA Burton Medal, and at 3 atoms thick, and according to the Guinness Book of Records, had the world's thinnest sheet of glass. He has 5 patents, and has published more than 200 papers, with over 21,000 citations.

### Previous Awardees

|      |                 |
|------|-----------------|
| 2007 | D.B. Williams   |
| 2008 | J. I. Goldstein |
| 2009 | D.E. Newbury    |
| 2010 | D.C. Joy        |
| 2011 | J.R. Michael    |
| 2012 | J. Bentley      |
| 2013 | E. Lifshin      |
| 2014 | O. L. Krivanek  |
| 2015 | P. J. Statham   |

## KURT F.J. HEINRICH AWARD

### Julien M. Allaz University of Colorado Boulder (USA)

Dr. Julien Allaz obtained an MSc and a PhD in Geology at the Universities of Lausanne and Bern (Switzerland), respectively. During his early career, he focused on structural geology and metamorphic petrology in the Swiss Alps, which required a large dose of electron microprobe analysis, a zest for isotopic work (Ar-Ar dating and stable oxygen isotopes), all served over a generous bed of fieldwork. His attraction to the EPMA led him to the University of Massachusetts-Amherst in 2009, where he pursued a post-doc on trace element analysis and monazite dating by EPMA. He currently is a Research Associate at the University of Colorado-Boulder and manages the electron microprobe laboratory.



Julien's affection for the WWW led him to the development of the "Database for electron Microprobe Analysis (De-MA)", which compiles essential information for EPMA users. In 2015, with the help of A. von der Handt and O.K. Neill, he initiated a Focused Interest Group on MicroAnalytical Standards (FIGMAS) under the umbrella of both MAS and MSA. This group aims to create an international database of standards and reference materials, and facilitate the development of tomorrow's reference materials. Julien has recently taken part in the organization of the EPMA TC 2016 in Madison, WI. Author or co-author on 11 papers in internationally-recognized journals, Julien has also presented at over 20 conferences including 6 invited talks. His current research interests include magmatic and metamorphic petrology, geochronology, ore deposits (REE), and the development of databases for the EPMA community to help acquire precise and accurate data.

### Previous Awardees

|      |                 |
|------|-----------------|
| 1986 | P.J. Statham    |
| 1987 | J.T. Armstrong  |
| 1988 | D.B. Williams   |
| 1989 | R.D. Leapman    |
| 1990 | R.W. Linton     |
| 1991 | A.D. Romig, Jr. |
| 1992 | S.J. Pennycook  |
| 1993 | P.E. Russell    |
| 1994 | J.R. Michael    |
| 1995 | E.N. Lewis      |
| 1997 | R. Gauvin       |
| 1998 | V.P. Dravid     |
| 1999 | J. Bruley       |
| 2000 | H. Ade          |

|      |                |
|------|----------------|
| 2001 | C. Jacobsen    |
| 2002 | D.A. Wollman   |
| 2005 | M. Watanabe    |
| 2006 | M. Toth        |
| 2007 | G. Kothleitner |
| 2008 | P.G. Kotula    |
| 2009 | D. Drouin      |
| 2010 | H. Demers      |
| 2011 | L.N. Brewer    |
| 2012 | E.A. Marquis   |
| 2013 | J.M. LeBeau    |
| 2014 | B.P. Gorman    |
| 2015 | P. Pinard      |

## PRESIDENTIAL SCIENCE AWARD

**Michael J. Jercinovic**  
University of Massachusetts,  
Amherst, MA (USA)



Mike Jercinovic is an Associate Professor in the Department of Geosciences at the University of Massachusetts and the director of the UMass Electron Microprobe/SEM Facility. Mike's general research focuses on EPMA in minor and trace element applications. Specifically, he works toward refinement of background characterization techniques in complex phases, the use of blanks and heterogeneous materials in the assessment of accuracy, and the evaluation of dynamic emission effects due to beam damage and contamination.

Applications for this research can be found in such diverse fields as meteoritics, climate science, and igneous and metamorphic petrology. Primarily, however, research at Mike's UMass facility has centered on the potential application of EPMA toward geochronologic problems associated with complex tectonic histories. This endeavor, in collaboration with colleague Michael Williams, has provided the impetus for significant instrumentation and technique development, and has motivated the NSF-sponsored development of the one-of-a-kind Cameca SX-Ultrachron to explore high spatial resolution analysis at high sensitivity. At this point, EPMA has evolved to become a critical and sometimes indispensable contributor in many tectonic/geochronologic evaluations, particularly as high spatial resolution and comprehensive geochemistry are becoming increasingly recognized as vital aspects of the characterization of the pertinent accessory phases. This research has led to the recognition that EPMA can establish evidence of reactions that result in the growth or breakdown of phases such as monazite in structural and petrologic (major phase evolution) context, therefore offering the potential to directly date the reactions themselves. The fine-scale of accessory phase polygenesis can be extraordinary, requiring equally extraordinary analytical methods to characterize. In two cases, sub-micron domains have been successfully dated, revealing new details of tectonic histories, and providing unique evidence for the interpretation of inconsistencies in some spatially coarser geochronologic datasets.

Mike received his PhD in geology from the University of New Mexico (1988). He was first introduced to electron probe micro-analysis by Klaus Keil Of UNM's Institute of Meteoritics, who greatly influenced him and encouraged pursuit of a career in geochemistry and microanalysis. After post doctorate work, Mike directed the MIT electron microprobe facility for several years where he continued to refine his analytical methods. After briefly working on microelectronic evaluation in the private sector, he returned to academia when he became research faculty at UMass in 1997.

### Previous Awardees

|      |                 |      |                |
|------|-----------------|------|----------------|
| 1977 | R. Castaing     | 1999 | R.A. Sareen    |
| 1978 | K.F.J. Heinrich | 2000 | R.F. Egerton   |
| 1979 | P. Duncumb      | 2001 | P.E. Batson    |
| 1980 | D.B. Wittry     | 2002 | K. Keil        |
| 1981 | S.J.B. Reed     | 2003 | P.E. Russell   |
| 1982 | R. Shimizu      | 2004 | J.T. Armstrong |
| 1983 | J. Philibert    | 2005 | G. Slodzian    |
| 1984 | L.S. Birks      | 2006 | B.J. Griffin   |
| 1985 | E. Lifshin      | 2007 | R.D. Leapman   |
| 1986 | R.L. Myklebust  | 2008 | T. F. Kelly    |
| 1987 | O.C. Wells      | 2009 | J.R. Michael   |
| 1988 | J.D. Brown      | 2010 | J.J. Donovan   |
| 1989 | J. Hillier      | 2011 | P.J. Statham   |
| 1990 | T.E. Everhart   | 2012 | N.J. Zaluzec   |
| 1997 | D.B. Williams   | 2013 | P. Echlin      |
| 1998 | F.H. Schamber   | 2014 | H.L. Fraser    |
|      |                 | 2015 | M.R. Keenan    |

## PRESIDENTIAL SERVICE AWARD

**Heather Lowers**



Heather Lowers received a BS in Geology from Mount Union College and a MS in Geochemistry from the Colorado School of Mines. Heather is the director of the Denver Microbeam Laboratory for the U.S. Geological Survey in Denver. The laboratory is equipped with two SEM/EDS systems with hyperspectral CL, an electron microprobe, and microCT. The laboratory serves USGS scientists and outside collaborators working on a variety of projects including, but not limited to, geologic and tectonic analyses, ore assessments, characterization of volcanic materials, environmental geochemistry related to natural disaster response, and evaluation of inorganic materials and biological tissue.

Heather joined the Microanalysis Society as a student member in 2003. Since that time, she has had various roles with the Society including session chair at M&M meetings, Director (2009-2012), MicroNews Editor (2009-2015), Secretary (2012-present), and co-organizer of the Microanalytical Reference Materials (2012) and EPMA (2016) Topical Conferences.

### Previous Awardees

|      |                |      |                |
|------|----------------|------|----------------|
| 1977 | P. Lublin      | 1997 | J.A. Small     |
| 1978 | D.R. Beaman    | 1998 | J.J. McCarthy  |
| 1979 | M.A. Giles     | 1999 | T.G. Huber     |
| 1980 | A.A. Chodos    | 2000 | R.B. Marinenko |
| 1981 | R.L. Myklebust | 2001 | C.E. Lyman     |
| 1982 | J. Doyle       | 2002 | J.F. Mansfield |
| 1983 | D.E. Newbury   | 2003 | I.H. Musselman |
| 1984 | J.I. Goldstein | 2004 | J.R. Michael   |
| 1985 | M.C. Finn      | 2005 | G.P. Meeker    |
| 1986 | V. Shull       | 2006 | H.A. Freeman   |
| 1987 | D.C. Joy       | 2007 | P.K. Carpenter |
| 1988 | C.G. Cleaver   | 2008 | L.M. Ross      |
| 1989 | W.F. Chambers  | 2009 | V. Woodward    |
| 1990 | C.E. Fiori     | 2010 | S.A. Wight     |
| 1991 | T.G. Huber     | 2011 | D.T. Kremser   |
| 1992 | E.S. Etz       | 2012 | C. Johnson     |
| 1993 | H.A. Freeman   | 2013 | J.J. McGee     |
| 1994 | J.L. Worrall   | 2014 | I.M. Anderson  |
| 1995 | R.W. Linton    | 2015 | S. McKernan    |
| 1996 | P. F. Hlava    |      |                |

## MAS OUTSTANDING PAPER AWARDS (2015)

These awards are presented annually to the authors of outstanding papers from the previous annual meeting in each of four categories.

### RAYMOND CASTAING – STUDENT PAPER AWARD:

#### ***Atom-Probe Tomography Measurements of Isotopic Ratios of High-field Materials with Corrections and Standardization: a Case Study of the $^{12}\text{C}/^{13}\text{C}$ of Meteoritic Nanodiamonds***

J. B. Lewis<sup>1</sup>, D. Isheim<sup>2</sup>, C. Floss<sup>1</sup>, T. L. Daulton<sup>1,3</sup>, D. N. Seidman<sup>2</sup>

1. Laboratory for Space Sciences, Physics Department, Washington University, St. Louis, MO, USA.
2. Center for Atom-Probe Tomography, and Dept. of Materials Science and Engineering, Northwestern University, Evanston, IL, USA.
3. Institute of Materials Science and Engineering, Washington University, St. Louis, MO, USA.

### V.G. MACRES – SOFTWARE PAPER AWARD:

#### ***Dealing With Multiple Grains in TEM Lamellae Thickness for Microstructure Analysis Using Scanning Precession Electron Diffraction***

A. Valery<sup>1,2</sup>, E. F. Rauch<sup>2</sup>, A. Pofelski<sup>1</sup>, L. Clément<sup>1</sup>, F. Lorut<sup>1</sup>

1. STMicroelectronics, Crolles, France
2. SIMAP/GPM2 Laboratory, Saint Martin d'Hères, France

### V.E. COSSLETT – INVITED PAPER AWARD:

#### ***Decomposing Electron Diffraction Signals in Multi-Component Microstructures***

Alexander S Eggeman<sup>1</sup>, Duncan Johnstone<sup>1</sup>, Robert Krakow<sup>1</sup>, Jing Hu<sup>2</sup>, Sergio Lozano-Perez<sup>2</sup>, Chris Grovenor<sup>2</sup>, and Paul A. Midgley<sup>1</sup>

1. Department of Materials Science and Metallurgy, University of Cambridge, Cambridge, UK
2. Department of Materials Science, University of Oxford, Oxford, UK

### L.S. BIRKS – CONTRIBUTED PAPER AWARD:

#### ***Quantitative Phase Analysis of Rapid Solidification Products in Al-Cu Alloys by Automated Crystal Orientation Mapping in the TEM***

K. W. Zweigacker<sup>1</sup>, M. A. Gordillo<sup>1</sup>, C. Liu<sup>1</sup>, J. T. McKeown<sup>2</sup>, G. H. Campbell<sup>2</sup>, T. LaGrange<sup>3</sup>, B. W. Reed<sup>3</sup>, J. M. Wiezorek<sup>1</sup>

1. University of Pittsburgh, Pittsburgh, PA, USA
2. Lawrence Livermore National Laboratory, Livermore, CA, USA
3. Integrated Dynamic Electron Solution, Inc, Pleasanton, CA, USA

**Advanced MicroBeam, Inc.**  
**Applied Physics Technologies, Inc.**  
**Bruker Nano Analytics**  
**CAMECA Instruments Inc.**  
**Carl Zeiss Microscopy, LLC**  
**Diatome US**  
**EDAX Inc.**  
**Electron Microscopy Sciences**  
**EXpressLO LLC**  
**FEI Company**  
**Gatan Inc.**  
**Geller MicroAnalytical Laboratory, Inc.**  
**Hitachi High Technologies America, Inc.**  
**ibss Group, Inc.**  
**IXRF Systems, Inc.**  
**JEOL USA, Inc.**  
**Lehigh Microscopy School**  
**Leica Microsystems, Inc.**  
**MAS, LLC**  
**Materials Analytical Services**  
**Micron, Inc.**  
**Oxford Instruments America, Inc.**  
**PNDetector GmbH**  
**Probe Software, Inc.**  
**PulseTor LLC**  
**SEMTEC Laboratories, Inc.**  
**SEMTEch Solutions, Inc.**  
**South Bay Technology, Inc.**  
**SPI Supplies/Structure Probe, Inc.**  
**Ted Pella, Inc.**  
**TESCAN USA**  
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**XEI Scientific, Inc.**

## M&M Student Scholar Awards

*Sponsored by*



**Felix Baeuerlein**, MPI Biochemistry (Germany) – Raleigh & Clara Miller Scholarship

**Matthew Cabral**, North Carolina State University

**Ramyavardhanee Chandrasekaran**, Vanderbilt University

**Rebecca Dillard**, Emory University

**Yimo Han**, Cornell University

**Soohyun Im**, The Ohio State University

**Ruoqian Lin**, Brookhaven National Laboratory

**Pengzi Liu**, Cornell University

**Jade Noble**, Cornell University

**Suhas Sreehari**, Purdue University

**Cameron Varano**, Virginia Tech

**Xiaoyue Wang**, McMaster University (Canada)

**Linxi Zhang**, Stony Brook University

## M&M Student Scholar Awards

*Sponsored by*



**Jessica Alexander**, The Ohio State University

**David Baek**, Cornell University

**Samuel Briggs**, University of Wisconsin

**Barnaby Levin**, Cornell University

**Kevin Fisher**, University of Michigan

**Yu-Tsun Shao**, University of Illinois

**Sebastian Schneider**, TU Dresden (Germany)

**Andrew Stevens**, Duke University

**Eren Suyolcu**, MPI Solid State (Germany)

**Michael Tanksalvala**, University of Colorado-Boulder

**Chaoyi Teng**, McGill University (Canada)

**Yung-Chen Wang**, University of Washington

**Fehmi Yasin**, University of Oregon

**Brian Zutter**, University of California, Los Angeles

## M&M Postdoctoral Scholar Awards

**Kate Burgess**, Naval Research Laboratory – Eric Samuel Memorial Scholarship

**Zhen Chen**, Monash University (Australia)

**Bin Feng**, University of Toyko (Japan)

**Cheri Hampton**, Emory University – Robert P. Apkarian Memorial Scholarship

**Qian He**, Oak Ridge National Laboratory

**Robert Hovden**, Cornell University – Robert P. Apkarian Memorial Scholarship

**Gabriel Sanchez-Santolino**, University of Toyko (Japan)

**Suhas Somnath**, Oak Ridge National Laboratory

**Steven Spurgeon**, Pacific Northwest National Laboratory

**Pengyang Zhao**, The Ohio State University

## M&M Professional Technical Staff Awards

**Camenzind Robinson**, Howard Hughes Medical Institute

**Jinsong Wu**, Northwestern University

## BOARD OF DIRECTORS

|                          |                                                                                                              |
|--------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>President</b>         | Jaret J. Fraford                                                                                             |
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| <b>Financial Officer</b> | David Rollings                                                                                               |
| <b>Secretary</b>         | Judith L. Arner                                                                                              |
| <b>Past President</b>    | Richard A. Blackwell                                                                                         |
| <b>Directors</b>         | George Abraham<br>Michael Covert<br>Daniel P. Dennies<br>Brain J. Joyce<br>Gabriel M. Lucas<br>Coralee McNee |
| <b>Board Liaison</b>     | Ryan M. Deacon                                                                                               |

## IMS APPOINTED OFFICERS

|                                                 |               |
|-------------------------------------------------|---------------|
| <b>Executive Director</b>                       | Thomas Dudley |
| <b>Administrator of<br/>Affiliate Societies</b> | Joanne Miller |
| <b>SlipLines<br/>Managing Editor</b>            | Julie Lucko   |

## IMS CORPORATE SPONSORS

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|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>IMS Benefactors</b> | Buehler<br>Precision Surfaces International                                                                                                                    |
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| <b>IMS Associates</b>  | Carl Zeiss Microscopy LLC<br>Evans Analytical Group<br>Hoeganaes Corp.<br>Metkon Instruments Ltd.<br>MetLab Corp.<br>PACE Technologies Corp.<br>Ted Pella Inc. |
| <b>IMS Sponsors</b>    | IMR Test Labs<br>Leco Corp.<br>Nikon Metrology Inc.<br>Scot Forge Co.                                                                                          |

## THE 2016 INTERNATIONAL METALLOGRAPHIC CONTEST JUDGING TEAM

|                    |                                                                                                                                                                                                        |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Chair</b>       | Steven Gentz, NASA Langley Research Center                                                                                                                                                             |
| <b>Local Chair</b> | Elvin Beach, Worthington Industries Inc.<br>Chris Bagnall, MSC Associates Inc.<br>Lee Garrett, Alcoa<br>Tom Murphy, Hoeganaes Corp.<br>Tim Weber, Buehler<br>Sylvia Whitt, Worthington Industries Inc. |

## Past Presidents

|           |                      |
|-----------|----------------------|
| 1968–1971 | John H. Bender Jr.   |
| 1971–1973 | Arthur E. Calabra    |
| 1973–1975 | E. Daniel Albrecht   |
| 1975–1977 | James H. Richardson  |
| 1977–1979 | Robert J. Gray       |
| 1979–1981 | P.M. French          |
| 1981–1983 | George Vander Voort  |
| 1983–1985 | James E. Bennett     |
| 1985–1987 | William E. White     |
| 1987–1989 | M.R. Louthan, Jr.    |
| 1989–1991 | Donald W. Stevens    |
| 1991–1993 | Ian LeMay            |
| 1993–1995 | Japnell D. Brown     |
| 1995–1997 | E. Daniel Albrecht   |
| 1997–1999 | Mahmoud T. Shehata   |
| 1999–2001 | Elliot A. Clark      |
| 2001–2003 | Richard K. Ryan      |
| 2003–2005 | Allan J. Lockley     |
| 2005–2007 | Dennis W. Hetzner    |
| 2007–2009 | David J. Fitzgerald  |
| 2009–2011 | Frauke Hogue         |
| 2011–2013 | Natalio T. Saenz     |
| 2013–2015 | Richard A. Blackwell |

## We would like to thank the following volunteers and their co-chairs who helped organize the M&M 2016 meeting:

**Daniel P. Dennies**, *M&M 2016 IMS Co-Chair*,  
*P07 Symposia Co-Chair, P08 Symposia Co-Chair*

**Coralee McNee**, *M&M 2017 IMS Co-Chair*,  
*P11 Symposia Co-Chair*

**Noah Budiansky**, *P07 Symposia Co-Chair*

**William Kane**, *P07 Symposia Co-Chair*

**Manuel Garcia-Leiner**, *P08 Symposia Co-Chair*

**Michael Yost**, *P08 Symposia Co-Chair*

**Eve L. Berger**, *P09 Symposia Co-Chair*

**Francis M. McCubbin**, *P09 Symposia Co-Chair*

**Adrian J. Brearley**, *P09 Symposia Co-Chair*

**Ronald J. Parrington**, *P10 Symposia Co-Chair*

**Richard E. Chinn**, *P10 Symposia Co-Chair*

**George Vander Voort**, *P11 Symposia Co-Chair*

## PRESIDENT'S AWARD (SERVICE TO IMS)

### Steve J. Dekanich (2015)

Having a dual background in Metallurgical and Nuclear Engineering, Steve Dekanich serves as a Senior Metallurgist at the Y-12 National Security Complex in Oak Ridge, TN. He is responsible for addressing materials related problems, new technology development and deployment, project management, and chairing local ASM Materials Camps for high school students.



After starting as a student metallurgist in 1970, his career experience grew to include metallography, metallurgical, and materials laboratory management, failure analysis, materials applications, process operations, new technology development, and technology transfer. During his 45+ year career, metallography, metallurgy, and materials science became a passion. That passion led him to involvement with three uranium enrichment processes, materials applications for the (US space station, the Navy Sea Wolf program, and the Star Wars program), weapons development, plasma spray filter development, and serving as Chairman and/or Principal Investigator on catastrophic failures. The passion for metallography also led to numerous international metallographic competition awards including the highest achievable award in metallography, the Jacquet-Lucas Award for Excellence in Metallography.

Steve served on the IMS Board of Directors and is currently serving on the Executive Committee for the Oak Ridge Chapter of ASM International and is a member of the Editorial Board of the *Metallography, Microstructure and Analysis* journal. He has numerous technical and non-technical publications and three patents.

Steve was presented the 2015 IMS President's Award "in sincere and grateful appreciation for lifelong mentoring, unwavering loyalty, and many years of dedicated service."

## Previous Awardees

|      |                           |
|------|---------------------------|
| 1977 | Carus K. H. DuBose        |
| 1978 | Richard D. Buchheit       |
| 1979 | Arthur E. Calabra         |
| 1980 | James L. McCall           |
| 1981 | E. Daniel Albrecht        |
| 1982 | James H. Richardson       |
| 1983 | Robert J. Gray            |
| 1984 | Japnell D. Braun          |
| 1986 | P. Michael French         |
| 1987 | George F. Vander Voort    |
| 1988 | Robert S. Crouse          |
| 1989 | Ian Le May                |
| 1990 | William E. White          |
| 1991 | Chris Bagnall             |
| 1992 | Gary W. Johnson           |
| 1993 | Donald W. Stevens         |
| 1994 | MacIntyre R. Louthan, Jr. |
| 1995 | Gunter Petzow             |
| 1996 | James Nelson              |
| 1997 | John Wylie                |
| 1998 | John W. Simmons           |
| 1999 | William Forgeng, Jr.      |
| 2000 | Nat Saenz                 |
| 2001 | William W. Scott, Jr.     |
| 2002 | George Blann              |
| 2003 | Jeff Stewart              |
| 2004 | Elliot A. Clark           |
| 2005 | Chris Bagnall             |
| 2006 | Art Geary                 |
| 2007 | Richard K. Ryan           |
| 2008 | Thomas S. Passek          |
| 2009 | David & Dale Fitzgerald   |
| 2010 | Jaret Frafjord            |
| 2011 | Donald F. Susan           |
| 2012 | Sarina Pastoric           |
| 2013 | Frauke Hogue              |
| 2014 | Judith L. Arner           |

## History of the IMS Awards

**HENRY CLIFTON SORBY AWARD**—The Sorby Award was established to recognize outstanding contributions to the field of metallography by an internationally recognized senior figure in the field of metallography. This award is a personalized plaque, and the recipient is honored during the M&M Conference Sorby lecture and at the IMS Annual Meeting banquet.

**PIERRE JACQUET-FRANCIS F. LUCAS AWARD**—The Jacquet-Lucas Award is given each year to the International Metallographic Contest entry judged "Best in Show" by a panel of judges. This is a joint IMS/ASM award with origins dating back to 1946, and has been endowed by Buehler since 1976. The winners receive the Jacquet Gold Medal, the ASM Lucas Award, a cash award, and are honored at banquets at both the IMS Annual Meeting and the ASM Annual Event.

**PRESIDENT'S AWARD**—This award is presented to an individual deemed deserving of special recognition by the Society. This award is a plaque personalized for the recipient.

**IMS BUEHLER TECHNICAL PAPER MERIT AWARD**—This award shall be given annually to the author of the technical paper published that year in the journal *Metallography, Microstructure and Analysis* that was determined most outstanding by a panel of IMS judges. A plaque and cash award is given to the recipient each year by Buehler.

**PAST-PRESIDENTS AWARD**—This award shall be presented by the Board of Directors to the out-going Past-President in recognition of their contributions to the Society. This award is a plaque personalized for the recipient.

**PRESENTATION OF THE IMS AWARDS**—The awards are presented at the annual banquet on Wednesday, July 27, 2016, at 6:30 PM.

## JACQUET-LUCAS AWARD

### Peter Kirbiš (2015)



The ASM Metallographic Award was established in 1946 for the best entry in the annual ASM metallographic competition. In 1958, it became known as the Francis F. Lucas Metallographic Award. In 1972, ASM joined with The International Metallographic Society (IMS) in sponsoring the Pierre Jacquet Gold Medal and the Francis F. Lucas Award for Excellence in Metallography. This award has been endowed by Buehler since 1976.

The 2015 recipient of the Jacquet-Lucas Award is Peter Kirbiš from the University of Maribor, Slovenia, for his entry entitled "Welding of Novel High Carbon Bainitic Steel." Kirbiš is currently working as a doctoral candidate at the faculty of mechanical engineering at this university. His thesis is titled "Modeling of Rapid Bainite Formation at Very Low Temperatures" and is a continuation of his master's degree work in mechanical engineering.

He earned his master's in 2014, with the work titled "Development of Nanostructured Bainitic Steels," under the mentorship of Prof. Dr. Ivan Anžel. This resulted in development of three steels, which form fully carbide-free bainitic microstructures during air cooling. The same year, a segment of the work was submitted in Class 3 of the International Metallographic Contest and won third place. In the field of metallography, he grew fond of tint etching and one of his images can be seen in the current Buehler calendar.

### Previous Awardees

|      |                                                               |
|------|---------------------------------------------------------------|
| 1946 | G.R. Kuhn                                                     |
| 1947 | R.H. Hays                                                     |
| 1948 | E.C. Pearson                                                  |
| 1949 | D.H. Rowland                                                  |
| 1950 | S.O. Modin                                                    |
| 1951 | H.P. Roth                                                     |
| 1952 | H. Griffin                                                    |
| 1953 | B.C. Leslie, R.J. Gray                                        |
| 1954 | R.D. Buchheit, J.E. Boyd, A.A. Watts, F.C. Holden             |
| 1955 | F.M. Cain, Jr.                                                |
| 1956 | D. Mannas                                                     |
| 1957 | T.K. Bierlein, B. Mastel                                      |
| 1958 | J.C. Gower, E.P. Griggs, W.E. Denny, J.E. Epperson, R.J. Gray |
| 1959 | F.M. Beck                                                     |
| 1960 | G.C. Woodside                                                 |
| 1961 | J.F. Radavich, W. Coutts, Jr                                  |
| 1962 | D. Medlin                                                     |
| 1963 | W.C. Coons                                                    |
| 1964 | B.C. Leslie, R.J. Gray                                        |
| 1965 | W.C. Coons, A. Davinroy                                       |
| 1966 | D.M. Maher, A. Eikum                                          |
| 1967 | J.F. Kisiel                                                   |
| 1968 | R.M.N. Pelloux, Mrs. H. Wallner                               |
| 1969 | R.H. Beauchamp,<br>R.P. Nelson                                |
| 1970 | D.R. Betner, W.D. Hepfer                                      |
| 1971 | R.J. Gray                                                     |
| 1972 | C.J. Echer, S.L. Digiallonardo                                |

|      |                                                                 |
|------|-----------------------------------------------------------------|
| 1973 | M.S. Grewal, B.H. Alexander, S.A. Sastri                        |
| 1974 | M.P. Pinnel, D.E. Heath, J.E. Bennett,<br>G.V. McIlharagie      |
| 1975 | W.C. Coons                                                      |
| 1976 | L.E. Soderqvist                                                 |
| 1977 | R.H. Beauchamp, D.H. Parks, N.T. Saenz, K.R. Wheeler            |
| 1978 | C. Bagnall, R. Witkowski                                        |
| 1979 | M.J. Bridges, S.J. Dekanich                                     |
| 1980 | R.H. Beauchamp, K. Fredriksson                                  |
| 1981 | F. Kurosawa, I. Taguchi, H. G. Suzuki                           |
| 1982 | M.J. Carr, M.C. Mataya, T.O. Wilford, J.L. Young                |
| 1983 | V. Carle, E. Schmid                                             |
| 1984 | R.H. Beauchamp, N.T. Saenz, J.T. Prater                         |
| 1985 | U. Taffner, R. Telle                                            |
| 1986 | N.T. Saenz, C.A. Lavender, M.T. Smith, D.H. Parks, G.M. Salazar |
| 1987 | S.A. David, J.M. Vitek, C.P. Haltom, A.G. Barcomb               |
| 1988 | A. David, J.M. Vitek, A. Boatner, G.C. Marsh,<br>A.B. Baldwin   |
| 1989 | G. Hoerz, M.C. Kallfass                                         |
| 1990 | A. David, J.M. Vitek, A.B. Baldwin                              |
| 1991 | M.R. Jones                                                      |
| 1992 | G.F. VanderVoort                                                |
| 1993 | T. Leonhardt, F. Terepka, M. Singh, G. Soltis                   |
| 1994 | J.W. Simmons, B.S. Covino, Jr., S.D. Cramer, J.S. Dunning       |
| 1995 | Kamal, K. Soni, R. Levi-Setti, S. Shah, S.J. Gentz              |
| 1996 | R.L. Bodnar, S.J. Lawrence                                      |
| 1997 | J. Yewko, D.L. Marshall                                         |
| 1998 | R. Pereyra, E.G. Zukas                                          |
| 1999 | K.R. Luer                                                       |
| 2000 | D.J. Lewis, S. Allen                                            |
| 2001 | D. Chakrapani                                                   |
| 2002 | F.F. Noecker, II                                                |
| 2003 | F.F. Noecker, II                                                |
| 2004 | R. Unocic, P.M. Sarosi, M.J. Mills                              |
| 2005 | K. Kimura, S. Hata, S. Matsumura, T. Horiuchi                   |
| 2006 | R. Deacon                                                       |
| 2007 | K.A. Unocic, G.S. Daehn                                         |
| 2008 | T. Nizolek                                                      |
| 2009 | B. Gerard                                                       |
| 2010 | Hendrik O. Colijn and Christopher G. Roberts                    |
| 2011 | Christopher Marvel                                              |
| 2012 | Zhiping Luo                                                     |
| 2013 | Nabeel Hussain Alharthi                                         |
| 2014 | Thomas J. Nizolek                                               |

## HENRY CLIFTON SORBY AWARD

### Frank Mücklich (2016)

The Henry Clifton Sorby Award is presented annually to recognize lifetime achievement in the field of metallurgy. Recipients are acknowledged for 25 years or more of dedication to research, teaching, or laboratory sales and service. The 2016 Sorby award, consisting of an engraved plaque, will be presented to Prof. Frank Mücklich of Saarland University, DE. Prof. Mücklich.



Dr. Mücklich is director of the Materials Engineering Center Saarland (MECS), Research Center of the Steinbeis Foundation in Saarbrücken, Germany. His areas of expertise include 3D analysis of materials microstructures in the micro, nano, and atomic scale; new theoretical and experimental methods for microstructure preparation and image analysis; design of high-performance surfaces by laser patterning techniques; and development of advanced functional materials with tailored microstructures for high electrical impact and energetic applications.

He earned his undergraduate degree from the Freiberg Mining Academy in 1985, and his doctorate from the same institution in 1987. In addition to his position as Director of the Materials Engineering Center Saarland (MECS), he heads the Department Functional Materials and is the Chairman of the European School for Materials at Saarland University. He is also Editor of the journal Practical Metallography - Preparation, Imaging and Analysis of Microstructures

He won the Doerrenberg Steel Award 2014 for a metallographic serial sectioning technique for large volumes with exceptional high resolution, and the Copper Prize 2013 for the best copper innovation of the year from the German Copper Institute, as well as many others too numerous to list. Dr. Mücklich will give the Sorby lecture titled From Correlative Microscopy to 3D Understanding of Material Microstructures on Monday, July 25th at M&M 2016.

## Previous Awardees

|      |                          |
|------|--------------------------|
| 1976 | Georg L. Kehl            |
| 1977 | Cyril Stanley Smith      |
| 1978 | Adolph Buehler           |
| 1979 | Frederick N. Rhines      |
| 1980 | Len E. Samuels           |
| 1981 | Robert J. Gray           |
| 1982 | Gunter Petzow            |
| 1983 | William D. Forgeng       |
| 1984 | Ervin E. Underwood       |
| 1985 | Alan Price               |
| 1986 | Robert W. K. Honeycombe  |
| 1987 | Gareth Thomas            |
| 1988 | Franz Jeglitsch          |
| 1989 | Tanjore R. Anantharaman  |
| 1990 | E. Daniel Albrecht       |
| 1991 | W. C. Leslie             |
| 1992 | Charles S. Barrett       |
| 1993 | Raimond B. Castaing      |
| 1994 | F. Brian Pickering       |
| 1995 | Erhard Hornbogen         |
| 1996 | Peter Duncumb            |
| 1997 | Robert T. DeHoff         |
| 1998 | Kay Geels                |
| 1999 | Joseph Goldstein         |
| 2000 | Hans Eckhart Exner       |
| 2001 | Brian Ralph              |
| 2002 | Walter Mannheimer        |
| 2003 | Enrica Stagno            |
| 2004 | George F. Vander Voort   |
| 2005 | Iain LeMay               |
| 2006 | Arlan Benscoter          |
| 2007 | McIntyre R. Louthan, Jr. |
| 2008 | Lawrence E. Murr         |
| 2009 | Chris Bagnall            |
| 2010 | Albert C. Kneissl        |
| 2011 | David Williams           |
| 2012 | Michael Pohl             |
| 2013 | Arun M. Gokhale          |
| 2014 | Stanley P. Lynch         |
| 2015 | David K. Matlock         |

## IMS BUEHLER TECHNICAL PAPER MERIT AWARD (2016)

M. Cohen, D. Ashkenazi, Y. Kahanov, A. Stern, S. Klein, D. Cvikel,  
**"The Brass Nails of the Akko Tower Wreck (Israel): Archeometallurgical Analyses,"**  
*Metallography, Microstructure, and Analysis.* (2015) 188-206.

# FRIDAY, JULY 22, 2016

All events are located at the Greater Columbus Convention Center unless otherwise noted.

|                   |             |              |
|-------------------|-------------|--------------|
| 8:30 AM – 5:00 PM | MSA Council | Hyatt–Marion |
|-------------------|-------------|--------------|

# SATURDAY, JULY 23, 2016

|                   |             |              |
|-------------------|-------------|--------------|
| 8:30 AM – 5:00 PM | MSA Council | Hyatt–Marion |
|-------------------|-------------|--------------|

# SUNDAY, JULY 24, 2016

|                   |                                                                                                                                                                                                                               |                                                |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| 8:30 AM – 5:00 PM | IMS Board of Directors                                                                                                                                                                                                        | E161-A                                         |
| 8:30 AM – 5:00 PM | <b>Sunday Short Courses</b>                                                                                                                                                                                                   |                                                |
|                   | X10 – Cryo-Preparation for Biological EM                                                                                                                                                                                      | C110                                           |
|                   | X11 – Electron Cryotomography Image Processing Using RELION                                                                                                                                                                   | C111                                           |
|                   | X12 – Imaging and Analysis with Variable Pressure or Environmental SEM                                                                                                                                                        | C112                                           |
|                   | X13 – Practical Considerations for Image Analysis and Use of ImageJ/Fiji                                                                                                                                                      | C113                                           |
|                   | X14 – Advanced Focused Ion Beam Methods                                                                                                                                                                                       | C114                                           |
|                   | X15 – Nanomaterial Microscopy & Microanalysis: Tools and Preparation                                                                                                                                                          | C115                                           |
| 8:30 AM – 5:00 PM | <b>Pre-Meeting Congress 1</b><br>(Organized by the Electron Crystallography and Automated Mapping Methods Focused Interest Group)<br><b>Exploiting the Diffractive Properties of Electrons for Solving Materials Problems</b> | C210-211-212                                   |
| 8:30 AM – 5:00 PM | <b>Pre-Meeting Congress 2</b> (Organized by the Atom Probe Field Ion Microscopy Focused Interest Group)<br><b>Essentials of Atom Probe Tomography</b>                                                                         | C213-214-215                                   |
| 8:30 AM – 5:00 PM | IMS Poster Judging                                                                                                                                                                                                            | E160-A                                         |
| 9:00 AM – 5:00 PM | MAS Council                                                                                                                                                                                                                   | Hyatt–Marion                                   |
| 1:00 PM – 2:45 PM | Microscopy Today Editors                                                                                                                                                                                                      | Eisenman & Trott                               |
| 6:30 PM – 9:00 PM | Sunday Evening Social Event                                                                                                                                                                                                   | Hyatt–Regency Ballroom (2 <sup>nd</sup> Level) |

# MONDAY, JULY 25, 2016

|                    |                                                                                                                                                                                                                       |                        |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| 7:15 AM – 8:15 AM  | MSA Awards & Fellows Committees                                                                                                                                                                                       | Eisenman & Trott       |
| 7:15 AM – 8:15 AM  | Technologists' Forum Board                                                                                                                                                                                            | C125                   |
| 7:15 AM – 8:15 AM  | MaM Editorial Board                                                                                                                                                                                                   | C223                   |
| 8:30 AM – 12:00 PM | <b>M&amp;M 2016 Plenary Session</b>                                                                                                                                                                                   | Union Station Ballroom |
|                    | Opening Welcome                                                                                                                                                                                                       |                        |
|                    | PLENARY TALK #1:<br><b>Drew Berry</b> , Walter and Eliza Hall Institute of Medical Research, Melbourne, Australia<br><i>Beyond the Limits of Microscopy: Revealing the Unseeable through Hollywood Visual Effects</i> |                        |
|                    | MAS Awards Presentation                                                                                                                                                                                               |                        |
|                    | IMS Awards Presentation                                                                                                                                                                                               |                        |
|                    | Coffee & Donuts Break                                                                                                                                                                                                 |                        |
|                    | MSA Awards Presentation                                                                                                                                                                                               |                        |
|                    | M&M Meeting Awards Presentation                                                                                                                                                                                       |                        |
|                    | PLENARY TALK #2:<br><b>Mark Miodownik</b> , University College London, UK<br><i>New Materials for the 21st Century</i>                                                                                                |                        |

# MONDAY, JULY 25, 2016 *continued*

|                    |                                                                                                                                          |                             |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 12:00 PM – 1:30 PM | <b>Lunch Break</b>                                                                                                                       |                             |
| 12:00 PM – 5:30 PM | <b>Exhibit Hall Open</b>                                                                                                                 | <b>Exhibit Hall CD</b>      |
| 12:15 PM – 1:15 PM | <b>MAS Meal with a Mentor</b>                                                                                                            | <b>Eisenman &amp; Trott</b> |
| 12:15 PM – 1:15 PM | <b>Instrumentation Grant Writing Roundtable Lunch</b> <i>Organized by FOM FIG</i>                                                        | <b>C226</b>                 |
| 12:15 PM – 1:15 PM | <b>FIG: Diagnostic Microscopy</b>                                                                                                        | <b>C125</b>                 |
| 12:15 PM – 1:15 PM | <b>FIG: MicroAnalytical Standards</b>                                                                                                    | <b>C220</b>                 |
| 12:15 PM – 1:15 PM | <b>FIG: Focused Ion Beam</b>                                                                                                             | <b>C221</b>                 |
| 12:15 PM – 1:15 PM | <b>FIG: Atom Probe Field Ion Microscopy</b>                                                                                              | <b>C222</b>                 |
| 1:30 PM – 3:00 PM  | <b>PM Symposia &amp; Sessions</b>                                                                                                        |                             |
|                    | <b>X99</b> – IMS Henry Clifton Sorby Award & Lecture                                                                                     | <b>C123-124</b>             |
|                    | <b>A04</b> – Advances in FIB Instrumentation and Applications in Materials and Biological Sciences                                       | <b>C214</b>                 |
|                    | <b>A06</b> – Analytical Electron Microscopy for Advanced Characterization from Multi-dimensional Data Acquisition to Integrated Analysis | <b>C224-225</b>             |
|                    | <b>A11</b> – Advances in Scanning Electron/Ion Instrumentation and Detectors                                                             | <b>C121-122</b>             |
|                    | <b>A15</b> – Quantitative Measurement of Intensities and Distances in Electron Microscopy                                                | <b>C212</b>                 |
|                    | <b>B01</b> – Nanostructured Scaffolds for Regenerative MedicineM                                                                         | <b>C110</b>                 |
|                    | <b>B07</b> – 3D Structures of Macromolecular Assemblies, Cellular Organelles and Whole Cells                                             | <b>C115</b>                 |
|                    | <b>P02</b> – Electron Microscopy of Materials for Electrochemical Power Systems                                                          | <b>E160</b>                 |
|                    | <b>P06</b> – Magnetic Materials, Phenomena and Imaging at the Nanoscale                                                                  | <b>C213</b>                 |
|                    | <b>P09</b> – From Angstrom to AU: Studies of Planet-Forming Material                                                                     | <b>C113</b>                 |
| 2:30 PM – 3:00 PM  | <b>IMS General Members' Meeting</b>                                                                                                      | <b>C123-124</b>             |
| 3:00 PM – 5:00 PM  | <b>Monday Poster Presentations</b>                                                                                                       | <b>Exhibit Hall CD</b>      |
|                    | <b>A06</b> – Analytical Electron Microscopy for Advanced Characterization from Multi-dimensional Data Acquisition to Integrated Analysis |                             |
|                    | <b>A11</b> – Advances in Scanning Electron/Ion Instrumentation and Detectors                                                             |                             |
|                    | <b>A15</b> – Quantitative Measurement of Intensities and Distances in Electron Microscopy                                                |                             |
|                    | <b>B07</b> – 3D Structures of Macromolecular Assemblies, Cellular Organelles and Whole Cells                                             |                             |
|                    | <b>P02</b> – Electron Microscopy of Materials for Electrochemical Power Systems                                                          |                             |
|                    | <b>P06</b> – Magnetic Materials, Phenomena and Imaging at the Nanoscale                                                                  |                             |
|                    | <b>P09</b> – From Angstrom to AU: Studies of Planet-Forming Material                                                                     |                             |
|                    | Post-Deadline Posters will be presented on Monday                                                                                        |                             |
| 3:30 PM – 4:30 PM  | <b>Technologists' Forum Business Meeting</b>                                                                                             | <b>C125</b>                 |
| 4:15 PM – 5:15 PM  | <b>MSA-CUP Book Series Advisory Board Meeting</b>                                                                                        | <b>C221</b>                 |
| 5:00 PM – 5:30 PM  | <b>Student Poster Awards — Exhibit Hall Poster Stage</b>                                                                                 | <b>Exhibit Hall CD</b>      |
| 5:30 PM – 7:00 PM  | <b>Student Mixer</b>                                                                                                                     | <b>C110-112</b>             |
| 5:45 PM – 6:45 PM  | <b>Vendor Tutorials</b> (Sign up at MSA MegaBooth)                                                                                       | <b>Exhibit Hall CD</b>      |
| 7:00 PM – 9:00 PM  | <b>IMS Icebreaker</b>                                                                                                                    | <b>Offsite</b>              |

|                     |                                                                                                                                   |                  |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------|------------------|
| 7:00 AM – 8:15 AM   | <b>Metallography, Microstructure and Analysis Editorial Board Meeting</b>                                                         | C222             |
| 7:15 AM – 8:15 AM   | <b>Joint Breakfast: MSA Local Affiliated Societies + MAS Affiliated Regional Societies</b>                                        | Eisenman & Trott |
| 7:15 AM – 8:15 AM   | <b>Microscopy Today Editorial Board Meeting</b>                                                                                   | E162-A           |
| 8:30 AM – 10:00 AM  | <b>AM Symposia &amp; Sessions</b>                                                                                                 |                  |
|                     | X90 – Microscopy Outreach: Microscopy in the Classroom                                                                            | C123-124         |
|                     | X30 – Technologists' Forum: Analysis of Real Data and Recognition of Artifacts                                                    | C125             |
|                     | X43 – Physical Sciences Tutorial: Diffraction Mapping and 4D STEM                                                                 | C211             |
|                     | A04 – Advances in FIB Instrumentation and Applications in Materials and Biological Sciences                                       | C216             |
|                     | A05 – Applications of Correlative Microscopy to Physical and Biological Sciences                                                  | C210             |
|                     | A06 – Analytical Electron Microscopy for Advanced Characterization from Multi-dimensional Data Acquisition to Integrated Analysis | C224-225         |
|                     | A09 – Advanced Scanning Diffraction: Mapping Functionality in Reciprocal Space at Nanometer Resolution                            | C220             |
|                     | A11 – Advances in Scanning Electron/Ion Instrumentation and Detectors                                                             | C121-122         |
|                     | A15 – Quantitative Measurement of Intensities and Distances in Electron Microscopy                                                | C212             |
|                     | B02 – New Technologies for Digital Pathologies                                                                                    | C110             |
|                     | B06 – Pharmaceuticals and Medical Science                                                                                         | C111             |
|                     | B07 – 3D Structures of Macromolecular Assemblies, Cellular Organelles and Whole Cells                                             | C115             |
|                     | B08 – Utilizing Microscopy for Research and Diagnosis of Diseases in Humans, Plants and Animals                                   | C114             |
|                     | P01 – Dr. Gareth Thomas Symposium: Materials Solutions through Microscopy                                                         | C214             |
|                     | P02 – Electron Microscopy of Materials for Electrochemical Power Systems                                                          | E160             |
|                     | P06 – Magnetic Materials, Phenomena and Imaging at the Nanoscale                                                                  | C213             |
|                     | P07 – Failure Analysis Applications of Microanalysis, Microscopy, Metallography and Fractography                                  | C215             |
|                     | P09 – From Nanometers to AU: Studies of Planet-Forming Material                                                                   | C113             |
| 10:00 AM – 5:30 PM  | <b>Exhibit Hall Open</b>                                                                                                          | Exhibit Hall CD  |
| 10:00 AM – 10:30 AM | <b>Coffee Break</b>                                                                                                               | Exhibit Hall CD  |
| 10:00 AM – 11:00 AM | <b>M&amp;M 2017 - Program Planning Meeting</b>                                                                                    | E161-A           |
| 10:30 AM – 12:00 PM | <b>AM Symposia &amp; Sessions (Cont'd)</b>                                                                                        |                  |
|                     | X90 – Microscopy Outreach: Microscopy in the Classroom                                                                            | C123-124         |
|                     | X32 – Technologists' Forum: Roundtable Discussion on Artifacts                                                                    | C125             |
|                     | A04 – Advances in FIB Instrumentation and Applications in Materials and Biological Sciences                                       | C216             |
|                     | A05 – Applications of Correlative Microscopy to Physical and Biological Sciences                                                  | C210             |
|                     | A06 – Analytical Electron Microscopy for Advanced Characterization from Multi-dimensional Data Acquisition to Integrated Analysis | C224-225         |
|                     | A09 – Advanced Scanning Diffraction: Mapping Functionality in Reciprocal Space at Nanometer Resolution                            | C220             |
|                     | A11 – Advances in Scanning Electron/Ion Instrumentation and Detectors                                                             | C121-122         |
|                     | A13 – <i>In-situ</i> Electron Microscopy and Big Data Analytics in 2D and 3D                                                      | C221             |
|                     | A15 – Quantitative Measurement of Intensities and Distances in Electron Microscopy                                                | C212             |
|                     | B05 – Pathology: When Normal Goes Wrong                                                                                           | C110             |
|                     | B06 – Pharmaceuticals and Medical Science                                                                                         | C111             |
|                     | B07 – 3D Structures of Macromolecular Assemblies, Cellular Organelles and Whole Cells                                             | C115             |
|                     | B08 – Utilizing Microscopy for Research and Diagnosis of Diseases in Humans, Plants and Animals                                   | C114             |
|                     | P01 – Dr. Gareth Thomas Symposium: Materials Solutions through Microscopy                                                         | C214             |
|                     | P02 – Electron Microscopy of Materials for Electrochemical Power Systems                                                          | E160             |
|                     | P07 – Failure Analysis Applications of Microanalysis, Microscopy, Metallography and Fractography                                  | C215             |
|                     | P09 – From Angstrom to AU: Studies of Planet-Forming Material                                                                     | C113             |
|                     | P11 – Metallography and Microstructural Characterization of Metals                                                                | C112             |



# TUESDAY, JULY 26, 2016 *continued*

|                    |                                                                                                                                               |                             |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 12:00 PM – 1:30 PM | <b>Lunch Break</b>                                                                                                                            |                             |
| 12:15 PM – 1:15 PM | <b>MSA Distinguished Scientist Awardee Lectures</b> ( <i>lunch provided to first 100 participants</i> )                                       | <b>C121-122</b>             |
| 12:15 PM – 1:15 PM | <b>FIG: Facilities Operations &amp; Management (FOM)</b>                                                                                      | <b>Eisenman &amp; Trott</b> |
| 12:15 PM – 1:15 PM | <b>FIG: Cryo-Preparation</b>                                                                                                                  | <b>E161-A</b>               |
| 12:15 PM – 1:15 PM | <b>FIG: Electron Crystallography</b>                                                                                                          | <b>C223</b>                 |
| 12:15 PM – 1:15 PM | <b>FIG: Electron Microscopy in Liquids &amp; Gases</b>                                                                                        | <b>E162</b>                 |
| 12:15 PM – 1:15 PM | <b>MSA Standards Committee</b>                                                                                                                | <b>C211</b>                 |
| 12:15 PM – 1:15 PM | <b>Professional Development Session</b> ( <i>lunch provided to first 60 participants</i> )                                                    | <b>C226</b>                 |
| 1:30 PM – 3:00 PM  | <b>PM Symposia &amp; Sessions</b>                                                                                                             |                             |
|                    | <b>X31</b> – Technologists' Forum Special Topic: Image Analysis and a Practical Approach to Current Software Solutions and Their Applications | <b>C125</b>                 |
|                    | <b>X42</b> – Biological Sciences Tutorial: Building and Validating Atomic Models for EM Density Maps                                          | <b>C211</b>                 |
|                    | <b>A03</b> – X-ray Imaging and Analysis                                                                                                       | <b>C115</b>                 |
|                    | <b>A04</b> – Advances in FIB Instrumentation and Applications in Materials and Biological Sciences                                            | <b>C216</b>                 |
|                    | <b>A05</b> – Applications of Correlative Microscopy to Physical and Biological Sciences                                                       | <b>C210</b>                 |
|                    | <b>A06</b> – Analytical Electron Microscopy for Advanced Characterization from Multi-dimensional Data Acquisition to Integrated Analysis      | <b>C224-225</b>             |
|                    | <b>A09</b> – Advanced Scanning Diffraction: Mapping Functionality in Reciprocal Space at Nanometer Resolution                                 | <b>C220</b>                 |
|                    | <b>A11</b> – Advances in Scanning Electron/Ion Instrumentation and Detectors                                                                  | <b>C121-122</b>             |
|                    | <b>A13</b> – <i>In-situ</i> Electron Microscopy and Big Data Analytics in 2D and 3D                                                           | <b>C221</b>                 |
|                    | <b>A15</b> – Quantitative Measurement of Intensities and Distances in Electron Microscopy                                                     | <b>C212</b>                 |
|                    | <b>B05</b> – Pathology: When Normal Goes Wrong                                                                                                | <b>C110</b>                 |
|                    | <b>B06</b> – Pharmaceuticals and Medical Science                                                                                              | <b>C111</b>                 |
|                    | <b>P01</b> – Dr. Gareth Thomas Symposium: Materials Solutions through Microscopy                                                              | <b>C214</b>                 |
|                    | <b>P02</b> – Electron Microscopy of Materials for Electrochemical Power Systems                                                               | <b>E160</b>                 |
|                    | <b>P09</b> – From Angstrom to AU: Studies of Planet-Forming Material                                                                          | <b>C113</b>                 |
|                    | <b>P11</b> – Metallography and Microstructural Characterization of Metals                                                                     | <b>C112</b>                 |
| 3:00 PM – 5:00 PM  | <b>Tuesday Poster Presentations</b>                                                                                                           | <b>Exhibit Hall CD</b>      |
|                    | <b>X31</b> – Technologists' Forum Special Topic: Image Analysis and a Practical Approach to Current Software Solutions and Their Applications |                             |
|                    | <b>X90</b> – Microscopy Outreach: Microscopy in the Classroom                                                                                 |                             |
|                    | <b>A03</b> – X-ray Imaging and Analysis                                                                                                       |                             |
|                    | <b>A04</b> – Advances in FIB Instrumentation and Applications in Materials and Biological Sciences                                            |                             |
|                    | <b>A05</b> – Applications of Correlative Microscopy to Physical and Biological Sciences                                                       |                             |
|                    | <b>A09</b> – Advanced Scanning Diffraction: Mapping Functionality in Reciprocal Space at Nanometer Resolution                                 |                             |
|                    | <b>B02</b> – New Technologies for Digital Pathologies                                                                                         |                             |
|                    | <b>B05</b> – Pathology: When Normal Goes Wrong                                                                                                |                             |
|                    | <b>B06</b> – Pharmaceuticals and Medical Science                                                                                              |                             |
|                    | <b>B08</b> – Utilizing Microscopy for Research and Diagnosis of Diseases in Humans, Plants and Animals                                        |                             |
|                    | <b>P01</b> – Dr. Gareth Thomas Symposium: Materials Solutions through Microscopy                                                              |                             |
|                    | <b>P04</b> – Nano-characterization of Low Dimensional Materials: Carbon to 2D TMDs                                                            |                             |
|                    | <b>P05</b> – Nuclear and Irradiated Materials: Fundamental Defect Properties                                                                  |                             |
|                    | <b>P07</b> – Failure Analysis Applications of Microanalysis, Microscopy, Metallography and Fractography                                       |                             |
|                    | <b>P11</b> – Metallography and Microstructural Characterization of Metals                                                                     |                             |

# TUESDAY, JULY 26, 2016 *continued*

*All events are located at the Greater Columbus Convention Center unless otherwise noted.*

|                   |                                                           |                  |
|-------------------|-----------------------------------------------------------|------------------|
| 3:00 PM – 4:00 PM | <b>FIG: 3D EM in the Biological Sciences</b>              | C111             |
| 3:30 PM – 4:30 PM | <b>FIG Business Meeting</b>                               | E162-A           |
| 3:30 PM – 4:30 PM | <b>MSA Education Committee Meeting</b> <i>(Combined)</i>  | E161-A           |
| 5:00 PM – 5:30 PM | <b>Student Poster Awards — Exhibit Hall Poster Stage</b>  | Exhibit Hall CD  |
| 5:15 PM – 6:15 PM | <b>FIG: Aberration Correction EM</b>                      | C211             |
| 5:30 PM – 6:30 PM | <b>Symposium Organizers – Appreciation Event</b>          | Eisenman & Trott |
| 5:30 PM – 6:30 PM | <b>Post-Doctoral Researchers' Reception</b>               | C222             |
| 5:45 PM – 6:45 PM | <b>Vendor Tutorials</b> <i>(Sign up at MSA MegaBooth)</i> | Exhibit Hall CD  |
| 6:30 PM – 8:30 PM | <b>Presidents' Reception</b> <i>(Invitation Only)</i>     | Offsite          |

# WEDNESDAY, JULY 27, 2016

|                     |                                                                                                                                          |                 |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 7:15 AM – 8:15 AM   | <b>MSA Certification Board</b>                                                                                                           | Trott           |
| 7:15 AM – 8:15 AM   | <b>MSA Membership Committee</b>                                                                                                          | Eisenman        |
| 8:30 AM – 10:00 AM  | <b>AM Symposia &amp; Sessions</b>                                                                                                        |                 |
|                     | <b>X40 – Career Tracks in Government and Industry: A Panel Discussion</b>                                                                | C211            |
|                     | <b>A01 – Vendor Symposium</b>                                                                                                            | C110            |
|                     | <b>A03 – X-ray Imaging and Analysis</b>                                                                                                  | C115            |
|                     | <b>A06 – Analytical Electron Microscopy for Advanced Characterization from Multi-dimensional Data Acquisition to Integrated Analysis</b> | C224-225        |
|                     | <b>A07 – Surface and Subsurface Microscopy and Analysis</b>                                                                              | C216            |
|                     | <b>A08 – Quantitative and Qualitative Microanalysis by EPMA and SEM</b>                                                                  | C113            |
|                     | <b>A09 – Advanced Scanning Diffraction: Mapping Functionality in Reciprocal Space at Nanometer Resolution</b>                            | C220            |
|                     | <b>A11 – Advances in Scanning Electron/Ion Instrumentation and Detectors</b>                                                             | C123-124        |
|                     | <b>A13 – In-situ Electron Microscopy and Big Data Analytics in 2D and 3D</b>                                                             | C221            |
|                     | <b>A14 – Single Atom Electron Microscopy and Spectroscopy</b>                                                                            | C212            |
|                     | <b>B03 – Super-resolution Visualization of Cellular and Inter-Cellular Processes in Health and Disease</b>                               | C111            |
|                     | <b>P02 – Electron Microscopy of Materials for Electrochemical Power Systems</b>                                                          | E160            |
|                     | <b>P05 – Microscopy for Thin Films of Metals, Semiconductors, and Insulators</b>                                                         | C114            |
|                     | <b>P10 – Microscopy and Characterization of Ceramics, Polymers and Composites</b>                                                        | C214            |
|                     | <b>P11 – Metallography and Microstructural Characterization of Metals</b>                                                                | C112            |
|                     | <b>P12 – Microscopy and Analysis in Forensic Science</b>                                                                                 | C213            |
| 10:00 AM – 5:30 PM  | <b>Exhibit Hall Open</b>                                                                                                                 | Exhibit Hall CD |
| 10:00 AM – 10:30 AM | <b>Coffee Break</b>                                                                                                                      | Exhibit Hall CD |
| 10:30 AM – 12:00 PM | <b>AM Symposia &amp; Sessions</b> <i>(Cont'd)</i>                                                                                        |                 |
|                     | <b>X44 – Physical Sciences Tutorial: Compressive Sensing Applications in Microscopy</b>                                                  | C211            |
|                     | <b>A01 – Vendor Symposium</b>                                                                                                            | C110            |
|                     | <b>A03 – X-ray Imaging and Analysis</b>                                                                                                  | C115            |
|                     | <b>A06 – Analytical Electron Microscopy for Advanced Characterization from Multi-dimensional Data Acquisition to Integrated Analysis</b> | C224-225        |

# WEDNESDAY, JULY 27, 2016 *continued*

|                     |                                                                                                               |                 |
|---------------------|---------------------------------------------------------------------------------------------------------------|-----------------|
| 10:30 AM – 12:00 PM | <b>AM Symposia &amp; Sessions (Cont'd)</b>                                                                    |                 |
|                     | <b>A07</b> – Surface and Subsurface Microscopy and Analysis                                                   | <b>C216</b>     |
|                     | <b>A08</b> – Quantitative and Qualitative Microanalysis by EPMA and SEM                                       | <b>C113</b>     |
|                     | <b>A09</b> – Advanced Scanning Diffraction: Mapping Functionality in Reciprocal Space at Nanometer Resolution | <b>C220</b>     |
|                     | <b>A12</b> – Research and Applications in Atom Probe Tomography                                               | <b>C226</b>     |
|                     | <b>A13</b> – <i>In-situ</i> Electron Microscopy and Big Data Analytics in 2D and 3D                           | <b>C221</b>     |
|                     | <b>A14</b> – Single Atom Electron Microscopy and Spectroscopy                                                 | <b>C212</b>     |
|                     | <b>B04</b> – Microscopy and Morphogenesis                                                                     | <b>C111</b>     |
|                     | <b>P02</b> – Electron Microscopy of Materials for Electrochemical Power Systems                               | <b>E160</b>     |
|                     | <b>P03</b> – Combining Simulation, Experiment, and Data Science for Materials Characterization and Design     | <b>C210</b>     |
|                     | <b>P05</b> – Microscopy for Thin Films of Metals, Semiconductors, and Insulators                              | <b>C114</b>     |
|                     | <b>P10</b> – Microscopy and Characterization of Ceramics, Polymers and Composites                             | <b>C214</b>     |
|                     | <b>P11</b> – Metallography and Microstructural Characterization of Metals                                     | <b>C112</b>     |
|                     | <b>P12</b> – Microscopy and Analysis in Forensic Science                                                      | <b>C213</b>     |
| 12:00 PM – 1:30 PM  | <b>Lunch Break</b>                                                                                            |                 |
| 12:15 PM – 1:15 PM  | <b>MAS - ANSI Meeting</b>                                                                                     | <b>Trott</b>    |
| 12:15 PM – 1:15 PM  | <b>MSA Members Meeting</b> ( <i>lunch provided to first 100 participants</i> )                                | <b>C123-125</b> |
| 12:15 PM – 1:15 PM  | <b>FIG: Pharmaceuticals</b>                                                                                   | <b>Eisenman</b> |
| 1:30 PM – 3:00 PM   | <b>PM Sessions &amp; Symposia</b>                                                                             |                 |
|                     | <b>X91</b> – Microscopy Outreach: It's a Family Affair! Hands-on Microscopy Workshop for All Ages             | <b>C121-122</b> |
|                     | <b>X41</b> – Biological Sciences Tutorial: Effective Tactics for Getting an Equipment Grant                   | <b>C211</b>     |
|                     | <b>A01</b> – Vendor Symposium                                                                                 | <b>C110</b>     |
|                     | <b>A03</b> – X-ray Imaging and Analysis                                                                       | <b>C115</b>     |
|                     | <b>A07</b> – Surface and Subsurface Microscopy and Analysis                                                   | <b>C216</b>     |
|                     | <b>A08</b> – Quantitative and Qualitative Microanalysis by EPMA and SEM                                       | <b>C113</b>     |
|                     | <b>A12</b> – Research and Applications in Atom Probe Tomography                                               | <b>C226</b>     |
|                     | <b>A13</b> – <i>In-situ</i> Electron Microscopy and Big Data Analytics in 2D and 3D                           | <b>C221</b>     |
|                     | <b>A14</b> – Single Atom Electron Microscopy and Spectroscopy                                                 | <b>C212</b>     |
|                     | <b>A16</b> – New Frontiers in Monochromated EELS                                                              | <b>C224-225</b> |
|                     | <b>B04</b> – Microscopy and Morphogenesis                                                                     | <b>C111</b>     |
|                     | <b>P02</b> – Electron Microscopy of Materials for Electrochemical Power Systems                               | <b>E160</b>     |
|                     | <b>P03</b> – Combining Simulation, Experiment, and Data Science for Materials Characterization and Design     | <b>C210</b>     |
|                     | <b>P05</b> – Microscopy for Thin Films of Metals, Semiconductors, and Insulators                              | <b>C114</b>     |
|                     | <b>P10</b> – Microscopy and Characterization of Ceramics, Polymers and Composites                             | <b>C214</b>     |
|                     | <b>P11</b> – Metallography and Microstructural Characterization of Metals                                     | <b>C112</b>     |
|                     | <b>P12</b> – Microscopy and Analysis in Forensic Science                                                      | <b>C213</b>     |



WEEK AT-A-GLANCE

# WEDNESDAY, JULY 27, 2016

continued

All events are located at the Greater Columbus Convention Center unless otherwise noted.

|                   |                                                                                     |                 |
|-------------------|-------------------------------------------------------------------------------------|-----------------|
| 3:00 PM – 5:00 PM | <b>Wednesday Poster Presentations</b>                                               | Exhibit Hall CD |
|                   | <b>A01</b> – Vendor Symposium                                                       |                 |
|                   | <b>A08</b> – Quantitative and Qualitative Microanalysis by EPMA and SEM             |                 |
|                   | <b>A13</b> – <i>In-situ</i> Electron Microscopy and Big Data Analytics in 2D and 3D |                 |
|                   | <b>A14</b> – Single Atom Electron Microscopy and Spectroscopy                       |                 |
|                   | <b>B04</b> – Microscopy and Morphogenesis                                           |                 |
|                   | <b>P02</b> – Electron Microscopy of Materials for Electrochemical Power Systems     |                 |
|                   | <b>P05</b> – Microscopy for Thin Films of Metals, Semiconductors, and Insulators    |                 |
|                   | <b>P10</b> – Microscopy and Characterization of Ceramics, Polymers and Composites   |                 |
|                   | <b>P12</b> – Microscopy and Analysis in Forensic Science                            |                 |
| 5:00 PM – 5:30 PM | <b>Student Poster Awards — Exhibit Hall Poster Stage</b>                            | Exhibit Hall CD |
| 5:15 PM – 6:15 PM | <b>MAS Business Meeting</b>                                                         | C111-112        |
| 5:45 PM – 6:45 PM | <b>Vendor Tutorials</b> (Sign up at MSA MegaBooth)                                  | Exhibit Hall CD |
| 6:30 PM – 8:30 PM | <b>MAS Members Social</b> (Visit MAS Booth for details)                             |                 |
| 6:30 PM – 9:00 PM | <b>IMS Awards Banquet</b> (Visit IMS Booth for details)                             |                 |

# THURSDAY, JULY 28, 2016

|                     |                                                                                                           |                  |
|---------------------|-----------------------------------------------------------------------------------------------------------|------------------|
| 8:30 AM – 10:00 AM  | <b>M&amp;M Sustaining Members Meeting</b>                                                                 | Eisenman & Trott |
| 8:30 AM – 10:00 AM  | <b>AM Symposia &amp; Sessions</b>                                                                         |                  |
|                     | <b>A02</b> – TEM Phase Plate Imaging in Biological and Materials Science                                  | C111             |
|                     | <b>A07</b> – Surface and Subsurface Microscopy and Analysis                                               | C216             |
|                     | <b>A08</b> – Quantitative and Qualitative Microanalysis by EPMA and SEM                                   | C113             |
|                     | <b>A10</b> – Advances in Image Processing, Display, and Analysis                                          | C115             |
|                     | <b>A12</b> – Research and Applications in Atom Probe Tomography                                           | C226             |
|                     | <b>A13</b> – <i>In-situ</i> Electron Microscopy and Big Data Analytics in 2D and 3D                       | C221             |
|                     | <b>A16</b> – New Frontiers in Monochromated EELS                                                          | C224-225         |
|                     | <b>P03</b> – Combining Simulation, Experiment, and Data Science for Materials Characterization and Design | C210             |
|                     | <b>P04</b> – Nuclear and Irradiated Materials                                                             | E160             |
|                     | <b>P05</b> – Microscopy for Thin Films of Metals, Semiconductors, and Insulators                          | C114             |
|                     | <b>P08</b> – Microscopy of Additive Manufacturing and 3D Printing in Materials and Biology                | C213             |
|                     | <b>P10</b> – Microscopy and Characterization of Ceramics, Polymers and Composites                         | C214             |
| 10:00 AM – 11:00 AM | <b>MSA Student Committee Meeting</b>                                                                      | C212             |
| 10:00 AM – 2:00 PM  | <b>Exhibit Hall Open</b>                                                                                  | Exhibit Hall CD  |
| 10:00 AM – 12:00 PM | <b>Coffee Break + Poster Session</b>                                                                      | Exhibit Hall CD  |
| 10:00 AM – 12:00 PM | <b>Thursday Poster Sessions</b>                                                                           | Exhibit Hall CD  |
|                     | <b>A02</b> – TEM Phase Plate Imaging in Biological and Materials Science                                  |                  |
|                     | <b>A07</b> – Surface and Subsurface Microscopy and Analysis                                               |                  |
|                     | <b>A10</b> – Advances in Image Processing, Display, and Analysis                                          |                  |
|                     | <b>A12</b> – Research and Applications in Atom Probe Tomography                                           |                  |

# THURSDAY, JULY 28, 2016 *continued*

|                     |                                                                                                           |                             |
|---------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------|
| 10:00 AM – 12:00 PM | <b>Thursday Poster Sessions (Cont'd)</b>                                                                  | <b>Exhibit Hall CD</b>      |
|                     | <b>A13</b> – <i>In-situ</i> Electron Microscopy and Big Data Analytics in 2D and 3D                       |                             |
|                     | <b>A16</b> – New Frontiers in Monochromated EELS                                                          |                             |
|                     | <b>P03</b> – Combining Simulation, Experiment, and Data Science for Materials Characterization and Design |                             |
|                     | <b>P04</b> – Nuclear and Irradiated Materials                                                             |                             |
|                     | <b>P05</b> – Microscopy for Thin Films of Metals, Semiconductors, and Insulators                          |                             |
|                     | <b>P08</b> – Microscopy of Additive Manufacturing and 3D Printing in Materials and Biology                |                             |
| 12:00 PM – 12:30 PM | <b>Student Poster Awards — Exhibit Hall Poster Stage</b>                                                  | <b>Exhibit Hall CD</b>      |
| 12:00 PM – 1:30 PM  | <b>Lunch Break</b>                                                                                        |                             |
| 1:30 PM – 3:00 PM   | <b>PM Symposia</b>                                                                                        |                             |
|                     | <b>A02</b> – TEM Phase Plate Imaging in Biological and Materials Science                                  | <b>C111</b>                 |
|                     | <b>A07</b> – Surface and Subsurface Microscopy and Analysis                                               | <b>C216</b>                 |
|                     | <b>A10</b> – Advances in Image Processing, Display, and Analysis                                          | <b>C115</b>                 |
|                     | <b>A12</b> – Research and Applications in Atom Probe Tomography                                           | <b>C226</b>                 |
|                     | <b>A13</b> – <i>In-situ</i> Electron Microscopy and Big Data Analytics in 2D and 3D                       | <b>C221</b>                 |
|                     | <b>A16</b> – New Frontiers in Monochromated EELS                                                          | <b>C224-225</b>             |
|                     | <b>P03</b> – Combining Simulation, Experiment, and Data Science for Materials Characterization and Design | <b>C210</b>                 |
|                     | <b>P04</b> – Nuclear and Irradiated Materials                                                             | <b>E160</b>                 |
|                     | <b>P05</b> – Microscopy for Thin Films of Metals, Semiconductors, and Insulators                          | <b>C114</b>                 |
|                     | <b>P08</b> – Microscopy of Additive Manufacturing and 3D Printing in Materials and Biology                | <b>C213</b>                 |
| 3:00 PM – 3:30 PM   | <b>Coffee Break</b>                                                                                       | <b>C Rooms Foyer</b>        |
| 3:30 PM – 5:00 PM   | <b>PM Symposia (Cont'd)</b>                                                                               |                             |
|                     | <b>A02</b> – TEM Phase Plate Imaging in Biological and Materials Science                                  | <b>C111</b>                 |
|                     | <b>A07</b> – Surface and Subsurface Microscopy and Analysis                                               | <b>C216</b>                 |
|                     | <b>A10</b> – Advances in Image Processing, Display, and Analysis                                          | <b>C115</b>                 |
|                     | <b>A12</b> – Research and Applications in Atom Probe Tomography                                           | <b>C226</b>                 |
|                     | <b>A13</b> – <i>In-situ</i> Electron Microscopy and Big Data Analytics in 2D and 3D                       | <b>C221</b>                 |
|                     | <b>A16</b> – New Frontiers in Monochromated EELS                                                          | <b>C224-225</b>             |
|                     | <b>P03</b> – Combining Simulation, Experiment, and Data Science for Materials Characterization and Design | <b>C210</b>                 |
|                     | <b>P04</b> – Nuclear and Irradiated Materials                                                             | <b>E160</b>                 |
|                     | <b>P05</b> – Microscopy for Thin Films of Metals, Semiconductors, and Insulators                          | <b>C114</b>                 |
|                     | <b>P08</b> – Microscopy of Additive Manufacturing and 3D Printing in Materials and Biology                | <b>C213</b>                 |
| 5:30 PM – 6:30 PM   | <b>M&amp;M 2016 Wrap-Up &amp; Debrief (By invitation only)</b>                                            | <b>Eisenman &amp; Trott</b> |

# Welcome from the Program Chairs



## Welcome to Microscopy and Microanalysis 2016 in Columbus, Ohio!

The Microscopy Society of America, the Microanalysis Society and the International Metallographic Society welcome you to Microscopy and Microanalysis 2016 in Columbus, Ohio.

As you have come to expect, Microscopy and Microanalysis 2016 will highlight the latest innovations in many different microscopy and microanalysis techniques as well as their applications to important research in both biological, physical and materials sciences. One new aspect of Microscopy and Microanalysis 2016 is that many of the 30+ featured symposia in biological, physical and analytical sciences presented at the meeting were suggested by you, the membership of MSA, MAS and IMS. In addition, we have two exciting pre-meeting Congresses planned. The Exhibition will again show off the newest developments in commercial technologies aimed at providing new and improved capabilities in your laboratory. Each day the poster sessions will be held in the exhibition hall giving the unique opportunity for lively discussion of the poster while enjoying a social event.

We are excited to have two excellent Plenary lectures scheduled. Drew Berry, a biomedical animator at the Walter and Eliza Hall Institute of Medical Research, Melbourne, Australia, will present his work in his lecture *"Beyond the limits of microscopy: Revealing the unseeable through Hollywood visual effects"*. Drew uses state-of-the-art animation techniques to produce eye-popping animations of cellular processes and mechanisms. Drew's work has been seen all over the world and he has received numerous awards and honors for his work. Our second Plenary speaker is Professor Mark Miodownik from University College London where he is the Director of the UCL Institute of Making. Prof. Miodownik regularly presents BBC TV programs on materials science and engineering which have reached millions of viewers in more than 200 countries and is author of *Stuff Matters* which won the Royal Society Winton Prize in 2014.

The Executive Program Committee and all of our symposium organizers have worked tirelessly to produce the technical program for Microscopy and Microanalysis 2016. On behalf of the program committee, MSA, MAS and IMS, welcome to Microscopy and Microanalysis 2016 and Columbus, Ohio!



**Joseph Michael**  
Program Committee Chair  
Sandia National Laboratories



**Brian Gorman**  
MAS Co-Chair  
Colorado School of Mines



**Jay Potts**  
Program Vice Chair  
University of South Carolina



**Daniel P. Dennies**  
IMS Co-Chair  
Consulting Metallurgical Engineer

### PLENARY SPEAKER

Drew Berry

Walter and Eliza Hall Institute of Medical Research, Melbourne, Australia

### *"Beyond the Limits of Microscopy: Revealing the Unseeable through Hollywood Visual Effects"*

MONDAY, JULY 25, 2016

Columbus Convention Center, Columbus, OH

Drew Berry is a biomedical animator who creates scientifically accurate and aesthetically rich visualisations that reveal the cellular and molecular processes for a wide range of audiences. Beginning his career as a cell biologist and microscopist Drew brings a rigorous scientific approach to each project, immersing himself in relevant research to ensure current data are represented. Since 1995, he has been a biomedical animator at the Walter and Eliza Hall Institute of Medical Research. His animations have exhibited at venues such as the Guggenheim Museum, MoMA, the Royal Institute of Great Britain and the University of Geneva. In 2010 he received a MacArthur Fellowship "Genius Grant". He has been profiled in articles in the New York Times, the New Yorker and the American Scientist. He has also received an Emmy for his contribution to a documentary on DNA.



### Drew Berry<sup>1</sup>

1. The Walter and Eliza Hall Institute of Medical Research, Melbourne Australia

This report describes the research and visualisation techniques used to create The Malaria Lifecycle animations. The animation required one year of full time production, including three months of research, two months of model building and seven months of animation development. The goal was to visualize the entire malaria lifecycle, accurately represented for parasite behaviour and cellular structure, founded on an extensive review of the malaria research literature. The intended audience was as broad as possible, including scientists, students, the media and the general public. Technical scientific jargon was avoided in the narration to make it more accessible to non-experts.

The Malaria Lifecycle is presented as two animations "Human Host" and "Mosquito Host". The animations were designed as succinct as possible with a duration under 4 minutes each, which is considered to be a reasonable attention span for a motivated audience listening to technical content, and the utility of brief visuals for use in classrooms, YouTube and lecture presentation.

The animation was created on an Apple MacPro with Maya animation software. Image rendering used Pixar's Renderman, Maya's internal renderer, Mental Ray, and OpenGL hardware. Most shot sequences were made of 20-50 layers which were then composited together in After Effects for the final result.

The animation begins with the neck of a sleeping child in the early evening, somewhere in the tropics. Early evening is the primary feeding time when *Anopheles* typically hunts for a blood meal. The colour of the shot is tinted towards dark blue to suggest the evening, supported by the nighttime jungle noises. An attempt was made to make the skin tone racially neutral and therefore relate to as broad an audience as possible.

The flight, landing and stance of the *Anopheles* mosquito (Fig 1) were derived from published video studies of the insect's behaviour. The mechanics of the bite, such as the proboscis bending into the wound and the fold of the labrum, were derived from papers on the mosquito feeding action. The 3D model for the mosquito required substantial detailing of textures, hairs and other features to make it resemble a realistic female *Anopheles* insect. The model also required kinematic rigging for movement. The mouthparts were accurately constructed with labrum and multiple mandible stylets and maxillae that make up the proboscis tube.

The capillaries and arterioles (Fig 2) were modelled from SEM of resin cast blood vessels from human skin. The blood flows in each of these vessel types was based upon video microscopy of a live mouse's ear. The malaria sporozoite gliding motility and infection in the liver was based on many excellent papers by Sinden *et al.*

The adherence of the merozoite to the erythrocyte is via a sticky coat of hairs (Fig 3). The parasite then reorients itself vertically, with its cytoplasmic entry apparatus pressed against the membrane. As the parasite pulls itself inside the red blood cell, it sheds its coat of hairs. Inside the infected cell, the parasite devours the haemoglobin and asexually reproduces to create 16 new parasites (Fig 4). When the merozoites are mature, they induce the infected shizont to inflate and rupture, releasing all of the parasites. The infected cell's membrane was generated with Maya nCloth dynamics to shred the membrane at the appropriate moment. The red blood cells and merozoites were particle sprites.

The freeze frame of the flying *Anopheles* mosquito was inspired by the extraordinary photography of Hugh Sturrock, Edinburgh University. The 'X-ray' view of the abdomen was based on multiple published studies of mosquito anatomy.

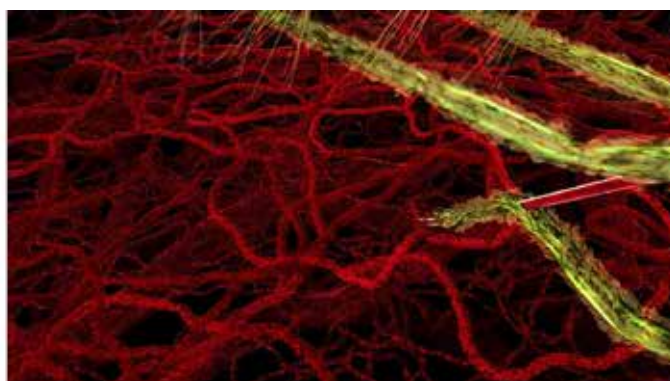
Depicted in this shot are the stomach, ovaries, malpighian tubules, circulatory, nervous and respiratory systems. All of the abdomen organs were created with Maya Paint FX and were accurate for scale, structure and location. The red blood cells were made with over 100,000 particle image sprites with Maya.

The rapidly maturing gametocytes expand approximately 3 times in size before rupturing the infected erythrocyte's membrane. The rupturing red blood cell membrane was created with Maya nCloth dynamics. The sperm flagella were driven by Maya Hair dynamics. The red blood cell random rotation was driven by a fractal node. The collision of red blood cells with the egg, Ookinete and sperm was keyframed by hand.

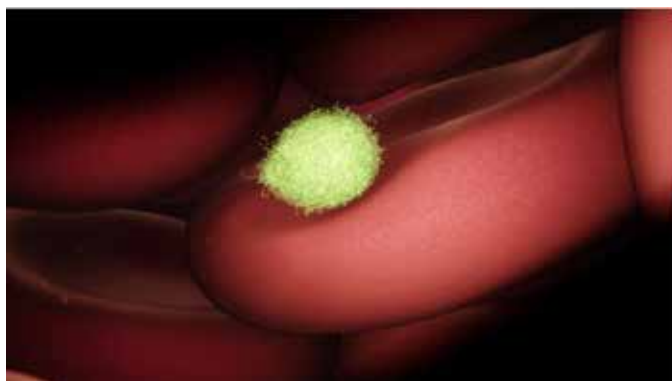
The distribution and number of cysts on the stomach wall were derived from a number of SEM studies of malaria-infected mosquitos. It is not clear from the literature how the sporozoites migrate from the cysts to the salivary glands, with evidence both for active motility and passive travel. The sporozoites and salivary glands were created with Maya Paint FX.



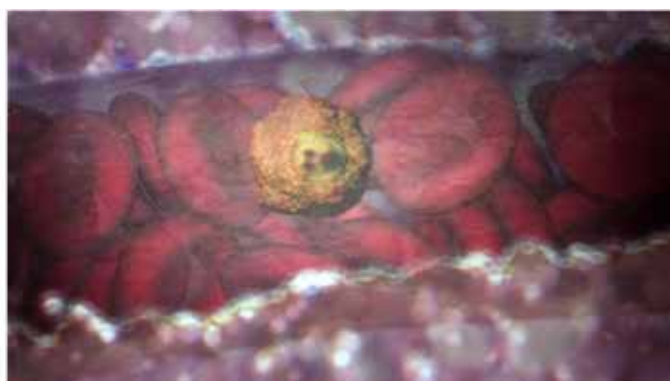
**Figure 1.** Animated *Anopheles* mosquito biting skin.



**Figure 2.** 'X-ray' view of proboscis and capillaries.



**Figure 3.** Merozoite invading red blood cell.



**Figure 4.** Infected red blood cell in bloodstream.

## PLENARY SPEAKER

Professor Mark Miodownik  
University College London, UK

### *"Materials for the 21st Century"*

MONDAY, JULY 25, 2016  
Columbus Convention Center

Professor Mark Miodownik is the UCL Professor of Materials & Society. He received his Ph.D in turbine jet engine alloys from Oxford University, and has worked as a materials engineer in the USA, Ireland and the UK. For more than ten years he has championed materials research that links the arts and humanities to medicine, engineering and materials science. This culminated in the establishment of the UCL Institute of Making where he is Director and runs the research programme ([www.instituteofmaking.org.uk](http://www.instituteofmaking.org.uk)). Prof Miodownik is a well known author and broadcaster. He regularly presents BBC TV programmes on materials science and engineering which have reached millions of viewers in more than 200 countries. In 2013 he was awarded the Royal Academy of Engineering Rooke Medal, and he was elected a fellow of the Royal Academy of Engineering in 2014. He is author of *Stuff Matters* which won the Royal Society Winton Prize in 2014.



#### Mark Miodownik<sup>1,2</sup>

1. Institute of Making, University College London, London, United Kingdom.
2. Mechanical Engineering Department, University College London, London, United Kingdom.

In this talk I look fifty years into the future of materials science to assess the needs for materials characterisation. Topics such as cities, energy, food and drink, and healthcare are explored in terms of their materials requirements and the requirements for microscopy and analysis. As the number of available materials increases, I assess the likelihood that the methodology of materials development itself might evolve. Will experiment combined with materials characterisation continue to dominate, or will approaches that combine big data and theory become more important forms of materials discovery?

Traditionally, approaches to materials selection and development were experimental and therefore slow. Much progress has been made, but it still takes decades to optimize suitable materials for a technological application. A principal reason for this long discovery process is that materials design is a complex, multidimensional optimization problem and the data needed to make informed choices usually do not exist. Theory blossomed in the 20th century, but its actual use in the invention of new materials in 2015 is still limited [2].

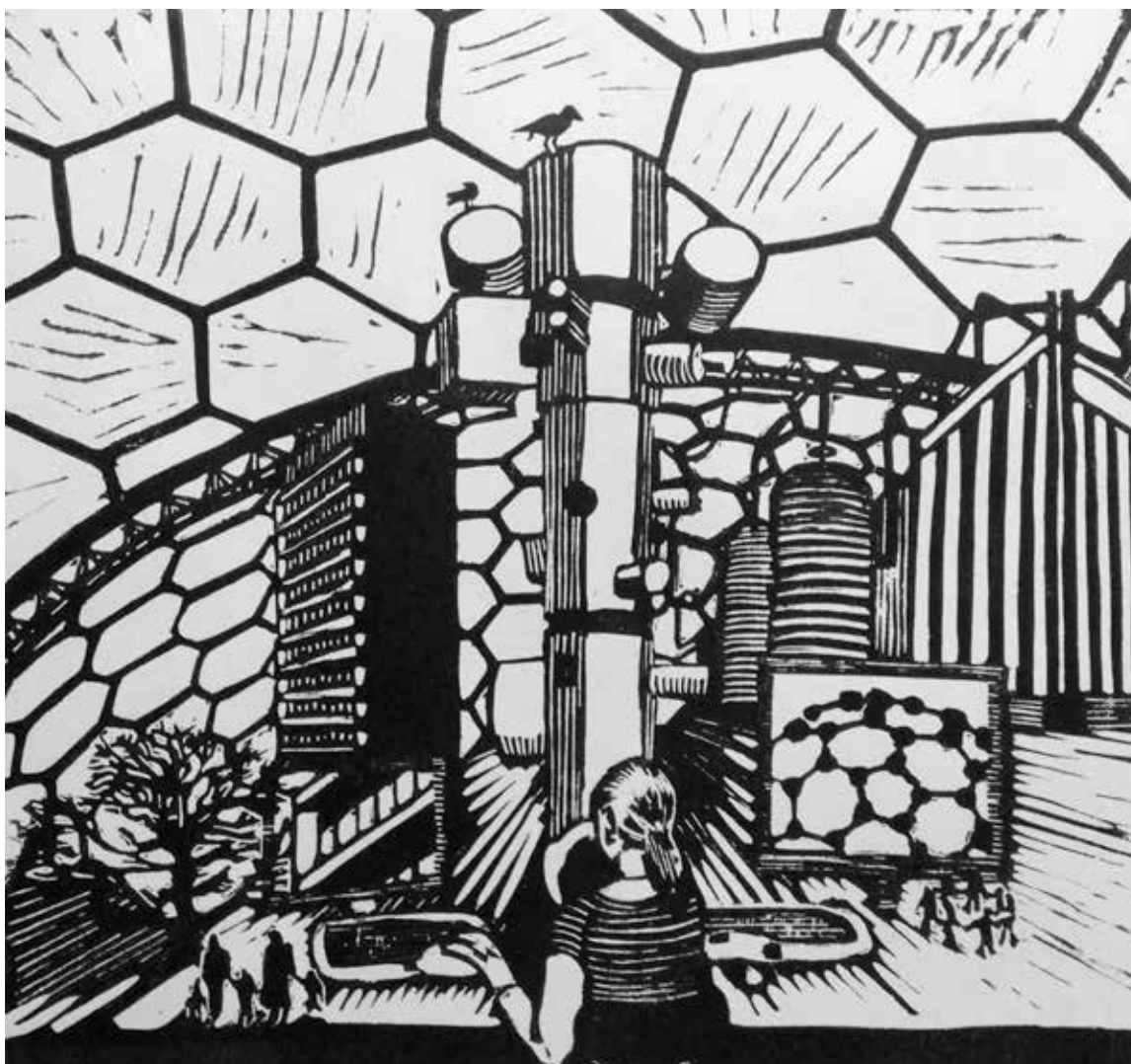
The US federal government's Materials Genome Initiative [2] recommends a change in methodology from a fragmented, experimentally based approach to a more integrated, theory- and data-led approach. This sounds appealing but this approach misses one very important issue, namely that there has been an increased specialization of materials practitioners, to the point where the scientists, technologists, and microscopists (i.e., the materials science community) involved in the development of new materials now move in both academic and social circles widely separated from those of industrial designers, architects, clothes makers, and medical experts (i.e., the materials arts community). It is the materials arts community who are experts in understanding the needs of society and therefore the materials requirements for future cities, energy, food and drink, and healthcare. In this talk I discuss ways to include the materials arts community into the development of new materials through a design-led methodology [3].

Materials are fundamentally multiscale, and there is as much to be learned about materials design through the production and trial of full-scale prototypes as through the application of theory. To assemble multidisciplinary teams with experts in each different scale requires laboratories that facilitate analysis, microscopy, and equipment to build and test physical prototypes. This will be a significant switch for materials scientists, who often hand over a material technology to the materials arts community and consider their work to be done [3].

There is much at stake, because materials have an immense cultural and environmental significance and the introduction of new materials by an isolated materials science community holds the prospect of a further deepening of the rift between scientists and society. Some combination of this materials arts approach and the materials genome approach is likely to be the hallmark of materials laboratories in the 21st century [4].

## References:

- [1] A. Jain *et al*, APL Mater. 1 (2013), p. 011002.
- [2] “Materials Genome Initiative Strategic Plan” (National Science and Technology Council, Washington, DC, 2014), available at [https://www.whitehouse.gov/sites/default/files/microsites/ostp/NSTC/mgi\\_strategic\\_plan\\_-\\_dec\\_2014.pdf](https://www.whitehouse.gov/sites/default/files/microsites/ostp/NSTC/mgi_strategic_plan_-_dec_2014.pdf) (accessed Feb 2016)
- [3] M.A. Miodownik, MRS Bulletin 40 (2015), p. 1188.
- [4] The author acknowledges funding from the EPSRC and the European Union’s Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 310311; the help of all members of the UCL Institute of Making for their help and technical support with this work; Ruby Wright for inspiration and the illustration.



**Figure 1.** A possible future where buildings are designed using truly multiscale methods.

## ORGANIZER: Elizabeth Wright, Emory University

- These full-day courses run from 8:30 AM to 5:00 PM on Sunday, July 24
- A certificate of participation will be issued to each participant
- Two (2) Continuing Microscopy Education Units are available
- Morning and afternoon coffee breaks are included (Breakfast & lunch are on your own)

## X10 Cryo-Preparation for Biological EM

**INSTRUCTORS:** Kent McDonald, Danielle Jorgens, Rick Webb, Helmut Gnaegi

**Room:** C110

In this course we review why cryo-techniques for biological specimen preparation are superior to conventional methods. We discuss some low-cost cryo-methods, as well as some of the latest equipment and techniques for high-pressure freezing, freeze substitution, cryosectioning and correlative LM-EM. We show how to recognize ice-damage artifacts and provide a library of reference materials that can be accessed online after the course. Persons taking this course leave with a better understanding of these biological cryotechniques and their role in different applications such as correlating light and EM, EM tomography, EM immunolabeling, cryo-EM of vitrified sections, as well as their routine use for the best-available preservation of cellular fine structure.

## X11 Electron Cryotomography Image Processing Using RELION

**INSTRUCTORS:** Sjors Scheres, Tanmay Bharat

**Room:** C111

The course begins with an explanation of the RELION algorithm. Next, the limitations of tomographic data will be discussed along with the missing wedge. Strategy for CTF estimation and CTF correction using the combined 3D CTF and missing wedge model in RELION are explained. The practical course that follows will show how to setup of files and directories for RELION sub-tomogram averaging, including generation of 3D CTF models. Tomographic data will then be classified in 2D and 3D. Finally, sub-tomogram averaging will be conducted using the auto-refinement program in RELION with an emphasis on how to assess refinement quality, Euler angle distributions and whether more data is needed.

## X13 Practical Considerations for Image Analysis and Use of ImageJ/Fiji

**INSTRUCTOR:** James Grande

**Room:** C113

The course first focuses on a wide range of practical topics in the field of image analysis, covered in an easy-to-understand format so that users with little or no experience can comprehend how image analysis can provide extensive quantitative measurements leading to better understanding of material performance. Treating image analysis as a problem-solving tool, along with discerning key metrics within a microstructure, are discussed through several real-life examples. The course then covers the use of the public-domain image-analysis package ImageJ/Fiji. This analysis tool is explored in terms of its extensive capabilities and types of image-analysis projects using several examples. Programming considerations are discussed with basic examples of batch-processing images for enhanced analysis of structural features. Finally, the strengths and weaknesses of image-analysis tools, and options for applying them in various types of imaging systems, are described and discussed.

## X14 Advanced Focused Ion Beam Methods

**INSTRUCTORS:** Lucille Giannuzzi, Joe Michael

**Room:** C114

The use of FIB instruments in materials and biological science laboratories is growing rapidly. The versatility and capabilities of these tools are also rapidly improving. This course firsts cover ion/solid interactions, which are so important for a user of FIB instrumentation to understand. We then discuss techniques of sample preparation for SEM and TEM, using conventional liquid-metal Ga<sup>+</sup> ion FIBs. We introduce liquid-metal alloy sources, the gas field-ionization source, the plasma-ion source, and the various ions that are now commercially available to benefit differing applications. The course concludes with discussions of 3D applications and nanofabrication.

## X15 Nanomaterial Microscopy & Microanalysis: Tools and Preparation

**INSTRUCTORS:** Lou Germinario, Phillip Russell, John Thornton

**Room:** C115

With the wide variety of analytical instrumentation available, the selection of the correct "tool" for analysis of nanomaterials is critical. By introducing various microscopy and microanalysis methods, this workshop provides a solid foundation for nanomaterial characterization for the beginning to intermediate investigator. The importance of choosing the proper preparation technique, to minimize introduction of artifacts and to ensure that representative samples are identified for subsequent analysis, are also discussed.

**Separate registration fee required — visit the Registration Desk to register.**

*Breakfast, lunch, and coffee breaks are included.*

## Exploiting the Diffractive Properties of Electrons for Solving Materials Problems

**Sunday, July 24, 2016 • 8:00 AM to 5:00 PM**

**Room C210-211-212, Greater Columbus Convention Center**

*Organized by the Electron Crystallography and Automated Mapping Methods Focused Interest Group*

### ORGANIZERS:

**Jörg Wiezorek, University of Pittsburgh**  
**Yousuf Picard, Carnegie Mellon University**  
**Sergei Rouvimov, University of Notre Dame**  
**Robert Stroud, nanoMegas**

This Pre-Meeting Congress reviews basic methodologies in the analysis of crystalline materials using electron diffraction. Both scanning electron microscopy and transmission electron microscopy methods are featured. This Congress will feature nine invited speakers, each an internationally renowned expert in the utilization of electron diffraction methods for analyzing one or more of the following structural properties of crystalline materials: phase/symmetry, orientation, defects, and strain. Each speaker will describe the fundamental physics, explain the basic methodologies and approaches, and highlight key recent research findings and/or important technique developments. This session provides an excellent opportunity for electron microscopists to review SEM and TEM methodologies based on electron diffraction, and gain new insights on the latest advances and applications of state-of-the-art diffraction methods.

## Essentials of Atom Probe Tomography

**Sunday, July 24, 2016 • 8:30 AM to 5:00 PM**

**Room C213-214-215, Greater Columbus Convention Center**

*Organized by the Atom Probe Focused Interest Group*

### ORGANIZERS:

**Richard L. Martens, The University of Alabama**  
**Arun Devaraj, Pacific Northwest National Laboratory**  
**Prakash Kolli, University of Maryland**  
**Baishakhi Mazumder, Oak Ridge National Laboratory**

Atom Probe Tomography (APT) has grown rapidly over the past decade. Commercial instrumentation and FIB-based specimen preparation have driven much of this growth. Accordingly, the number of academic and industrial users utilizing this atomic-scale analytical technique has also risen rapidly. This Congress presents the basics of APT in an introductory overview. Atom probe instrumentation, experimental design, theory, specimen preparation, data analysis and standards, and applications are discussed. Research leaders from academia and industry present, from basics to advanced applications in each specific area, including instrumentation developments, correlative microscopy, and standards development. Both academic and industrial users new to the field, as well as experienced APT users, will find this complete overview beneficial and educational.

**A**

## ADVANCES IN INSTRUMENTATION AND TECHNIQUES SYMPOSIA

### A01 Vendor Symposium

**ORGANIZERS:** Paul Kotula, Teresa Ruiz

**ROOM C110** Convention Center

**WEDNESDAY** 8:30 AM, 10:30 AM, and 1:30 PM  
3:30 PM POSTER SESSION

This symposium provides an opportunity for instrument manufacturers and vendors to showcase new developments resulting in improved technology solutions. Topics include new methods and techniques, new developments and technologies, breakthroughs and new instrumentation, and improvements to existing instrumentation.

### A02 TEM Phase Plate Imaging in Biological and Materials Science

**ORGANIZERS:** Radostin Danev, Mike Marko

**Room C111** Convention Center

**THURSDAY** 8:30 AM, 1:30 PM, and 3:30 PM  
10:00 AM POSTER SESSION

Conventional imaging with TEM relies on defocus to produce phase contrast. This approach has inherent problems in terms of non-optimal information transfer in Fourier space, especially for low spatial frequencies. Phase plates enable in-focus phase contrast and provide a practical solution for these problems. The theory, construction, and practical use of phase plates are explored. High-resolution low-dose imaging is facilitated in biological cryo-EM. In materials science, the combination of a physical phase plate with a Cs-corrector offers an opportunity for characterization of both atomic details and larger structures. The number of laboratories adopting phase plates is rapidly growing and this is a timely opportunity to share experiences.

### A03 X-Ray Imaging and Analysis

**ORGANIZERS:** Jeff Davis, Ric Wuhner, Eric Telfeyan

**Room C115** Convention Center

**TUESDAY** 1:30 PM

**WEDNESDAY** 8:30 AM, 10:30 AM, and 1:30 PM  
3:00 PM POSTER SESSION

This broad symposium focuses on all aspects of x-ray imaging and x-ray image analysis. Our goal is bringing together the diverse methods of x-ray imaging such as SEM-EDS mapping,  $\mu$ XRF,  $\mu$ XRD, and  $\mu$ CT. We also emphasize software for image analysis including quantitative analysis, multivariate statistical methods, machine learning methods

and contributions from the vendor community about new hardware, detectors, and techniques. Papers on practical applications of x-ray imaging and correlative microscopy are also presented.

### A04 Advances in FIB Instrumentation and Applications in Materials and Biological Sciences

**ORGANIZERS:** Lucille A. Giannuzzi, Nabil Bassim,  
Srinivas Subramaniam

**Room C216** Convention Center

**MONDAY** 1:30 PM

**TUESDAY** 8:30 AM, 10:30 AM, and 1:30 PM  
3:00 PM POSTER SESSION

Focused ion beam (FIB) instruments are mainstay capabilities for microscopy facilities. FIB columns may be used alone or combined with additional FIB or SEM columns or multiple analytical detectors on a single instrument. The FIB by itself or in combination with other beams and analytical capabilities provides unique methods of specimen preparation, 2D and 3D characterization, and prototyping opportunities. This sessions covers many of these topics including new applications of FIB-based development and applications.

### A05 Applications of Correlative Microscopy to Physical and Biological Sciences

**ORGANIZERS:** Si Chen, Renu Sharma, Nestor J. Zaluzec

**Room C210** Convention Center

**TUESDAY** 8:30 AM, 10:30 AM, and 1:30 PM  
3:00 PM POSTER SESSION

This symposium focuses on the latest developments in correlative microscopy and applications to physical and biological sciences. Both correlative imaging and spectroscopy are emerging methods that combine two or more complementary imaging or spectroscopy techniques to provide mesoscale or multiple parameter information of a sample or a reaction process. For example, correlative light and electron microscopy combines sub-micron scale information provided by optical and fluorescence signals with (sub-)nanoscale structural information obtained from electron scattering. Synchrotron-based x-ray fluorescence microscopy or spectroscopy in conjunction with electron microscopy provides chemical information in addition to information about the ultrastructure. Sample preparation, modifications to the microscope, or sample holders to suit multiple imaging/spectroscopy techniques and image registration are critical aspects for correlative microscopy, which are also covered in this symposium.

## A06 Analytical Electron Microscopy for Advanced Characterization from Multidimensional Data Acquisition to Integrated Analysis

**ORGANIZERS:** Chaoying Ni, Peter A. van Aken, Masashi Watanabe

**Room C224-225** Convention Center

**MONDAY** 1:30 PM

3:00 PM POSTER SESSION

**TUESDAY** 8:30 AM, 10:30 AM, and 1:30 PM

**WEDNESDAY** 8:30 AM and 10:30 AM

Recent advances in instrumentation related to analytical electron microscopy including high brightness electron sources, stable columns, and efficient signal-detectors allow high resolution analysis with concurrent acquisition of multi-dimensional data: not only traditional analytical signals such as x-rays and energy-loss electrons but also signals for imaging and diffraction. With these multidimensional data, more advanced quantitative information can be obtained such as chemical compositions, electronic structure and local nanostructures. The improved multidimensional data acquisitions including diffraction imaging and analytical tomography and advanced quantitative analysis require efficient data processing. This symposium focuses on the latest scientific impact in terms of hardware/software development and new applications of analytical electron microscopy.

## A07 Surface and Subsurface Microscopy and Analysis

**ORGANIZERS:** Vincent S. Smentkowski, John A. Chaney, Chanmin Su

**Room C216** Convention Center

**WEDNESDAY** 8:30 AM, 10:30 AM, and 1:30 PM

**THURSDAY** 8:30 AM, 1:30 PM, and 3:30 PM  
10:00 AM POSTER SESSION

Surface properties, such as composition, uniformity, thickness, topography, etc., dictate the performance of many systems. The surface analyst is asked to detect and image species present in ever-lower concentrations and within ever-smaller spatial and depth dimensions. This symposium emphasizes state of the art surface analytical instrumentation, all aspects of surface mass spectrometry and scanning probe microscopy including nanoscale chemical and physical property analysis via TERS, IR, and other probe based techniques. Advanced data analysis tools, the use of complementary surface analytical instrumentation to perform a complete analysis of complex material systems, and surface analytical challenges are also covered.

## A08 Quantitative and Qualitative Microanalysis by EPMA and SEM

**ORGANIZERS:** Julien Allaz, Paul Carpenter

**Room C113** Convention Center

**WEDNESDAY** 8:30 AM, 10:30 AM, and 1:30 PM

**THURSDAY** 8:30 AM

10:00 AM POSTER SESSION

This session covers advances in quantitative and qualitative microanalysis by EPMA and SEM using WDS and EDS detector systems, trace and light element microanalysis, complementary techniques applied to compositional mapping, the role of standard reference materials, and educational efforts directed toward improvements in microanalysis. Included are presentations from the scientific and vendor communities, and highlights of the efforts of young scientists and the role of education in microanalysis.

## A09 Advanced Scanning Diffraction: Mapping Functionality in Reciprocal Space at Nanometer Resolution

**ORGANIZERS:** Jim Ciston, Doug Medlin, Alex Eggemann

**Room C220** Convention Center

**TUESDAY** 8:30 AM, 10:30 AM, and 1:30 PM  
3:00 PM POSTER SESSION

**WEDNESDAY** 8:30 AM and 10:30 AM

Scanning microscopies drawing on the full field of reciprocal space are rapidly growing in development and application. Recording a full series of diffraction patterns mapped at nanometer resolution liberates the microscope from the limited geometries available for STEM detectors, but more importantly opens new modes for imaging that were previously inaccessible. In addition to structural imaging, it has become possible to map materials properties such as strain, electric/magnetic fields, and octahedral rotations at nanoscale resolution or better. Such developments are being catalyzed by the emergence of new, fast detectors for both electron microscopes and synchrotron sources. Few of these new methods provides a "direct" image, but rely instead upon extensive simulation and data reduction to extract meaningful information. This symposium focuses on the application of these new experimental techniques to nanoscale materials science as well as on the successes, challenges, and needs for the management, processing, and visualization of these large data streams.

## A10 Advances in Image Processing, Display, and Analysis

**ORGANIZERS:** William A. Heeschen, Clifford S. Todd, Kevin Eliceiri

**Room C115** Convention Center

**THURSDAY** 8:30 AM, 1:30 PM, and 3:30 PM  
10:00 AM POSTER SESSION

This symposium is focused on recent advances in digital image handling with emphasis on processing, display, and analysis. Potential topics are feature/pattern recognition, segmentation and classification, image transformation, alternate image representation, measurements, visual analytics, and advanced data analysis such as neural networks and machine learning. Advances in image management (storage, retrieval, format, etc.) and remote collaboration are also the scope of this symposium.

## A11 Advances in Scanning Electron/Ion Instrumentation and Detectors

**ORGANIZERS:** Brad Thiel, Matthew Phillips, Milos Toth

**Room C121-122** Convention Center

**MONDAY** 1:30 PM  
3:00 PM POSTER SESSION

**TUESDAY** 8:30 AM, 10:30 AM, and 1:30 PM

**WEDNESDAY** 8:30 AM

Recent advances in charged particle optics and instrumentation have the potential to revolutionize where, when and how scanning electron/ion microscopy is used. Miniature and microcolumns may permit SEM capability to be integrated into manufacturing equipment or combined with other analytical instrumentation. Arrays of minicolumns or single columns with beam splitters can provide high-throughput imaging of large areas at high resolution. New electron detector technologies are emerging which offer direct detection of lower energy electrons at high efficiency, and in some cases, energy filtering. Improved photon detectors are also enabling the use of cathodoluminescence in plasmonics research.

## A12 Research and Applications in Atom Probe Tomography

**ORGANIZERS:** Frederick Meisenkothen, Eric B. Steel

**Room C226** Convention Center

**WEDNESDAY** 10:30 AM and 1:30 PM

**THURSDAY** 8:30 AM, 1:30 PM, and 3:30 PM  
10:00 AM POSTER SESSION

Atom probe tomography (APT) is an emergent characterization technique with tremendous potential. To

fully realize this potential, researchers are actively exploring new application areas while simultaneously striving to improve the accuracy and reproducibility of the technique. This symposium is designed to bring together technicians, engineers, and scientists, from across disciplines, who share a common interest in atom probe tomography. The session encompasses research and applications spanning a wide variety of topics that include materials applications, optimization of acquisition conditions, correlative techniques, 3D reconstruction and data analysis, specimen preparation techniques, detector performance, modeling and measurements to understand the impact of specimen and instrument parameters, and accuracy and precision in APT measurements and the development of APT standards. (NOTE: Meeting attendees who are interested in this session should also consider attending the Atom Probe Pre-Meeting Congress "Essentials of Atom Probe Tomography" on Sunday, July 24)

## A13 In Situ Electron Microscopy and Big Data Analytics in 2D and 3D

**ORGANIZERS:** Huolin Xin, Peter Ercius, Kai He

**Room C221** Convention Center

**TUESDAY** 10:30 AM and 1:30 PM

**WEDNESDAY** 8:30 AM, 10:30 AM, and 1:30 PM  
3:00 PM POSTER SESSION

**THURSDAY** 8:30 AM, 1:30 PM, and 3:30 PM  
10:00 AM POSTER SESSION

The need to measure functionality and dynamics of nanomaterials in liquids and gases calls for imaging tools with high-throughput, spatial resolution, and analytical sensitivity. This symposium is dedicated to the development of advanced techniques for in situ S/TEM including realistic sample environments with functional stimuli and measurements, developments in high-throughput analytical dynamical imaging, big data analysis, and sample-beam interactions. Papers of work highlighting applications of environmental TEM in electrochemistry, nucleation and growth, catalysis, corrosion, and biological processes are also presented. Particular emphasis of this symposium is given to improvements in the time resolution of quantitative imaging by STEM-EELS, STEM-EDX, EF-TEM, ADF-STEM, STEM tomography, etc., for in situ and environmental experiments.

## A14 Single Atom Electron Microscopy and Spectroscopy

**ORGANIZERS:** Jingyue (Jimmy) Liu, Larry Allard  
**Room C212** Convention Center  
**WEDNESDAY** 8:30 AM, 10:30 AM, and 1:30 PM  
 3:00 PM POSTER SESSION

Atoms, the basic building blocks of matter, make up the universe and all life forms. Many factors affect how atoms behave, for example, how they are bonded to other atoms. The macro-properties of matter depend on the geometrical arrangement and the bonding of the individual atoms. Aberration-corrected electron microscopes make it possible to analyze the behavior of individual atoms, either supported on a substrate or embedded in a matrix. Spectroscopy techniques such as XEDS and EELS can be utilized to not only identify the nature of the individual atoms of interest but also investigate their electronic structure or oxidation state. This symposium provides a platform to bring together researchers from a variety of disciplines to highlight the most recent progress in characterizing the nature of individual atoms, studying their interactions with the surrounding environment, and investigating their unique properties. The symposium focuses on all aspects of imaging and analyses of, supported or embedded single atoms and the correlation of these observations with their functional properties; e.g., electrical, magnetic, catalytic, etc.

## A15 Quantitative Measurement of Intensities and Distances in Electron Microscopy

**ORGANIZERS:** James LeBeau, Jinwoo Hwang  
**Room C212** Convention Center  
**MONDAY** 1:30 PM  
 3:00 PM POSTER SESSION  
**TUESDAY** 8:30 AM, 10:30 AM, and 1:30 PM

Within the past few years, major breakthroughs have been achieved for quantifying the entire electron microscopy image (intensities, distances, phase, and amplitude). This symposium covers recent advances in accurate/precise measurements in both conventional high resolution and scanning transmission electron microscopies. Invited papers include technique development and applications where having an absolute, quantitative scale is critical to gaining new material insights. In particular, this symposium focuses on unique and innovative approaches to solve the challenges associated quantifying images. The target attendees are a broad mix of materials scientists and physicists aiming to extract more information from their electron microscopy data.

## A16 New Frontiers in Monochromated EELS

**ORGANIZERS:** Ian MacLaren, Peter Crozier  
**Room** C224-25 Convention Center  
**WEDNESDAY** 1:30 PM  
 3:00 PM POSTER SESSION  
**THURSDAY** 8:30 AM, 1:30 PM, and 3:30 PM  
 10:00 AM POSTER SESSION

Using EELS and EELS spectrum imaging with new monochromated instruments offering <200 meV energy resolution will revolutionize our understanding of nanoscale processes in materials, nanostructured systems and devices. Specifically, it will have a huge impact on our understanding on the nanoscale localization of low energy excitations in solids, including in plasmonics, vibrational spectroscopy, and interband transitions. Papers on instrumentation and technique development, applications and data analysis, theory, and correlation to complementary techniques are presented.

## B

### BIOLOGICAL SCIENCES SYMPOSIA

#### B01 Nanostructured Scaffolds for Regenerative Medicine

**ORGANIZERS:** Marco C. Bottino, Caroline A. Miller

**Room C110** Convention Center

**MONDAY** 1:30 PM

The principles of tissue engineering for regeneration involve the combination and interplay of three major elements such as scaffolds, stem cells, and cell signaling molecules. Advances in the science and technology of nanomaterials have led to increased enthusiasm for approaches such as electrospinning of nanofibers. In recent years, regenerative medicine has changed the therapeutics of a wide range of diseases. This symposium brings materials scientists, chemical/biomedical engineers, cell biologists, and clinician-scientists that provide research evidence on the major areas relevant to nanostructured scaffolds development for regenerative medicine. Discussions of the latest research approaches and technologies helps propose future directions targeting clinical use.

#### B02 New Technologies for Digital Pathology

**ORGANIZERS:** Rohit Bhargava, David Mayerich

**Room C110** Convention Center

**TUESDAY** 8:30 AM  
3:00 PM POSTER SESSION

A wealth of technologies is changing the traditional approach of careful sample preparation, staining, and manual recognition with light microscopy. New instrumentation for microscopy in different spectral regions, recognition algorithms, and imaginative new applications are merging in emerging digital pathology applications that promises more effective medical care and decision-making. This symposium explores the multifaceted activities related to microscopy for digital pathology. Experts describe cutting edge research in all three areas, with emphasis on innovative new solutions to traditional problems in pathology.

#### B03 Super-resolution Visualization of Cellular and Intercellular Processes in Health and Disease

**ORGANIZER:** Rob Gourdie

**Room C111** Convention Center

**WEDNESDAY** 8:30 AM  
3:00 PM POSTER SESSION

The 2014 Nobel Prize was awarded to Eric Betzig, W.E. Moerner and Stefan Hell for the development of super-resolved fluorescence microscopy, which has enabled imaging of cellular nanostructure at resolutions an order of magnitude below the Abbe limit of 200 nm. Super-resolution microscopy shifts the paradigm — with an impact on the field of cell biology comparable to the advent of laser scanning confocal microscopy or electron microscopy. This session covers examples of the application of both stochastic (e.g., PALM, STORM) and deterministic (e.g., STED, SSIM) super-resolution technologies to study homeostatic and diseased cells at the nanoscale.

#### B04 Microscopy and Morphogenesis

**ORGANIZERS:** Rich Goodwin, Jay Potts

**Room C111** Convention Center

**WEDNESDAY** 10:30 AM and 1:30 PM  
3:00 PM POSTER SESSION

Despite centuries of investigation, how biological organisms grow and develop specific shapes, colors, and structures is largely unknown. Yet, it is critically important for the continuity of life that certain shapes and structures be constructed in a precise and reproducible fashion. A fundamental problem facing investigation of the morphogenesis is the temporal and spatial resolution necessary to observe growing and differentiating cells over extended periods of time. The advent of new imaging and analytical tools promises to shed light on the cellular and molecular processes that drive the development of biological forms. This session focuses on how these new technologies are answering long held questions.

#### B05 Pathology: When Normal Goes Wrong

**ORGANIZERS:** Jay Jerome, Bill Gunning

**Room C110** Convention Center

**TUESDAY** 10:30 AM and 1:30 PM  
3:00 PM POSTER SESSION

Pathological situations are just those in which the homeostatic balance becomes disrupted outside of the range of cells, tissues, or organs to compensate effectively. This puts the organism in jeopardy. This session explores the underlying mechanisms of known homeostatic disruptions occurring in specific disease states, the consequences of the disruptions and possible therapies to restore balance. Although we explore individual disease states, we highlight the commonality of certain disruptions across diseases to encourage cross-discipline discussion.

## **B06 Pharmaceuticals and Medical Science**

**ORGANIZERS:** John Bruce Green, Bridget Carragher

**Room C111** Convention Center

**TUESDAY** 8:30 AM, 10:30 AM, and 1:30 PM  
3:00 PM POSTER SESSION

This symposium covers diverse content related to the research, development, manufacturing, and use of both pharmaceuticals and medical products. It includes discussions of new approaches to the characterization and understanding of pharmaceuticals as well as detailed case studies. These presentations generally address the unique challenges related to drug discovery, vaccine research, formulation, biocompatibility, production, product life cycle, medical product implementation, regulatory issues, and eventual patient use. Research topics include any of the instruments and methods found at the exposition, ranging from microCT for whole device imaging right down to high-resolution TEM for structural biology of vaccines.

## **B07 3D Structures of Macromolecular Assemblies, Cellular Organelles, and Whole Cells**

**ORGANIZERS:** Elizabeth R. Wright, Teresa Ruiz, Kristin N. Parent

**Room C115** Convention Center

**MONDAY** 1:30 PM  
3:00 PM POSTER SESSION

**TUESDAY** 8:30 AM and 10:30 AM

Our understanding of the 3D structure and functional subtleties of cells, microorganisms, and macromolecular assemblies has experienced great advances through recent developments of EM techniques and hybrid methodologies. This symposium highlights structural and ultrastructural studies of cells, microorganisms, and macromolecules using a variety of structural and hybrid techniques including electron tomography, electron crystallography, single-particle EM analysis, EM helical reconstruction, scanning and transmission electron microscopy, atomic force microscopy, x-ray crystallography, and modeling. Topics include eukaryotic and prokaryotic architecture, cellular metabolism, cell division and protein translation, cellular secretion, adhesion and motility, cell-cell communication and signaling, virus structure and virus-host interactions, and all aspects of structure and function of macromolecular assemblies.

## **B08 Utilizing Microscopy for Research and Diagnosis of Diseases in Humans, Plants, and Animals**

**ORGANIZERS:** Jon Charlesworth, Greg Ning, Betty Thompkins, Caroline Miller

**Room C114** Convention Center

**TUESDAY** 8:30 AM and 10:30 AM  
3:00 PM POSTER SESSION

Microscopy is not only useful but also critically important in the ongoing research, detection, diagnosis, and treatment of disease. Advances that improve rapid and accurate detection and treatment often involve the use of various microscopic techniques. These varied techniques provide us with an improved ability to diagnose and research the origins, development, and response of diseases in human, plant, and animal specimens. This is an opportunity to share information on the investigation of pathogenic cells, tissues, and entire organisms in clinical, diagnostic, and research laboratories. Emphasis is placed on using latest microscopy in both clinical and research laboratories.

**P**

## PHYSICAL SCIENCES SYMPOSIA

### **P01 Dr. Gareth Thomas Symposium: Materials Solutions Through Microscopy**

**ORGANIZERS:** David B. Williams, Ron Gronsky

**Room C214** Convention Center

**TUESDAY** 8:30 AM, 10:30 AM, and 1:30 PM  
3:00 PM POSTER SESSION

Gareth Thomas was primarily responsible for the growth of transmission electron microscopy to become the characterization tool for materials in the USA and around the world. Building on a large group of graduate students, postdocs, and international collaborators at University of California, Berkeley for almost 50 years from 1959 until the early 2000s, his ideas and his students diffused throughout the world of TEM. Together they transformed the TEM from a physics-based instrument for the study of electron scattering into a practical tool for the complete characterization of the physical, chemical, mechanical, electrical, and magnetic properties of crystalline materials. Many of the early fundamental studies of phase transformations and defects in crystalline materials can be traced to Gareth's influence: aluminum and Ni-base alloys and steels, through silicon-based ceramics, superconductors, and magnetic materials. Gareth's single-minded focus on creating the National Center for Electron Microscopy introduced many materials scientist to the need for thinking BIG about the future of the field. He was among the first electron microscopists to take a university leadership position, acting as Vice Chancellor for Student Affairs at Berkeley, during the troubled times around 1970. He was among the first to understand the need to commercialize some of our discoveries by starting companies based on his own research. In so many areas Gareth was ahead of his time and this symposium will gather many of his former students and what's left of his contemporaries to honor his achievements by showing how his influence continues to transform the combined fields of materials science and transmission electron microscopy.

### **P02 Electron Microscopy of Materials for Electrochemical Power Systems**

**ORGANIZERS:** Mark Aindow, Karren L. More

**Room E160** Convention Center

**MONDAY** 1:30 PM  
3:00 PM POSTER SESSION

**TUESDAY** 8:30 AM, 10:10 AM, and 1:30 PM

**WEDNESDAY** 8:30 AM, 10:10 AM, and 1:30 PM  
3:00 PM POSTER SESSION

This symposium highlights the roles of electron microscopy imaging, diffraction, and spectrometry in studies of materials,

components, and devices for electrochemical power systems. There are many different types of electrochemical systems; each of these presents its own materials-related technological challenges and microscopy is an essential tool for elucidating the materials degradation mechanisms and for developing new materials with significantly enhanced stability, durability, and performance. Papers in the areas of energy materials, such as electrocatalysts and catalyst supports, electrolytes, electrodes, interconnects and seals, as well as membrane electrode assemblies and complete cells/stacks are presented. Several sessions emphasize the microscopic and spectroscopic techniques used to study component materials and aging phenomena, whereas others are devoted to particular types of materials and cell technologies, including materials optimization and new materials development.

### **P03 Combining Simulation, Experiment, and Data Science for Materials Characterization and Design**

**ORGANIZERS:** Paul Voyles, Jinwoo Hwang, Mark Oxley

**Room C210** Convention Center

**WEDNESDAY** 10:30 AM and 1:30 PM  
3:00 PM POSTER SESSION

**THURSDAY** 8:30 AM, 1:30 PM, and 3:30 PM  
10:00 AM POSTER SESSION

Simulation of complex electron scattering phenomena is an essential tool for understanding microscopy data, which in turn provide essential constraints on materials simulations such as density functional theory and molecular dynamics. This symposium covers advances in simulation methods and new discoveries enabled by combining simulations and experiments. It also includes application of methods from data science, including machine learning and image processing that enable automated, quantitative analysis of microscopy data and simulations, and the use of microscopy to inform simulation-aided materials design in the spirit of the Materials Genome Initiative.

### **P04 Nuclear and Irradiated Materials**

**ORGANIZERS:** Chad M. Parish, Khalid Hattar,  
Peter Hosemann

**Room E160** Convention Center

**THURSDAY** 8:30 AM, 1:30 PM, and 3:30 PM  
10:00 AM POSTER SESSION

Materials in fission, fusion, accelerator, or space environments are subjected to irradiation and can undergo significant compositional and structural evolution as a result. Because damage cascades and transmutation are atomistic processes, understanding and predicting the changes in properties and performance in radiation environments require atomistic and microstructural tools. Radiation environments vary

from cryogenic temperatures, high energy, and low flux environments often found in space applications, to neutron damage of liquid helium cooled superconductors and 1200°C tungsten under helium and neutron bombardment in a fusion reactor. Modern microscopy and microanalysis tools provide the means to study not only the smallest defects at the atomic scale, but also the real-time evolution of radiation damage. Coupling these techniques with modeling can enable the understanding to be extended from nanometer through millimeter or larger. This symposium brings together instrumentation, modelling, and applications expertise to advance the science of materials for radiation environments.

## **P05 Microscopy for Thin Films of Metals, Semiconductors, and Insulators**

**ORGANIZERS:** Laxmikant V. Saraf, C. Barry Carter

**Room C114** Convention Center

**WEDNESDAY** 8:30 AM, 10:30 AM, and 1:30 PM  
3:00 PM POSTER SESSION

**THURSDAY** 8:30 AM, 1:30 PM, and 3:30 PM  
10:00 AM POSTER SESSION

This symposium emphasizes advances in S/TEM especially when linked to other microscopies as applied to metal, semiconductor, and insulator, i.e., inorganic, thin films. Defects in thin films, whether single layer or multilayer stacks, epitaxial (epitactic) or polycrystalline, must be characterized by combining analytical tools. Defects determine the physical and chemical properties in most thin films and thus control materials performance. This symposium covers all aspects of microscopy-based characterization of thin films produced using MBE, CVD, and other methods, including sputter deposition (DC/RF), evaporation, physical vapor deposition, e-beam evaporation, PLD, and ALD. Comparable studies of thin film growth using techniques suitable for deposition in other environments such as sol-gel, dip coating, casting, spray pyrolysis and exfoliation processes are presented. Studies using *i* or *operando* methods, or that combine different microscopies, are also presented. Applications of such studies include all aspects of detector/sensor technologies and development of alternative energy technologies.

## **P06 Magnetic Materials, Phenomena, and Imaging at the Nanoscale**

**ORGANIZERS:** Marc De Graef, Amanda Petford-Long

**Room C213** Convention Center

**MONDAY** 1:30 PM  
3:00 PM POSTER SESSION

**TUESDAY** 8:30 AM and 10:30 AM

A full understanding of bulk and nanoscale magnetic materials requires local probes that explore the magnetic

structure and its response to applied fields/temperature at appropriate length scales, and that correlate this with microstructure and chemistry. Suitable techniques include Lorentz TEM including differential phase contrast, holography, and other phase reconstruction methods, electron energy loss spectroscopy, dichroism techniques including vortex beam studies, magnetic force microscopy, and spin-polarized STM. The symposium brings together experimentalists involved in applying/developing these techniques, in addition to those involved in image simulations or the development of theory to explain quantitatively the observed magnetic contrast.

## **P07 Failure Analysis Applications of Microanalysis, Microscopy, Metallography, and Fractography**

**ORGANIZERS:** Daniel P. Dennies, Noah Budiansky, William Kane

**Room C215** Convention Center

**TUESDAY** 8:30 AM and 10:30 AM  
3:00 PM POSTER SESSION

This symposium is a forum for the exchange of information and knowledge regarding the use of microanalysis, microscopy, metallography, and fractography in materials-related failure analysis. Papers include those involving failure investigations where microstructures, metallography, and fractography are critical to identifying the root cause. Of particular interest are unique, innovative, and/or challenging applications of microscopy, metallography, fractography, and sample preparation in failure analysis. Target attendees include engineers and scientists from all levels of analytical expertise and all related backgrounds, not just materials engineers.

## **P08 Microscopy of Additive Manufacturing and 3D Printing in Materials and Biology**

**ORGANIZERS:** Manuel Garcia-Leiner, Daniel P. Dennies, Michael Yost

**Room C213** Convention Center

**THURSDAY** 8:30 AM, 1:30 PM, and 3:30 PM  
10:00 AM POSTER SESSION

Additive manufacturing/3D printing encompasses multiple methods for building parts directly from feedstock such as powders, filaments, wires, and biomaterials with only minimal or no post build machining to produce a final shape. Resultant microstructures can be unique to the process and properties can be strongly dependent on such microstructures. In recent years, technologies have been developed for the additive manufacturing of polymers, metals, ceramics, and biomaterials. In general, processes include powder-based fusion processes as well as extrusion or spray processes for the design of complex,

highly functional parts. These days, additive manufacturing techniques are introduced to highly demanding, and highly specialized applications. More recently, biological and medical opportunities have sprung up taking advantage of 3D bioprinting. Implantable devices, heart valves, blood vessels, and whole organs have begun to be manufactured. Each of these processes brings unique challenges to build parts and tissues that meet specifications and biocompatibility. Papers highlight additive manufacturing and 3D printing in all areas of science from metals, polymers, and ceramics to specific developments in biology and medicine.

## **P09 From Angstrom to AU: Studies of Planet-Forming Materials**

|                    |                                                                  |
|--------------------|------------------------------------------------------------------|
| <b>ORGANIZERS:</b> | <b>Eve L. Berger, Francis M. McCubbin, Adrian J. Brearley</b>    |
| <b>Room C113</b>   | <b>Convention Center</b>                                         |
| <b>MONDAY</b>      | <b>1:30 PM<br/>3:00 PM POSTER SESSION</b>                        |
| <b>TUESDAY</b>     | <b>8:30 AM, 10:30 AM, and 1:30 PM<br/>3:00 PM POSTER SESSION</b> |

Micro and nanoscale analyses of planetary materials, e.g., meteorites, IDPs, asteroidal and Lunar return samples, and experimental and terrestrial analogs, inform our understanding of our solar system's history. With the development of new techniques and novel implementations (EPMA, EELS, EDS, SIMS, FTIR, APT, EBSD, XCT, microscale geochronology, etc.) we further maximize the information gleaned from small-sample analyses. This symposium reports current research milestones gained through the use of these techniques, both individually, and as part of coordinated analyses of planetary materials.

## **P10 Microscopy and Characterization of Ceramics, Polymers, and Composites**

|                    |                                                                  |
|--------------------|------------------------------------------------------------------|
| <b>ORGANIZERS:</b> | <b>Richard E. Chinn, Ronald J. Parrington</b>                    |
| <b>Room C214</b>   | <b>Convention Center</b>                                         |
| <b>WEDNESDAY</b>   | <b>8:30 AM, 10:30 AM, and 1:30 PM<br/>3:00 PM POSTER SESSION</b> |
| <b>THURSDAY</b>    | <b>8:30 AM</b>                                                   |

Ceramics, polymers, and composites are key materials in many industrial applications, including cutting-edge technologies such as ceramic matrix composites (CMC) for high temperature gas turbine applications. This symposium examines the materialography, fractography, microscopic examination, and characterization of ceramics, polymers, and composites. While papers of traditional approaches to nonmetallic material microscopy and evaluation are presented, papers that address new and innovative sample preparation and evaluation techniques are of special interest.

## **P11 Metallography and Microstructural Characterization of Metals**

|                    |                                                        |
|--------------------|--------------------------------------------------------|
| <b>ORGANIZERS:</b> | <b>Coralee McNee, George Vander Voort</b>              |
| <b>Room C112</b>   | <b>Convention Center</b>                               |
| <b>TUESDAY</b>     | <b>10:30 AM and 1:30 PM<br/>3:00 PM POSTER SESSION</b> |
| <b>WEDNESDAY</b>   | <b>8:30 AM, 10:30 AM, and 1:30 PM</b>                  |

The field of metallurgy and materials science offers many challenges for revealing and characterizing the microstructure of metals and alloys. The art and science of metallography continues to advance to meet these challenges with new automated techniques for preparing and evaluating both new materials and traditional engineering alloys. This symposium covers all aspects of specimen preparation and evaluation for metals, microelectronics, and virtually any other metallic material, as they influence characterization techniques. The influence of specimen preparation upon properly revealing and characterizing microstructure will be the central focus of this symposium covering applications of light microscopy, quantitative metallography and image analysis, micro-indentation hardness, SEM imaging and EMPA, TEM, EBSD or WDS/EDS analysis, and any other relevant method.

## **P12 Microscopy and Analysis in Forensic Science**

|                    |                                                                  |
|--------------------|------------------------------------------------------------------|
| <b>ORGANIZERS:</b> | <b>S. Frank Platek, Stefanie L. Heckman</b>                      |
| <b>Room C213</b>   | <b>Convention Center</b>                                         |
| <b>WEDNESDAY</b>   | <b>8:30 AM, 10:30 AM, and 1:30 PM<br/>3:00 PM POSTER SESSION</b> |

The symposium topics include the application of light and electron microscopy including x-ray microanalysis, confocal microscopy, atomic force microscopy, FT-IR imaging and Raman mapping, and 3D surface metrology in forensic case samples and research. Topics include case histories and types of evidence presented for examination, identification of trace evidence, and sample preparation for microscopic examination. Also included are the interpretations of case-related microscopic and spectral results, forensic research topics as well as preparation and presentation of the results of microscopic analyses of trace evidence for court testimony.

The Technologists' Forum is a committee dedicated to the growth and development of technologists within the Microscopy Society of America. The Forum organizes a symposium, special topics/lecture workshops, and roundtable discussions and an exhibit booth at the annual M&M meeting. A semiannual newsletter, website, and bulk e-mailer are used to increase contact among its members and expand their participation to MSA. Forum services that are available to members include the Microscopy Facilities Directory. The Forum also sponsors the Professional Technical Staff Awards; it is a competitive program to encourage participation of the technologists at the annual meeting.

## **X30 Technologists' Forum: Real Analysis Data vs Artifact Recognition**

**ORGANIZERS:** Cathy Johnson and Caroline Miller

**Tuesday 8:30 AM • Room: C125 • Convention Center**

Critical to every researcher and technologist is the ability to identify and interpret data correctly. Incorrect and incomplete specimen preparation often results in compromised data, without any perception by the end user. This symposium allows you to improve your skills at recognizing both preparation and imaging artifacts that too often occur in today's published research. Guidance on improving analysis data is also offered. This Tech Forum Platform session reviews artifact identification in various Cryo-SEM and TEM techniques, in addition to room temperature imaging and analysis.

## **X31 Technologists' Forum Special Topic: A Practical Approach to Current Software Solutions and Their Applications**

**ORGANIZERS:** Frank Macaluso and Caroline Miller

**Tuesday 1:30 PM • Room: C125 • Convention Center**

Image analysis is an integral component of every imaging experiment for extracting quantitative information for meaningful presentation of image data. Freeware and commercial software packages are available for a myriad of applications including finding shapes, counting objects, measuring object properties, particle tracking, deconvolution, single particle reconstruction, morphometric analysis, 3D visualization and 4D quantitative analysis. This session features a practical approach to current software solutions and their applications.

## **X32 Technologists' Forum Roundtable: Discussion on Artifacts**

**PANELISTS:** E. Ann Ellis, Lee Cohen-Gould, and Vicky Bryg

**Tuesday 10:30 AM • Room: C125 • Convention Center**

This forum will be a continuation and further discussion of the artifacts and the interpretation of micrographs as it applies to material, biological, or cryo samples. Panelists include Core Facility directors and speakers from the special topic session who are able to respond to questions from participants about how to recognize artifacts, determine their cause(s), and correct procedures. Participants will thus be able to take this information home with them to successfully deal with these problems in their own labs and will be better able to explain the importance of following proper SOPs to their clients.

The physical sciences and biological sciences tutorials serve mainly as an educational tool for attendees of the annual Microscopy & Microanalysis meeting by affording a select number of researchers to give extended lectures on the practical aspects of certain microscopy techniques, methods, and computations. Generally focused on cutting-edge and/or immediately relevant microscopy, the tutorials give speakers the opportunity to venture well beyond the cursory introductory material of a platform presentation, which provides attendees with an in-depth and practical understanding of a given technique.

## BIOLOGICAL SCIENCES TUTORIALS

One Continuing Microscopy Education Unit is available for each Biological Sciences Tutorial attended (*fee \$10/members; \$50/non-members; register and pay at Registration Desk*)

**ORGANIZER:** Scott Stagg, Florida State University

### X40 Career Tracks in Government and Industry: A Panel Discussion

**INSTRUCTORS:** Benjamin Bammes, Gabriella Kiss, Paula Flicker, Scott M. Stagg

**Wednesday 8:30 AM • Room: C211 • Convention Center**

The instructors for this tutorial work in academia, industry, and government. Each of them discuss their careers in science and the strategies that they used to secure essential training and employment. The format of the tutorial includes the speakers' individual experiences and conclude with a roundtable discussion.

### X41 Effective Tactics for Getting an Equipment Grant

**INSTRUCTOR:** Ken Taylor

**Wednesday 1:30 PM • Room: C211 • Convention Center**

The instructor for this tutorial has been writing NIH and NSF shared instrumentation grants for 33 years (success rate 100%) and has been reviewing them for the NIH for 28 years, most recently in 2015. The tutorial draws on his experience.

### X42 Building and Validating Atomic Models for EM Density Maps

**INSTRUCTOR:** Matthew Baker

**Tuesday 1:30 PM • Room: C211 • Convention Center**

With a rapidly growing number of cryoEM structures achieving resolutions beyond 5Å, accurate interpretation of these density maps in terms of atomistic detail has become paramount in deciphering macromolecular structure and function. In this tutorial we discuss a number of software utilities for modeling protein structure in cryoEM density maps. In particular, we focus on our interactive model building toolkit, Gorgon, as well as our fully automated de novo modeling approach, Pathwalking. A short hands-on demonstration will provide new and existing users of the software with an overview of all of the latest features found in these tools. In addition, we also highlight Gorgon's new flexible fitting routine and our new model validation services.

## PHYSICAL SCIENCES TUTORIALS

One Continuing Microscopy Education Unit is available for each Physical Sciences Tutorial attended (*fee \$10/members; \$50/non-members; register and pay at Registration Desk*)

**ORGANIZER:** Patrick Phillips, University of Illinois, Chicago

### X43 Diffraction Mapping and 4D STEM

**INSTRUCTOR:** Christopher Gammer

**Thursday 8:30 AM • Room: C211 • Convention Center**

- Recent developments in fast electron detectors enable recording maps of diffraction patterns during STEM acquisition
- The recorded dataset allows reconstruction of virtual diffraction patterns from arbitrarily small regions or virtual dark-field images with specifically designed apertures
- Strain mapping using nanobeam electron diffraction combines nanometer resolution with a high precision and a very large field of view

### X44 Compressive Sensing Applications in Microscopy

**INSTRUCTOR:** Andrew Stevens

**Wednesday 10:30 AM • Room: C211 • Convention Center**

- Compressive sensing (CS) background
- How CS is different from traditional low dose and high-speed techniques
- Some approaches for CS microscopy (e.g., scanning probe, parallel beam, spectroscopy)
- Implementation difficulties

## O

### MICROSCOPY OUTREACH SESSIONS

Local educators and registered conference attendees are invited to participate in presentations, round table discussions, and demonstrations of effective strategies for microscopy outreach and education from K-12 and beyond. This session shows how microscopy in education serves as an important learning tool for inspiring our future STEM professionals. Those involved in microscopy education or educational outreach present about their successful program or lesson.

#### **X90 Microscopy in the Classroom - Strategies for Education and Outreach**

**SESSION CHAIRS:** Alyssa Waldron, Dave Becker

**Tuesday 8:30 AM and 10:30 AM**

**Room:** C123-124 • Convention Center

- Best Practices for incorporating microscopy into K-12 classrooms and curricula
- Corporate and academic institutions and programs involved in microscopy outreach, both locally and nationally
- Methods to expose students to microscopy in an engaging and successful manner

#### **X91 It's a Family Affair! Hands-on Microscopy for Kids of All Ages – All are Welcome!**

**INSTRUCTOR:** Elaine Humphrey

**Wednesday 1:30 PM • Room:** C121-121 • Convention Center

This exciting session will pique the scientific interest of children of all ages - no previous microscopy experience needed!

- Program designed for the delegates' families and friends
- Hands-on activities and demonstrations will prove that science is fun
- Solve the mystery using clues left at the scene of the crime using electron microscopes on the exhibit floor

Delegates who wish to develop outreach opportunities at their home institutions are encouraged to attend.

#### **X92 A Project MICRO Workshop**

**INSTRUCTORS:** Elaine Humphrey, Caroline Schooley

- The Project MICRO workshop will change its venue this year to the MegaBooth all week after the Exhibit Hall opens
- Visit the Outreach booth every day to see how to set up different stations in a classroom
- How to have fun with microscopy outreach and kids (adults love this too)
- Get to see different microscope systems for use in a classroom, in action

#### **EXHIBITOR/VENDOR TUTORIALS AND DEMOS**

**ORGANIZER:** MSA Education Committee

**Monday, Tuesday & Wednesday July 25-27**

**5:45 PM - 6:45 PM**

**Exhibit Hall**

Be the FIRST to demo the latest and greatest CUTTING EDGE technology from the vendors! Most all of the vendors release new products at M&M. This is your chance to be the FIRST to see these technological advancements! Signup information with titles and descriptions are at the MSA Education table in the MSA MegaBooth. *You must sign up in advance!* When you sign up you will be issued a ticket, which you will need to access the Exhibit Hall after it closes at 5:30 PM.

## M&M 2016 PLENARY LECTURES AND AWARDS

### SESSION CHAIRS:

Mike Marko, MSA President  
Thomas F. Kelly, MAS President  
Jaret J. Frafjord, IMS President  
Joseph R. Michael, M&M 2016 Program Chair

### Monday 8:30 AM • Union Station Ballroom

#### 8:30 AM OPENING WELCOME:

Mike Marko, MSA President  
Thomas F. Kelly, MAS President  
Jaret J. Frafjord, IMS President

#### 9:00 AM M&M PLENARY LECTURE

*Beyond the Limits of Microscopy: Revealing the Unseeable Through Hollywood Visual Effects*  
Drew Berry; The Walter + Eliza Hall Institute of Medical Research, Australia

#### 10:00 AM MAS Awards Presentation

#### 10:15 AM IMS Awards Presentation

#### 10:30 AM Coffee Break, Ballroom Foyer

#### 10:50 AM MSA Awards Presentation

#### 11:00 AM M&M Meeting Awards Presentation

#### 11:15 AM M&M Plenary Lecture

*Materials for the 21st Century*  
Mark Miodownik; University College London, United Kingdom

## ADVANCES IN INSTRUMENTATION SYMPOSIA—MONDAY AFTERNOON

### A04.1 Advances in FIB Instrumentation and Applications in Materials and Biological Sciences

#### SESSION CHAIR:

Lucille Giannuzzi, EXpressLO LLC

#### PLATFORM SESSION

#### Monday 1:30 PM • Room: C216

- 1:30 PM **3** *Simple Specimen Preparation Method for In Situ Heating Experiments*; Q Wang, J Wang, MJ Kim; The University of Texas, Dallas
- 1:45 PM **4** *Manipulation of Ceramic Fibers to EXpressLO™ Grids for FIB/TEM Analysis*; LA Giannuzzi; EXpressLO LLC; SL Harrison, KL Williams, RK Goduguchinta, EG Vaaler, JL Schneider, J Pegna; Free Form Fibers LLC
- 2:00 PM **5** (INVITED) *Focused Ion Beam on Radioactive Specimens: Operational Challenges and Approach*; A Parsi, PD Freyer; Westinghouse Electric Company LLC
- 2:30 PM **6** *Quantification of STEM-EDS with Ion Implantation*; Y Liu, R Garcia, FA Stevie; North Carolina State University
- 2:45 PM **7** *Nanoscale Analysis of Humidity Dependent Tonal Appearance of Platinum/Palladium Prints*; K Scott; National Institute of Standards and Technology; ML Clarke; Smithsonian Institution; A Myers; National Institute of Standards and Technology

### A06.1 Analytical Electron Microscopy for Advanced Characterization from Multi-Dimensional Data Acquisition to Integrated Analysis

#### SESSION CHAIRS:

Chaoying Ni, University of Delaware  
Peter van Aken, Max Planck Institute for Solid State Research  
Masashi Watanabe, Lehigh University

#### PLATFORM SESSION

#### Monday 1:30 PM • Room: C224-25

- 1:30 PM **8** (INVITED) *Fast Aberration Measurement in Multi-Dimensional STEM*; AR Lupini, M Chi, SV Kallinin, AY Borisevich, JC Idrobo, S Jesse; Oak Ridge National Laboratory
- 2:00 PM **9** *Application of High Speed Cameras for 4D Data Collection in S/TEM*; A Pakzad; C Czarnik; Gatan Inc.; R Geiss, E Jackson; Colorado State University; D Mastronarde; University of Colorado, Boulder
- 2:15 PM **10** *Electric and Magnetic Field Mapping with the pnCCD (S)TEM Camera*; M Huth, S Ihle, R Ritz, M Simson, H Soltau; PNDetector GmbH, Germany; V Migunov, M Duchamp, R Dunin-Borkowski; Ernst Ruska-Centre, Forschungszentrum Jülich, Germany; et al.
- 2:30 PM **11** **M&M 2016 STUDENT AWARDEE** *Reverse Engineering Cadmium Yellow Paint from Munch's "The Scream" with Correlative 3D Spectroscopic and 4D Crystallographic STEM*; B Levin, KX Nguyen, ME Holtz; Cornell University; MB Wiggins; University of Delaware; MG Thomas; Cornell University; ES Tveit; Munch Museum, Norway; JL Mass; Rijksmuseum, Netherlands; DA Muller; Cornell University, et al.
- 2:45 PM **12** *Simultaneous DualEELS and EDS Analysis Across the Ohmic Contact Region in FinFET Electronic Devices – Exploring the Effects of Electron Beam Damage*; P Longo; Gatan Inc.; H Zhang; Precision TEM, Inc.; RD Twisten; Gatan Inc

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION SYMPOSIA—MONDAY AFTERNOON *continued*

### A11.1 Advances in Scanning Electron/Ion Instrumentation and Detectors

#### SESSION CHAIR:

Brad Thiel, SUNY Polytechnic Institute

#### PLATFORM SESSION

Monday 1:30 PM • Room: C121-22

- 1:30 PM **13** (INVITED) *Multi-Beam Scanning Electron Microscope Design*; P Kruit, Y Ren; Delft University of Technology, Netherlands
- 2:00 PM **14** *Selective Detection of Backscattered Electrons in the Compound Lens Equipped UHR SEM*; P Wandrol, R Vašina; FEI Company, Czech Republic; AM Sandu, EJ Vesseur; FEI Company, Netherlands; L Tüma; FEI Company, Czech Republic
- 2:15 PM **15** *Design of an Ultra-High-Resolution SEM for Enhanced Analysis*; J Jiruše, M Havelka, J Polster; TESCAN Brno, s.r.o., Czech Republic
- 2:30 PM **16** (INVITED) *Miniature Electron Beam Columns: From the Lab to the Field*; LP Muray, S Davilla, JP Spallas; Keysight Technologies

### A15.1 Quantitative Measurement of Intensities and Distances in Electron Microscopy

#### SESSION CHAIR:

Jinwoo Hwang, Ohio State University

#### PLATFORM SESSION

Monday 1:30 PM • Room: C212

- 1:30 PM **17** (INVITED) *Quantification and Sensible Correction for Energy-Loss and Thickness-Dependent Contrast Complications in Atomic-scale Electron Energy-Loss Spectroscopy*; HL Xin; Brookhaven National Laboratory; H Tan; National Institute of Standards and Technology; C Dwyer; Arizona State University; Y Zhu; Monash University
- 2:00 PM **18** *Misalignment Induced Artifacts in Quantitative Annular Bright-Field Imaging*; P Gao; The University of Tokyo, China; A Kumamoto, R Ishikawa, N Lugg, N Shibata, Y Ikuhara; The University of Tokyo, Japan
- 2:15 PM **19** *Sample Tilt Effects on Atom Column Position Determination in ABF-STEM Imaging*; D Zhou; Max Planck Institute for Solid State Research, Germany; K Müller-Caspary; Universität Bremen, Germany; W Sigle; Max Planck Institute for Solid State Research, Germany; FF Krause, A Rosenauer; Universität Bremen, Germany; PA van Aken; Max Planck Institute for Solid State Research, Germany
- 2:30 PM **20** *Quantitative, Real-Space Statistical Analysis of Imperfect Lattices*; BH Savitzky, R Hovden, K Whitham, T Hanrath, LF Kourkoutis; Cornell University

- 2:45 PM **21** *Experimental Contrast of Atomically-Resolved Cc/Cs-Corrected 20-80kV SALVE Images of 2D-Objects Matches Calculations*; Z Li, J Biskupek, H Rose; Ulm University, Germany; M Linck, P Hartel, H Müller, M Haider; Corrected Electron Optical Systems GmbH, Germany, U Kaiser; Ulm University, Germany, et al.

B

## BIOLOGICAL SCIENCES SYMPOSIA— MONDAY AFTERNOON

### B01.1 Nanostructured Scaffolds for Regenerative Medicine

#### SESSION CHAIRS:

Marco C. Bottino, Indiana University

Caroline A Miller, Indiana University

#### PLATFORM SESSION

Monday 1:30 PM • Room: C111

- 1:30 PM **22** (INVITED) *Microporous Electrospun Scaffolds for Skin Repair and Regeneration*; PP Bonvallet, SL Bellis; University of Alabama, Birmingham
- 2:00 PM **23** (INVITED) *Nanofibers for Regenerative Dentistry: From Scaffolds to Drug Delivery Systems*; MC Bottino; Indiana University
- 2:30 PM **24** *3D Cell Culture and Microscopy in a Capsule with Scaffolds, Tumors & Stem Cells*; SL Goodman; Microscopy Innovations, LLC; T Lyden; University of Wisconsin-River Falls; W-J Li, T Yen; University of Wisconsin-Madison
- 2:45 PM **25** **M&M 2016 STUDENT AWARDEE** *The Prospective Application of Graphene Loaded Poly(4-Vinylpyridine) Fibrous Scaffolds on the Dental Pulp Stem Cells Proliferation and Differentiation*; L Zhang, C-C Chang, M Simon, M Rafailovich; Stony Brook University

### B07.1 3D Structures of Macromolecular Assemblies, Cellular Organelles and Whole Cells

#### SESSION CHAIRS:

Teresa Ruiz, University of Vermont

Kristin Parent, Michigan State University

#### PLATFORM SESSION

Monday 1:30 PM • Room: C115

- 1:30 PM **26** (INVITED) *Complete Cells and a Complete Scientist: A Tribute to Dr. Gina Sosinsky*; ME Martone; University of California, San Diego
- 2:00 PM **27** **MSA POST-DOCTORAL AWARDEE** *Strategies for CLEM Imaging*; CM Hampton, RS Dillard, TM Desai, M Marin, G Melikian, ER Wright; Emory University
- 2:15 PM **28** *Analysis of Mitochondrial Networks by Serial Block Face SEM*; RD Leapman, JD Hoyne, BC Kuo, GN Calco, G Zhang, MA Aronova; National Institutes of Health

2:30 PM **29** (INVITED) *The Structure of the Relaxed Thick Filaments from Lethocerus Flight Muscle*; Z Hu, DW Taylor; Florida State University; MK Reedy, RJ Edwards; Duke University Medical Center; KA Taylor; Florida State University

P

## PHYSICAL SCIENCES SYMPOSIA— MONDAY AFTERNOON

### P02.1 Electron Microscopy of Materials for Electrochemical Power Systems

#### SESSION CHAIR:

Karen L. More, Oak Ridge National Laboratory

#### PLATFORM SESSION

Monday 1:30 PM • Room: E160AB

1:30 PM **30** (INVITED) *Measuring Population Distributions and Catalytic Hierarchy of the Active Species in Gold on Metal Oxide Catalysts for Low Temperature CO Oxidation*; CJ Kiely; Lehigh University; Q He; Oak Ridge National Laboratory; S Freakley, JK Edwards, GJ Hutchings; Cardiff University, United Kingdom

2:00 PM **31** *Microstructural Transformations of  $\text{La}_{0.6}\text{Sr}_{0.4}\text{MnO}_3$  to Nano-Layered Mn Oxide During Electrochemical Water Oxidation*; B Deljoo, A Shirazi Amin; University of Connecticut; SE Balaghi, Y Mousazadeh; Islamic Azad University, Iran; T Jafari; University of Connecticut; MM Najafpour; Institute for Advanced Studies in Basic Sciences, Iran; SL Suib, M Aindow; University of Connecticut

2:15 PM **32** *Evolution of  $\text{Au}_{25}(\text{SR})_{18}$  Nanoclusters on Ceria Surfaces During In Situ Electron Beam Irradiation*; W Gao; University of California, Irvine; Z Wu; Oak Ridge National Laboratory; G Graham; University of Michigan; X Pan, K More; University of California, Irvine; M Chi; Oak Ridge National Laboratory

2:30 PM **33** (INVITED) *On the Study of PEM Fuel Cells by Transmission Electron Microscopy*; S Rasouli, D Groom, K Yu, A Godoy, A Bovik; University of Texas, Austin; D Myers; Argonne National Laboratory; N Nakashima; Kyushu University, Japan, PJ Ferreira; University of Texas, Austin

### P06.1 Magnetic Materials, Phenomena and Imaging at the Nanoscale

#### SESSION CHAIR:

Amanda Petford-Long, Argonne National Laboratory

#### PLATFORM SESSION

Monday 1:30 PM • Room: C213

1:30 PM **34** (INVITED) *Recent Advances and Future Opportunities with Magnetic Soft X-Ray Microscopy*; P Fischer; Lawrence Berkeley National Laboratory

2:00 PM **35** **M&M 2016 STUDENT AWARDEE** *Quantifying Magnetism on the nm Scale: EMCD on Individual FePt Nanoparticles*; SG Schneider, D Pohl; Leibniz-Institut für

Festkörper- und Werkstoffforschung, Dresden, Germany; S Löffler; Technische Universität Wien, Austria; D Kasinathan; Max Planck Institute for Chemical Physics of Solids, Germany; J Rusz; Uppsala University, Sweden; P Schattschneider; Technische Universität Wien, Austria; L Schultz, B Rellinghaus; Leibniz-Institut für Festkörper- und Werkstoffforschung, Dresden, Germany

2:15 PM **36** *Mapping Magnetic Ordering with Aberrated Electron Probes in STEM*; JC Idrobo; Oak Ridge National Laboratory; J Rusz, J Spiegelberg; Uppsala University, Sweden; MA McGuire, CT Symons, RR Vatsavai, C Cantoni, AR Lupini; Oak Ridge National Laboratory

2:30 PM **37** *Periodic Magnetization Pattern for Controlled Domain Wall Motion in Nanowires*; S Lopatin, YP Ivanov, J Kosel; King Abdullah University of Science & Technology, Saudi Arabia; A Chuvilin; CIC nanoGUNE, Spain

### P09.1 From Angstrom to AU: Studies of Planet-Forming Materials

#### SESSION CHAIR:

Eve L. Berger, NASA Johnson Space Center

#### PLATFORM SESSION

Monday 1:30 PM • Room: C113

1:30 PM **38** *Morphology of Cometary Dust at the Nanometre Scale Detected with MIDAS*; R Schmied, T Mannel, K Torkar, H Jeszenszky; Space Research Institute, Austria; J Romstedt; European Space Research and Technology Centre, Netherlands; MS Bentley; Space Research Institute, Austria

1:45 PM **39** *Atomic Resolution Analysis of Perovskite from the Early Solar System*; TJ Zega, V Magna, K Domanik, K Muralidharan; University of Arizona

2:00 PM **40** *Insights into Chondrule Formation Processes from EMP and LA-ICP-MS Analyses of Chondrule in a Chondrule from Allende*; J Das; Syracuse University; D Trail; University of Rochester; S Baldwin; Syracuse University

2:15 PM **41** (INVITED) *Cathodoluminescence Mapping of Chondrules and Their Constituents: Identification of Zoning Patterns in Olivine and Chondrules and Implications for Their Formation History and Parent Bodies Processes*; J Gross; Rutgers University; TL Dunn; Colby College

### Z02.1 Sorby Award Lecture

#### SESSION CHAIR:

Jaret J Frafjord, IMS President

#### PLATFORM SESSION

Monday 1:30 PM • Room: C123-124

1:30 PM **42** (INVITED) *From Correlative Microscopy to 3D Understanding of Material Microstructures*; F Muecklich; Universität des Saarlandes, Germany; D Britz; Materials Engineering Center Saarland, Saarbruecken, Germany; M Engstler; Universität des Saarlandes, Germany

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION POSTER SESSIONS—MONDAY AFTERNOON

### A06.P1 Analytical Electron Microscopy for Advanced Characterization from Multi-Dimensional Data Acquisition to Integrated Analysis

#### POSTER SESSION

Monday 3:00 PM • Room: Exhibit Hall

#### POSTER # 1

3:00 PM **43** *Initial Results from a CdTe High-Energy X-Ray Detector on a TEM*; HO Colijn, DW McComb; The Ohio State University

#### POSTER # 2

3:00 PM **44** *Atomic Resolution EELS Study of Polarization of BaTiO<sub>3</sub> in the Interface with Metallic Manganite*; X Hu, P Phillips, R Klie; University of Illinois, Chicago

#### POSTER # 3

3:00 PM **45** *Effective Method for Decreasing Detection Limit of Dopant Concentration in Semiconductor Using Dual SDD Analysis System*; K-I Fukunaga, N Endo; JEOL, Ltd, Japan; M Suzuki; Thermo Fischer Scientific Japan; Y Kondo; JEOL, Ltd, Japan

#### POSTER # 4

3:00 PM **46** *Ultrasensitive X-Ray Detection System of Two Very Large Sized SDDs for Aberration Corrected 300 kV Microscope*; I Ohnishi, K Miyatake, Y Jimbo, Y Iwasawa, M Morita, T Sasaki, H Sawada, E Okunishi; JEOL, Ltd, Japan

#### POSTER # 5

3:00 PM **47** *Study of Strain and Intermixing at the BaSnO<sub>3</sub>/SrTiO<sub>3</sub> and BaSnO<sub>3</sub>/LaAlO<sub>3</sub> Interfaces Using STEM and EELS*; K Ganguly, A Prakash, C Leighton, B Jalan, KA Mkhoyan, JS Jeong, H Yun; University of Minnesota

#### POSTER # 6

3:00 PM **48** *A Ge/SiNx Standard for Evaluating the Performance of X-Ray Detectors in the SEM, S/TEM and AEM*; NJ Zaluzec; Argonne National Laboratory; J-P DesOrmeaux, J Roussie; TEMWindows/SiMPore Inc

#### POSTER # 7

3:00 PM **49** *Aberration-Corrected Scanning Transmission Electron Microscopy and Spectroscopy of Nonprecious Metal Nanoparticles in Titania Aerogels*; TH Brintlinger, PA DeSario, JJ Pietron, DR Rolison, RM Stroud; U.S. Naval Research Laboratory

#### POSTER # 8

3:00 PM **50** *The Combination of STEM Tomography and STEM/EDS Analysis of NiSi formation Related Defects in Semiconductor Wafer-Foundries*; B Fu, M Gribelyuk, L Dumas, C Fang, N Lamanque, L Hodgkins, E Chen; GlobalFoundries, Inc

#### POSTER # 9

3:00 PM **51** *Beyond Electrochemical Analysis: 2D to 4D Correlation of Structure and Chemistry in Li-Ion Batteries*; S Freitag; Carl Zeiss Microscopy GmbH, Germany

#### POSTER # 10

3:00 PM **52** *A Challenge to Multivariate Statistical Analysis: Spent Nuclear Fuel*; CM Parish, TJ Gerczak, PD Edmondson, KA Terrani; Oak Ridge National Laboratory

#### POSTER # 11

3:00 PM **53** *Characterization of Palladium and Gold Nanoparticles on Granular Activated Carbon as an Efficient Catalyst for Hydrodechlorination of Trichloroethylene*; K Meduri, A Barnum; Portland State University; G O'Brien Johnson, PG Tratnyek; Oregon Health & Science University; J Jiao; Portland State University

#### POSTER # 12

3:00 PM **54** *Minimize Electron Beam Damage During Characterization of Carbon-Depletion in Ultra Low-K Dielectric Materials by STEM EELS Elemental Mapping*; WW Zhao, M Gribelyuk; GlobalFoundries, Inc

#### POSTER # 13

3:00 PM **55** *Performance of a Direct Electron Detector for the Application of Electron Energy-Loss Spectroscopy*; JL Hart, AC Lang; Drexel University; C Trevor, R Twisten; Gatan Inc.; ML Taheri; Drexel University

#### POSTER # 14

3:00 PM **56** *Simple and Compact Electrostatic Cs-Corrector Using Annular and Circular Electrodes*; T Kawasaki; Japan Fine Ceramics Center; T Ishida; Nagoya University, Japan; T Kodama; Meijo University, Japan; M Tomita; Vacuum Device Ltd, Japan; T Matsutani; Kinki University, Japan; T Ikuta; Osaka Electro-Communication University, Japan

### A11.P1 Advances in Scanning Electron/Ion Instrumentation and Detectors

#### POSTER SESSION

Monday 3:00 PM • Room: Exhibit Hall

#### POSTER # 15

3:00 PM **57** *Image Simulation and Analysis to Predict the Sensitivity Performance of a Multi-Electron Beam Wafer Defect Inspection Tool*; M Mukhtar, K Quoi; SUNY Polytechnic Institute; B Bunday, M Malloy; SEMATECH; B Thiel; SUNY Polytechnic Institute

#### POSTER # 16

3:00 PM **58** *Design of a HAADF Detector for Z Contrast in SEM*; G L'Esperance, J-P Bailon, O Sioui-Latulippe; Ecole Polytechnique, Montreal, Canada; J Hunt, S Gubbens; Gatan Inc.

#### POSTER # 17

3:00 PM **59** *A Combination BSE and CL Detector Using Silicon Photomultipliers*; NC Barbi, OE Healy, RB Mott; Pulsetor LLC

# Scientific Program

Monday, July 25

## POSTER # 18

3:00 PM **60** *In-Depth Sample Analysis with a Signal-Selective SEM Detection System*; M Havelka, J Jiruše, P Mareš, J Kološová; TESCAN Brno, s.r.o, Czech Republic

## POSTER # 19

3:00 PM **61** *Image Sharpness Measurement in Scanning Electron Microscopy Based on Derivative Methods in ISO/TS 24597 Document*; BC Park; Korea Research Institute of Standards and Science, Republic of Korea; S Kim; Chonbuk National University, Republic of Korea; I-S Oh, JS Kim; Chonbuk National University, Republic of Korea

## POSTER # 20

3:00 PM **62** *A Static Low Energy Ion Source for Local Surface Modification*; PH Trompenaars; FEI Company, Netherlands

## POSTER # 21

3:00 PM **63** *"Smart Microscopy": Feature Based Adaptive Sampling for Focused Ion Beam Scanning Electron Microscopy*; T Dahmen; Deutsche Forschungszentrum für Künstliche Intelligenz GmbH, Germany; N de Jonge; Leibniz Institute of New Materials, Germany; P Trampert; Deutsche Forschungszentrum für Künstliche Intelligenz GmbH, Germany; M Engstler, C Pauly, F Mücklich; Saarland University, Germany; P Slusallek; Deutsche Forschungszentrum für Künstliche Intelligenz GmbH, Germany

## POSTER # 22

3:00 PM **64** *A New Application of EBSD Technique – Determination of Unknown Bravais Lattice*; L Li, M Han; East China Jiaotong University, China; G Nolze; BAM Federal Institute for Materials Research and Testing, Germany

## POSTER # 23

3:00 PM **65** *Practical Considerations for High-Resolution Transmission Kikuchi Diffraction Mapping and Analysis in Titanium Alloys*; J Orsborn, G Lee, SA Romo; The Ohio State University; TF Broderick; General Electric; AJ Ramirez, DW McComb, HL Fraser; The Ohio State University

## POSTER # 24

3:00 PM **66** *EDS Windows and Plasma Cleaning: Characterization and Damage Mechanisms*; J Rafaelsen; EDAX, Inc

## POSTER # 25

3:00 PM **67** *The Study of "Window-less" EDS Detector with Low Voltage FE-SEM*; Y Yamamoto, H Takahashi; JEOL, Ltd, Japan; H Morita, Oxford Instruments, Japan; H Yamada, National Institute of Technology, Japan; M Takakura, N Kikuchi, T Nokuo; JEOL, Ltd, Japan; N Erdman; JEOL USA, Inc.

## A15.P1 Quantitative Measurement of Intensities and Distances in Electron Microscopy

### POSTER SESSION

Monday 3:00 PM • Room: Exhibit Hall

## POSTER # 26

3:00 PM **68** *An Extended Ageing Study of a Uranium Dioxide Layer on Uranium Metal Using the EDS/XPP Method*; CP Poulter; AWE plc, United Kingdom

## POSTER # 27

3:00 PM **69** *Electron Beam Induced Mass Loss Dependence on Stained Thin Epon Resin Sections*; R Skoupy; Institute of Scientific Instruments ASCR, Czech Republic; J Nebesarova; Biology Center ASCR, Czech Republic; V Krzyzanek; Institute of Scientific Instruments ASCR, Czech Republic

## POSTER # 28

3:00 PM **70** *Image Processing of Energy Filtered Transmission Electron Microscopy Maps in Order to Extract Nanoscale Magnetic Properties of CoCr-Based Magnetic Thin Films*; JF Al-Sharab, M Benalla; Northwestern State University

## POSTER # 29

3:00 PM **71** *Oxygen Octahedral Picker: A Digital Micrograph Script Tool for Extracting Quantitative Information from HAADF and ABF Images*; Y Wang, U Salzberger, W Sigle, YE Suyolcu, PA van Aken; Max Planck Institute for Solid State Research, Germany

## POSTER # 30

3:00 PM **72** *Extraction of Quantitative Information from Non-Optimum-Focus Aberration-Corrected HRTEM Images by Image Processing*; C Wen; Southwest University of Science and Technology, China; DJ Smith; Arizona State University

## POSTER # 31

3:00 PM **73** **M&M 2016 STUDENT AWARDEE** *Effect of Probe Channeling on Differential Phase Contrast at the Atomic Scale*; S Im, JM Johnson, J Hwang; The Ohio State University

## POSTER # 32

3:00 PM **74** *Evaluation of Electron Microscopy Techniques for the Purpose of Classification of Nanomaterials*; J Mielke; BAM Federal Institute for Materials Research and Testing, Germany; F Babick; Technische Universität Dresden, Germany; T Uusimäki; EAWAG Aquatic Research, Switzerland; P Müller; BASF SE, Germany; E Verleysen; CODA-CERVA, Belgium; V-D Hodoroba; BAM Federal Institute for Materials Research and Testing, Germany

## POSTER # 33

3:00 PM **75** *High-Throughput, Semi-Automated Quantitative STEM Atom Counting in Supported Metal Nanoparticles Using a Conventional TEM/STEM*; SD House; University of Pittsburgh; Y Chen, R Jin; Carnegie Mellon University; JC Yang; University of Pittsburgh

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION POSTER SESSIONS—

MONDAY AFTERNOON *continued*

### POSTER # 34

3:00 PM **76** *Development of Real-Time Probe Current Calibration for Performing Quantitative STEM with a Cold Field-Emission Gun*; SD House; University of Pittsburgh; CT Schamp, R Henry; Hitachi High Technologies America, Inc.; D Su, EA Stach; Brookhaven National Laboratory; JC Yang; University of Pittsburgh

### POSTER # 35

3:00 PM **77** *Exploring Boltzmann-Factor Distributions of Precipitation-Nuclei in the TEM*; JC Roberts, P Fraundorf; University of Missouri; J Kasthuri; SunEdison Solar Inc.; D Osborn; University of Missouri

### POSTER # 36

3:00 PM **78** *Determining Interplanar Distances from STEM-EDX Hyperspectral Maps*; J Ditto, G Mitchson, DR Merrill; University of Oregon; DL Medlin; Sandia National Laboratories; ND Browning; Pacific Northwest National Laboratory; DC Johnson; University of Oregon

### POSTER # 37

3:00 PM **79** *Determination of Image Distortion Through Fitting of a Reference Lattice*; G Buscher; The University of Tennessee, Knoxville; MF Chisholm; Oak Ridge National Laboratory

### POSTER # 38

3:00 PM **80** *Challenges of Oversimplifying Z-Contrast in Atomic Resolution ADF-STEM*; RJ Wu, ML Odlyzko, KA Mkhoyan; University of Minnesota

### POSTER # 39

3:00 PM **81** *Local Crystallography for Quantitative Analysis of Atomically Resolved Images*; A Belianinov, Q He, M Kravchenko; Oak Ridge National Laboratory; S Jesse; The Center for Nanophase Materials Sciences; A Borisevich, SV Kalinin; Oak Ridge National Laboratory

B

## BIOLOGICAL SCIENCES POSTER SESSIONS—MONDAY AFTERNOON

### B07.P1 3D Structures of Macromolecular Assemblies, Cellular Organelles and Whole Cells

#### POSTER SESSION

Monday 3:00 PM • Room: Exhibit Hall

### POSTER # 40

3:00 PM **82** *Role of DDR2 ECD Oligomerization in Binding to Collagen*; D Yeung, C Wang, J Wellmerling, G Agarwal; The Ohio State University

### POSTER # 41

3:00 PM **83** *Three-Dimensional Structure of Neuropeptide Y Pre-Pro-Peptide to Reveal its Interaction with Lipid Membrane*; L Xing, VM Hsiao, ZZ Kuang, Y Ngo, S Kim, LF Drummy; U.S. Air Force Research Laboratory, WPAFB

### POSTER # 42

3:00 PM **84** *3D Reconstruction of the NADH:Ubiquinone Oxidoreductase (Complex I) from Yarrowia lipolytica Lacking Subunit NUMM*; CT Nolan; University of Vermont; K Kmita, V Zickermann; Goethe University of Frankfurt, Germany; T Ruiz, M Radermacher; University of Vermont

### POSTER # 43

3:00 PM **85** *Structural Significance of EmaA Glycosylation in A. actinomycetemcomitans*; A Watson, G Tang-Siegel, CJ Brooks, M Radermacher, KP Mintz, T Ruiz; University of Vermont

### POSTER # 44

3:00 PM **86** *Structural Rearrangements in R432A Variant of AAV2 Affect Genome Packaging*; LM Drouin, B Lins; University of Florida; M Janssen; University of California, San Diego; A Bennett, PR Chipman, N Muzyczka; University of Florida; TS Baker; University of California, San Diego, M Agbandje-McKenna; University of Florida, et al.

### POSTER # 45

3:00 PM **87** *Cryo-Electron Tomography Provides Insight Into the Native Architecture of the Measles Virus Assembly Site*; JD Strauss; Emory University School of Medicine; Z Ke; Georgia Institute of Technology; RK Plemper; Georgia State University; ER Wright; Emory University School of Medicine

### POSTER # 46

3:00 PM **88** *Choice of Specimen Thickness in Axial Bright-Field STEM Tomography of Cells*; Q He, RD Leapman; National Institutes of Health

### POSTER # 47

3:00 PM **89** *A Correlative Immunoconfocal and Electron Microscopic Study of Gap Junctions in Interlocking Domains of the Lens*; SK Biswas, L Brako, W-K Lo; Morehouse School of Medicine

### POSTER # 48

3:00 PM **90** *Freeze Drying Method with Gaseous Nitrogen to Preserve Fine Ultrastructure of Biological Organizations for Scanning Electron Microscopy, Helium Ion beam Microscopy and Fluorescence Microscopy*; K Uryu, NH Soplop, D Acehan; The Rockefeller University

### POSTER # 49

3:00 PM **91** *Generation of 3D Surface Models from Scanning Electron Microscope Images*; TE Amish, BT Hansen, ER Fischer; Rocky Mountain Labs/NIAID/NIH

### POSTER # 50

3:00 PM **92** *Morphological and Production Changes in Stressed Red Yeasts Monitored Using SEM and Raman Spectroscopy*; K Hrubanova, O Samek; Institute of Scientific Instruments ASCR, Czech Republic; A Haronikova; Brno University

of Technology, Czech Republic; S Bernatova, P Zemanek; Institute of Scientific Instruments ASCR, Czech Republic; I Marova; Brno University of Technology, Czech Republic; V Krzyzanek; Institute of Scientific Instruments ASCR, Czech Republic

## POSTER # 51

3:00 PM **93** *Ultrastable Gold Substrates Improve the Resolution of 3D Reconstructed Density Maps from Electron Micrographs and Tomograms*; CJ Russo, IS Fernandez, TA Bharat, LA Passmore; MRC Laboratory of Molecular Biology, United Kingdom

## POSTER # 52

3:00 PM **94** **MSA PTSA AWARDEE** *Automated Infrastructure for High-Throughput Acquisition of Serial Section TEM Image Volumes*; CG Robinson; Howard Hughes Medical Institute, Janelia; J Price; Hudson Price Designs, LLC; D Milkie, O Torrens; Coleman Technologies, Inc.; E Perlman, Z Zheng, RD Fetter, DD Bock; Howard Hughes Medical Institute, Janelia

## POSTER # 53

3:00 PM **95** *A Third Hand for Array Tomography*; E Hanssen; The University of Melbourne, Australia

## P

## PHYSICAL SCIENCES POSTER SESSIONS—MONDAY AFTERNOON

### P02.P1 Electron Microscopy of Materials for Electrochemical Power Systems

#### POSTER SESSION

Monday 3:00 PM • Room: Exhibit Hall

## POSTER # 54

3:00 PM **96** *Microstructural Investigation on Degradation Mechanism of Layered  $\text{LiNi}_{0.6}\text{Co}_{0.2}\text{Mn}_{0.2}\text{O}_2$  Cathode Materials by Analytical TEM/STEM*; NY Kim, Z Lee; Ulsan National Institute of Science and Technology, Republic of Korea

## POSTER # 55

3:00 PM **97** *Quantitative HAADF Study of Twin Boundaries in  $\text{Cu}_3\text{Pt}$  Nanoparticles*; G Drazic, M Bele, A Lautar, A Pavlisic, P Jovanovic, M Gaberscek; National Institute of Chemistry, Ljubljana, Slovenia

## POSTER # 56

3:00 PM **98** **MSA POST-DOCTORAL AWARDEE** *Direct Visualization of the Grain Boundary Solute Segregation in Oxide Material at Atomic Resolution Using STEM-EDS*; B Feng; The University of Tokyo, Japan; T Yokoi; Osaka University, Japan; A Kumamoto; The University of Tokyo, Japan; M Yoshiya; Osaka University, Japan; Y Ikuhara, N Shibata; The University of Tokyo, Japan

## POSTER # 57

3:00 PM **99** *Electron Microscopy and Electrochromic Studies of  $\text{V}_2\text{O}_5$  Thin Films Deposited by RF Magnetron Sputtering*; DR Acosta, A Perez, CR Magaña, F Hernandez; Universidad Nacional Autonoma de Mexico

## POSTER # 58

3:00 PM **100** *Characterization of Gadolinium Doped Cerium (IV) Oxides Deposited by Reactive Spray Deposition Technology for Intermediate Temperature Fuel Cell Applications*; A Poozhikunnath, M Aindow, R Maric; University of Connecticut

## POSTER # 59

3:00 PM **101** *Combined Electron Channeling Contrast Imaging (ECCI) and Transmission Electron Microscopy (TEM) Studies of Coherent Domain Boundaries in Strained  $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$  (LSM) Epitaxial Thin Films*; M Yan; National Energy Technology Laboratory; YN Picard, PA Salvador; Carnegie Mellon University

## POSTER # 60

3:00 PM **102** *Analytical Electron Microscopy Study of SiSn/ (Reduced Graphene Oxide) Nanocomposite Powder Applicable to Li-Ion Battery Anodes*; M Kawasaki; JEOL USA, Inc.; V Laokawee, T Sarakonsri; Chiang Mai University, Thailand; T Hashizume; University of Toyama, Japan; M Shiojiri; Kyoto Institute of Technology, Japan

## POSTER # 61

3:00 PM **103** *New Electrode Material Based on  $\text{Mn}_3\text{O}_4$  Nanoparticles Embedded in Organometallic-Derived Carbon (ODC)*; D Arenas-Esteban, D Ávila-Brandé, LC Otero-Díaz, E Urones-Garrote; Universidad Complutense de Madrid, Spain

## POSTER # 62

3:00 PM **104** *Examining Li Diffusion in All-Solid-State Batteries Through Optically and Electron Transparent Electrodes*; A Yulaev; National Institute of Standards and Technology; MS Leite; University of Maryland; AA Talin; Sandia National Laboratories; A Kolmakov; National Institute of Standards and Technology

## POSTER # 63

3:00 PM **105** *Mapping Trends In Electronic Structure Variation With Aging In  $\text{LiFePO}_4$  Cathodes: A Lorentz Oscillator Model Approach*; SA Channagiri, M Canova, DW McComb; The Ohio State University

## POSTER # 64

3:00 PM **106** *Composition of Epitaxial  $\text{ZrO}_2\text{:Y}_2\text{O}_3/\text{SrTiO}_3$  Heterostructures*; FJ Scheltens, DE Huber, RE Williams, DW McComb; The Ohio State University

## POSTER # 65

3:00 PM **107** *On the Degradation of PtNi Nanocatalysts for PEM Fuel Cells: An Identical Location Aberration-Corrected STEM Study*; S Rasouli; University of Texas, Austin; T Fujigaya; Kyushu University, Japan; D Myers; Argonne National Laboratory; N Nakashima; Kyushu University; P Ferreira; University of Texas, Austin

## POSTER # 66

3:00 PM **108** *Revealing 3D Information of Porous Catalytic Structures Prepared by Template Methods*; X Zhang, MT Paul, BK Pilapil, B Brenden, BD Gates; Simon Fraser University, Canada

# Scientific Program

P

## PHYSICAL SCIENCES POSTER SESSIONS—MONDAY AFTERNOON *continued*

### P06.P1 Magnetic Materials, Phenomena and Imaging at the Nanoscale

#### POSTER SESSION

Monday 3:00 PM • Room: Exhibit Hall

#### POSTER # 67

3:00 PM **109** *A TEM Structural Study of the Origin of Perpendicular Magnetic Anisotropy in Ultra-Thin CoFeB Film*; Z Li, S Li, Y Zheng, J Fang, L Chen, L Hong, H Wang; Western Digital Corporation

#### POSTER # 68

3:00 PM **110** *Nonstoichiometric Twin Defects in Fe<sub>3</sub>O<sub>4</sub>(111) Thin Films: Atomic and Electronic Structure*; VK Lazarov; University of York, United Kingdom; D Kepaptsoglou; SuperSTEM Laboratory, United Kingdom; K McKenna, Z Nedelkoski, B Kuerbanjiang; University of York, United Kingdom; Q Ramasse; SuperSTEM Laboratory, United Kingdom; T Susaki, K Matsuzaki; Tokyo Institute of Technology, Japan, et al.

#### POSTER # 69

3:00 PM **111** *TEM Study of the Cobalt-Rich Hf-Co Intermetallic Compounds*; X-Z Li, Y-L Jin, M-Y Wang, JE Shield, R Skomski, DJ Sellmyer; University of Nebraska-Lincoln

#### POSTER # 70

3:00 PM **112** *Development of Pulse Magnetization System on Aberration Corrected 1.2-MV Cold Field-Emission Transmission Electron Microscope*; T Tanigaki, T Akashi, A Sugawara; Hitachi, Ltd, Japan; K Niitsu, X Yu; RIKEN, Japan; Y Tomioka; National Institute of Advanced Industrial Science and Technology, Japan; D Shindo, Y Tokura; RIKEN, Japan, et al.

#### POSTER # 71

3:00 PM **113** *Unitary Detector DPC Imaging with Multiscale Capabilities for Analysis of Local Magnetic Field of Nanomaterials*; I Ivanov, S Lopatin, J Kosel; King Abdullah University of Science & Technology, Saudi Arabia; A Chuvilin; CIC nanoGUNE, Spain

#### POSTER # 72

3:00 PM **114** *Extended Foucault Method for External Magnetic Fields with Conventional TEM*; H Nakajima, A Kotani; Osaka Prefecture University, Japan; K Harada; RIKEN, Japan; Y Ishii, S Mori; Osaka Prefecture University, Japan

#### POSTER # 73

3:00 PM **115** *Proposal for Magnetic Dichroism with a Standard STEM Probe Beam*; TR Harvey; University of Oregon; V Grillo; Consiglio Nazionale delle Ricerche, Italy; BJ McMorran; University of Oregon

#### POSTER # 74

3:00 PM **116** *Observation of an Electron Vortex Beam Created from a Self-Charging Rod*; AM Blackburn; Hitachi Cambridge Laboratory, United Kingdom

#### POSTER # 75

3:00 PM **117** *Characterization of the CoFe<sub>2</sub>O<sub>4</sub>@Mn Fe<sub>2</sub>O<sub>4</sub> Magnetic Particles Using Differential Phase Contrast in STEM*; D-Y Kim, J-I Son, B-K Park, S-H Lee; FEI Company, Republic of Korea; I-B Shim, S-J Kim, H-K Choi; Kookmin University, Republic of Korea

#### POSTER # 76

3:00 PM **118** *Atomic Resolution and In Situ STEM-EELS of Superparamagnetic Iron Oxide Nanoparticles*; R Hufschmid; University of Washington; RM Ferguson; LodeSpin Labs; E Teeman, KM Krishnan; University of Washington; ND Browning; Pacific Northwest National Laboratory

#### POSTER # 77

3:00 PM **119** *Tailoring Magnetic Nanostructures with Neon in the Ion Microscope*; G Hlawacek, R Bali; Helmholtz-Zentrum Dresden-Rossendorf, Germany; F Röder; Technische Universität Dresden, Germany; A Semisalova, K Wagner, H Schultheiss, S Facsko, J Fassbender; Helmholtz-Zentrum Dresden-Rossendorf, Germany, et al.

#### POSTER # 78

3:00 PM **120** *4D-STEM for Quantitative Imaging of Magnetic Materials with Enhanced Contrast and Resolution*; KX Nguyen, P Purohit, E Turgut, MW Tate, LF Kourkoutis, GD Fuchs, SM Gruner, DA Muller; Cornell University, et al.

#### POSTER # 79

3:00 PM **121** *Magnetic Domain Imaging of Ni-Mn-Ga Heusler Alloys Using Lorentz TEM*; I Kashyap, M De Graef; Carnegie Mellon University

#### POSTER # 80

3:00 PM **122** *Electron Energy-loss Magnetic Circular Dichroism of L10 FePt Nanograins*; J Zhu, R Zhang, Y Zhang, B Ozdol, S Myers, A Greene; Western Digital Corporation

## **P09.P1 From Angstrom to AU: Studies of Planet-Forming Materials**

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### **POSTER SESSION**

**Monday 3:00 PM • Room: Exhibit Hall**

#### **POSTER # 81**

3:00 PM **123** *Stoichiometry Fitter, a GUI for Fitting Solid Solutions and Analyzing Mineral Phases*; Z Gainsforth; University of California, Berkeley

#### **POSTER # 82**

3:00 PM **124** *Quantitative EPMA of Nitrogen in Silicate Glasses*; A von der Handt, C Dalou; University of Minnesota

#### **POSTER # 83**

3:00 PM **125** *Electron Microscopy of Spirulina (Arthrospira spp) Nanoparticles Obtained by Means of Mechanical Milling*; HA Calderon; Instituto Politecnico Nacional, Mexico; K Bustillo; Lawrence Berkeley National Laboratory; EE Neri-Torres, JJ Chanona Perez; Instituto Politecnico Nacional, Santo Tomás, Mexico; N Torres Figueredo; Instituto Politecnico Nacional, Mexico; GA Chamorro Ceballos, GH Calderon-Dominguez; Instituto Politecnico Nacional, Santo Tomás, Mexico

#### **POSTER # 84**

3:00 PM **126** *Inclusions and the Color of Obsidian*; SK Menon, A Camargo, CC Luhrs; Naval Postgraduate School; RP Mariella; Lawrence Livermore National Laboratory

#### **POSTER # 85**

3:00 PM **127** *Analogs for Unlayered-Graphene Droplet-Formation in Stellar Atmospheres*; P Fraundorf; University of Missouri Saint Louis; M Lipp; Universität Stuttgart, Germany; T Savage; University of Missouri Saint Louis

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION SYMPOSIA—TUESDAY MORNING

### A04.2 Advances in FIB Instrumentation and Applications in Materials and Biological Sciences

#### SESSION CHAIR:

Srinivas Subramaniam, Intel Corporation

#### PLATFORM SESSION

Tuesday 8:30 AM • Room: C216

8:30 AM **128** (INVITED) *FIB Milling of Polymer Ceramic Nanocomposites: Far-Reaching Thermal Artefacts and Application to Analysis of Corrosion Barrier Coatings*; K Rykaczewski, D Mieritz, M Liu; Arizona State University; EB Iezzi; U.S. Naval Research Laboratory; LP Wang, KN Solanki, DK- Seo, RY Wang; Arizona State University; et al.

9:00 AM **129** *Exploring Differences in Amorphous Layer Formation During FIB Sample Preparation Between Metals and Non Metals*; M Presley, J Jensen, D Huber, HL Fraser; The Ohio State University

9:15 AM **130** *Evaluation of Neon Focused Ion Beam Milling for TEM Sample Preparation*; TC Pekin, FI Allen, AM Minor; University of California, Berkeley

9:30 AM **131** (INVITED) *Femtosecond Laser Damage in Metals and Semiconductors During TriBeam Tomography*; MP Echlin, MS Titus, WC Lenthe; University California, Santa Barbara; M Straw; FEI Company; P Gumbsch; Karlsruhe Institute of Technology, Germany; TM Pollock; University of California, Santa Barbara

### A05.1 Applications of Correlative Microscopy to Physical and Biological Sciences

#### SESSION CHAIRS:

Renu Sharma, National Institute of Standards and Technology

Si Chen, Argonne National Laboratory

Xiao-ying Yu, Pacific Northwest National Laboratory

#### PLATFORM SESSION

Tuesday 8:30 AM • Room: C210

8:30 AM **132** (INVITED) *Large-scale EM & Correlative Microscopy (Nanotomography & CLEM)*; BN Giepmans, P de Boer, KA Sjollem, J Kuipers, AG Wolters; University Medical Center Groningen, Netherlands

9:00 AM **133** *Application of Ionic Liquid on Biological Samples in Correlative Optical Microscopy and Scanning Electron Microscopy*; X Chen; University of Toronto, Canada; J Howe; Hitachi High-Technologies Canada, Inc., F Luo; University of Toronto, Canada; P Woo; Hitachi High-Technologies Canada, Inc., D Perovic, E Edwards; University of Toronto, Canada

9:15 AM **134** **M&M 2016 STUDENT AWARDEE** *Analysis of Phage-Pilus Interactions in *Caulobacter crescentus**; RS Dillard, RE Storms, L De Masi, C Hampton; Emory University; G Panis, PH Viollier; University of Geneva, Switzerland; ER Wright; Emory University

9:30 AM **135** *Correlative Microscopy Application in Spinal Cord Injury Research*; B Deng, CM Freria; The Ohio State University; T Burnett; The University of Manchester, United Kingdom; IN Boona; The Ohio State University; PJ Withers; The University of Manchester, United Kingdom; PG Popovich, DW McComb; The Ohio State University

9:45 AM **136** *Fluorescence Recovery of GFP Emission in Samples Embedded for TEM Upon Exposure to an Alkaline Solution*; DR Keene; Shriners Hospital for Children; CS López; Oregon Health Sciences University; S Kwon; Oregon Health Sciences University; S Gonzales; Shriners Hospital for Children; J Gray; Oregon Health Science University

### A06.2 Analytical Electron Microscopy for Advanced Characterization from Multi-Dimensional Data Acquisition to Integrated Analysis

#### SESSION CHAIRS:

Chaoying Ni, University of Delaware

Peter van Aken, Max Planck Institute for Solid State Research

Masashi Watanabe, Lehigh University

#### PLATFORM SESSION

Tuesday 8:30 AM • Room: C224-25

8:30 AM **137** *Detection of Oxygen Sub-Lattice Ordering in A-Site Deficient Perovskites Through Monochromated Core-Loss EELS Mapping*; D Kepaptsoglou; SuperSTEM Laboratory, United Kingdom; F Azough; University of Manchester, United Kingdom; D Hernandez Maldonado; SuperSTEM Laboratory, United Kingdom; R Freer; University of Manchester, United Kingdom; Q Ramasse; SuperSTEM Laboratory, United Kingdom

8:45 AM **138** *Pseudo Atomic Column EELS & EDS Mapping of Silicon Reconstructed with K and L Electrons Using STEM-Moiré Method*; Y Kondo, E Okunishi; JEOL, Ltd., Japan

9:00 AM **139** *Unveiling Complex Plasmonic Resonances in Archimedean Nanospirals Through Cathodoluminescence in a Scanning Transmission Electron Microscope*; J Hachtel, R Davidson; Vanderbilt University; M Chisholm, B Lawrie; Oak Ridge National Laboratory; R Haglund, S Pantelides; Vanderbilt University

9:15 AM **140** *Visualizing Interface Effects in Two-Dimensionally Doped  $\text{La}_2\text{CuO}_4$  and  $\text{La}_2\text{CuO}_4/\text{La}_{2-x}\text{Sr}_x\text{NiO}_4$  Superlattices*; Y Wang, W Sigle, U Salzberger, F Baiutti, G Gregori, C Georg, G Logvenov, J Maier; Max Planck Institute for Solid State Research, Germany; et al.

9:30 AM **141** *Connecting Phase Stability to the Grain Growth Behavior of Ni-W Alloys*; CJ Marvel, D Yin, MP Harmer; Lehigh University

9:45 AM **142** *Novel Characterization of Deformation Mechanisms in a Ni-Base Superalloy Using HAADF Imaging and Atomic Ordering Analysis*; D McAllister, D Lv; The Ohio State University; H Deutchman, B Peterson; Honeywell Aerospace; Y Wang, M Mills; The Ohio State University

## A09.1 Advanced Scanning Diffraction: Mapping Functionality in Reciprocal Space at Nanometer Resolution

### SESSION CHAIR:

Jim Ciston, Lawrence Berkeley National Laboratory

### PLATFORM SESSION

Tuesday 8:30 AM • Room: C220

- 8:30 AM **143** (INVITED) *Phase Contrast Imaging of Weakly-Scattering Samples with Matched Illumination and Detector Interferometry – Scanning Transmission Electron Microscopy (MIDI-STEM)*; C Ophus, J Ciston, H Yang; Lawrence Berkeley National Laboratory; J Pierce, TT Harvey, J Chess, BJ McMorran; University of Oregon, C Czarnik; Gatan Inc., et al.
- 9:00 AM **144** *Enhanced Phase Contrast Transfer Using Ptychography Combined with a Pre-Specimen Phase Plate in a Scanning Transmission Electron Microscope*; H Yang, P Ercius, C Ophus; Lawrence Berkeley National Laboratory; PD Nellist; University of Oxford, United Kingdom
- 9:15 AM **145** *Towards 3D Electron Ptychographic Reconstruction*; S Gao; Nanjing University, China; F Zhang; Harwell Oxford Campus, United Kingdom; AI Kirkland; University of Oxford, United Kingdom; X Pan, P Wang; Nanjing University, China
- 9:30 AM **146** (INVITED) *The Use of Electron Ptychography to Implement Efficient Phase Imaging in STEM*; PD Nellist; University of Oxford, United Kingdom; H Yang; Lawrence Berkeley National Laboratory; L Jones, GT Martinez, RN Rutte, BG Davis; University of Oxford, United Kingdom; TJ Pennycook; University of Vienna, Austria, M Simson; PNDetector GmbH, Germany; et al.

## A11.2 Advances in Scanning Electron/Ion Instrumentation and Detectors

### SESSION CHAIR:

Matthew Phillips, University of Technology Sydney

### PLATFORM SESSION

Tuesday 8:30 AM • Room: C121-22

- 8:30 AM **147** (INVITED) *Imaging a 1mm<sup>3</sup> Volume of Rat Cortex Using a MultiBeam SEM*; RL Schalek, JW Lichtman, D Cox, H Pfister; Harvard University; N Kasthuri; Argonne National Laboratory; D Lee, A Peleg, T Jones; Harvard University; et al.
- 9:00 AM **148** *Multi-beam Electron Microscopy: Principles and Applications*; AL Eberle, D Zeidler; Carl Zeiss Microscopy GmbH, Germany
- 9:15 AM **149** *Patterned Wafer Inspection with Multi-beam SEM Technology*; B Thiel, M Mukhtar, K Quoi; SUNY Polytechnic Institute; B Bunday, M Malloy; SEMATECH

- 9:30 AM **150** *Towards Enhancing the Throughput and Eliminating the 4 Dimensions of Stitching Errors in Large Area, High-Resolution SEM for Integrated Circuit Reverse Engineering and Connectomics*; JE Sanabia; Raith America, Inc., CE Korman, A Popratiloff; The George Washington University; V Boegli, M Rasche, R Jede; Raith GmbH, Germany

- 9:45 AM **151** *IPrep – Automated Serial-Section Broad-Ion-Beam Tomography*; TC Hosman, S Coyle, A Abbott, M Olvera, M Hassel-Shearer, JA Hunt; Gatan, Inc.

## A15.2 Quantitative Measurement of Intensities and Distances in Electron Microscopy

### SESSION CHAIR:

James LeBeau, North Carolina State University

### PLATFORM SESSION

Tuesday 8:30 AM • Room: C212

- 8:30 AM **152** (INVITED) *Quantification of ADF STEM Image Data for Nanoparticle Structure and Strain Measurements*; PD Nellist, L Jones, A Varambhia; University of Oxford, United Kingdom; A De Backer, S Van Aert; University of Antwerp, Belgium; D Ozkaya; Johnson Matthey Technology Centre, United Kingdom
- 9:00 AM **153** *Imaging Local Polarization and Domain Boundaries with Picometer-Precision Scanning Transmission Electron Microscopy*; ME Holtz, JA Mundy, CS Chang; Cornell University; JA Moyer; University of Illinois Urbana-Champaign; R Hovden, ES Padgett, DG Schlom, DA Muller; Cornell University; et al.
- 9:15 AM **154** *Distortion Correction in Scanning Transmission Electron Microscopy with Controllable Scanning Pathways*; X Sang, AR Lupini, RR Unocic, T Meyer, TZ Ward, HN Lee, E Endeve, RK Archibald; Oak Ridge National Laboratory; et al.
- 9:30 AM **155** *Three-Dimensional Imaging of Single La Vacancies in LaMnO<sub>3</sub>*; J Feng, A Kvit, C Zhang, D Morgan, P Voyles; University of Wisconsin-Madison
- 9:45 AM **156** *MSA POST-DOCTORAL AWARDEE Tracking BO<sub>6</sub> Coupling in Perovskite Superlattices to Engineer Magnetic Interface Behavior*; Q He; Oak Ridge National Laboratory; S Ghosh; Vanderbilt University; EJ Moon, S May; Drexel University; S Pantelides; Vanderbilt University; A Borisevich, AR Lupini; Oak Ridge National Laboratory

# Scientific Program

B

## BIOLOGICAL SCIENCES SYMPOSIA— TUESDAY MORNING

### B02.1 New Technologies for Digital Pathology

#### SESSION CHAIRS:

Rohit Bhargava, University of Illinois

David Mayerich, University of Houston

#### PLATFORM SESSION

Tuesday 8:30 AM • Room: C110

- 8:30 AM **157** (INVITED) *Slide-Free Microscopy via UV Surface Excitation*; R Levenson, F Fereidouni, Z Harmany; University of California, Davis Medical Center; S Demos; Lawrence Livermore National Laboratory
- 9:00 AM **158** (INVITED) *Histopathological Image Analysis: Path to Acceptance Through Evaluation*; MN Gurcan; The Ohio State University
- 9:30 AM **159** (INVITED) *Computerized Histologic Image Based Risk Predictor (CHIRP): Identifying Disease Aggressiveness Using Sub-Visual Image Cues from Image Data*; A Madabhushi; Case Western Reserve University

### B06.1 Pharmaceuticals and Medical Science

#### SESSION CHAIR:

John-Bruce Green, Baxter Healthcare

#### PLATFORM SESSION

Tuesday 8:30 AM • Room: C111

- 8:30 AM **160** (INVITED) *Compendial Guidance for Particles*; DS Aldrich; Ultramicro, LLC
- 9:00 AM **161** (INVITED) *Detection of Crystalline Components in Amorphous Solid Dispersions by Correlative Imaging Techniques*; JP Neilly, J Roth; AbbVie, Inc.
- 9:30 AM **162** (INVITED) *Applications of the FDA's Counterfeit Detection Device (CD3+) to the Examination of Suspect Counterfeit Pharmaceutical Tablets and Packaging*; SF Platek, N Ranieri, JS Batson; U.S. Food and Drug Administration

### B07.2 3D Structures of Macromolecular Assemblies, Cellular Organelles and Whole Cells

#### SESSION CHAIRS:

Kristin Parent, Michigan State University

Teresa Ruiz, University of Vermont

#### PLATFORM SESSION

Tuesday 8:30 AM • Room: C115

- 8:30 AM **163** (INVITED) *Receptor Recognition by Porcine Circovirus 2*; R Khayat; City College of New York

- 9:00 AM **164** *A Polymerase-Activating Host Factor, YajQ, Bound to the Bacteriophage  $\phi$ 6 Capsid*; B Heymann; National Institute of General Medical Sciences, NIH; D Nemecek; Sanofi-Pasteur, France; R Huang; Howard Hughes Medical Institute; N Cheng; National Institutes of Health; J Qiao, L Mindich; University of Medicine and Dentistry of New Jersey; ACSteven; National Institutes of Health

- 9:15 AM **165** *Cryo-Electron Microscopy of Influenza Vaccine Nanoparticles Indicates Full Occupancy of Displayed Epitopes Is Facilitated by Particle Design*; JR Gallagher, AK Harris; National Institutes of Health

- 9:30 AM **166** *Microscopic Evidence for a Stargate Structure in the Giant Virus, Samba virus*; JR Schrad; Michigan State University; JS Abrahão; Universidade Federal de Minas Gerais, Brazil; JR Cortines; Universidade Federal do Rio de Janeiro, Brazil; KN Parent; Michigan State University

- 9:45 AM **167** *Native-State Structural Analysis of Respiratory Syncytial Virus*; Z Ke; Georgia Institute of Technology; RS Dillard, CM Hampton, RE Storms, JD Strauss, ER Wright; Emory University

### B08.1 Utilizing Microscopy for Research and Diagnosis of Diseases in Humans, Plants and Animals

#### SESSION CHAIRS:

Jon Charlesworth, Mayo Clinic

Greg Ning, Pennsylvania State University

#### PLATFORM SESSION

Tuesday 8:30 AM • Room: C114

- 8:30 AM **168** *Quantitative Characterization of Theranostic Nanoparticles by Electron Microscopy*; MA Aronova; National Institutes of Health; AA Sousa; Federal University of São Paulo, Brazil; RD Leapman; National Institutes of Health
- 8:45 AM **169** *Ferritin Mineral Core Composition in Health and Disease*; A Blissett, B Ollander, B Deng, T Nocera, E Calomeni, D McComb, D McTigue, G Agarwal; The Ohio State University; et al.
- 9:00 AM **170** (INVITED) *Use of Transmission Electron Microscopy in the Diagnosis of Canine Kidney Disease*; RE Cianciolo; The Ohio State University
- 9:30 AM **171** *Composition Analysis with EDS: Possibilities for Life Science*; M Falke, A Kaepfel, R Terborg; Bruker, Germany

P

## PHYSICAL SCIENCES SYMPOSIA—

TUESDAY MORNING

### P01.1 Dr. Gareth Thomas Symposium: Materials Solutions Through Microscopy

#### SESSION CHAIRS:

Ron Gronsky, University of California, Berkeley

Dave Williams, The Ohio State University

#### PLATFORM SESSION

Tuesday 8:30 AM • Room: C214

- 8:30 AM **172** Professor Gareth Thomas: Colleague, Friend, Mentor, Oenophile, and Rugby Player; R Gronsky; University of California, Berkeley; DB Williams; The Ohio State University
- 9:00 AM **173** Microstructure-Based Modeling of Metal Plasticity and Electron Microscopy Characterization of Automotive Structural Metals at Multi-Scales; RK Mishra; General Motors Research & Development Center
- 9:15 AM **174** (INVITED) Dislocations and Grain Boundaries in Ceramics and Metals; CB Carter; University of Connecticut
- 9:30 AM **175** (INVITED) Instrumentation/Technique Developments in Gareth Thomas's Research Group; OL Krivanek; Nion Company
- 9:45 AM **176** (INVITED) High-Resolution Electron Microscopy of Grain Boundary Motion During Island Grain Shrinkage; U Dahmen; Lawrence Berkeley National Laboratory; T Radetic; University of Belgrade, Serbia; M Bowers; C Ophus; A Gautam; Lawrence Berkeley National Laboratory; F Lancon; Institut Nanosciences et Cryogénie-CEA, France

### P02.2 Electron Microscopy of Materials for Electrochemical Power Systems

#### SESSION CHAIR:

Mark Aindow, University of Connecticut

#### PLATFORM SESSION

Tuesday 8:30 AM • Room: E160AB

- 8:30 AM **177** (INVITED) Contribution of Transmission Electron Microscopy to Proton Exchange Membrane Fuel Cell Electrodes Development and Degradation Understanding; L Guetaz, M Lopez-Haro, P Bayle-Guillemaud, A Morin, S Escribano; Institut Nanosciences et Cryogénie-CEA, France
- 9:00 AM **178** Quantitative Information from Cryo-Electron Tomography of Energy Materials; E Padgett, N Andrejevic; Cornell University; Z Liu; General Motors; K Moriyama; Honda R&D Company, Japan; R Kukreja; General Motors; Y Jiang, V Elser, DA Muller; Cornell University; et al.
- 9:15 AM **179** Structural Characterization of Bimetallic Nanocrystal Electrocatalysts; BT Sneed; Oak Ridge National Laboratory; C-H Kuo; Academia Sinica, Taiwan; DA Cullen; Oak Ridge National Laboratory

- 9:30 AM **180** (INVITED) Fuel Cell Electrode Optimization Through Multi-Scale Analytical Microscopy; DA Cullen, BT Sneed, KL More; Oak Ridge National Laboratory

### P06.2 Magnetic Materials, Phenomena and Imaging at the Nanoscale

#### SESSION CHAIR:

Marc De Graef, Carnegie Mellon University

#### PLATFORM SESSION

Tuesday 8:30 AM • Room: C213

- 8:30 AM **181** (INVITED) Domain Behavior in Functional Materials Studied Using Lorentz Microscopy; C Phatak, S Zhang, W Jiang, SG te Velthuis, A Hoffmann, JF Mitchell, H Zheng, MR Norman; Argonne National Laboratory; et al.
- 9:00 AM **182** Formation of Magnetic Textures in the Ferromagnetic Phase of  $\text{La}_{0.825}\text{Sr}_{0.175}\text{MnO}_3$ ; A Kotani, H Nakajima; Osaka Prefecture University, Japan; K Harada; RIKEN, Japan; Y Ishii, S Mori; Osaka Prefecture University, Japan
- 9:15 AM **183** Investigation of Layer Composition and Morphology in Perpendicular Magnetic Tunnel Junctions; D Reifsnnyder Hickey; University of Minnesota; H Almasi, W Wang; University of Arizona; KA Mkhoyan; University of Minnesota
- 9:30 AM **184** (INVITED) Iterative Reconstruction of the Magnetization and Charge Density Using Vector Field Electron Tomography; KA Mohan; Purdue University; P K C; Carnegie Mellon University; C Phatak; Argonne National Laboratory; M De Graef; Carnegie Mellon University; CA Bouman; Purdue University

### P07.1 Failure Analysis Applications of Microanalysis, Microscopy, Metallography & Fractography

#### SESSION CHAIR:

Daniel P. Dennies, Consulting Metallurgical Engineer

#### PLATFORM SESSION

Tuesday 8:30 AM • Room: C215

- 8:30 AM **185** (INVITED) Failure Analysis of a Ruptured Cast Aluminum Alloy Fire Hose Manifold; SN Rosenbloom; WI Gore & Associates, Inc., D Crowe; Corrosion Probe, Inc., K Hessler; Corrosion Testing Laboratories, Inc.
- 9:00 AM **186** Failure of Mountain-Anchors as Consequence of Hydrogen Embrittlement; M Panzenboeck, C Freitag; Montanuniversitaet Leoben, Austria
- 9:15 AM **187** Troubleshooting Fabricated Products via Microscopic Defect and Failure Analysis; EI Garcia-Meitin, MM Kapur, RM Patel; The Dow Chemical Company
- 9:30 AM **188** (INVITED) Residue Induced Product Failures - Microanalysis; P Verghese, N Budiansky, P Ledwith, D Bauer; Exponent, Inc.

# Scientific Program

P

## PHYSICAL SCIENCES SYMPOSIA—

TUESDAY MORNING *continued*

### P09.2 From Angstrom to AU: Studies of Planet-Forming Materials

#### SESSION CHAIR:

Eve L. Berger, NASA Johnson Space Center

#### PLATFORM SESSION

Tuesday 8:30 AM • Room: C113

- 8:30 AM **189** *MultiLaue: A Technique to Extract d-Spacings from Laue XRD*; Z Gainsforth; University of California, Berkeley; MA Marcus, N Tamura; Lawrence Berkeley National Laboratory; AJ Westphal; University of California, Berkeley
- 8:45 AM **190** *Determination of the Modal Abundance of Nanoscale Amorphous Phases Using Selected Area Electron Diffraction Mapping*; BT De Gregorio, RM Stroud; U.S. Naval Research Laboratory; NM Abreu; Pennsylvania State University, Dubois; KT Howard; American Museum of Natural History
- 9:00 AM **191** (INVITED) *Investigation of Organic Matter at the Micron Scale in Carbonaceous Chondrites: a Spyglass to Study The Early Solar System*; L Remusat; Museum National D'Histoire Naturelle, France; C Le Guillou; Université de Lille, France; S Bernard, V Vinogradoff; Museum National D'Histoire Naturelle, France; A Brearley; University of New Mexico
- 9:30 AM **192** (INVITED) *Microanalysis of Fossil Micrometeorites and Meteorites to Study a Major Asteroid Collision ~470 Million Years Ago*; PR Heck; The Field Museum of Natural History; B Schmitz; Lund University, Sweden

TF

## TECHNOLOGISTS' FORUM—

TUESDAY MORNING

### X30.1 Real Analysis Data vs Artifact Recognition

#### SESSION CHAIRS:

Cathy Johnson, Mager Scientific

Caroline Miller, Indiana University

#### PLATFORM SESSION

Tuesday 9:00 AM • Room: C125

- 9:00 AM **193** (INVITED) *Artifacts in Cryo-Preparation for Electron Microscopy*; KH Rensing; Fibics Inc., Canada
- 9:30 AM **194** (INVITED) *Artifacts in Neuroimaging - Pitfalls in Volume Electron Microscopy for CLEM and in Freeze-Fracture Replica Immunogold Labeling*; N Kamasawa; Max Planck Florida Institute for Neuroscience

T

## PHYSICAL SCIENCES TUTORIAL—

TUESDAY MORNING

### X43.1 Diffraction Mapping and 4D STEM

#### SESSION CHAIR:

Patrick Phillips, University of Illinois, Chicago

#### PLATFORM SESSION

Tuesday 8:30 AM • Room: C211

- 8:30 AM **195** *Automated Analysis of Large Datasets Acquired with STEM Diffraction Mapping*; C Gammer; University of Vienna, Austria

O

## MICROSCOPY OUTREACH —

TUESDAY MORNING

### X90.1 Microscopy in the Classroom: Strategies for Education and Outreach

#### SESSION CHAIRS:

Alyssa Waldron &amp; David Becker

Bergen County Technical Schools

#### PLATFORM SESSION

Tuesday 9:00 AM • Room: C123-24

- 9:00 AM **196** *The "WOW Factor": Using Scanning Electron Microscopy to Stimulate Interest in STEM Disciplines*; M Gury, NA Butkevich; Schoolcraft College
- 9:15 AM *Discussion*
- 9:30 AM **197** *Macro to Micro: Innovation Inspired by Nature*; S Okerstrom; Lichen Labs LLC; P Anderson; Ely Memorial High School
- 9:45 AM *Discussion*

A

## ADVANCES IN INSTRUMENTATION SYMPOSIA—TUESDAY MORNING

### A04.3 Advances in FIB Instrumentation and Applications in Materials and Biological Sciences

#### SESSION CHAIR:

Nabil Bassim, U.S. Naval Research Lab

#### PLATFORM SESSION

Tuesday 10:30 AM • Room: C216

- 10:30 AM **198** *FIB-Milled Nanopore Sensors for Tracking Virus Assembly*; Z Harms, LS Lee, A Zlotnick, SC Jacobson; Indiana University
- 10:45 AM **199** *Use of Single Crystal Masks for Improved Mill Characteristics in High Current Xenon Plasma FIB Instrumentation*; S Subramaniam, L Smath, A Brown, K Johnson; Intel Corporation
- 11:00 AM **200** *The Neon Focused Ion Beam – Stabilizing the Emission Process*; JA Notte, JW Huang, R Rickert; Carl Zeiss Microscopy
- 11:15 AM **201** (INVITED) *GFIS in Semiconductor Applications*; S Tan, R Hallstein, R Livengood; Intel Corporation
- 11:45 AM **202** *Polarization Control via He-Ion Beam Induced Nanofabrication in Layered Ferroelectric Semiconductors*; A Belianinov, V Iberi, A Tselev, MA Susner, MA McGuire; Oak Ridge National Laboratory; D Joy; University of Tennessee; S Jesse, AJ Rondinone; Oak Ridge National Laboratory; et al.

### A05.2 Applications of Correlative Microscopy to Physical and Biological Sciences

#### SESSION CHAIRS:

Si Chen, Argonne National Laboratory

Renu Sharma, National Institute of Standards and Technology

Nestor Zaluzec, Argonne National Laboratory

#### PLATFORM SESSION

Tuesday 10:30 AM • Room: C210

- 10:30 AM **203** (INVITED) *The Agony and the Ecstasy: Correlative Microscopy from Photons to Electrons and X-Rays Lessons from Recent Case Studies*; L-M Joubert; Stanford University
- 11:00 AM **204** (INVITED) *Correlative Chemical Element Imaging in Cells Using Fluorescence Microscopy and Synchrotron X-Ray Fluorescence*; R Ortega, S Roudeau, L Perrin, A Carmona; Centre National de la Recherche Scientifique, France
- 11:30 AM **205** (INVITED) *A New Microscopy Facility for Optical, Electron and X-Ray Imaging at Diamond*; P Quinn, J Parker, F Cacho-Nerin; Diamond Light Source Ltd., United Kingdom; J Kim, A Kirkland; University of Oxford, United Kingdom; D Ozakaya; Johnson Matthey, United Kingdom

### A06.3 Analytical Electron Microscopy for Advanced Characterization from Multi-Dimensional Data Acquisition to Integrated Analysis

#### SESSION CHAIRS:

Chaoying Ni, University of Delaware

Peter van Aken, Max Planck Institute for Solid State Research

Masashi Watanabe, Lehigh University

#### PLATFORM SESSION

Tuesday 10:30 AM • Room: C224-25

- 10:30 AM **206** (INVITED) *Spectral Electron Tomography as a Quantitative Technique to Investigate Functional Nanomaterials*; S Bals, D Zanaga, B Goris, M Pfannmoeller, S Turner; University of Antwerp, Belgium; B Freitag; FEI Company, Netherlands
- 11:00 AM **207** *Automated 3D EDS Acquisition for Spatially Resolved Elemental Characterization of Catalyzed MgH<sub>2</sub> Nanostructures*; B Van Devenar; The University of Utah; KJ McIlwrath; JEOL USA, Inc., S Kim; AppFive LLC; Z Zak Fang, C Zhou; The University of Utah
- 11:15 AM **208** *Quantitative Measurements of the Penumbra of XEDS Systems in an AEM*; NJ Zaluzec, J Wen, J Wang, DJ Miller; Argonne National Laboratory
- 11:30 AM **209** *Characterization of VLSI Processing Defects Using STEM-EELS Tomography*; FH Baumann, J Miller, B Rhoads, A Friedman, B Fu; GlobalFoundries, Inc.
- 11:45 AM **210** **MSA POST-DOCTORAL AWARDEE** *Multidimensional Analysis of Nanoscale Phase Separation in Complex Materials Systems*; SR Spurgeon, Y Du, T Droubay, A Devaraj; Pacific Northwest National Laboratory; X Sang; North Carolina State University; P Longo; Gatan Inc., PG Kotula; Sandia National Laboratories, SA Chambers; Pacific Northwest National Laboratory; et al.

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION SYMPOSIA—TUESDAY MORNING *continued*

### A09.2 Advanced Scanning Diffraction: Mapping Functionality in Reciprocal Space at Nanometer Resolution

#### SESSION CHAIR:

Doug Medlin, Sandia National Laboratories

#### PLATFORM SESSION

Tuesday 10:30 AM • Room: C220

- 10:30 AM **211** (INVITED) *Mapping of Nanoscale Structural Fluctuations in Ferroelectric BaTiO<sub>3</sub> Using STEM-CBED*; K Tsuda; Tohoku University, Japan
- 11:00 AM **212** *Revealing Point Defects in a Large-Scale Scanning Diffraction Dataset*; R Dos Reis, C Ophus, J Ciston, P Ercius, U Dahmen; Lawrence Berkeley National Laboratory
- 11:15 AM **213** *Reconstruction of Polarization Vortices by Diffraction Mapping of Ferroelectric PbTiO<sub>3</sub>/SrTiO<sub>3</sub> Superlattice Using a High Dynamic Range Pixelated Detector*; KX Nguyen, P Purohit; Cornell University; AK Yadav; University of California, Berkeley; MW Tate, CS Chang; Cornell University; R Ramesh; University of California, Berkeley; SM Gruner, DA Muller; Cornell University
- 11:30 AM **214** **MSA POST-DOCTORAL AWARDEE** *Facilitating Quantitative Analysis of Atomic Scale 4D STEM Datasets*; Z Chen, M Weyland, C Zheng, MS Fuhrer; Monash University, Australia; AJ D'Alfonso, LJ Allen; The University of Melbourne, Australia; SD Findlay; Monash University, Australia
- 11:45 AM **215** *Towards Mapping Perovskite Oxide 3D Structure Using Two-Dimensional Pixelated STEM Detector*; M Nord, A Ross; University of Glasgow, United Kingdom; I Hallsteinsen, T Tybell; Norwegian University of Science and Technology; I MacLaren; University of Glasgow, United Kingdom

### A11.3 Advances in Scanning Electron/Ion Instrumentation and Detectors

#### SESSION CHAIR:

Brad Thiel, SUNY Polytechnic Institute

#### PLATFORM SESSION

Tuesday 10:30 AM • Room: C121-22

- 10:30 AM **216** (INVITED) *Silicon Photomultipliers: Properties, Latest Developments at FBK and Applications*; C Piemonte; Fondazione Bruno Kessler, Italy
- 11:00 AM **217** *Figure of Merit of Silicon Photomultiplier/Scintillator Electron Detector*; MB Tzolov; Lock Haven University of Pennsylvania; NC Barbi; Pulsetor LLC; CT Bowser; Lock Haven University of Pennsylvania; OE Healy; Pulsetor LLC
- 11:15 AM **218** *Real-World Electron Detector Performance in Scanning Electron Microscopes*; OE Healy, RB Mott; Pulsetor LLC

- 11:30 AM **219** *How New Electron Detector Concepts Can Help to Increase Throughput and Sensitivity of Single- and Multi-Beam Scanning Electron Microscopes*; A Liebel; PNDetector GmbH, Germany; G Lutz; PNSensor GmbH, Germany; U Weber, M Schmid, A Niculae, H Soltan; PNDetector GmbH, Germany

### A13.1 In Situ Electron Microscopy and Big Data Analytics in 2D and 3D

#### SESSION CHAIRS:

Huolin Xin, Brookhaven National Laboratory

Kai He, Northwestern University

#### PLATFORM SESSION

Tuesday 10:30 AM • Room: C221

- 10:30 AM **220** *Beyond Movie Mode: Bridging the Gap of Time Resolution*; BW Reed, ST Park, DJ Masiel; Integrated Dynamic Electron Solutions, Inc.
- 10:45 AM **221** (INVITED) *Pump-Probe and Time-Resolved Electron Microscopy and Big Data Analysis of Electron-Lattice Dynamics in Strongly Correlated Electron Systems*; Y Zhu, J Li, L Wu, P Zhu, T Konstantinova, J Tao, J Hill; Brookhaven National Laboratory, X Wang; SLAC National Accelerator Laboratory
- 11:15 AM **222** (INVITED) *Local Strain Measurements During In Situ TEM Deformation with Nanobeam Electron Diffraction*; A Minor; University of California, Berkeley; C Gammer; University of Vienna, Austria; Y Deng; Nanjing University, China; C Ophus, P Ercius, J Ciston; Lawrence Berkeley National Laboratory
- 11:45 AM **223** *Probing Stress-Induced Grain Boundary Migration and Hypofriction at High Resolution*; ML Bowers, C Ophus; Lawrence Berkeley National Laboratory; AM Minor; University of California, Berkeley; U Dahmen; Lawrence Berkeley National Laboratory

### A15.3 Quantitative Measurement of Intensities and Distances in Electron Microscopy

#### SESSION CHAIR:

James LeBeau, North Carolina State University

#### PLATFORM SESSION

Tuesday 10:30 AM • Room: C212

- 10:30 AM **224** (INVITED) *Direct Electromagnetic Structure Observation by Aberration-Corrected Differential Phase Contrast Scanning Transmission Electron Microscopy*; N Shibata; The University of Tokyo, Japan; SD Findlay; Monash University, Australia; T Matsumoto, T Seki, G Sánchez-Santolino; The University of Tokyo, Japan; Y Kohn; JEOL, Ltd., Japan; H Sawada; JEOL, Ltd., United Kingdom; Y Ikuhara; The University of Tokyo, Japan; et al.
- 11:00 AM **225** *Atomic Level Structure-Property Relationship in a Spin-Orbit Mott Insulator: Scanning Transmission Electron and Scanning Tunneling Microscopy Studies*; M Ziatdinov, A Maksov, W Zhou, A Baddorf, S Kalinin; Oak Ridge National Laboratory

- 11:15 AM **226** *Atomic Resolution Distortion Analysis of Yttrium-Doped Barium Zirconate*; J Ding; Georgia Institute of Technology; X Sang, J Balachandran; Oak Ridge National Laboratory; N Bassiri-Gharb; Georgia Institute of Technology; P Ganesh, RR Unocic; Oak Ridge National Laboratory
- 11:30 AM **227** *Exploring Thermal Properties of MoS<sub>2</sub> Using In Situ Quantitative STEM*; JM Johnson; The Ohio State University; CH Lee; The Ohio State University; S Rajan, W McCulloch, Y Wu, J Hwang; The Ohio State University
- 11:45 AM **228** *Aberration Corrected STEM Imaging of Domain Walls in Congruent LiNbO<sub>3</sub>*; D Mukherjee, GA Stone, K Wang, V Gopalan, N Alem; The Pennsylvania State University

## B

### BIOLOGICAL SCIENCES SYMPOSIA— TUESDAY MORNING

#### B05.1 Pathology: When Normal Goes Wrong

##### SESSION CHAIRS:

Jay Jerome, Vanderbilt University  
Bill Gunning, University of Toledo

##### PLATFORM SESSION

Tuesday 10:30 AM • Room: C110

- 10:30 AM **229** *When the Immunoreactions Don't Help*; WT Gunning; University of Toledo
- 10:45 AM **230** *The Use of a Degradable Biomaterial to Regulate Fibrosis at the Implant-Host Interface*; KA Harmon, BA Lane, JF Eberth; University of South Carolina; MJ Yost; Medical University of South Carolina; HI Friedman, RL Goodwin; University of South Carolina
- 11:00 AM **231** *STEM Imaging and Analysis of Ferritin Nanoparticles in Organs: Spatial and Temporal Association of Ferritin with Invader Nanoparticles and Oxidation States Revealed*; AK Dozier; National Institute for Occupational Safety and Health; UM Graham; University of Kentucky; C Wang, JE Fernback, ME Birch; National Institute for Occupational Safety and Health; G Oberdoester; University of Rochester; BH Davis; University of Kentucky
- 11:15 AM **232** (INVITED) **M&M 2016 STUDENT AWARDEE** *Visualizing the Entry of Clostridium difficile Toxin A into Human Colonic Epithelial Cells*; R Chandrasekaran, DB Lacy; Vanderbilt University

#### B06.2 Pharmaceuticals and Medical Science

##### SESSION CHAIR:

John-Bruce Green, Baxter Healthcare

##### PLATFORM SESSION

Tuesday 10:30 AM • Room: C111

- 10:30 AM **233** (INVITED) *Mapping Chemistry, Composition, and Dynamics with Coherent Raman Imaging*; MT Cicerone, CH Camp, R Sharon-Frilling, YJ Lee; National Institute of Standards and Technology
- 11:00 AM **234** (INVITED) *Time of Flight Secondary Ion Mass spectrometry: Chemical Imaging*; S Attavar, DA Cole, A Ginwalla, JH Gibson; Evans Analytical Group
- 11:30 AM **235** (INVITED) *Applications of Optical Coherence Tomography for Nondestructive Evaluation of Materials*; J Slepicka; Baxter Healthcare

#### B07.3 3D Structures of Macromolecular Assemblies, Cellular Organelles and Whole Cells

##### SESSION CHAIRS:

Cheri Hampton, Emory University  
Kristin Parent, Michigan State University

##### PLATFORM SESSION

Tuesday 10:30 AM • Room: C115

- 10:30 AM **236** (INVITED) *Structure of the Full-Length TRPV<sub>2</sub> Channel by Cryo-EM*; VY Moiseenkova-Bell, KW Huynh, MR Cohen; Case Western Reserve University; J Jiang; University of California, Los Angeles; A Samanta, DT Lodowski; Case Western Reserve University; ZH Zhou; University of California, Los Angeles
- 11:00 AM **237** *Structural Oncology – Determining 3D Structures of Breast Cancer Assemblies*; BL Gilmore, CE Winton, V Karageorge, Z Sheng, DF Kelly; Virginia Polytechnic Institute and State University
- 11:15 AM **238** **M&M 2016 STUDENT AWARDEE** *Probing the Nanoscale Features of Rhodobacter Sphaeroides: Insight Gained from Cryo- Focused Ion Beam and Cryo-Electron Tomography*; JM Noble; Cornell University; J Lubieniecki, H Engelhardt, J Plitzko, W Baumeister; Max Planck Institute of Biochemistry, Germany; L Kourkoutis; Cornell University
- 11:30 AM **239** (INVITED) *Sub-Tomogram Averaging in RELION*; TA Bharat, SH Scheres; MRC Laboratory of Molecular Biology, United Kingdom

# Scientific Program

B

## BIOLOGICAL SCIENCES SYMPOSIA— TUESDAY MORNING *continued*

### B08.2 Utilizing Microscopy for Research and Diagnosis of Diseases in Humans, Plants and Animals

#### SESSION CHAIRS:

Jon Charlesworth, Mayo Clinic

Betty Thompkins, University of Pennsylvania

#### PLATFORM SESSION

Tuesday 10:30 AM • Room: C114

- 10:30 AM **240** *Using Scanning Transmission Electron Microscopy (STEM) for Accurate Virus Dosing Quantification*; CD Blancett, DP Fetterer, KA Koistinen, EM Morazzani, MK Monniger, AE Piper, PJ Glass, MG Sun; U.S. Army Medical Research Institute; et al;
- 10:45 AM **241** *Improved Virus Specimen Preparation for Transmission Electron Microscopy Using mPrep/g Capsules: Applications in BSL3-4 Laboratories*; MK Monninger, CA Nguessan, CD Blancett; U.S. Army Medical Research Institute of Infectious Diseases; SL Goodman; Microscopy Innovations, LLC; MG Sun; U.S. Army Medical Research Institute of Infectious Diseases
- 11:00 AM **242** (INVITED) *Vacuolar Myopathies: Ultrastructural Studies Benefit Diagnosis*; R Goffredi; Children's Hospital Colorado
- 11:30 AM **243** *Thrombosis, Inflammation, and Hematopoiesis Visualized by Multi-Scale In Vivo 1p, 2p, and On-Chip Imaging Systems*; S Nishimura; Jichi Medical University, Japan
- 11:45 AM **244** *SEM Visualization of Biological Samples Using Hitachi Ionic Liquid HILEM® IL 1000: A Comparative Study*; L-M Joubert; Stanford University; KL McDonald; University of California, Berkeley

P

## PHYSICAL SCIENCES SYMPOSIA— TUESDAY MORNING

### P01.2 Dr. Gareth Thomas Symposium: Materials Solutions through Microscopy

#### SESSION CHAIRS:

R Gronsky, University of California Berkeley

D Williams, The Ohio State University

#### PLATFORM SESSION

Tuesday 10:30 AM • Room: C214

- 10:30 AM **245** (INVITED) *The Microstructure of Dislocated Martensite: Size, Microscopy and Microanalysis*; JW Morris; University of California, Berkeley
- 10:45 AM **246** (INVITED) *Nanomagnetic Materials in Medicine: Recent Developments in Imaging, Diagnostics and Therapy*; KM Krishnan; University of Washington
- 11:00 AM **247** (INVITED) *A Grain Boundary "TTT" – "Tribute to Thomas"!*; MP Harmer, CJ Marvel; Lehigh University; PR Cantwell; Rose-Hulman Institute of Technology
- 11:15 AM **248** (INVITED) *Observation of a Metastable Cu Phase Formed at a Crystalline Si/Liquid Al-Alloy Interface in an Al-Cu-Mg-Si Alloy*; JM Howe; University of Virginia; MM Schneider; University of Central Florida
- 11:30 AM **249** (INVITED) *Impact of Analytical Electron Microscopy in Advancing Materials Technology in the Refining and Petrochemical Industry*; R Ayer; SK Innovation, Republic of Korea
- 11:45 AM **250** (INVITED) *Contributions to High-Resolution Electron Microscopy by Gareth Thomas' NCEM*; MA O'Keefe; OKCS

### P02.3 Electron Microscopy of Materials for Electrochemical Power Systems

#### SESSION CHAIR:

Dean J. Miller, Argonne National Laboratory

#### PLATFORM SESSION

Tuesday 10:10 AM • Room: E160AB

- 10:10 AM **251** (INVITED) *Progress in Soft X-Ray Microscopy Characterization of PEM Fuel Cell Catalyst Layers*; AP Hitchcock, J Wu, V Lee, N Appathurai; McMaster University, Canada; T Tyliczszak, HW Shiu, D Shapiro; Lawrence Berkeley National Laboratory, V Berejnov; Automotive Fuel Cell Cooperation Corporation, Canada; et al.
- 10:40 AM **252** *Bridging the Pressure Gap in Electron Beam Induced Current Microscopy: Imaging Charge Transport in Metal Oxide Nanowires Under Atmospheric Pressures*; A Stevanovic, J Velmurugan; University of Maryland; F Yi, D Lavan, A Kolmakov; National Institute of Standards and Technology
- 10:55 AM **253** *Electron Dose Management for High Angle Annular Dark Field Scanning Transmission Electron Microscope Tomography of Beam Sensitive Materials*; F Voisard, H Demers; McGill University, Canada; M Trudeau; Research Institute D'hydro-Québec, Canada; GP Demopoulos, R Gauvin; McGill University, Canada; K Zaghib; Research Institute D'hydro-Québec, Canada

**11:10 AM 254** *Comparison of Energy Filtered TEM Spectra Image and Automatic Computer Orientation Mapping in LiFePO<sub>4</sub>/FePO<sub>4</sub> Phase Mapping*; X Mu, A Kobler; Karlsruhe Institute of Technology, Germany; VSK Chakravadhanula; Helmholtz-Institute Ulm for Electrochemical Energy Storage, Germany; P Norby; Technical University of Denmark; C Kübel; Karlsruhe Institute of Technology, Germany

**11:25 AM 255** *Time-Resolved Atomic-Scale Chemical Imaging of the Phase Transformation in Li-Rich Layered Cathode Materials Induced by Electron-Beam Irradiations*; P Lu; Sandia National Laboratories; P Yan, C Wang; Pacific Northwest National Laboratory

## P06.3 Magnetic Materials, Phenomena and Imaging at the Nanoscale

### SESSION CHAIR:

Charudatta Phatak, Argonne National Laboratory

### PLATFORM SESSION

Tuesday 10:30 AM • Room: C213

**10:30 AM 256** (INVITED) *Ferromagnetic Resonance Force Microscopy: Spectroscopy on the Nano-Scale*; SP White, PC Hammel; The Ohio State University

**11:00 AM 257** (INVITED) *Three-Dimensional Induction Mapping of Magnetic Nanoscale Materials by Electron Holographic Tomography*; D Wolf, A Lubk, H Lichte; Technical University Dresden, Germany

**11:30 AM 258** *Visualization of Magnetization in CoFe Nanofibers by Lorentz TEM and Electron Holography*; S Zhang, Z Zhou, G Grocke, A Petford-Long, Y Liu, X Chen, C Phatak; Argonne National Laboratory

**11:45 AM 259** *Controlled Magnetization by Electron Holography of Polycrystalline Cobalt Nanowires*; JE Sanchez, J Cantu-Valle, E Ortega; University of Texas, San Antonio; I Betancourt; Universidad Nacional Autónoma de México; MM Maqableh, BJ Stadler; University of Minnesota; M Jose Yacamán; University of Texas, San Antonio, A Ponce; University of Texas, San Antonio

## P07.2 Failure Analysis Applications of Microanalysis, Microscopy, Metallography & Fractography

### SESSION CHAIRS:

Daniel P. Dennies, Consulting Metallurgical Engineer

Noah Budiansky, Exponent

William Kane, Exponent

### PLATFORM SESSION

Tuesday 10:30 AM • Room: C215

**10:30 AM 260** (INVITED) *Prediction of Fatigue-Initiating Twin Boundaries in Polycrystalline Nickel Superalloys Informed by TriBeam Tomography*; WC Lenthe, J-C Stinville, MP Echlin, TM Pollock; University of California, Santa Barbara

**11:00 AM 261** *TEM Characterization of HSLA Steels and Welds*; B Shalchi Amirkhiz, D-Y Park, C Bibby, P Liu; Natural Resources Canada

**11:15 AM 262** *Combining Orientation Mapping and In Situ TEM to Investigate High-Cycle Fatigue and Failure*; DC Bufford; Sandia National Laboratories; D Stauffer; Hysitron, Inc., WM Mook; Sandia National Laboratories; SAS Asif; Hysitron, Inc., BL Boyce, K Hattar; Sandia National Laboratories

**11:30 AM 263** *High-Resolution Cathodoluminescence Investigation of Degradation Processes in InGaN Green Laser Diodes*; D Gachet; Attolight AG, Switzerland; C De Santi, M Meneghini; University of Padova, Italy; G Mura, M Vanzi; University of Cagliari, Italy; G Meneghesso, E Zanoni; University of Padova, Italy

**11:45 AM 264** *In Situ SEM Study of Mechanical Properties of Aluminide Bond Coating at Elevated Temperature*; S Bhowmick, S Asif; Hysitron, Inc.

## P09.3 From Angstrom to AU: Studies of Planet-Forming Materials

### SESSION CHAIR:

Eve L. Berger, NASA Johnson Space Center

### PLATFORM SESSION

Tuesday 10:30 AM • Room: C113

**10:30 AM 265** (INVITED) *Deformation Analysis of Forsterite Olivine Using Electron Channeling Contrast Imaging and Electron Backscatter Diffraction*; S Kaboli; University of Nevada, Las Vegas; R Guavin; McGill University, Canada; P Burnley; University of Nevada, Las Vegas

**11:00 AM 266** *Can Zircons be Suitable Paleomagnetic Recorders? – A Correlative Study of Bishop Tuff Zircon Grains Using High-Resolution Lab X-Ray Microscopes and a Quantum Diamond Microscope*; RR Fu; Columbia University; BP Weiss, EA Lima, J Ferraz; Massachusetts Institute of Technology; J Gelb; Carl Zeiss X-Ray Microscopy, Inc., D Glenn, P Kehayias; Harvard University, JF Einsle; University of Cambridge, United Kingdom; et al.

**11:15 AM 267** *TEM Analyses of Itokawa Regolith Grains and Lunar Soil Grains to Directly Determine Space Weathering Rates on Airless Bodies*; EL Berger, LP Keller, R Christoffersen; NASA Johnson Space Center

**11:30 AM 268** **MSA POST-DOCTORAL AWARDEE** *Nanophase Fe-Oxide, Fe-Sulfide, and Ilmenite in High-Ti Lunar Soil Using Aberration-Corrected STEM-EELS and EDS*; K Burgess; ASEE Naval Research Laboratory; R Stroud; U.S. Naval Research Laboratory

**11:45 AM 269** *In Situ Heating of Lunar Soil in the Transmission Electron Microscope: Simulating Micrometeorite Impacts*; MS Thompson, TJ Zega; University of Arizona; JY Howe; Hitachi High-Technologies Canada Inc.

# Scientific Program

P

## PHYSICAL SCIENCES SYMPOSIA— TUESDAY MORNING *continued*

### P11.1 Metallography and Microstructural Characterization of Metals

#### SESSION CHAIRS:

George Vander Voort, Vander Voort Consulting LLC  
Coralee McNee, United Technologies

#### PLATFORM SESSION

Tuesday 10:30 AM • Room: C112

- 10:30 AM **270** (INVITED) *Atomic Level Characterization of Novel Hardening Mechanisms in High-Mn-Steels*; J Mayer; RWTH Aachen University, Germany; M Beigmohamadi, M Lipinska-Chwalek; Forschungszentrum Jülich, Germany; JE Wittig; Vanderbilt University
- 11:00 AM **271** *The Power of Correlative Microscopy – Understanding Deformation Compatibility with HR-EBSD and HR-DIC*; J Jiang, T Zhang, F Dunne, B Britton; Imperial College London, United Kingdom
- 11:15 AM **272** *STEM Optical Sectioning for Imaging Screw Dislocations Core Structures in BCC Metals*; D Hernandez-Maldonado; SuperSTEM Laboratory, United Kingdom; H Yang; Lawrence Berkeley National Laboratory; L Jones; University of Oxford, United Kingdom; R Gröger; Institute of Physics of Materials ASCR, Czech Republic; PB Hirsch; University of Oxford, United Kingdom; QM Ramasse; SuperSTEM Laboratory, United Kingdom; PD Nellist; University of Oxford, United Kingdom
- 11:30 AM **273** *Investigating Dislocation-Twin Boundary Interactions in Nickel Using Diffraction Contrast Scanning Transmission Electron Microscopy*; DL Medlin; Sandia National Laboratories; ML Bowers, C Ophus; Lawrence Berkeley National Laboratory; SK Lawrence, B Somerday, RA Karnesky; Sandia National Laboratories
- 11:45 AM **274** *Through-Focal HAADF-STEM Analysis of Dislocation Cores in a High-Entropy Alloy*; TM Smith, BD Esser, MS Hooshmand; The Ohio State University; EP George; Ruhr University Bochum; F Otto; Ruhr University Bochum, Germany; M Ghazisaeidi, DW McComb, MJ Mills; The Ohio State University

TF

## TECHNOLOGISTS' FORUM— TUESDAY MORNING

### X32.1 Roundtable Discussion on Artifacts

#### PANELISTS:

E. Ann Ellis, Consultant In Biological Electron Microscopy  
Lee Cohen-Gould, Weill Cornell Medical College

#### PLATFORM SESSION

Tuesday 10:30 AM • Room: C125

- 10:30 AM **275** *Recognizing and Preventing Artifacts in Microscopy: A Roundtable Discussion*; EA Ellis; Consultant In Biological Electron Microscopy; L Cohen-Gould; Weill Cornell Medical College

## MSA DISTINGUISHED SCIENTIST AWARDEE LECTURES

12:15 - 1:15 PM • Room C121-122

*Lunch served to first 100 participants*

### DISTINGUISHED SCIENTIST—PHYSICAL

George D.W. Smith  
Oxford University, UK

*Some Atoms I Have Known: The Origins, Development, and Current Status of Atom Probe Tomography*

### DISTINGUISHED SCIENTIST—BIOLOGICAL

Ken Downing  
Lawrence Berkeley National Laboratory, Berkeley

*From Tubulin to Microtentacles: Structures for Potential Cancer Therapy Targets*

A

## ADVANCES IN INSTRUMENTATION SYMPOSIA—TUESDAY AFTERNOON

### A03.1 X-Ray Imaging and Analysis

#### SESSION CHAIR:

Jeff Davis, PNDetector

#### PLATFORM SESSION

Tuesday 1:30 PM • Room: C115

- 1:30 PM **276** (INVITED) *Novel Methods for Hard X-Ray Holographic Lensless Imaging*; MT Saliba; University of Zurich, Switzerland; J Bosgra; Paul Scherrer Institute, Switzerland; AD Parsons, UH Wagner, C Rau; Diamond Light Source Ltd., United Kingdom; P Thibault; University of Southampton, United Kingdom
- 2:00 PM **277** *High-Throughput Quantitative Phase Mapping Using Synchrotron X-Ray Diffraction*; J-H Her, Y Gao, E Jezek, J Rijssenbeek; GE Global Research Center; H Zhong, J Parise; Stony Brook University
- 2:15 PM **278** **M&M 2016 STUDENT AWARDEE** *Coherent Ptychographic Imaging Microscope With 17.5nm Spatial Resolution Employing 13.5nm High Harmonic Light*; M Tanksalvala, DF Gardner, GF Mancini, ER Shanblatt; University of Colorado, Boulder; X Zhang; Kapteyn-Murnane Laboratories; BR Galloway, CR Porter, R Karl; University of Colorado, Boulder; et al
- 2:30 PM **279** (INVITED) *Simultaneously Synchrotron X-Ray Fluorescence and Ptychographic Imaging of Frozen Biological Single Cells*; S Chen; Argonne National Laboratory; J Deng; Northwestern University; Y Nashed; Argonne National Laboratory; Q Jin; Northwestern University; D Vine; Lawrence Berkeley National Laboratory; T Peterka; Argonne National Laboratory; K Brister; Northwestern University, C Jacobsen; Argonne National Laboratory; et al.

### A04.4 Advances in FIB Instrumentation and Applications in Materials and Biological Sciences

#### SESSION CHAIR:

Srinivas Subramaniam, Intel Corporation

#### PLATFORM SESSION

Tuesday 1:30 PM • Room: C216

- 1:30 PM **280** *SIMS on the Helium Ion Microscope: A Powerful Tool for High-Resolution High-Sensitivity Nano-Analytics*; T Wirtz, D Dowsett, J-N Audinot, S Eswara; Luxembourg Institute of Science and Technology
- 1:45 PM **281** *Flexible Grid Holder Enabling FIB-SEM Sample Prep and Analysis*; C Hartfield; Oxford Instruments Nanoanalysis; F Bauer; Oxford Instruments, Germany
- 2:00 PM **282** *Localization of Subsurface Structures for Site-Specific Cryo-FIB Lift-Out Preparation of Solid-Liquid Interfaces*; MJ Zachman, LF Kourkoutis; Cornell University

- 2:15 PM **283** *Monolithic Multi-Grating Diffraction in a Convergent Electron Beam*; A Agarwal, C-S Kim, R Hobbs; Massachusetts Institute of Technology; D Van Dyck; University of Antwerp, Belgium; KK Berggren; Massachusetts Institute of Technology
- 2:30 PM **284** (INVITED) *FIB Sample Preparation for X-Ray Microscopy and ROI Target Cross-sectioning*; E Zschech, J Gluch, R Rosenkranz, Y Standke; Fraunhofer Institute for Ceramic Technologies and Systems, Germany; S Niese; AXO Dresden GmbH, Germany

### A05.3 Applications of Correlative Microscopy to Physical and Biological Sciences

#### SESSION CHAIRS:

Nestor Zaluzec, Argonne National Laboratory

Renu Sharma, National Institute of Standards and Technology

Si Chen, Argonne National Laboratory

#### PLATFORM SESSION

Tuesday 1:30 PM • Room: C210

- 1:30 PM **285** (INVITED) *Temperature Programmed Reduction of a PdCu Bimetallic Catalyst via Atmospheric Pressure In Situ STEM-EDS and In Situ X-Ray Adsorption Analysis*; MA Kulzick; BP Research Center; E Prestat; University of Manchester, United Kingdom; P Dietrich, E Dskocil; BP Research Center; SJ Haigh, MG Burke; University of Manchester, United Kingdom; NJ Zaluzec; Argonne National Laboratory
- 2:00 PM **286** *Multimodal Approach for Rationalization and Quantification of Structural Disorder in Transition Al<sub>2</sub>O<sub>3</sub>*; L Kovarik, M Bowden, A Andersen, N Washton, J Szanyi, J Hu, CH Peden; Pacific Northwest National Laboratory, J-H Kwak; Ulsan National Institute of Science and Technology, Republic of Korea; et al.
- 2:15 PM **287** *Combined Scanning Probe Microscopy and Confocal Raman Spectroscopy for Functional Imaging of the Layered Materials*; AV Ievlev, M Susner, M McGuire, P Maksymovych, S Kalinin; Oak Ridge National Laboratory
- 2:30 PM **288** *Correlative Imaging and Spectroscopy of Particles in Liquid*; X-Y Yu, B Arey, HJ Jung, L Kovarik, Z Zhu, J Yao; Pacific Northwest National Laboratory; T Troy, M Ahmed; Lawrence Berkeley National Laboratory et al.
- 2:45 PM **289** *Distinguishing Isotopes in the Electron Microscope: In Situ TEM-SIMS Correlative Analysis*; L Yedra, S Eswara, D Dowsett, T Wirtz; Luxembourg Institute of Science and Technology

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION SYMPOSIA—TUESDAY AFTERNOON *continued*

### A06.4 Analytical Electron Microscopy for Advanced Characterization from Multi-dimensional Data Acquisition to Integrated Analysis

#### SESSION CHAIRS:

Chaoying Ni, University of Delaware

Peter van Aken, Max Planck Institute for Solid State Research

Masashi Watanabe, Lehigh University

#### PLATFORM SESSION

Tuesday 1:30 PM • Room: C224-25

- 1:30 PM **290** (INVITED) *Improved Data Analysis and Reconstruction Methods for EDX Tomography*; Z Saghi, J Einsle, R Blukis, A Strodahs, R Leary; University of Cambridge, United Kingdom; P Burdet; École Polytechnique Fédérale de Lausanne, Switzerland; R Harrison, P Midgley; University of Cambridge, United Kingdom
- 2:00 PM **291** *Quantifying the Advantages of Compressive Sensing and Sparse Reconstruction for Scanning Transmission Electron Microscopy*; BW Reed, ST Park, DJ Masiel; Integrated Dynamic Electron Solutions, Inc.
- 2:15 PM **292** *High Performance Computing Tools for Cross Correlation of Multi-Dimensional Data Sets Across Instrument Platforms*; A Belianinov; Oak Ridge National Laboratory; D Gobeljic, VV Shvartsman; University of Duisburg-Essen, Germany; E Endeve, EJ Lingerfelt, R Archibald, SV Kalinin, S Jesse; Oak Ridge National Laboratory
- 2:30 PM **293** *The Enabler Framework: an Object-Oriented Toolkit for Microscopy Data Analysis*; MK Kundmann; e-Metrikos
- 3:00 PM **294** *Using Multivariate Analysis of Scanning-Rochigram Data to Reveal Material Functionality*; S Jesse, M Chi, AY Borisevich, A Belianinov, SV Kalinin, E Endeve, RK Archibald, CT Symons; Oak Ridge National Laboratory; et al.

### A09.3 Advanced Scanning Diffraction: Mapping Functionality in Reciprocal Space at Nanometer Resolution

#### SESSION CHAIR:

Jim Ciston, Lawrence Berkeley National Laboratory

#### PLATFORM SESSION

Tuesday 1:30 PM • Room: C220

- 1:30 PM **295** (INVITED) *An Electron Microscope Pixel Array Detector as a Universal STEM Detector*; DA Muller, KX Nguyen, MW Tate, P Purohit, C Chang, M Cao, SM Gruner; Cornell University

- 2:00 PM **296** *STEM Phase Imaging by Annular Pixel Array Detector (A-PAD) Combined with Quasi-Bessel Beam*; T Kawasaki; Japan Fine Ceramics Center; T Ishida; Nagoya University, Japan; T Kodama; Meijo University, Japan; T Tanji; Nagoya University, Japan; T Ikuta; Osaka Electro-Communication University, Japan
- 2:15 PM **297** *Multivariate Statistical Analysis of Series of Diffraction Patterns*; PG Kotula, MH Van Benthem; Sandia National Laboratories; H Ryll; PNsens GmbH, Germany; M Simpson, H Soltan; PNDetector GmbH, Germany
- 2:30 PM **298** (INVITED) *Measurement of Atomic Electric Fields by Scanning Transmission Electron Microscopy (STEM) Employing Ultrafast Detectors*; K Müller-Caspary, FF Krause; Universität Bremen, Germany; A Béché; Universiteit Antwerpen, Belgium; M Duchamp; Forschungszentrum Jülich, Germany; M Schowalter; Universität Bremen, Germany; M Huth; PNDetector GmbH, Germany; S Löffler; Technische Universität Wien, Austria, A Rosenauer; Universität Bremen, Germany; et al.

### A11.4 Advances in Scanning Electron/Ion Instrumentation and Detectors

#### SESSION CHAIR:

Matthew Phillips, University of Technology Sydney

#### PLATFORM SESSION

Tuesday 1:30 PM • Room: C121-22

- 1:30 PM **299** (INVITED) *Nanoscale Imaging of Structural and Optical Properties Using Helium Temperature Scanning Transmission Electron Microscopy Cathodoluminescence of Nitride Based Nanostructures*; F Bertram, M Müller, G Schmidt, P Veit, J Christen; Institute of Experimental Physics, Germany; S Albert, E Calleja; Universidad Politécnica de Madrid, Spain
- 2:00 PM **300** *Nanoscale Cathodoluminescence of an InGaN Single Quantum Well Intersected by Individual Dislocations*; P Veit, S Metzner, C Berger, F Bertram, A Dadgar, A Strittmatter, J Christen; Otto-Von-Guericke University Magdeburg, Germany
- 2:15 PM **301** *STEM/SEM, Chemical Analysis, Atomic Resolution and Surface Imaging At  $\leq 30$  kV with No Aberration Correction for Nanomaterials on Graphene Support*; T Sunaoshi, K Kaji, Y Orai; Hitachi High-Technologies Corporation, Japan; T Schamp, E Voelkl; Hitachi High Technologies America, Inc.
- 2:30 PM **302** *Is it Possible to Image the Auger Electron Signal in a Conventional SEM Using a Segmented Annular BSED and Stage Bias?*; BJ Griffin, AA Suvorova; The University of Western Australia; JR Michael; Sandia National Laboratories; DC Joy; Oak Ridge National Laboratory
- 2:45 PM **303** *Comparison of Secondary, Backscattered and Low Loss Electron Imaging for Dimensional Measurements in the Scanning Electron Microscope - Part 2*; MT Postek, AE Vladar, J Villarrubia; National Institute of Standards and Technology; A Muto; Hitachi High Technologies America, Inc.

## A13.2 *In Situ* Electron Microscopy and Big Data Analytics in 2D and 3D

### SESSION CHAIR:

Renu Sharma, National Institute of Standards and Technology

### PLATFORM SESSION

Tuesday 1:30 PM • Room: C221

- 1:30 PM **304** (INVITED) *Structural Dynamics of Supported Metal Nanoparticles*; JC Yang; University of Pittsburgh
- 2:00 PM **305** (INVITED) *Recent Advancement of Environmental TEM for Material Process Characterization*; S Takeda, H Yoshida, T Uchiyama; Osaka University, Japan
- 2:30 PM **306** (INVITED) *Automated Image Processing Scheme to Measure Atomic-Scale Structural Fluctuations*; R Sharma, ZA Hussaini, P Lin; National Institute of Standards and Technology; W Zhu; State University of New York, Binghamton; B Natarajan; National Institute of Standards and Technology

## A15.4 Quantitative Measurement of Intensities and Distances in Electron Microscopy

### SESSION CHAIR:

Jinwoo Hwang, The Ohio State University

### PLATFORM SESSION

Tuesday 1:30 PM • Room: C212

- 1:30 PM **307** (INVITED) *Three-Dimensional Determination of the Coordinates of Individual Atoms in Materials*; J Miao; University of California, Los Angeles
- 2:00 PM **308** *Reconstruction of the Nanoscale Three-Dimensional Mass-Density Autocorrelation Function of Individual Cells*; Y Li, D Zhang, I Capoglu, D Damania, K Hujsak, L Cherkezyan, E Roth, R Bleher; Northwestern University; et al.
- 2:15 PM **309** (INVITED) *Retrieving Atomic Structure from Dynamical Rocking Curve Measurements in Both Real and Reciprocal Space*; CT Koch, WR Van den Broek, F Wang, RS Pennington; Humboldt University, Berlin, Germany
- 2:45 PM **310** *Quantitative Comparison of Phase Contrast Imaging in Conventional TEM Focal Series and STEM Ptychography*; E Liberti; University of Oxford, United Kingdom; H Yang; Lawrence Berkeley National Laboratory; G Martinez, P Nellist, A Kirkland; University of Oxford, United Kingdom

B

## BIOLOGICAL SCIENCES SYMPOSIA—

TUESDAY AFTERNOON

## B05.2 Pathology: When Normal Goes Wrong

### SESSION CHAIRS:

Bill Gunning, University of Toledo

Jay Jerome, Vanderbilt University

### PLATFORM SESSION

Tuesday 1:30 PM • Room: C110

- 1:30 PM **311** (INVITED) *In Late-Staged Atherosclerotic Foam Cells, Autophagy Exacerbates Lysosome Dysfunction and Cellular Homeostasis*; WG Jerome, C Netherland-Van Dyke, CE Romer; Vanderbilt University
- 2:00 PM **312** (INVITED) *Second Harmonic Generation and Multiphoton Excited Fluorescence Microscopy as a Phenotypic Tool in an Animal Model*; AL Nestor-Kalinoski; University of Toledo
- 2:30 PM **313** (INVITED) *Pathological Consequences of Altered Hemodynamics During Heart Valve Development*; JD Potts; University of South Carolina; V Menon, J Eberth, L Junor

## B06.3 Pharmaceuticals and Medical Science

### SESSION CHAIR:

Bridget Carragher, Nanoimaging Services

### PLATFORM SESSION

Tuesday 1:30 PM • Room: C111

- 1:30 PM **314** (INVITED) *EM by EM: High-Efficiency Epitope Mapping Using High-Throughput Electron Microscopy*; A Estevez; Genentech Inc., C Garvey, C Ciferri; Genentech Inc.
- 2:00 PM **315** (INVITED) *Structural Characterization of Monoclonal Antibody Therapeutics by Transmission Electron Microscopy and 2D Classification Analysis*; A Schneemann, JJ Sung, JA Speir, SK Mulligan, K On, J Quispe, B Carragher, CS Potter; Nanoimaging Services, Inc.
- 2:30 PM **316** *Characterization of the Shielding Properties of Serum Albumin on a Plant Viral Nanoparticle*; NM Gulati, AS Pitek, NF Steinmetz, PL Stewart; Case Western Reserve University
- 2:45 PM **317** *Fine Tuned Seed Mediated Synthesis and Photothermal Response of Gold Nanorods*; B Gates, I Guo, T Chung; Simon Fraser University, Canada

# Scientific Program

P

## PHYSICAL SCIENCES SYMPOSIA—

TUESDAY AFTERNOON

### P01.3 Dr. Gareth Thomas Symposium: Materials Solutions through Microscopy

#### SESSION CHAIRS:

Ronald Gronsky, University of California, Berkeley

David Williams, The Ohio State University

#### PLATFORM SESSION

Tuesday 1:30 PM • Room: C214

- 1:30 PM **318** (INVITED) *Antiphase Ordered Domains and Optical Diffraction for Copper-Gold and Samarium-Doped Ceria: Reflections on Gareth Thomas*; R Sinclair, SC Lee, AL Koh; Stanford University
- 1:45 PM **319** *In Situ Study of the Order-Disorder Transformation in Lithium Ferrite*; OO Van der Biest; Katholieke Universiteit Leuven, Belgium
- 2:00 PM **320** (INVITED) *Molecular Biomimetics vs Materials Science*; M Sarikaya; University of Washington
- 2:15 PM **321** *Pulsed Plasma Surface Modifications (PPSM) from an Industrial Perspective: Pico-Technology, Nano-Structures and Novel Structures with Unique Properties*; RH Hoel; MOTech Plasma a.s., Norway
- 2:30 PM **322** (INVITED) *Polar Vortices in Oxide Superlattices*; R Ramesh; University of California, Berkeley
- 2:45 PM **323** *Using Energy-Filtered TEM to Solve Practical Materials Problems with Inspirations from Gareth Thomas*; JD Sugar, F El Gabaly; Sandia National Laboratories; W Chueh; Stanford University; PG Kotula, N Bartelt; Sandia National Laboratories; JT McKeown; Lawrence Livermore National Laboratory; AM Glaeser, R Gronsky; University of California, Berkeley; et al.

### P02.4 Electron Microscopy of Materials for Electrochemical Power Systems

#### SESSION CHAIR:

David A. Cullen, Oak Ridge National Laboratory

#### PLATFORM SESSION

Tuesday 1:30 PM • Room: E160AB

- 1:30 PM **324** (INVITED) *Microstructural Evolution in Transition-Metal-Oxide Cathode Materials for Lithium-Ion Batteries*; DJ Miller; Argonne National Laboratory
- 2:00 PM **325** *On Growth and Chemistry of Electrodeposited Mg Layers with Electrolytes Having Varying Cl Content for Battery Application*; M Bachhav; University of Michigan
- 2:15 PM **326** *Revealing Microstructural Defects in Commercial Li-Ion Batteries Under Electrochemical Fatigue Cycling*; J Gelb; Carl Zeiss X-Ray Microscopy, Inc., D Finegan, D Brett, P Shearing; University College London, United Kingdom
- 2:30 PM **327** *STEM/EELS Analysis of  $\text{Li}(\text{Ni}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05})\text{O}_2$  Held at High Voltages*; P Mukherjee; Rutgers University; D Su; Brookhaven National Laboratory; N Pereira, G Amatucci, F Cosandey; Rutgers University

- 2:45 PM **328** *A “Hidden” Mesoscopic Feature Revealed by Electron Microscopy could Facilitate Ion Transport in Solid Electrolytes*; C Ma, K More, N Dudney, Y Cheng, M Chi; Oak Ridge National Laboratory

### P09.4 From Angstrom to AU: Studies of Planet-Forming Materials

#### SESSION CHAIR:

Eve L. Berger, NASA Johnson Space Center

#### PLATFORM SESSION

Tuesday 1:30 PM • Room: C113

- 1:30 PM **329** (INVITED) *Volatile Addition to the Inner Solar System Between 4.566 and 4.564 Ga: Evidence from Angrite Meteorites*; AR Sarafian, SG Nielsen, HR Marschall, GA Gaetani; Woods Hole Oceanographic Institution; EH Hauri; Carnegie Institution of Washington; K Righter; NASA Johnson Space Center; E Sarafian; Woods Hole Oceanographic Institution
- 2:00 PM **330** (INVITED) *Investigating the History of Magmatic Volatiles in the Moon Using NanoSIMS*; JJ Barnes, M Anand, IA Franchi; The Open University, United Kingdom
- 2:30 PM **331** (INVITED) *Identifying the Carrier of Martian Water in the Nakhla Meteorite*; MR Lee, I MacLaren; University of Glasgow, United Kingdom

### P11.2 Metallography and Microstructural Characterization of Metals

#### SESSION CHAIRS:

George Vander Voort, Vander Voort Consulting LLC

Coralee McNee, United Technologies

#### PLATFORM SESSION

Tuesday 1:30 PM • Room: C112

- 1:30 PM **332** (INVITED) *Nonmetallic Inclusions in Steel – Origin, Estimation, Interpretation and Control*; AA Kazakov; Peter The Great Saint Petersburg Polytechnic University, Russian Federation
- 2:00 PM **333** (INVITED) *EBS-DBased Analysis of the Relation Between Oxide Scale Microstructure and Pickling Characteristics of a Commercial Hot Rolled Strip*; G Karacali; Erdemir-Eregli Iron and Steel Works, Inc., Turkey; K Davut; Atılım University, Turkey
- 2:30 PM **334** *The Application of Automated Microanalysis on SEM to the Characterization of Steel Samples*; J Goulden, H Jiang; Oxford Instruments Nanoanalysis, United Kingdom; K Thomsen, K Mehnert; ST Development ApS, Denmark
- 2:45 PM **335** *Results of Interlaboratory Test Programs to Assess the Precision of Inclusion Ratings by Methods A, C and D of ASTM E45*; GF Vander Voort; Vander Voort Consulting LLC

TF

## TECHNOLOGISTS' FORUM—

TUESDAY AFTERNOON

### X31.1 Special Topic: A Practical Approach to Current Software Solutions and their Applications

#### SESSION CHAIRS:

Frank Macaluso, Einstein College of Medicine

Caroline Miller, Indiana University

#### PLATFORM SESSION

Tuesday 1:30 PM • Room: C125

- 1:30 PM **336** (INVITED) *Performing Quantitative Imaging Acquisition, Analysis and Visualization Using the Best of Open Source and Commercial Software Solutions*; SM Shenoy; Albert Einstein College of Medicine
- 2:00 PM **337** (INVITED) *ImageJ: Image Analysis Interoperability for the Next Generation of Biological Image Data*; CT Rueden, MC Hiner, KW Eliceiri; University of Wisconsin-Madison
- 2:30 PM **338** (INVITED) *An Image Processing Workflow to Quantify Penetration of Blob-like Structures into an Arbitrary Region of Interest*; TW Lancon; FEI Company

T

## BIOLOGICAL SCIENCES TUTORIAL—

TUESDAY AFTERNOON

### X42 Building and Validating Atomic Models for EM Density Maps

#### SESSION CHAIR:

Scott Stagg, Florida State University

- 1:30 PM **339** *Building and Validating Atomic Models for Cryo-EM Density Maps*; ML Baker, M Chen, T Durmaz, PR Baldwin; Baylor College of Medicine; T Ju; Washington University in St. Louis; SJ Ludtke; Baylor College of Medicine

A

## ADVANCES IN INSTRUMENTATION

POSTER SESSIONS—TUESDAY AFTERNOON

### A03.P1 X-Ray Imaging and Analysis

#### POSTER SESSION

Tuesday 3:00 PM • Room: Exhibit Hall

#### POSTER # 86

3:00 PM **340** *X-Ray Mapping and Particle Searching with a Benchtop SEM*; J Maas, K Kersten, J Smulders; Phenom-World BV, Netherlands; K Mason; Eastern Analytical Pty Ltd., Belgium

#### POSTER # 87

3:00 PM **341** *Automated Analysis of EDS Maps*; C Lang, M Hiscock; Oxford Instruments Nanoanalysis, United Kingdom

#### POSTER # 88

3:00 PM **342** *Characterisation of Recycled Aggregate Concrete Through X-Ray Mapping*; Q Huang, T Murphy, EL Tan, R Wuhrer; Western Sydney University, Australia

#### POSTER # 89

3:00 PM **343** *Analysis of Food Packaging Layered Polymers by SEM/EDS and Raman Spectroscopy*; J Konopka, M Wall; Thermo Fisher Scientific

#### POSTER # 90

3:00 PM **344** *Quantification of Elemental Distribution in Spherical Core-Shell Nanoparticles Measured by STEM-EDX*; JT Held, K Hunter, UR Kortshagen, KA Mkhoyan; University of Minnesota

#### POSTER # 91

3:00 PM **345** *Chemically Specific Buried Interface Imaging with a Coherent EUV Nanoscope*; CL Porter, ER Shanblatt, DF Gardner, GF Mancini, RM Karl, MD Tanksalvala, CS Bevis, HC Kapteyn; University of Colorado, Boulder; et al.

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION

### POSTER SESSIONS—

TUESDAY AFTERNOON *continued*

#### A04.P1 Advances in FIB Instrumentation and Applications in Materials and Biological Sciences

##### POSTER SESSION

Tuesday 3:00 PM • Room: Exhibit Hall

##### POSTER # 92

3:00 PM **346** *Micromachining of Si<sub>3</sub>N<sub>4</sub> by Ga<sup>+</sup>-Ion Implantation and Dry Etching*; M Baluktsian, K Keskinbora, UT Sanli, G Schütz; Max Planck Institute for Intelligent Systems, Germany

##### POSTER # 93

3:00 PM **347** *FIB Tomography of Bacterial Biofilms Grown on Gold and Polystyrene*; T Chou, M Libera, J Gu; Stevens Institute of Technology

##### POSTER # 94

3:00 PM **348** *New Attempts on Preparing Tungsten FIB Sample*; Z Pengcheng, S Zhiwei, C Pengtao, Z Xinai; Xi'an Jiaotong University, China

##### POSTER # 95

3:00 PM **349** *Novel TEM Specimen Preparation Using Multi-Source Focused Ion Beam for Real-Time Electrostatic Biasing Studies*; JA Peoples; Wright State University; B Howe; U.S. Air Force Research Laboratory, WPAFB; L Grazulis; University of Dayton; K Mahalingam; UES, Inc.

##### POSTER # 96

3:00 PM **350** *Xe<sup>+</sup> FIB Milling and Measurement of Amorphous Damage in Diamond*; B Van Leer, R Kelley, A Genc, A Savenko; FEI Company

##### POSTER # 97

3:00 PM **351** *Site Specific Preparation of Powders for High-Resolution Analytical Electron Microscopy Using a Ga<sup>+</sup> Focused Ion Beam*; S Vitale, JD Sugar; Sandia National Laboratories; PD Cappillino; University of Massachusetts, Dartmouth; LA Giannuzzi; EXpressLO LLC; DB Robinson; Sandia National Laboratories

##### POSTER # 98

3:00 PM **352** *Fabrication of Frozen-Hydrated Sections by Focused Ion Beam (FIB) Method*; J Zhang; Institute of Biophysics, CAS, China

##### POSTER # 99

3:00 PM **353** *MEMS-Based Heating Element for In Situ Dynamical Experiments on FIB/SEM Systems*; L Novak, T Vystavel, J Starek; FEI Company, Czech Republic; L Mele; FEI Company, Netherlands

##### POSTER # 100

3:00 PM **354** *An In Situ Method for Preserving Buried Voids and Cracks During TEM Sample Preparation Using FIB*; X Zhong; The University of Manchester, United Kingdom; P Withers, MG Burke; University of Manchester, United Kingdom

##### POSTER # 101

3:00 PM **355** *Novel Investigative Preparation of Human Hair*; IN Boona, RE Williams, D Huber; The Ohio State University; JM Marsh, M Mamak; Procter & Gamble Company; DW McComb; The Ohio State University

##### POSTER # 102

3:00 PM **356** *Automatic FIB-SEM Preparation of Straight Pillars for Micro-Compression Testing*; T Volkenandt; Carl Zeiss Microscopy GmbH, Germany; A Laquerre; Fibics Inc., Canada; M Postolski, F Pérez-Willard; Carl Zeiss Microscopy GmbH, Germany

##### POSTER # 103

3:00 PM **357** *The Application of Cryogenic Focused Ion Beam Scanning Electron Microscopy to Hydrogel Characterisation*; CD Parmenter, A Baki, KM Shakesheff; University of Nottingham, United Kingdom

##### POSTER # 104

3:00 PM **358** *Quantification of Milling Rate and Reduction in Amorphous Damage Using Low Energy, Small Spot, Argon Ion Milling for TEM Specimens Prepared by FIB*; M Abadier, M Boccabella, J Liu, P Fischione; E.A. Fischione Instruments

##### POSTER # 105

3:00 PM **359** *Curtaining-Free Top-Down TEM Lamella Preparation from a Cutting Edge Integrated Circuit*; A Denisjuk; TESCAN Orsay Holding a.s., Česká republika; T Hrnčíř, JV Oboňa, M Petrenec; TESCAN Brno, s.r.o., Česká republika; J Michalička; TESCAN Orsay Holding a.s., Česká republika

#### A05.P1 Applications of Correlative Microscopy to Physical and Biological Sciences

##### POSTER SESSION

Tuesday 3:00 PM • Room: Exhibit Hall

##### POSTER # 106

3:00 PM **360** *Multimodal Low-Dimensional Materials Characterization with Correlative Microscopy: Raman-PL-FLIM-AFM-SNOM-SEM*; U Schmidt; WITec GmbH, Germany; W Liu; WITec Instruments; D Steinmetz, T Dieing, O Hollricher; WITec GmbH, Germany

##### POSTER # 107

3:00 PM **361** *Correlative Characterization of Graphene with the Linkage of SEM and KFM*; Y Hashimoto; Hitachi High-Technologies Corporation, Japan; T Yamaoka; Hitachi High-Tech Science Corporation, Japan; S Takeuchi, T Sunaoshi, A Miyaki, M Sasajima; Hitachi High-Technologies Corporation, Japan; A Muto, J-J Yu; Hitachi High Technologies America, Inc.

##### POSTER # 108

3:00 PM **362** *Correlative Isotopic Analysis by Image Fusion of Electron Microscopy and Secondary Ion Mass Spectrometry Data*; JG Tarolli, BE Naes, D Willingham; Pacific Northwest National Laboratory

## POSTER # 109

3:00 PM **363** *Correlative Light and Electron Microscopy in Atmosphere*; M Nakabayashi, M Shoji, M Yoshihara; Hitachi High-Technologies Corporation, Japan; A Hisada; Hitachi, Ltd., Japan; Y Ominami; Hitachi High-Technologies Corporation, Japan

## POSTER # 110

3:00 PM **364** *Correlative Fluorescence and Scanning Electron Microscope Imaging of Cultured Neurons Pretreated with Ionic Liquid*; A Muto; Hitachi High Technologies America, Inc., M Shibata; Max Planck Florida Institute for Neuroscience; M Konomi; Hitachi High-Technologies Corporation, Japan; R Yasuda, N Kamasawa; Max Planck Florida Institute for Neuroscience

## POSTER # 111

3:00 PM **365** *The Effects of Chemical Fixation on the Cellular Nanostructure: A Correlative Study of Back-Scattered Interference Spectrometry Microscopy and TEM*; Y Li, L Almassalha, J Chandler, Y Cyrus, R Bleher, H Subramanian, I Szleifer, V Backman; Northwestern University; et al.

## POSTER # 112

3:00 PM **366** *Processing a Biological Tissue from Cryo-SEM to Replica*; N Vaskovicova, K Hrubanova, V Krzyzanek; Institute of Scientific Instruments ASCR, Czech Republic

## POSTER # 113

3:00 PM **367** *Linking Length Scales and Modalities with Integrated, Correlative Microscopy*; J Gelb, W Harris, L Lechner, A Merkle; Carl Zeiss X-Ray Microscopy, Inc.

## POSTER # 114

3:00 PM **368** *Learning from Scanning Transmission Electron Microscopy to Enhance Transmission X-Ray Microscopy: How We Can Merge STEM and TXM Datasets?*; X Yang, D Gürsoy, C Phatak, V De Andrade; Argonne National Laboratory; EB Gulsoy; Northwestern University; F De Carlo; Argonne National Laboratory

## POSTER # 115

3:00 PM **369** *Correlative NanoSIMS and Atom Probe Study of Nacre: Toward Understanding Polymorphism Effects in a Chinese Pearl*; HG Francois-Saint-Cyr; CAMECA Instruments, Inc., G Wille; BRGM, French Geological Survey; I Martin; CAMECA Instruments, Inc., A Cabin-Flaman; Université de Rouen, France; DJ Larson; CAMECA Instruments, Inc.

## POSTER # 116

3:00 PM **370** *Advancements in Interfaced SEM and Raman Spectromicroscopy ( $\mu$ RS)*; S Prihodko; University of California, Los Angeles; A King; Renishaw Inc., I Kakoulli; University of California, Los Angeles

## POSTER # 117

3:00 PM **371** *Correlative Light and Electron Microscopy (CLEM) Utilizing Hitachi HILEM IL1000 Ionic Liquid*; JP Kilcrease, O Takagi; Hitachi High Technologies America, Inc., G Baughan; U.S. Department of Agriculture

## POSTER # 118

3:00 PM **372** *A New Solution of Non-Integrated Correlative Light and Electron Microscopy Based on High-Vacuum Optical Platform*; S Li, G Ji, X Huang, L Sun, J Zhang, W Xu, F Sun; Institute of Biophysics, CAS, China

## POSTER # 119

3:00 PM **373** *Morphology and Composition of Biomineralized Ceria and Ceria-Zirconia Nanocrystals*; L Lu, C Curran, C Kiely, B Berger, S McIntosh; Lehigh University

## A09.P1 Advanced Scanning Diffraction: Mapping Functionality in Reciprocal Space at Nanometer Resolution

### POSTER SESSION

Tuesday 3:00 PM • Room: Exhibit Hall

## POSTER # 120

3:00 PM **374** **MSA POST-DOCTORAL AWARDEE** *Quantitative Atomic Resolution Differential Phase Contrast Imaging Using a Segmented Area All Field Detector*; G Sanchez-Santolino, T Seki, N Lugg, R Ishikawa; The University of Tokyo, Japan; DJ Taplin, SD Findlay; Monash University, Australia; Y Ikuhara, N Shibata; The University of Tokyo, Japan

## POSTER # 121

3:00 PM **375** **M&M 2016 STUDENT AWARDEE** *Development of STEM-Holography*; FS Yasin, TR Harvey, JJ Chess, JS Pierce, BJ McMorran; University of Oregon

## POSTER # 122

3:00 PM **376** *Phase Imaging in STEM Allowing for Post-Acquisition Aberration Correction and 3D Optical Sectioning Using Ptychography Wigner-Distribution Deconvolution*; H Yang; Lawrence Berkeley National Laboratory; L Jones, RN Rutte, BD Davis; University of Oxford, United Kingdom; TJ Pennycook; University of Vienna, Austria; M Simson, M Huth, H Soltan; PNDetector GmbH, Germany; et al.

## POSTER # 123

3:00 PM **377** *Low-Frequency Response of Ptychography in the TEM*; DJ Johnson, AM Maiden; The University of Sheffield, United Kingdom

## POSTER # 124

3:00 PM **378** *Pushing the Limits of Fast Acquisition in TEM Tomography and 4D-STEM*; M Simson; PNDetector GmbH, Germany; RE Dunin-Borkowski; Ernst Ruska-Centre, Forschungszentrum Jülich, Germany; R Hartmann; PNSensor GmbH, Germany; M Huth, S Ihle; PNDetector GmbH, Germany; L Jones; University of Oxford, United Kingdom; Y Kondo; JEOL, Ltd., Japan, V Migunov; Ernst Ruska-Centre, Forschungszentrum Jülich, Germany; et al.

## POSTER # 125

3:00 PM **379** *Mega-Electron-Volt Femtosecond Electron Micro-Diffraction*; X Shen, R Li, X Wang; SLAC National Accelerator Laboratory

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION POSTER SESSIONS—

TUESDAY AFTERNOON *continued*

### POSTER # 126

3:00 PM **380 M&M 2016 STUDENT AWARDEE** *Fundamental Symmetry of Barium Titanate Single Crystal Determined Using Energy-Filtered Scanning Convergent Beam Electron Diffraction*; Y-T Shao, J-M Zuo; University of Illinois Urbana-Champaign

### POSTER # 127

3:00 PM **381** *Nanoscale Strain and Composition Mapping in Ionic Thin Film Heterostructures for Resistive Switching Devices*; WJ Bowman; Arizona State University; S Schweiger; ETH Zürich, Switzerland; A Darbal; AppFive LLC; PA Crozier; Arizona State University; JL Rupp; ETH Zürich, Switzerland

### POSTER # 128

3:00 PM **382** *STEM Strain Measurement From a Stream of Diffraction Patterns Recorded on a Pixel-Free Delay-Line Detector*; K Müller-Caspary; Universität Bremen, Germany; A Oelsner; Surface Concept GmbH, Germany; P Potapov; GlobalFoundries, Dresden, Germany

### POSTER # 129

3:00 PM **383** *Nanoscale Strain Mapping During In Situ Deformation of Annealed Al-Mg Alloys*; TC Pekin; University of California, Berkeley; J Ciston; Lawrence Berkeley National Laboratory; C Gammer; University of Vienna, Austria; AM Minor; University of California, Berkeley

### POSTER # 130

3:00 PM **384** *De-Coupling Anelastic and Elastic Deformation in Metallic Glass Thin Films via Measurement of Micro Strain Tensors Using In Situ Electron Diffraction*; R Sarkar; Arizona State University; C Ebner; C Rentenberger; University of Vienna, Austria; J Rajagopalan; Arizona State University

### POSTER # 131

3:00 PM **385** *Texture and Phase Analysis in Nanocrystalline Ni Thin Films by Precession Electron Diffraction Microscopy*; S-T Hu, P Ferreira; University of Texas, Austin; K Hattar; Sandia National Laboratories

### POSTER # 132

3:00 PM **386** *Fast Scanning Electron Diffraction and Electron Holography as Methods to Acquire Structural Information on  $\text{Au}_{102}(\text{p-MBA})_{44}$  Nanoclusters*; JE Ortega, U Santiago, A Bruna, D Alducin, G Plascencia-Villa, RL Whetten, A Ponce, M Jose-Yacamán; University of Texas, San Antonio

### POSTER # 133

3:00 PM **387** *Developing Rapid and Advanced Visualisation of Magnetic Structures Using 2D Pixelated STEM Detectors*; M Nord, M Krajnak; University of Glasgow, United Kingdom; R Bali, J Fassbender; Helmholtz-Zentrum Dresden-Rossendorf, Germany; S McVitie, GW Paterson, I MacLaren, D McGrouther; University of Glasgow, United Kingdom; et al.

B

## BIOLOGICAL SCIENCES POSTER SESSIONS—TUESDAY AFTERNOON

### B02.P1 New Technologies for Digital Pathology

#### POSTER SESSION

Tuesday 3:00 PM • Room: Exhibit Hall

#### POSTER # 134

3:00 PM **388** *Imaging and Feature Selection Using GA-FDA Algorithm for the Classification of Mid-Infrared Biomedical Images*; RD Mankar; University of Houston; V Verma, M Walsh; University of Illinois, Chicago; C Bueso-Ramos; University of Texas MD Anderson Cancer Center; D Mayerich; University of Houston

#### POSTER # 135

3:00 PM **389** *Fully-Automated Immunogold Labeling of Resin-Embedded Specimens and On-Grid Deposition of Gold Fiducial Particles*; E Frankel, B August, A Audhya; University of Wisconsin-Madison; T Strader; Microscopy Innovations, LLC

### B05.P1 Pathology: When Normal Goes Wrong

#### POSTER SESSION

Tuesday 3:00 PM • Room: Exhibit Hall

#### POSTER # 136

3:00 PM **390** *Comparison of Rat Lung Tissue Following Inhalation and Intratracheal Administration of Metal Oxide Nanoparticles*; K Yamamoto, T Yoshida, T Hayashida; National Institute of Advanced Industrial Science and Technology, Japan; H Izumi, Y Morimoto; University of Occupational and Environmental Health, Japan

#### POSTER # 137

3:00 PM **391** *Ultrastructural Evaluation of the Planter Nerve after Transection of the Ramus Communicans in the Horse*; F Al-Bagdadi; Louisiana State University; J Schumacher; University of Tennessee; R Henry; Lincoln Memorial University; J Carter, F Tóth; University of Tennessee

### B06.P1 Pharmaceuticals and Medical Science

#### POSTER SESSION

Tuesday 3:00 PM • Room: Exhibit Hall

#### POSTER # 138

3:00 PM **392** *Protocol for the Isolation and Rapid Characterization of Foreign Debris in Pharmaceutical Products Using Light and Electron Microscopy*; RS Brown; MVA Scientific Consultants

#### POSTER # 139

3:00 PM **393** *Characterizing Dense Suspensions Using Image Analysis: A Case Study from the Pharmaceutical Industry*; NN Khawaja; Merck Research Laboratories; DJ Goldfarb; Merck Manufacturing Division

## POSTER # 140

3:00 PM **394** *Using Microscopy to Qualitatively Assess Protein A Resin and Guide Cleaning In Place (CIP) Strategy*; LM Dimemmo, M Mayani, S Chollangi, E Schutsky, K Sing, Y Li, M Hubert; Bristol-Myers Squibb Company

## POSTER # 141

3:00 PM **395** *Particle Induced X-Ray Emission Imaging of Gadolinium Distribution into Xenograft U87 Human Glioblastoma after AGuIX Nanoparticles Injection*; A Carmona, S Roudeau, R Ortega, Y Prezado; Centre National de la Recherche Scientifique, France; F Pouzoulet; Institut Curie, France

## POSTER # 142

3:00 PM **396** **M&M 2016 STUDENT AWARDEE** *Synthesis and Characterization of Paramagnetic Iron Nanoparticles with Minimal Gold Coating for Optimal Drug Delivery*; DJ Banner, E Firlar; The University of Illinois, Chicago; H Asayesh-Ardakani; Michigan Technological University; R Shahbazian-Yassar, T Shokuhfar; The University of Illinois, Chicago

## POSTER # 143

3:00 PM **397** *Altering Lentiviral Tropism: Design and Implications of a Targeted Drug-Delivery System*; R Gleyzer, C Queenan, A Waldron, R Pergolizzi; Bergen County Academies

## B08.P1 Utilizing Microscopy for Research and Diagnosis of Diseases in Humans, Plants and Animals

### POSTER SESSION

Tuesday 3:00 PM • Room: Exhibit Hall

## POSTER # 144

3:00 PM **398** *TEM Investigation of Nanocarriers Distribution in Mice Brain*; R Nikkhah-Moshaie; A Kaushik; RD Jayant; Florida International University; V Bhardwaj; Western Carolina University; M Nair; Florida International University

## POSTER # 145

3:00 PM **399** *Ultrastructural Characterization of Nucleolar Organization in Human Gingival Fibroblast Overexpressing CEMP1*; CE Villegas-Mercado, L Agredano-Moreno, LF Jiménez-García; Universidad Nacional Autónoma de México

## POSTER # 146

3:00 PM **400** *Image Analysis of Transient Expression in Bombarded Soybean (Glycine max) Immature Embryos*; T Cicak, K Effinger, S Chennareddy, D Pareddy; Dow Agrosciences

## POSTER # 147

3:00 PM **401** *Environmental Scanning Electron Microscopy as a Useful Tool for Taxonomical Documentation of Parasitical Helminths*; E Tihlaříková, V Neděla; Institute of Scientific Instruments ASCR, Czech Republic; Š Mašová; Masaryk University, Czech Republic

## POSTER # 148

3:00 PM **402** *Study of Plant Waxes Using Low Temperature Method for ESEM*; V Neděla, E Tihlaříková; Institute of Scientific Instruments ASCR, Czech Republic; P Schiebertová, I Zajíčková, K Schwarzerová; Charles University, Czech Republic

## POSTER # 149

3:00 PM **403** *Decreased Aflatoxin Biosynthesis Upon Uptake of 20nm-sized Citrate Coated Silver Nanoparticles by the Aflatoxin Producer Aspergillus parasiticus*; C Mitra, A Chanda, S Ghoshroy, J Lead; University of South Carolina

## POSTER # 150

3:00 PM **404** *Emergence of Previously Unknown Poxviruses*; CS Goldsmith, MG Metcalfe, Y Li, WB Davidson, K Wilkins, AA Roess, LU Osadebe, NM Vora; Centers for Disease Control and Prevention; et al.

## POSTER # 151

3:00 PM **405** *Drebrin Depletion Causes Abnormal Morphology in Mouse Skin*; G Ning, RK Reynolds; The Pennsylvania State University; A August; Cornell University

## POSTER # 152

3:00 PM **406** *Development of a New Autophagosome Sensor with an LC3-Interacting Region (LIR) Motif and a Hydrophobic Domain*; YH Huh; Korea Basic Science Institute, Republic of Korea; Y-K Lee; Hannam University, Republic of Korea; Y-W Jun, S-M Um; Kyungpook National University, Republic of Korea; B-K Kaang; Seoul National University, Republic of Korea; D-J Jang; Kyungpook National University, Republic of Korea; J-A Lee; Hannam University, Republic of Korea

## POSTER # 153

3:00 PM **407** *Memantine Treatment for Prevention of Neuronal Cell Death in Traumatic Brain Injury*; R Rosenthal, C Queenan, A Wadron; Bergen County Academies

## POSTER # 154

3:00 PM **408** *Nano-Structure Mediated Delivery of a Chemotherapeutic Agent for Improved Leukemia Treatment*; A Molotkova, C Queenan, A Waldron; Bergen County Academies

## POSTER # 155

3:00 PM **409** *Microscopy in the Study of the Eye Disease Glaucoma*; CR Hann, MP Fautsch; Mayo Clinic

## POSTER # 156

3:00 PM **410** *Ultrastructural Imaging of Collagen Fibrils in Mouse Model of Abdominal Aortic Aneurysm*; JR Tonniges, B Albert; The Ohio State University; E Calomeni; Wexner Medical Center; C Hans; Nationwide Children's Hospital; G Agarwal; The Ohio State University

## POSTER # 157

3:00 PM **411** *Post Embedding Immunogold Labeling for Transmission Electron Microscopy, to Confirm Light Chain Restriction in Renal Diseases*; E Roberts, LA Anderson, R Gupta; Johns Hopkins University

# Scientific Program

B

## BIOLOGICAL SCIENCES POSTER SESSIONS—

TUESDAY AFTERNOON *continued*

### POSTER # 158

3:00 PM **412** *Bacterial Growth on Contact Lenses: Links Between Lens Care and Bacterial Formation Patterns*; K Prive; Northern Kentucky University

### POSTER # 159

3:00 PM **413** *Leaf Anatomical Changes Induced by Paclobutrazol Tree Growth Regulator in Cherrybark Oak*; Y Qi; Southern University and A&M College

### POSTER # 160

3:00 PM **414** *Localization of UV Absorbing Compounds in Nuttall Oak (Quercus nuttallii) Leaves Using Naturstoffreagenz-A (NA) and the Leica DMI6000 B Inverted Robotic Microscope*; VA Ferchaud; Southern University Agricultural Research & Extension Center; Y Qi; Southern University and A&M College

### POSTER # 161

3:00 PM **415** *Effect of Arsenic on Chloroplast Ultrastructure in Azolla filliculoides Lam*; A Zavaleta-Mancera; Colegio de Postgraduados en Ciencias Agrícolas, Mexico; LG Ortega-Ramirez, LF Jimenez-Garcia; Universidad Nacional Autónoma de México; G Sánchez-Viveros; Universidad Veracruzana, Mexico; A Alarcon; Colegio de Postgraduados en Ciencias Agrícolas, Mexico

### POSTER # 162

3:00 PM **416** *Effects of Bacillus thuringiensis Cry Proteins On the Morphology of Western Corn Rootworm (Diabrotica virgifera virgifera) Midgut Cells*; AJ Bowling, HE Pence; Dow Agrosiences; AM Turchi; Indiana University; SY Tan, KE Narva; Dow Agrosiences

### POSTER # 163

3:00 PM **417** *Alleviating Damage from Epirubicin-Induced Cardiotoxicity with an Increased Dosage of Cardioprotective Magnesium*; G Shukla, C Queenan, A Waldron; Bergen County Academies

### POSTER # 164

3:00 PM **418** *Blocking Intra-Bacterial Communication to Improve Water Quality in Developing Countries*; R Gohil, A Waldron, D Leonardi; Bergen County Academies

### POSTER # 165

3:00 PM **419** *Determining the Effectiveness of a Salicylic Acid Regimen to Reduce Cytotoxic ROS Associated with Anthracycline Treatment*; A Lekan, C Queenan, A Waldron; Bergen County Academies

P

## PHYSICAL SCIENCES POSTER SESSIONS—TUESDAY AFTERNOON

### P01.P1 Dr. Gareth Thomas Symposium: Materials Solutions through Microscopy

#### POSTER SESSION

Tuesday 3:00 PM • Room: Exhibit Hall

### POSTER # 166

3:00 PM **420** *Electron Microscopy of Morphed Graphene Nanostructures Synthesized by Mechanical Milling*; HA Calderon; Instituto Politécnico Nacional, Mexico City, Mexico; F Alvarez Ramirez; Instituto Mexicano Del Petróleo; I Estrada Guel; Centro de Investigación en Materiales Avanzados, S.C., Mexico; VG Handjiev, FC Robles-Hernandez; University of Houston

### POSTER # 167

3:00 PM **421** *Low Dose Electron Microscopy of Cobalt Oxide Heterostructures, the Genuine Atomic Structure and Dose Limit*; HA Calderon; Escuela Superior de Física y Matemáticas-IPN, Mexico; OE Cigarros-Mayorga; Instituto Politécnico Nacional, Mexico City, Mexico; CF Kisielowski; Lawrence Berkeley National Laboratory

### POSTER # 168

3:00 PM **422** *STEM Video of Electronically-Driven Metal-Insulator Transitions in Nanoscale NbO<sub>2</sub> Devices*; WA Hubbard; University of California, Los Angeles; T Joshi, P Borisov, D Lederman; West Virginia University; BC Regan; University of California, Los Angeles

### POSTER # 169

3:00 PM **423** *TEM Analysis of InGaAs/GaAs Quantum Well-Quantum Dot Structures for Optoelectronics Applications*; V Kanzyuba, S Rouvimov; University of Notre Dame; S Mintairov, NA Kalyuzhnyy, M Maximov, A Zhukov; Academic University, Russian Federation; A Nadochty; Ioffe Physical-Technical Institute of Russian Academy of Science

### POSTER # 170

3:00 PM **424** *Coarsening Evolution in a Nickel-Base Superalloy with a Bimodal Gamma Prime Precipitate Distribution*; S Meher, LK Aagesen, LJ Carroll, MC Carroll; Idaho National Laboratory; TM Pollock; University of California, Santa Barbara

### POSTER # 171

3:00 PM **425** *Quantitative Dark-Field Transmission Electron Microscopy of the Microstructure Evolution in a 2618A Aluminum Alloy During Ageing*; G Rockenhäuser, B Skrotzki; Bundesanstalt für Materialforschung und -prüfung, Germany

### POSTER # 172

3:00 PM **426** *Further Development of an Environmental HVTEM for Reaction Science by a New Non-Exposure Transfer Holder*; N Tanaka, S Arai; Nagoya University, Japan; S Ohta; JEOL, Ltd., Japan

## POSTER # 173

3:00 PM **427** *The Role of Grain Boundary Dislocations in the Segregation-Induced Grain Boundary Embrittlement of Copper by Bismuth*; CA Wade; University of Manchester, United Kingdom; I McLaren; University of Glasgow, United Kingdom; RP Vinci, M Watanabe; Lehigh University

## POSTER # 174

3:00 PM **428** *Characterizing Atomic Ordering in Intermetallic Compounds Using X-Ray Energy Dispersive Spectroscopy in an Aberration-Corrected (S)TEM*; RE Williams; The Ohio State University; A Carlsson, A Genc; FEI Company; J Sosa, D McComb, H Fraser; The Ohio State University

## POSTER # 175

3:00 PM **429** *Microstructure Evolution in Nanostructured High-Performance Thermoelectrics: The Case of P-Type  $Pb_{1-x}Na_xTe-SrTe$* ; X Zhang, G Tan, S Hao, CM Wolverton, MG Kanatzidis, VP Dravid; Northwestern University

## POSTER # 176

3:00 PM **430** *Characterization of Nanoscale Instabilities in Titanium Alloys Using Aberration-Corrected Scanning Transmission Electron Microscope*; Y Zheng, RE Williams, HL Fraser; The Ohio State University

## POSTER # 177

3:00 PM **431** *Electron Microscopy Study on Hydrothermally Synthesized  $(SnO_2)_x(ZnO)_{1-x}$  Powders*; S Turan, P Kaya; Anadolu University, Turkey

## P07.P1 Failure Analysis Applications of Microanalysis, Microscopy, Metallography & Fractography

### POSTER SESSION

Tuesday 3:00 PM • Room: Exhibit Hall

## POSTER # 178

3:00 PM **432** *Flex Bending Fatigue of Dental Archwires*; JL Gbur, KN Gupte, JJ Lewandowski; Case Western Reserve University

## POSTER # 179

3:00 PM **433** *Site-Specific Manipulation of CNTs to EXpressLO™ Grids for TEM Analysis*; PA Anzalone; Nanocomp Technologies, Inc., LA Giannuzzi; EXpressLO LLC

## POSTER # 180

3:00 PM **434** *Temperature Dependence of Fracture Initiation in Silicon from In Situ SEM*; E Hintsala; Hysitron, Inc., S Bhowmick; Hysitron Inc., R Ballarini; University of Houston; W Gerberich; University of Minnesota

## P11.P1 Metallography and Microstructural Characterization of Metals

### POSTER SESSION

Tuesday 3:00 PM • Room: Exhibit Hall

## POSTER # 181

3:00 PM **435** *Column-Like Structure Observed in Aluminum-Copper-Iron Alloy*; AJ Baker, C Li, A Sobolewski, M Bair, H Hampikian; Clarion University; L Wang; Changchun Institute of Applied Chemistry, CAS, China; M Hua; University of Pittsburgh, D Li; Youngstown State University; et al.

## POSTER # 182

3:00 PM **436** *An Electron Microscopy Study on Morphology and Microstructure of a NiCoAlFeMoTiCr High-Entropy Alloy Synthesized by Arc-Melting*; FJ Baldenebro-López, CD Gómez-Esparza; Universidad Autónoma de Ciudad Juárez, Mexico; JA Baldenebro-López; Universidad Autónoma de Sinaloa, Mexico; I Estrada-Guel; Centro de Investigación en Materiales Avanzados, S.C., Mexico; JT Elizalde-Galindo, CA Rodríguez-González; Universidad Autónoma de Ciudad Juárez, Mexico; R Martínez-Sánchez; Centro de Investigación en Materiales Avanzados, S.C., Mexico; H Camacho-Montes; Universidad Autónoma de Ciudad Juárez, Mexico

## POSTER # 183

3:00 PM **437** *Effect on Microstructure and Microhardness of Equiatomic NiCoAlFeMoTi High Entropy Alloys Produced by Mechanical Alloying and Subsequent Arc-Melting*; FJ Baldenebro-López; Universidad Autónoma de Sinaloa, Mexico; CD Gómez-Esparza; Universidad Autónoma de Ciudad Juárez, Mexico; JA Baldenebro-López; Universidad Autónoma de Sinaloa, Mexico; I Estrada-Guel; Centro de Investigación en Materiales Avanzados, S.C., Mexico; JT Elizalde-Galindo, H Camacho-Montes; Universidad Autónoma de Ciudad Juárez, Mexico; R Martínez-Sánchez; Centro de Investigación en Materiales Avanzados, S.C., Mexico

## POSTER # 184

3:00 PM **438** *Synthesis of AlCoNi-SiC Composite Prepared by Mechanical Alloying*; FJ Baldenebro-López; Universidad Autónoma de Sinaloa, Mexico; CD Gómez-Esparza; Centro de Investigación en Materiales Avanzados, S.C., Mexico; JA Baldenebro-López, JH Castorena-González, MD Pellegrini-Cervantes, RA Vargas-Ortiz; Universidad Autónoma de Sinaloa, Mexico; R Martínez-Sánchez; Centro de Investigación en Materiales Avanzados, S.C., Mexico; JL Almaral-Sánchez; Universidad Autónoma de Sinaloa, Mexico

## POSTER # 185

3:00 PM **439** *Microstructural Characterization of Hardened AISI 4140 Using TiN/SiC Coating*; JL Bernal, AI Martínez, EE Vera; Universidad Politécnica de Pachuca, Mexico

# Scientific Program

P

## PHYSICAL SCIENCES POSTER SESSIONS—

TUESDAY AFTERNOON *continued*

### POSTER # 186

3:00 PM **440** *Solid State Reaction Detected Between Hexagonal Boron Nitride and Iron During Sintering*; KP Furlan, DR Consoni; Universidade Federal de Santa Catarina, Florianópolis, Brazil; B Leite; JEOL USA, Inc., AN Klein; Universidade Federal de Santa Catarina, Florianópolis, Brazil

### POSTER # 187

3:00 PM **441** *Effect Mg Addition on Microstructure and Hardness of Al2024 Alloy after Thermo-Mechanical Treatments*; CG Garay-Reyes, IK Gómez-Barraza, MA Ruiz-Esparza-Rodríguez, E Cuadros-Lugo, HM Medrano-Prieto, I Estrada-Guel, MC Maldonado-Orozco, R Martínez-Sánchez; Centro de Investigación en Materiales Avanzados, S.C., Mexico

### POSTER # 188

3:00 PM **442** *Microstructure and Mechanical Properties of Al2024 Alloy Modified with Mg and Zn Additions After Hot-Extrusion and Aging Processes*; CG Garay-Reyes, MA Ruiz-Esparza-Rodríguez, E Cuadros-Lugo, HM Medrano-Prieto, I Estrada-Guel, MC Maldonado-Orozco, R Martínez-Sánchez; Centro de Investigación en Materiales Avanzados, S.C., Mexico

### POSTER # 189

3:00 PM **443** *Relative Strain in Cu-Nb Composite Wound Wire*; RE Goddard, KH Han; National High Magnetic Field Laboratory-Florida State University; DN Nguyen; National High Magnetic Field Laboratory-Los Alamos Laboratory

### POSTER # 190

3:00 PM **444** *Comparison of Microstructure and Hardness of an Equiatomic NiCo Alloy Produced by Two Routes*; CD Gómez Esparza, FJ Baldenebro López; Universidad Autónoma de Ciudad Juárez, Mexico; I Estrada Guel; Centro de Investigación en Materiales Avanzados, S.C., Mexico; JA Baldenebro López; Universidad Autónoma de Sinaloa, Mexico; JT Elizalde Galindo, CA Rodríguez González; Universidad Autónoma de Ciudad Juárez, Mexico; R Martínez Sánchez; Centro de Investigación en Materiales Avanzados, S.C., Mexico

### POSTER # 191

3:00 PM **445** *Microstructural Characterization of a Metal Matrix Composite CoCrFeMnMoNi-ZnO Nanoparticles*; CD Gómez Esparza, FJ Baldenebro López; Universidad Autónoma de Ciudad Juárez, Mexico; R Martínez Sánchez, I Estrada-Guel; Centro de Investigación en Materiales Avanzados, S.C., Mexico; H Camacho Montes, C López Díaz-De-León, CA Rodríguez González; Universidad Autónoma de Ciudad Juárez, Mexico

### POSTER # 192

3:00 PM **446** *Microstructural Study of the Gradient Structured Austenitic Stainless Steel Treated by Shot Peening*; Y He; Changwon National University, China; K Shin; Changwon National University, Republic of Korea

### POSTER # 193

3:00 PM **447** *Unveiling Solid State Dissimilar Ni-Base Alloy 625 / Structural Steel Joints Using Transmission Kikuchi Diffraction*; GW Lee, J Orsborn, AJ Ramirez; The Ohio State University

### POSTER # 194

3:00 PM **448** *TEM Study of Microstructure of 316L Stainless Steel with Different Specimen Preparation Techniques*; S-C Liou, W-A Chiou; University of Maryland

### POSTER # 195

3:00 PM **449** *HRTEM of Amorphous and Crystalline Bi Nanoparticles Prepared by Pulsed Laser Deposition*; L Liu; Universidade Católica do Rio de Janeiro, Brazil; Y Xing, DF Franceschini; Universidade Federal Fluminense, Brazil; IG Solórzano; Universidade Católica do Rio de Janeiro, Brazil

### POSTER # 196

3:00 PM **450** *Effect of Ce Addition and Deformation on the Microstructure and Hardness of (Al-Si-Mg) A356 Type Alloys*; HM Medrano-Prieto, CG Garay-Reyes, MC Maldonado-Orozco, R Martínez-Sánchez; Centro de Investigación en Materiales Avanzados, S.C., Mexico

### POSTER # 197

3:00 PM **451** *Optimizing the 3D Microstructure Observation Conditions of Pearlite Steel Through SEM-FIB Technique*; H Nakamichi, T Nishiyama, M Nagoshi; JFE Steel Corporation, Japan

### POSTER # 198

3:00 PM **452** *AEM Study of Grain Boundary Precipitation Phenomena in Alloy 33 (Cr-Fe-Ni-N) Resulting from the Direct-Aging at 700 °C*; JC Spadotto; Pontificia Universidade Católica do Rio de Janeiro, Brazil; M Watanabe; Lehigh University; IG Solórzano; Pontificia Universidade Católica do Rio de Janeiro, Brazil

### POSTER # 199

3:00 PM **453** *HRTEM and HRSTEM Study of Nanostructured Materials Prepared by Pulsed Laser Deposition*; Y Xing; Universidade Federal Fluminense, Brazil; L Liu; Pontificia Universidade Católica do Rio de Janeiro, Brazil; DF Franceschini, WC Nunes; Universidade Federal Fluminense, Brazil; DJ Smith; Arizona State University; IJ Kiely; Pontificia Universidade Católica do Rio de Janeiro, Brazil; G Solórzano

### POSTER # 200

3:00 PM **454** *Morphologic Evidence of In Situ Gold Deposition in Lateritic Placer Deposits from Guyana Shield of Venezuela*; JA Silverstein, M Krekeler, J Rakovan; Miami University

### POSTER # 201

3:00 PM **455** *Characterization of Sphere-like Structure in Aluminum Based Alloy*; C Li; Clarion University; L Wang; Changchun Institute of Applied Chemistry, CAS, China; H Hampikian, M Bair; Clarion University; A Baker; Clarion University; A Sobolewski; Clarion University; M Hua; University of Pittsburgh, D Li; Youngstown State University; et al.

## POSTER # 202

3:00 PM **456** *Analysis of Strain Localization at High Angle Grain Boundaries During Creep of a Polycrystalline Superalloy Using SEM-Based Digital Image Correlation*; CE Slone, MJ Mills; The Ohio State University

## POSTER # 203

3:00 PM **457** *"Colossal" Interstitial Supersaturation in Delta Ferrite in 17-7 PH Stainless Steels after Low-Temperature Nitridation*; D Wang, H Kahn, F Ernst, A Heuer; Case Western Reserve University

TF

## TECHNOLOGISTS' FORUM POSTER SESSION—TUESDAY AFTERNOON

### **X31.P1** SPECIAL TOPIC: A Practical Approach to Current Software Solutions and their Applications

#### POSTER SESSION

Tuesday 3:00 PM • Room: Exhibit Hall

## POSTER # 204

3:00 PM **458** *Advanced Platform for 3D Visualization, Reconstruction, and Segmentation with Electron Tomography*; Y Jiang; Cornell University; MD Hanwell; Kitware, Inc., E Padgett; Cornell University; S Waldon; Kitware, Inc., DA Muller, R Hovden; Cornell University

## POSTER # 205

3:00 PM **459** *A Digital Micrograph Script for Detection of Astigmatism in TEM Images*; R Yan, W Jiang; Purdue University

O

## MICROSCOPY OUTREACH POSTER SESSION—TUESDAY AFTERNOON

### **X91.P1** A Family Affair

#### POSTER SESSION

Tuesday 3:00 PM • Room: C123-24

## POSTER # 206

3:00 PM **460** *Complex Web Construction: a Possible Clue to Mechanical Properties an Investigation by Middle School Students in Collaboration with MIT and JEOL, USA*; DX Shattuck; Concord Middle School, Massachusetts

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION SYMPOSIA—WEDNESDAY MORNING

### A01.1 Vendor Symposium

#### SESSION CHAIRS:

Paul Kotula, Sandia

Teresa Ruiz, University of Vermont

#### PLATFORM SESSION

Wednesday 8:30 AM • Room: C110

- 8:30 AM **461** *Innovative Air Protection Sample Holder for Ion Milling-SEM-SPM and Shared-Alignment Sample Holder for SEM-SPM*; U Diestelhorst, T Yamaoka, H Tsujikawa, K Ando; Hitachi High-Tech Science Corporation, Japan; Y Dan, M Sakaue, A Kaneko, Y Hashimoto; Hitachi High-Technologies Corporation, Japan
- 8:45 AM **462** *A New, Versatile, High Performance SEM*; EJR Vesseur; FEI Company, Netherlands; P Wandrol; FEI Company, Czech Republic; A Sandu, D Hahn; FEI Company, Netherlands
- 9:00 AM **463** *Sample Preparation Using Broad Argon Ion Beam Milling for Electron Backscatter Diffraction (EBSD) Analysis*; P Nowakowski, J Schlenker, M Ray, P Fischione; E.A. Fischione Instruments
- 9:15 AM **464** *The Nanoworkbench: Automated Nanorobotic System Inside of Scanning Electron or Focused Ion Beam Microscopes*; D Peters, I Burkart, V Klocke, E Burkart; Klocke Nanotechnik GmbH, Germany
- 9:30 AM **465** *Enhancing Materials and Device Analysis Capability in the SEM and FIB-SEM by Using a Nanomanipulator*; M Hiscock, C Lang; Oxford Instruments Nanoanalysis, United Kingdom; F Bauer; Oxford Instruments Nanoanalysis, Germany; C Hartfield; Oxford Instruments Nanoanalysis; P Statham; Oxford Instruments Nanoanalysis, United Kingdom
- 9:45 AM **466** *The Application of the AZtec EBSD System to the Study of Strain in the SEM*; J Goulden, A Bewick; Oxford Instruments Nanoanalysis, United Kingdom

### A03.2 X-Ray Imaging and Analysis

#### SESSION CHAIR:

Jeff Davis, PNDetector

#### PLATFORM SESSION

Wednesday 8:30 AM • Room: C115

- 8:30 AM **467** (INVITED) *Current State of Combined EDS-WDS Quantitative X-Ray Mapping*; K Moran; Moran Scientific, Australia; R Wuhler; Western Sydney University, Australia
- 9:00 AM **468** *Compositional Stage Mapping by EPMA and Micro-XRF*; PK Carpenter; Washington University in St. Louis
- 9:15 AM **469** **M&M 2016 STUDENT AWARDEE** *X-Ray Microanalysis Phase Map on Rare Earth Minerals with a Conventional and an Annular Silicon Drift Detector*; C Teng, H Demers, N Brodusch, KE Waters, R Gauvin; McGill University, Canada

- 9:30 AM **470** (INVITED) *X-Ray Mapping of an Impact-Resistant Crustacean-Derived Biocomposite*; NA Yaraghi; University of California, Riverside; N Guarín-Zapata; Purdue University; E Hintsala; University of Minnesota; S Bhowmick; Hysitron Inc.; L Sheppard; Western Sydney University, Australia; PD Zavattieri; Purdue University; R Wuhler; Western Sydney University, Australia; D Kisailus; University of California, Riverside

### A06.5 Analytical Electron Microscopy for Advanced Characterization from Multi-Dimensional Data Acquisition to Integrated Analysis

#### SESSION CHAIRS:

Chaoying Ni, University of Delaware

Peter van Aken, Max Planck Institute for Solid State Research

Masashi Watanabe, Lehigh University

#### PLATFORM SESSION

Wednesday 8:30 AM • Room: C224-25

- 8:30 AM **471** (INVITED) *Plasmons in Mesoscopic Gold Tapers*; W Sigle, N Talebi, S Guo, C Knipf; Max Planck Institute for Solid State Research, Germany; C Lienau, M Esmann, R Vogelgesang; Carl Von Ossietzky University Oldenburg, Germany, PA van Aken; Max Planck Institute for Solid State Research, Germany; et al.
- 9:00 AM **472** *Temperature Dependence of the Volume Plasmon in Silicon Nanoparticles*; M Mecklenburg; University of Southern California; B Zutter, BC Regan; University of California, Los Angeles
- 9:15 AM **473** *Hyperspectral Imaging of Surface-Plasmon-Enhanced Local Electric Fields by EELS with Tunable <60meV Energy Resolution*; P Abellan; SuperSTEM Laboratory, United Kingdom; PZ El-Khoury; Pacific Northwest National Laboratory; FS Hage; SuperSTEM Laboratory, United Kingdom; J Cottom; University of Leeds, United Kingdom; AG Joly, WP Hess; Pacific Northwest National Laboratory; RBrydson; University of Leeds, United Kingdom, QM Ramasse; SuperSTEM Laboratory, United Kingdom
- 9:30 AM **474** (INVITED) *Unveiling Nanometric Plasmons Optical Properties with Advanced Electron Spectroscopy in the Scanning Transmission Electron Microscope*; M Kociak; Centre National de la Recherche Scientifique, France

## A07.1 Surface and Subsurface Microscopy and Analysis

### SESSION CHAIR:

Vincent Smentkowski, General Electric

### PLATFORM SESSION

Wednesday 8:30 AM • Room: C216

- 8:30 AM **475** (INVITED) *A Novel Hybrid Dual Analyzer SIMS Instrument for Improved Surface and 3D-Analysis*; A Pirkel, R Moellers, H Arlinghaus, F Kollmer, E Niehuis; ION-TOF GmbH, Germany; A Makarov, S Horning; Thermo Fisher Scientific, Germany; M Passarelli; National Physical Laboratory, United Kingdom; et al.
- 9:00 AM **476** (INVITED) *Complementing Secondary Ion Mass Spectrometry with other Ion-, Electron- and Photon-Based Analytical Microscopies*; F Horr  ard, P Peres, A Merkulov; CAMECA Instruments, Inc., France; DJ Larson; CAMECA Instruments, Inc.
- 9:30 AM **477** (INVITED) *New Data Analysis Tools for X-Ray Photoelectron Spectroscopy (XPS) and Spectroscopic Ellipsometry (SE): Uniqueness Plots and Width Functions in XPS, and Distance, Principal Component, and Cluster Analyses in SE*; MR Linford; Brigham Young University

## A08.1 Quantitative and Qualitative Microanalysis by EPMA and SEM

### SESSION CHAIR:

Paul Carpenter, Washington University in St. Louis

### PLATFORM SESSION

Wednesday 8:30 AM • Room: C113

- 8:30 AM **478** (INVITED) *Rigorous Quantitative SEM/EDS Microanalysis Requires Careful Inspection of the Peak-Fitting Residual Spectrum to Reveal Hidden Constituents*; DE Newbury, NW Ritchie; National Institute of Standards and Technology
- 9:00 AM **479** *Uncertainty Is Our Friend - Rethinking Microanalysis Around Uncertainty Metrics*; NW Ritchie, DE Newbury; National Institute of Standards and Technology
- 9:15 AM **480** *X-Ray Emission From Thin Films on a Substrate - Experiments and Simulation*; Y Yuan, H Demers, N Brodusch, R Gauvin; McGill University, Canada
- 9:30 AM **481** *Quantitative Stage Mapping of a Zircon grain by WDS on an SEM*; SM Seddio; Thermo Fisher Scientific; RC Economos; Southern Methodist University
- 9:45 AM **482\*** *Spectral Deconvolution and Quantification in EDS Using Low Energy X-Ray Lines from Steel Spectra*; R Terborg; Bruker, Germany; T Salge; Natural History Museum, United Kingdom; PT Pinard, S Richter; RWTH Aachen University, Germany
- \*MOVED TO POSTER SESSION A08.P1 - THURSDAY.**

## A09.4 Advanced Scanning Diffraction: Mapping Functionality in Reciprocal Space at Nanometer Resolution

### SESSION CHAIR:

Doug Medlin, Sandia National Laboratories

### PLATFORM SESSION

Wednesday 8:30 AM • Room: C220

- 8:30 AM **483** (INVITED) *Fluctuation Electron Microscopy and Computational Structure Refinement for the Structure of Amorphous Materials*; JJ Maldonis, P Zhang, L He, A Gujral, MD Ediger, PM Voyles; University of Wisconsin-Madison
- 9:00 AM **484** *Radial Distribution Function Imaging by Diffraction Scanning Electron Microscopy*; X Mu, D Wang; Karlsruhe Institute of Technology, Germany; T Feng; Nanjing University of Science and Technology, China; C K  bel; Karlsruhe Institute of Technology, Germany
- 9:15 AM **485** *Effect of Medium Range Order on Crystallization Kinetics of Cu<sub>x</sub>Zr<sub>1-x</sub> Thin Film Metallic Glasses*; TT Li, GH Campbell; Lawrence Livermore National Laboratory
- 9:30 AM **486** *Development of Diffraction Scanning Techniques for Beam Sensitive Polymers*; KC Bustillo; Lawrence Berkeley National Laboratory; O Panova; University of California, Berkeley; C Gammer; Lawrence Berkeley National Laboratory; EB Trigg; University of Pennsylvania; XC Chen; Lawrence Berkeley National Laboratory; L Yan; University of Pennsylvania; NP Balsara; University of California, Berkeley; KI Winey; University of Pennsylvania; et al.
- 9:45 AM **487** *Study of Structure of Li- and Mn-rich transition Metal Oxides Using 4D-STEM*; AK Shukla; SuperSTEM Laboratory, United Kingdom; C Ophus; Lawrence Berkeley National Laboratory; C Gammer; University of Vienna, Austria; Q Ramasse; SuperSTEM Laboratory, United Kingdom

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION

SYMPOSIA—WEDNESDAY MORNING *continued*

### A11.5 Advances in Scanning Electron/Ion Instrumentation and Detectors

#### SESSION CHAIR:

Bradley Thiel, SUNY Polytechnic Institute

#### PLATFORM SESSION

Wednesday 8:30 AM • Room: C123-124

- 8:30 AM **488** (INVITED) *New methods for Measuring Chemistry and Temperature Using Scanning Ion and Electron Beams*; R Hull, H Parvaneh, X Wu; Rensselaer Polytechnic Institute
- 9:00 AM **489** *Hydrogen Ion Beams from Nanostructured Gas Field Ion Sources*; H Moritani; Hitachi High-Tech Science Corporation, Japan; R Urban; University of Alberta, Canada; M Salomons; National Institute for Nanotechnology, Canada; R Wolkow; University of Alberta, Canada; J Pitters; National Institute for Nanotechnology, Canada
- 9:15 AM **490** *Novel Scanning Ion Microscope with H<sub>3</sub><sup>+</sup> Gas Field Ionization Source*; S Matsubara, H Shichi; Hitachi, Ltd., Japan; Y Kawanami; Hitachi High-Tech Science Corporation, Japan; T Hashizume; Hitachi, Ltd., Japan
- 9:30 AM **491** *Reactive Gas Ion Beam Generation Using Single Atom W(111) Gas Field Ion Sources*; R Urban; University of Alberta, Canada; H Moritani; Hitachi High-Tech Science Corporation, Japan; RA Wolkow; University of Alberta, Canada; JL Pitters; National Research Council Canada
- 9:45 AM **492** *Nanometer Scale Time-of-Flight Back Scattering Spectrometry in the Helium Ion Microscope*; N Klingner, G Hlawacek, R Heller, J von Borany, S Facsko; Helmholtz-Zentrum Dresden-Rossendorf, Germany

### A13.3 In Situ Electron Microscopy and Big Data Analytics in 2D and 3D

#### SESSION CHAIR:

Xiaoqing Pan, University of California, Irvine

#### PLATFORM SESSION

Wednesday 8:30 AM • Room: C221

- 8:30 AM **493** *Fast Atomic-Scale Chemical Imaging by STEM EDS for study of Crystalline Materials and Dynamic Phase Transformations*; P Lu; Sandia National Laboratories; RL Yuan, JM Zuo; University of Illinois Urbana-Champaign
- 8:45 AM **494** (INVITED) *Atomic Scale In Situ Electron Microscopy: Challenges and Opportunities*; JR Jinschek; FEI Company, Netherlands
- 9:15 AM **495** **M&M 2016 STUDENT AWARDEE** *Increasing the Dimensionality of In Situ Electron Microscopy Data Sets by On-the-fly and Analytical Electron Tomography*; R Lin; Stony Brook University; L Han, HL Xin; Brookhaven National Laboratory
- 9:30 AM **496** (INVITED) *Transmission Electron Microscopy at Atmospheric Pressure*; X Pan; University of California, Irvine; S Zhang, S Dai, G Graham; University of Michigan

### A14.1 Single Atom Electron Microscopy and Spectroscopy

#### SESSION CHAIR:

Jingyue (Jimmy) Liu, Arizona State University

#### PLATFORM SESSION

Wednesday 8:30 AM • Room: C212

- 8:30 AM **497** (INVITED) *Electron Diffraction from a Single Atom and Optimal Signal Detection*; DA Muller; Cornell University
- 9:00 AM **498** *In-line Holography with Single Atom Sensitivity: Challenges and Achievements*; C Kisielowski; Lawrence Berkeley National Laboratory; P Specht; University of California, Berkeley; ID Sharp, J Yang; Lawrence Berkeley National Laboratory
- 9:15 AM **499** (INVITED) *Exploration of Single-Atom X-Ray Analysis in an Analytical Electron Microscope*; M Watanabe; Lehigh University
- 9:45 AM **500** *Observation of Single Atoms in Liquid and Liquid Inhomogeneous Structures*; T Miyata, T Mizoguchi; The University of Tokyo, Japan

B

## BIOLOGICAL SCIENCES SYMPOSIA—WEDNESDAY MORNING

### B03.1 Super Resolution Visualization of Cellular and Inter-Cellular Processes in Health and Disease

#### SESSION CHAIRS:

Rob Gourdie, Virginia Tech Carilion Research Institute

Sai Veeraraghavan, Virginia Tech Carilion Research Institute

#### PLATFORM SESSION

Wednesday 8:30 AM • Room: C111

- 8:30 AM **501** (INVITED) *Dissecting the Connexin43 Vesicular Transport Pathway by Super-Resolution Microscopy*; MJ Zeitz, CC James, JW Smyth; Virginia Polytechnic Institute and State University
- 9:00 AM **502** (INVITED) *Use of Super-Resolution Immunofluorescence Microscopy to Analyze Tight Junction Protein Interactions In Situ*; M Koval, SA Molina, B Schlingmann; Emory University School of Medicine
- 9:30 AM **503** (INVITED) *Single Molecule Localization Microscopy of DNA Damage Response Pathways in Cancer*; DR Whelan, Y Yin, K Bermudez-Hernandez, S Keegan, D Fenyo, E Rothenberg; New York University School of Medicine

P

## PHYSICAL SCIENCES SYMPOSIA—

WEDNESDAY MORNING

### P02.5 Electron Microscopy of Materials for Electrochemical Power Systems

#### SESSION CHAIR:

Chris Kiely, Lehigh University

#### PLATFORM SESSION

Wednesday 8:30 AM • Room: E160AB

- 8:30 AM **504** (INVITED) *Imaging of Fuel Cell and Battery Electrodes Using Focused Ion Beam Scanning Electron Microscopy*; S Barnett, S Wang, Z Liu, D Kennouche, K Yakal-Kremiski; Northwestern University
- 9:00 AM **505** *Investigating Side Reactions and Coating Effects on High Voltage Layered Cathodes for Lithium Ion Batteries*; P Yan, C Wang; Pacific Northwest National Laboratory
- 9:15 AM **506** *Enhanced Stability of Pt-TiO<sub>2</sub>-CNT Heterostructure Composite Cathodes for Li-O<sub>2</sub> Batteries Studied by High-Resolution AEM*; VP Oleshko; National Institute of Standards and Technology; M Noked, MA Schroeder, C Liu, AJ Pearse, SB Lee; University of Maryland; CL Soles; National Institute of Standards and Technology, GW Rubloff; University of Maryland
- 9:30 AM **507** *Dynamics of Electrochemical Conversion of Nanoscale Metal-Metal Oxide Multilayer Architecture*; FC Castro, Q Li, G Evmenenko, B Buchholz, J Wu, M Bedzyk, V Dravid; Northwestern University
- 9:45 AM **508** *Aberration Corrected STEM and High-Resolution EELS Study Investigating Magnesium Intercalation in Vanadium Pentoxide Cathode*; A Mukherjee; University of Illinois, Chicago; N Sa; Argonne National Laboratory; PJ Phillips; University of Illinois, Chicago; J Andrews, S Banerjee; Texas A&M University; AK Burrell; Argonne National Laboratory; RF Klie; University of Illinois, Chicago

### P05.1 Microscopy for Metal, Semiconductor and Insulator Thin Films

#### SESSION CHAIRS:

Lax Saraf, Clemson University

Ian McClaren, University of Glasgow

#### PLATFORM SESSION

Wednesday 8:30 AM • Room: C114

- 8:30 AM **509** (INVITED) *Quantification of Atomic Arrangements at Heterostructure Interfaces*; DN Leonard, O Dyck, J Poplawsky, KL More; Oak Ridge National Laboratory; L Edge, C Jackson, E Pritchett, P Deelman; HRL Laboratories, LLC
- 9:00 AM **510** *Growth and In Situ Characterization of Oxide Epitaxial Heterostructures with Atomic Plane Precision*; Q He, S Jesse, A Lupini, M Fuentes-Cabrera; Oak Ridge National Laboratory; A Akbashev, J Spanier; Drexel University; S Kalinin, A Borisevich; Oak Ridge National Laboratory; et al.

- 9:15 AM **511** *Observing Misfit Dislocation Interactions Across Thin Film Oxide Heterostructures*; ED Grimley, E Sachet; North Carolina State University; BF Donovan, PE Hopkins; University of Virginia; J-P Maria, JM Lebeau; North Carolina State University
- 9:30 AM **512** *Characterization of a Ferroelectric BaTiO<sub>3</sub>/SrTiO<sub>3</sub> Heterostructure with Interface-Induced Polarization*; H Wu, T Aoki; Arizona State University; P Ponath, AA Demkov; The University of Texas, Austin; MR McCartney, DJ Smith; Arizona State University
- 9:45 AM **513** *Stability Studies of MAPbI<sub>3</sub>: Identification of Degradation Pathways and Strategies for Observing the Native Structure of Lead Halide Perovskites*; MC Scott, J Suh, J Wu, AM Minor; University of California, Berkeley

### P10.1 Microscopy and Characterization of Ceramics, Polymers and Composites

#### SESSION CHAIRS:

R Parrington, Engineering Systems, Inc.

Richard Chinn, National Energy Technology Laboratory

#### PLATFORM SESSION

Wednesday 8:30 AM • Room: C214

- 8:30 AM **514** *Microstructural Development of Green Micro-Machined Injection-Molded Silicon Carbide*; RE Chinn; U.S. Department of Energy; SV Atre, KH Kate; University of Louisville; R Onler, OB Ozdoganler; Carnegie Mellon University
- 8:45 AM **515** *Correlative Microscopy in Characterization of Polycrystalline YAG Fibers*; KN Shugart, HJ Kim; UES, Inc.; R Hay; U.S. Air Force Research Laboratory, WPAFB; B Griffin, A Kadhim; UES, Inc.
- 9:00 AM **516** *Imaging 180° Polarization Reversal in Ferroelectric Oxides with Electron Backscatter Diffraction*; MJ Burch, CM Fancher, S Patala, EC Dickey; North Carolina State University
- 9:15 AM **517** *Electron-Beam-Induced Antiphase Boundary Reconstructions in ZrO<sub>2</sub>-La<sub>2</sub>/3 Sr<sub>1</sub>/3 MnO<sub>3</sub> Pillar-Matrix Structures*; D Zhou, W Sigle, M Kelsch, HU Habermeier, PA van Aken; Max Planck Institute for Solid State Research, Germany
- 9:30 AM **518** *Formation of Strontium Titanate Bicrystal by the Spark Plasma Sintering Method*; LA Hughes, K van Benthem; University of California, Davis
- 9:45 AM **519** *Atomically Resolved Local Structure of Conductive Domain Walls in Ferroelectric BiFeO<sub>3</sub>*; A Bencan; Jozef Stefan Institute, Slovenia; G Drazic; National Institute of Chemistry, Ljubljana, Slovenia; H Ursic; Jozef Stefan Institute, Slovenia; N Sakamoto; Shizuoka University, Japan; B Jancar, B Malic; Jozef Stefan Institute, Slovenia; D Damjanovic; Swiss Federal Institute of Technology, Switzerland, T Rojac; Jozef Stefan Institute, Slovenia; et al.

# Scientific Program

P

## PHYSICAL SCIENCES SYMPOSIA—

WEDNESDAY MORNING *continued*

### P11.3 Metallography and Microstructural Characterization of Metals

#### SESSION CHAIRS:

George Vander Voort, Vander Voort Consulting LLC  
Coralee McNee, United Technologies

#### PLATFORM SESSION

Wednesday 8:30 AM • Room: C112

- 8:30 AM **520** (INVITED) *Characterization of T8 tempered Al-Li-Cu alloy (AA2195) by Using AC- STEM*; DH Anjum; King Abdullah University of Science & Technology, Saudi Arabia; M Khushaim; Taibah University, Saudi Arabia; ZC Leseman; University of New Mexico
- 9:00 AM **521** *Hexagonal to Orthorhombic Symmetry Reduction in a Lamellar Ti-42Al-8.5Nb Alloy*; H Gabrisch, U Lorenz, F Pyczak, M Rackel, A Stark; Helmholtz-Zentrum Geesthacht, Germany
- 9:15 AM **522** *In Situ TEM Straining of Ultrafine-Grained Aluminum Films of Different Textures Using Automated Crystal Orientation Mapping*; E Izadi; Arizona State University; A Darbal; AppFive LLC; P Peralta, J Rajagopalan; Arizona State University
- 9:30 AM **523** *TEM Study of Cu-Ni Core-Shell Nanowires*; J-G Zheng; University of California, Irvine; Q Wang; Yangzhou University, China; Y Ma; Nanjing University of Posts and Telecommunications, China
- 9:45 AM **524** *Revealing Transformation and Deformation Mechanisms in NiTiHf and NiTiAu High Temperature Shape Memory Alloys Through Microstructural Investigations*; L Casalena, JM Sosa; The Ohio State University; DR Coughlin; Los Alamos National Laboratory; F Yang; The Ohio State University; GS Bigelow, RD Noebe; NASA Glenn Research Center; MJ Mills; The Ohio State University

### P12.1 Microscopy and Analysis in Forensic Science

#### SESSION CHAIRS:

S. Frank Platek, U.S. Food and Drug Administration Forensic Chemistry Center  
Stefanie L. Heckman, U.S. Food and Drug Administration Forensic Chemistry Center

#### PLATFORM SESSION

Wednesday 8:30 AM • Room: C213

- 8:30 AM **525** (INVITED) *The Utilization of Microscopy in Developing Investigative Leads from the Examination of Microscopic Trace Evidence in Forensic Investigations*; SJ Palenik, CS Palenik; Microtrace LLC
- 9:00 AM **526** *Case Study: Not a Normal Hair Case—An Alpaca Hair Comparison*; EN Weber; Hamilton County Coroner's Office Crime Laboratory

- 9:15 AM **527** *Determination of Needle Size Based on Measurements of Punctures in Pharmaceutical Vial Stoppers*; SL Heckman, SF Platek; U.S. FDA Forensic Chemistry Center
- 9:30 AM **528** *Standard Operating Procedure for the Microscopical Analysis of Foreign Object Debris (FOD)*; RS Brown; MVA Scientific Consultants
- 9:45 AM **529** *Analysis of Pedological Traces in Forensic Practice and New Possibilities in this Field*; M Kotrly; Institute of Criminalistics Prague, Czech Republic

T

## BIOLOGICAL SCIENCES TUTORIAL—

WEDNESDAY MORNING

### X40 Career Tracks in Government and Industry

#### SESSION CHAIR:

Patrick Phillips, University of Illinois-Chicago

- 8:30 AM **530** *Navigating the Job Market for Careers Inside and Outside of Academia*; S Staggs; Florida State University; B Bammes; Direct Electron; G Kiss; FEI Company; P Flicker; National Institute of General Medical Sciences, NIH

A

## ADVANCES IN INSTRUMENTATION SYMPOSIA—WEDNESDAY MORNING

### A01.2 Vendor Symposium

#### SESSION CHAIRS:

Paul Kotula, Sandia  
Teresa Ruiz, University of Vermont

#### PLATFORM SESSION

Wednesday 10:30 AM • Room: C110

- 10:30 AM **531** *New Developments in RISE Microscopy: Correlative Raman and SEM Imaging*; U Schmidt, P Ayasse, O Hollricher; WITec GmbH, Germany
- 10:45 AM **532** *Scanning Electron Microscopes with Integrated Raman Spectrometer Revealing New Complementary Information*; S Freitag; Carl Zeiss Microscopy GmbH, Germany
- 11:00 AM **533** *Why We Need to Use 3D Fourier Transform Analysis to Evaluate a High Performance TEM?*; K Ishizuka; HREM Research Inc., Japan; K Kimoto; National Institute for Materials Science, Japan
- 11:15 AM **534** *Reducing the Missing Wedge in TEM Tomography*; A Genc; FEI Company; L Kovarik; Pacific Northwest National Laboratory; L Pullan, J Ringnald; FEI Company
- 11:30 AM **535** *Array Tomography and Beam Deceleration – High-Throughput Imaging with the ZEISS GeminiSEM Using Atlas 5 and Beam Deceleration*; R Kirmse, I Angert; Carl Zeiss Microscopy GmbH, Germany; K Czymmek; Carl Zeiss Microscopy GmbH; M Thaler; Carl Zeiss Microscopy GmbH, Germany
- 11:45 AM **536** *Helios G4: Pushing the Limits of TEM Sample Preparation and STEM Resolution*; T Vystavěl, L Tůma, J Skalický, R Young; FEI Company, Czech Republic

## A03.3 X-Ray Imaging and Analysis

### SESSION CHAIR:

Ric Wuhler, University of Western Sydney

### PLATFORM SESSION

Wednesday 10:30 AM • Room: C115

10:30 AM **537** (INVITED) *High Speed, High-Resolution imaging spectrometers Based on pnCCDs for XRF and XRD applications*; L Strueder, R Hartmann, P Holl; PNSensor GmbH, Germany; S Ihle, M Huth, J Schmidt, C Thamm; PNDetector GmbH, Germany, B Kanngießer; Technische Universität Berlin, Germany; et al.

11:00 AM **538** *Analysis of Polymorphs Using Simultaneous X-Ray Fluorescence and Diffraction with an Imaging Spectrometer*; JM Davis, J Schmidt, M Huth; PNDetector GmbH, Germany; R Hartmann; PNSensor GmbH, Germany; S Ihle, D Steigenhöfer, H Soltau; PNDetector GmbH, Germany, L Strueder; PNSensor GmbH, Germany

11:15 AM **539** *Applying Pattern Recognition to the Analysis of X-Ray Computed Tomography Data of Polymer Foams*; NL Cordes, ZD Smith, K Henderson, JC Mertens; Los Alamos National Laboratory; JJ Williams, T Stannard; Arizona State University; X Xiao; Argonne National Laboratory, N Chawla; Arizona State University; et al.

11:30 AM **540** *High-Resolution Tomography for Characterization of Microstructures in Lightweight Alloy*; T Wenzel; YXLON International GmbH, Germany; M Salamon, N Uhlmann; Fraunhofer-Entwicklungszentrum Röntgentechnik, Germany; D Steiner; COMET Technologies USA, Inc.; N Frindt; YXLON International GmbH, Germany

11:45 AM **541** *Non-Invasive Multi-Scale Imaging and Modeling Using X-Ray Microscopy*; M Andrew; Carl Zeiss X-Ray Microscopy, Inc., R Chica-Szot; Instytut Nafty i Gazu-PIB, Poland; S Linden; Math2Market GmbH, Germany; G Lesniak; Instytut Nafty i Gazu-PIB, Poland; A Wiegmann; Math2Market GmbH, Germany; J Gelb; Carl Zeiss X-Ray Microscopy, Inc.; M Marsh; Object Research Systems, Canada, A Steinbach; Carl Zeiss X-Ray Microscopy, Inc.; et al.

## A06.6 Analytical Electron Microscopy for Advanced Characterization from Multi-Dimensional Data Acquisition to Integrated Analysis

### SESSION CHAIRS:

Chaoying Ni, University of Delaware

Peter van Aken, Max Planck Institute for Solid State Research

Masashi Watanabe, Lehigh University

### PLATFORM SESSION

Wednesday 10:30 AM • Room: C224-25

10:30 AM **542** (INVITED) *Strategies for Obtaining High Spatial Resolution in Imaging and Spectroscopy of Beam-Sensitive TEM Specimens*; R Egerton; University of Alberta, Canada

11:00 AM **543** *Quantitative Annular Dark-Field Imaging at Atomic Resolution*; S Yamashita; Kyushu University, Japan; S Koshiya; National Institute for Materials Science, Japan; K Ishizuka; HREM Research Inc., Japan; K Kimoto; National Institute for Materials Science, Japan

11:15 AM **544** *Integrated Differential Phase Contrast (iDPC) STEM: A New Atomic Resolution STEM Technique to Image All Elements Across the Periodic Table*; EG Bosch, I Lazić, S Lazar; FEI Company, Netherlands

11:30 AM **545** **M&M 2016 STUDENT AWARDEE** *Linking Dopant Distribution and Interatomic Distortions at  $\text{La}_{1.6}\text{M}_{0.4}\text{CuO}_4/\text{La}_2\text{CuO}_4$  Superconducting Interfaces*; YE Suyolcu, Y Wang, W Sigle, G Cristiani, G Logvenov, PA van Aken; Max Planck Institute for Solid State Research, Germany

11:45 AM **546** *Improvement of Imaging Performance with a New ASCOR Probe-Corrector in a 200 kV JEM-ARM200CF*; M Watanabe; Lehigh University; T Nakamura; JEOL USA, Inc.; T Ishikawa; JEOL, Ltd., Japan

## A07.2 Surface and Subsurface Microscopy and Analysis

### SESSION CHAIR:

John A. Chaney, Aerospace Corp

### PLATFORM SESSION

Wednesday 10:30 AM • Room: C216

10:30 AM **547** (INVITED) **M&M 2016 STUDENT AWARDEE** *Characterization of Protein G B1 Immobilized Gold Nanoparticles Using Time of Flight Secondary Ion Mass Spectrometry and X-Ray Photoelectron Spectroscopy*; Y-C Wang, DG Castner; University of Washington

11:00 AM **548** (INVITED) *A Revolutionary Approach for Molecular Imaging with TOF-SIMS Parallel Imaging MS/MS*; JS Hammond, GL Fisher, PE Larson, SR Bryan; Physical Electronics, Inc.

11:30 AM **549** *Sub-Micron Resolution Imaging with Bio-Molecular Identification by TOF-SIMS Parallel Imaging MS/MS*; GL Fisher; Physical Electronics, Inc.; N Ogrinc Potocnik, AL Bruinen; Maastricht University, Netherlands; JS Hammond, SR Bryan; Physical Electronics, Inc.; RM Heeren; Maastricht University, Netherlands

11:45 AM **550** *Imaging in Liquids Through Ultrathin Membranes: A Comparative Analysis of Scanning Electron and Scanning Microwave Microscopies*; A Tselev; Oak Ridge National Laboratory; J Velmurugan, A Kolmakov; National Institute of Standards and Technology

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION SYMPOSIA—WEDNESDAY MORNING *continued*

### A08.2 Quantitative and Qualitative Microanalysis by EPMA and SEM

#### SESSION CHAIR:

Paul Carpenter, Washington University in St. Louis

#### PLATFORM SESSION

Wednesday 10:30 AM • Room: C113

10:30 AM **551** (INVITED) *Conditions for Low Voltage Microanalysis and X-Ray Mapping*; R Wuhler; Western Sydney University, Australia

11:00 AM **552** *Determination of Soft X-Ray Emission Spectroscopy Parameters Using Experimental Data for Quantitative Microanalysis*; H Demers; McGill University, Canada; CM MacRae, NC Wilson; CSIRO, Australia; P Hovington, V Timoshevskii; Hydro-Quebec Research Institute, Canada; R Gauvin; McGill University, Canada; K Zaghib; Hydro-Quebec Research Institute, Canada

11:15 AM **553** *Collecting and Analysing - 1.6eV - 20keV Emission Spectra in an EPMA*; CM MacRae, N Wilson, A Torpy; CSIRO, Australia; J Bergmann; Bruker, Australia; H Takahashi; JEOL, Ltd., Japan

11:30 AM **554** *What is the Effective Geometrical Collection Efficiency of Your XEDS Detector? A Routine Procedure Applied in a SEM Laboratory*; N Avishai, A Avishai; Case Western Reserve University; V-D Hodoroba; Bundesanstalt für Materialforschung und -prüfung, Germany

11:45 AM **555** *Chemical States Analysis of Trace-Boron by Using an Improved SEM-SXES*; M Terauchi; Tohoku University, Japan; H Takahashi, M Takakura, T Murano; JEOL, Ltd., Japan; M Koike, T Imazono; Japan Atomic Energy Agency; T Nagano, H Sasai; Shimadzu Corporation, Japan; et al.

### A09.5 Advanced Scanning Diffraction: Mapping Functionality in Reciprocal Space at Nanometer Resolution

#### SESSION CHAIR:

Alex Eggeman, University of Cambridge

#### PLATFORM SESSION

Wednesday 10:30 AM • Room: C220

10:30 AM **556** (INVITED) *Solving Challenging Crystallographic Problems with Automated Electron Diffraction Tomography (ADT)*; U Kolb; Johannes Gutenberg-University, Germany

11:00 AM **557** *Three-Dimensional Nanostructure Determination Based on Scanning Electron Nanodiffraction*; Y Meng, J-M Zuo; University of Illinois Urbana-Champaign

11:15 AM **558** *Crystal Orientation Angular Resolution with Precession Electron Diffraction*; EF Rauch, M Veron; Université Grenoble Alpes-CNRS, France

11:30 AM **559** (INVITED) *Quantitative Structural Analysis of Complex Materials by Scanning Nanobeam Diffraction*; C Gammer; University of Vienna, Austria; BV Özdöl, KC Bustillo, J Ciston, AM Minor; Lawrence Berkeley National Laboratory

### A12.1 Research and Applications in Atom Probe Tomography

#### SESSION CHAIR:

Eric Steel, National Institute of Standards and Technology

#### PLATFORM SESSION

Wednesday 10:30 AM • Room: C226

10:30 AM **560** (INVITED) *On the Accuracy of Compositional Quantification for Atom Probe Tomography*; M Thuvander; Chalmers University of Technology, Sweden

11:00 AM **561** *Semi-Statistical Atom Probe Tomography Analysis of Thin Film Grain Boundaries*; A Stokes; Colorado School of Mines; M Al-Jassim; National Renewable Energy Laboratory; B Gorman; Colorado School of Mines

11:15 AM **562** *Atom Probe Tomography of Interfacial Segregation in CdTe-Based Solar Cells*; JD Poplawsky, W Guo; Oak Ridge National Laboratory; NR Paudel; The University of Toledo; C Li; The University of Vienna, Austria; A Ng; Vanderbilt University; KL More; Oak Ridge National Laboratory; Y Yan; The University of Toledo, SJ Pennycook; National University of Singapore

11:30 AM **563** (INVITED) *Experimental Evaluation of the Interrelationships Between Laser Energy, Temperature, Applied Bias, and Measured Composition in Laser Pulsed Atom Probe Tomography*; DR Diercks, BP Gorman; Colorado School of Mines

### A13.4 In Situ Electron Microscopy and Big Data Analytics in 2D and 3D

#### SESSION CHAIR:

Jorg R. Jinschek, FEI Company

#### PLATFORM SESSION

Wednesday 10:30 AM • Room: C221

10:30 AM **564** *Environmental TEM Studies of CoMn Nanoalloys as Model Fischer-Tropsch Catalysts*; CS Bonifacio; University of Pittsburgh; N Liakakos, M Salmeron; Lawrence Berkeley National Laboratory; JC Yang; University of Pittsburgh

10:45 AM **565** *Design and Application of an In Situ Illumination System for an Aberration-Corrected Environmental Transmission Electron Microscope*; Q Liu, L Zhang, PA Crozier; Arizona State University

11:00 AM **566** *The Synergic Effect of Atomic Hydrogen and Catalyst Spreading on Ge Nanowire Growth Orientation and Kinking*; M Kolibal, T Pejchal; Brno University of Technology, Czech Republic; L Novák, T Vystavěl; FEI Company, Czech Republic; T Šíkola; Brno University of Technology, Czech Republic

- 11:15 AM **567** *Visualization of Phase Segregation and Surface Reconstruction of Pt-Based Bi-Metallic Clusters During In Situ Oxidation*; JY Howe; Hitachi High-Technologies Canada Inc.; Y-HC Chin, W Tu, Y Yang, J Shangguan; University of Toronto, Canada; S Dogel, D Hoyle; Hitachi High-Technologies Canada Inc.; H Hosseinkhannazer; Norcada Inc., Canada; et al.
- 11:30 AM **568** *Monitoring the Dynamics of Heterogeneous Catalysts by Electron Microscopy*; R Farra, M Greiner, A Rinaldi, M-G Willinger, R Schlögl, J Cao; Fritz Haber Institute of The Max Planck Society, Germany
- 11:45 AM **569** *Operando Electron Microscopy of Catalysts*; BK Miller, PA Crozier; Arizona State University

## A14.2 Single Atom Electron Microscopy and Spectroscopy

### SESSION CHAIR:

Lawrence Allard, Oak Ridge National Laboratory

### PLATFORM SESSION

Wednesday 10:30 AM • Room: C212

- 10:30 AM **570** (INVITED) *Microscopy and Spectroscopy of Catalysts and Energy Storage Materials*; S Prabhudev, S Stambula, L Chincilla, H Liu, D Rossouw, C Wiktor, M Bugnet, GA Botton; McMaster University, Canada; et al.
- 11:00 AM **571** *Dynamic Aberration-Corrected STEM of Bimetallic Nanocatalysts During Surface Diffusion*; V Ortalan, CW Han; Purdue University; R Zanella, A Aguilar-Tapia; Centro de Ciencias Aplicadas y Desarrollo Tecnológico, Mexico
- 11:15 AM **572** (INVITED) *Atomically Dispersed Precious Metal Species on Various Oxide Supports for Catalytic Hydrogen Upgrading and Emission Control*; M Yang; General Motors Research & Development Center; LF Allard; Oak Ridge National Laboratory; M Flytzani-Stephanopoulos; Tufts University
- 11:45 AM **573** *Catalysis by Supported Single Metal Atoms*; J Liu, S Duan, J Xu, B Qiao, Y Lou; Arizona State University

B

## BIOLOGICAL SCIENCES SYMPOSIUM— WEDNESDAY MORNING

### B04.1 Microscopy and Morphogenesis

#### SESSION CHAIRS:

Rich Goodwin, University of South Carolina, Greenville

Jay Potts, University of South Carolina School of Medicine, Columbia

#### PLATFORM SESSION

Wednesday 10:30 AM • Room: C111

- 10:30 AM **574** (INVITED) *Utilizing Microscopy To Understand Mechanisms of Heart Valve Morphogenesis*; LJ Anstine, TE Horne, BF Austin, J Lincoln; Nationwide Children's Hospital
- 11:00 AM **575** (INVITED) *Use of a Novel Panel of Monoclonal Antibodies Against CENP-F for the Analysis of Cancerous Cells*; DM Bader; KA Compton; EL Mace, ER Pfaltzgraff, SC Borinstein; Vanderbilt University School of Medicine
- 11:30 AM **576** (INVITED) *Establishing Three Dimensional High-Throughput Imaging Pipeline for Deep Phenotyping Mouse Embryonic Development*; C-W Hsu, L Wong, S Kalaga, ME Dickinson; Baylor College of Medicine

# Scientific Program

P

## PHYSICAL SCIENCES SYMPOSIA— WEDNESDAY MORNING

### P02.6 Electron Microscopy of Materials for Electrochemical Power Systems

#### SESSION CHAIR:

Karren L. More, Oak Ridge National Laboratory

#### PLATFORM SESSION

Wednesday 10:30 AM • Room: E160AB

- 10:30 AM **577** (INVITED) *Using TEM Operando Methods to Understand Energy Storage*; CB Carter, MT Janish; University of Connecticut; KL Jungjohann; Sandia National Laboratories; MG Norton; Washington State University
- 11:00 AM **578** *In Situ TEM Observation on Formation of Uniform Amorphous Layer on SnO<sub>2</sub> Nanotube*; JH Chang; Institute for Basic Science, Republic of Korea; JY Cheong, I-D Kim; Korea Advanced Institute of Science and Technology, Republic of Korea; JY Lee; Institute for Basic Science, Republic of Korea
- 11:15 AM **579** *In Situ TEM Study of Coating Layer Function on Silicon Anode Particle for Lithium Ion Battery*; C Wang, L Luo; Pacific Northwest National Laboratory
- 11:30 AM **580** (INVITED) *In Situ TEM for Electrochemical Energy Storage and Conversion Systems*; ME Holtz, Y Yu, J Rivera, HD Abruna, DA Muller; Cornell University

### P03.1 Combining Simulation, Experiment, and Data Science for Materials Characterization and Design

#### SESSION CHAIR:

Paul Voyles, University of Wisconsin-Madison

#### PLATFORM SESSION

Wednesday 10:30 AM • Room: C210

- 10:30 AM **581** (INVITED) *Is HRTEM Image Simulation Correct? A Premise-Free Calibration Approach*; A Thust; Forschungszentrum Juelich, Germany; J Barthel; RWTH Aachen University, Germany; C-L Jia; Forschungszentrum Juelich, Germany
- 11:00 AM **582** *Surface and Point Defect Measurements of Detonation Nanodiamond Using Combined Cs-Cc Corrected TEM and Ab Initio Calculations*; SL Chang; Arizona State University; AS Barnard; CSIRO, Australia; C Dwyer; Arizona State University; CB Boothroyd; Forschungszentrum Jülich, Germany; E Osawa; Nanocarbon Research Institute, Japan; RJ Nicholls; University of Oxford, United Kingdom
- 11:15 AM **583** *The Origin of Magnetic Ordering in Sr<sub>3</sub>YCo<sub>4</sub>O<sub>10+x</sub>: T Kishida; Asahi Kasei Corporation, Japan; MD Kapetanakis; Vanderbilt University; J Yan, BC Sales; Oak Ridge National Laboratory; ST Pantelides; Vanderbilt University; SJ Pennycook; National University of Singapore; MF Chisholm; Oak Ridge National Laboratory*

11:30 AM **584** *Correlative Microscopic, Spectroscopic, and Computational Analysis of the Nucleation and Growth of Europium (III) Oxalate Nanoparticles*; JA Soltis, MA Conroy, WC Isley, GB Hall, S Chatterjee, Z Wang, SM Kathmann, JJ De Yoreo; Pacific Northwest National Laboratory; et al.

11:45 AM **585** *Atomistic Study of Model CdTe Grain Boundaries*; T Paulauskas; University of Illinois, Chicago; F Sen; Argonne National Laboratory; C Sun; University of Texas, Dallas; E Barnard; Lawrence Berkeley National Laboratory; K Moon; University of Texas, Dallas; M Chan; Argonne National Laboratory; S Sivalingham, R Klie; University of Illinois, Chicago; et al.

### P05.2 Microscopy for Metal, Semiconductor and Insulator Thin Films

#### SESSION CHAIRS:

Donavan Leonard, Oak Ridge National Laboratory  
Isabelle Martin, CAMECA Instruments, Inc.

#### PLATFORM SESSION

Wednesday 10:30 AM • Room: C114

- 10:30 AM **586** *Structural Properties of (Sn,Mn)Se<sub>2</sub> - A New 2D Magnetic Semiconductor with Potential for Spintronic Applications*; V Kanzyuba, S Dong, X Liu, S Rouvimov; University of Notre Dame; S Vishwanath, D Jena, HG Xing; Cornell University, J Furdyna; University of Notre Dame; et al.
- 10:45 AM **587** *Crystallization Kinetics of the Phase Change Material GeSb<sub>6</sub>Te Measured with Dynamic Transmission Electron Microscopy*; MM Winseck; Oregon State University; HY Cheng; Macronix International Co, Ltd., Taiwan; GH Campbell; Lawrence Livermore National Laboratory; MK Santala; Oregon State University
- 11:00 AM **588** *High-Resolution STEM Study of Dy-Doped Bi<sub>2</sub>Te<sub>3</sub> Thin Films*; V Srot; Max Planck Institute for Solid State Research, Germany; P Schönherr; University of Oxford, United Kingdom; B Bussmann; Max Planck Institute for Solid State Research, Germany; SE Harrison; University of Oxford, United Kingdom; PA van Aken; Max Planck Institute for Solid State Research, Germany; T Hesjedal; University of Oxford, United Kingdom
- 11:15 AM **589 M&M 2016 STUDENT AWARDEE** *Impurity Segregation via Extended Defects in Oxide Thin Films Probed by Aberration-Corrected STEM-EELS*; DJ Baek; Cornell University; D Lu; Stanford University; Y Hikita; SLAC National Accelerator Laboratory; HY Hwang; Stanford University; LF Kourkoutis; Cornell University
- 11:30 AM **590** *Combining STEM Imaging and EELS Mapping to Understand the Growth of La<sub>2</sub>CoMnO<sub>6</sub> Double Perovskites on (111) Oriented Perovskite Substrates*; I MacLaren, T-M Yu, B Sala; University of Glasgow, United Kingdom; D Hernandez-Maldonado, D Kepaptsoglou; SuperSTEM Laboratory, United Kingdom; J Kleibeuker, E-M Choi, JL MacManus Driscoll; University of Cambridge, United Kingdom

**11:45 AM 591** *Correlative Aberration-Corrected STEM-HAADF and STEM-EELS Analysis of Interface-Induced Polarization in LaCrO<sub>3</sub>-SrTiO<sub>3</sub> Superlattices*; SR Spurgeon; Pacific Northwest National Laboratory; DM Kepaptsoglou; SuperSTEM Laboratory; L Jones; University of Oxford; RB Comes; Pacific Northwest National Laboratory; QM Ramasse; SuperSTEM Laboratory; P-V Ong, PV Sushko, SA Chambers; Pacific Northwest National Laboratory

## P10.2 Microscopy and Characterization of Ceramics, Polymers and Composites

### SESSION CHAIRS:

R Parrington, Engineering Systems, Inc.

Richard Chinn, National Energy Technology Laboratory

### PLATFORM SESSION

Wednesday 10:30 AM • Room: C214

**10:30 AM 592** (INVITED) *The Use of Mechanical Testing, Photomicrography, and Electron Microscopy to Characterize an Insulating Fiberglass Composite Post-Electrical Arc Failure*; RJ Pieper; Element Materials Technology

**11:00 AM 593** (INVITED) *Void Content in Out-of-Autoclave Manufacturing Processes*; CL Wilson; Exponent, Inc.; E Currens, JF Rakow; Exponent, Inc.

**11:30 AM 594** *Non-Destructive, Multi-Scale 3D Fractographic Analysis of a Carbon Fiber Composite Hockey Stick after Compressive Failure*; J Gelb, W Harris, N Kotwal, W Broderick, L Lavery, H Bale, A Merkle; Carl Zeiss X-Ray Microscopy, Inc.

**11:45 AM 595** *TEM Sample Preparation of Ceramic Matrix Composites Using FIB*; S Poges, JE Cloud, M Aindow, SL Suib; University of Connecticut

## P11.4 Metallography and Microstructural Characterization of Metals

### SESSION CHAIRS:

George Vander Voort, Vander Voort Consulting LLC

Coralee McNee, United Technologies

### PLATFORM SESSION

Wednesday 10:30 AM • Room: C112

**10:30 AM 596** (INVITED) *On the Current State of Powder Characterization*; JW Newkirk, CS Kriewall; Missouri University of Science & Technology

**11:00 AM 597** *Effect of Thermal Exposure on Microstructure in P/M Superalloys*; B Bedard; University of Connecticut; MA Kaplan, MP Bochiechio; Pratt & Whitney; M Aindow; University of Connecticut

**11:15 AM 598** *Microstructural Characterization of Additively Manufactured Inconel 625*; BW Baker, JJ Schubbe, ME Hamp; U.S. Naval Academy; KE Knipling; U.S. Naval Research Laboratory

**11:30 AM 599** *Microstructure Characterization of a Fe-25Mn-3Al-3Si TWIP-TRIP Steel*; J Benzing; Vanderbilt University; J Bentley; Microscopy and Microanalytical Sciences; W Poling, K Findley; Colorado School of Mines; D Pierce; Oak Ridge National Laboratory; J Sosa, H Fraser; The Ohio State University; D Raabe; Max-Planck-Institut Für Eisenforschung, Germany; et al.

**11:45 AM 600** *Chemical Segregation and Microstructural Evolution of Fiber Laser-Welded Low Carbon Sheet Steel*; AN Chiaramonti, SL Miller, PT Blanchard, E Pfeif; National Institute of Standards and Technology

## P12.2 Microscopy and Analysis in Forensic Science

### SESSION CHAIRS:

Stefanie L. Heckman, U.S. Food and Drug Administration Forensic Chemistry Center

S. Frank Platek, U.S. Food and Drug Administration Forensic Chemistry Center

### PLATFORM SESSION

Wednesday 10:30 AM • Room: C213

**10:30 AM 601** (INVITED) *Pharmaceutical Characterization Meets Forensics Science: What Happened to Our Product?!*; A Vogt, J Roth, M Pheil, J Neilly; Abbvie, Inc.

**11:00 AM 602** *Application of 3D and 2D Imaging Techniques in the Examination of Suspect Tablets for the Detection of Counterfeit FDA-Regulated Products*; N- Ranieri, SF Platek, JS Batson, D- Albright; U.S. Food and Drug Administration

**11:15 AM 603** *Detection and Link Analysis of Counterfeit Altuzan® Printing Defects Using Light Microscopy and Digital Imaging*; DC Albright; U.S. FDA Forensic Chemistry Center

**11:30 AM 604** *Development of a Compendium of Microcrystal Tests for Illicit Drugs*; SB Sparenga, KM Brinsko, D Golemis, MB King, GJ Laughlin; McCrone Research Institute

**11:45 AM 605** *Characterization of Resultant Micro Chemical Test Crystalline Formations Using Optical, Fourier Transform Infrared (FT-IR) and Raman Microscopies*; MR Witkowski, JB Crowe; U.S. Food and Drug Administration

### T

## PHYSICAL SCIENCES TUTORIAL—WEDNESDAY MORNING

## X44 Compressive Sensing Applications in Microscopy

### SESSION CHAIR:

Patrick Phillips, University of Illinois-Chicago

**10:30 AM 606** *Compressive Sensing in Microscopy: A Tutorial*; A Stevens; Pacific Northwest National Laboratory; H Yang; Lawrence Berkeley National Laboratory; L Kovarik, N Browning; Pacific Northwest National Laboratory

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION SYMPOSIA— WEDNESDAY AFTERNOON

### A01.3 Vendor Symposium

#### SESSION CHAIRS:

Paul Kotula, Sandia

Teresa Ruiz, University of Vermont

#### PLATFORM SESSION

Wednesday 1:30 PM • Room: C110

- 1:30 PM **607** *Aberration Corrected Analytical Scanning and Transmission Electron Microscope for High-Resolution Imaging and Analysis for Multi-User Facilities*; H Inada, Y Taniguchi, T Yotsuji, Y Hirayama, T Dobashi, K Watanabe, H Kikuchi, H Muto; Hitachi High-Technologies Corporation, Japan; et al.
- 1:45 PM **608** *Ultra-High Vacuum Aberration-Corrected STEM for In Situ Studies*; MT Hotz, GJ Corbin, N Dellby, OL Krivanek; Nion Co; C Mangler, JC Meyer; University of Vienna, Austria
- 2:00 PM **609** *Integrated Differential Phase Contrast (iDPC) – Direct Phase Imaging in STEM for Thin Samples*; I Lazić, EG Bosch, S Lazar, M Wirix, E Yücelen; FEI Company, Netherlands
- 2:15 PM **610** *Mass Thickness Measurement in TEM: A New Single Standard Method for Convenient Quantification by TEM EDS*; PJ Statham, J Sagar, J Holland; Oxford Instruments Nanoanalysis, United Kingdom; J Manktelow, S Lozano-Perez; University of Oxford, United Kingdom
- 2:30 PM **611** *Novel Silicon Drift Detector Devices for Ultra-Fast, High-Resolution X-Ray Spectroscopy*; A Niculae, A Bechteler, R Eckhardt, K Hermenau, A Liebel; PNDetector GmbH, Germany; G Lutz; PNSensor GmbH, Germany; H Soltau; PNDetector GmbH, Germany, L Strüder; PNSensor GmbH, Germany
- 2:45 PM **612** *New Opportunities with Oval-Shaped Silicon Drift Detectors for High-Throughput EDX Analysis in Electron Microscopy*; A Niculae, A Bechteler, R Eckhardt, K Hermenau, A Liebel, A Schöning, H Soltau; PNDetector GmbH, Germany, L Strüder; PNSensor GmbH, Germany; et al.

### A03.4 X-Ray Imaging and Analysis

#### SESSION CHAIR:

Eric Telfeyan, GE Global Research

#### PLATFORM SESSION

Wednesday 1:30 PM • Room: C115

- 1:30 PM **613** (INVITED) *Towards Li Quantification at High Spatial Resolution Using EDS*; P Hovington, V Timoshevskii; Hydro-Quebec, Canada; S Burgess, P Statham; Oxford Instruments, United Kingdom; H Demers, R Gauvin; McGill University, Canada; K Zaghib; Hydro-Quebec, Canada

- 2:00 PM **614** *Windowless EDS Detection of N Lines and Their Practical Use in Sub 2 kV X-Ray Mapping to Optimize Spatial Resolution*; S Burgess, J Holland, P Statham, C McCarthy; Oxford Instruments Nanoanalysis, United Kingdom
- 2:15 PM **615** *X-Ray Mapping Characterisation of Materials that have a Large Dynamic Compositional Range*; R Wuhler, K Moran; Western Sydney University, Australia
- 2:30 PM **616** *Detection of Osteogenesis in Explanted Synthetic Hydroxyapatite-Silicone Orbital Implants Using 3D X-Ray Microscopy*; M Hahn; University Medical Center Hamburg-Eppendorf, Germany; H Bale, L Lavery; Carl Zeiss X-Ray Microscopy, Inc., B Busse; University Medical Center Hamburg-Eppendorf, Germany
- 2:45 PM **617** *Novel, High Brightness X-Ray Source and High Efficiency X-Ray Optic for Development of X-Ray Instrumentation*; W Yun, SJ Lewis; Sigray, Inc.

### A07.3 Surface and Subsurface Microscopy and Analysis

#### SESSION CHAIR:

Chanmin Su, Bruker

#### PLATFORM SESSION

Wednesday 1:30 PM • Room: C216

- 1:30 PM **618** (INVITED) *Atomic force Microscopy of Polymer Systems: From Morphology to Properties to Chemical Imaging and Spectroscopy*; GF Meyers; The Dow Chemical Company
- 2:00 PM **619** *Surface Modifications During a Catalytic Reaction: a Combined APT and FIB/SEM Analysis of Surface Segregation*; C Barroo, N Janvelyan, B Zugic, AP Magyar, AJ Akey; Harvard University; J Biener; Lawrence Livermore National Laboratory; CM Friend, DC Bell; Harvard University
- 2:15 PM **620** (INVITED) *A Review of Recent Developments in Low Energy Ion Scattering (LEIS) and Its Applications*; P Brüner, T Grehl, HH Brongersma, E Niehuis; ION-TOF GmbH, Germany
- 2:45 PM **621** *Atomic Surface Structures of Oxide Nanoparticles with Well-Defined Shapes*; J Wen; Argonne National Laboratory; Y Lin; Northwestern University; H Sheng, L Wang, DJ Miller; Argonne National Laboratory; Z Wu; Oak Ridge National Laboratory; KR Poeppelmeier, LD Marks; Northwestern University; et al.

### A08.3 Quantitative and Qualitative Microanalysis by EPMA and SEM

#### SESSION CHAIR:

Julien Allaz, University of Colorado Boulder

#### PLATFORM SESSION

Wednesday 1:30 PM • Room: C113

- 1:30 PM **622** (INVITED) *Low Voltage FEG-EPMA in Earth Sciences – Problems and Solutions for Analysis of Unstable Materials*; SL Kearns, B Buse; University of Bristol, United Kingdom

- 2:00 PM **623** *Low Voltage Analysis: How Accurately Do You Need to Know Your Coating Thickness?*; MB Matthews, SL Kearns, B Buse; University of Bristol, United Kingdom
- 2:15 PM **624** *Calibrated Procedure for Setting Pulse-Height Parameters in Wavelength-Dispersive Spectrometry*; PK Carpenter; Washington University in St. Louis
- 2:30 PM **625** *Low Voltage Soft X-Ray Emission Analysis from 100 V for Depth Chemical Information from a Few nm to Several Hundred nm*; H Takahashi, S Asahina, T Kanazawa, Y Yamamoto, Y Sakuda; JEOL, Ltd., Japan; M Terauchi; Tohoku University, Japan; V Robertson, P McSwiggen; JEOL USA, Inc., et al.

## A12.2 Research and Applications in Atom Probe Tomography

### SESSION CHAIR:

Frederick Meisenkothen, National Institute of Standards and Technology

### PLATFORM SESSION

Wednesday 1:30 PM • Room: C226

- 1:30 PM **626** (INVITED) *Assessing the Composition of Wide Bandgap Compound Semiconductors by Atom Probe Tomography: A Metrological Problem*; L Rigutti, L Mancini, E Di Russo, I Blum, F Moyon, W Lefebvre, D Blavette, F Vurpillot; University of Rouen, France; et al.
- 2:00 PM **627** *Mapping Isotopes in Nanoscale and Quantum Materials Using Atom Probe Tomography*; S Mukherjee; Ecole Polytechnique, Montreal, Canada; D Isheim, DN Seidman; Northwestern University; O Moutanabbir; École Polytechnique, Montréal, Canada
- 2:15 PM **628** *Correlated Atom-Probe Tomography and Transmission Electron Microscopy of Meteoritic Nanodiamonds*; JB Lewis; Washington University in St. Louis; D Isheim; Northwestern University; C Floss, TL Daulton; Washington University in St Louis; DN Seidman; Northwestern University
- 2:30 PM **629** (INVITED) *Oxide Scales Revealed by Atom Probe Tomography*; Y Dong, T Barth; University of Michigan; Y Chen; CAMECA Instruments, Inc., EA Marquis; University of Michigan

## A13.5 In Situ Electron Microscopy and Big Data Analytics in 2D and 3D

### SESSION CHAIR:

Peter Ercius, Lawrence Berkeley National Laboratory

### PLATFORM SESSION

Wednesday 1:30 PM • Room: C221

- 1:30 PM **630** (INVITED) *Data Analytics Applied to Chemical Transformations in Liquids*; RR Unocic, AV Ievlev, S Jesse, X Sang, KL More, SV Kalinin; Oak Ridge National Laboratory

- 2:00 PM **631** (INVITED) *Liquid Cell TEM Study of Nanoparticle Diffusion and Interaction in Liquids*; H Zheng; Lawrence Berkeley National Laboratory; AS Powers; University of California, Berkeley; H-G Liao; Lawrence Berkeley National Laboratory
- 2:30 PM **632** *Direct Observation of the Growth of Au-Pd Core-Shell Nanoparticles Using Low-Dose STEM with the Liquid Cell In Situ*; N Bhattacharai, T Prozorov; Ames Laboratory
- 2:45 PM **633** **M&M 2016 STUDENT AWARDEE** *Biom mineralization of Hydroxyapatite Revealed by In Situ Electron Microscopy*; X Wang, J Yang, C Andrei, L Soleymani, K Grandfield; McMaster University, Canada

## A14.3 Single Atom Electron Microscopy and Spectroscopy

### SESSION CHAIR:

David Muller; Cornell University

### PLATFORM SESSION

Wednesday 1:30 PM • Room: C212

- 1:30 PM **634** (INVITED) *Single Atom Imaging and Spectroscopy of Impurities in 2D Materials*; W Zhou, AR Lupini; Oak Ridge National Laboratory; J Lin; Vanderbilt University; Y Gong; Rice University; Z Liu; Nanyang Technological University, Singapore; MD Kapetanakis; Vanderbilt University; MP Oxley, JC Idrobo; Oak Ridge National Laboratory; et al.
- 2:00 PM **635** *Z-Contrast Imaging as a Tool for Atomic Level Analysis of Bimetallic Structures*; MC Akatay, SI Sanchez, SA Bradley; Honeywell UOP, LLC
- 2:15 PM **636** *Every Atom has a Story to Tell: Using Single-Atom-Sensitivity Imaging and Spectroscopy to Determine Origins of Cosmic Nanodiamonds*; RM Stroud, ND Bassim; U.S. Naval Research Laboratory
- 2:30 PM **637** (INVITED) *Single-Atom Spectroscopy in Low-Dimensional Materials Using Low-voltage STEM*; K Suenaga; National Institute of Advanced Industrial Science and Technology, Japan

## A16.1 New Frontiers in Monochromated EELS

### SESSION CHAIR:

Ian MacLaren, University of Glasgow

### PLATFORM SESSION

Wednesday 1:30 PM • Room: C224-25

- 1:30 PM **638** (INVITED) *Monochromated EELS to Probe the Local Optical Properties of Low-Dimensional Materials*; K Suenaga; National Institute of Advanced Industrial Science and Technology, Japan
- 2:00 PM **639** (INVITED) *Opportunities and Challenges in Ultra-High Energy Resolution EELS*; OL Krivanek, N Dellby, MV Hoffman, TC Lovejoy; Nion Company
- 2:30 PM **640** *Mapping EELS Vibrational Modes in MgO Nanocubes*; MJ Lagos, PE Batson; Rutgers University

# Scientific Program

B

## BIOLOGICAL SCIENCES SYMPOSIUM— WEDNESDAY AFTERNOON

### B04.2 Microscopy and Morphogenesis

#### SESSION CHAIRS:

Jay Potts, University of South Carolina School of Medicine, Columbia  
Rich Goodwin, University of South Carolina, Greenville

#### PLATFORM SESSION

Wednesday 1:30 PM • Room: C111

- 1:30 PM **641** (INVITED) *Aintegumenta-Like6 can Functionally Replace Aintegumenta but Alters Arabidopsis Flower Development When Misexpressed at High Levels*; H Han, B Krizek; University of South Carolina
- 2:00 PM **642** *Exceptionally High Ni Concentration in Phloem of Roots of Nickel-Hyperaccumulating Berkheya zeyheri subsp. rehmannii var. rogersiana*; J Mesjasz-Przybylowicz, AD Barnabas, WJ Przybylowicz; iThemba LABS, South Africa
- 2:15 PM **643** (INVITED) *Multiple-Beam Laser Guidance-Based Microscope for Patterning Adult Cardiomyocytes*; L Schmidt, Z Wang, N Erdman, T Ye; Clemson University; TK Borg; Medical University of South Carolina; BZ Gao; Clemson University
- 2:45 PM **644** *STORM-Based Quantitative Assessment of Sodium Channel Localization Relative to Junctional Proteins within the Cardiac Intercalated Disk*; R Veeraraghavan, RG Gourdie; Virginia Technical College Carilion Research Institute

P

## PHYSICAL SCIENCES SYMPOSIUM— WEDNESDAY AFTERNOON

### P02.7 Electron Microscopy of Materials for Electrochemical Power Systems

#### SESSION CHAIR:

Mark Aindow, University of Connecticut

#### PLATFORM SESSION

Wednesday 1:30 PM • Room: E160AB

- 1:30 PM **645** (INVITED) *Electron Energy-loss Spectroscopy and Energy-Filtered TEM Imaging for the In Situ Assessment of Reduction-Oxidation Reactions in Ni-Based Solid Oxide Fuel Cells*; Q Jeangros, AB Aebersold; École Polytechnique Fédérale de Lausanne, Switzerland; TW Hansen, JB Wagner; Technical University of Denmark; RE Dunin-Borkowski; Forschungszentrum Jülich, Germany; C Hébert, J Van Herle, A Hessler-Wyser; École Polytechnique Fédérale de Lausanne, Switzerland
- 2:00 PM **646** *Electronic Structure Analysis of Aged Commercial LiFePO<sub>4</sub> Battery Cathodes Using Low Loss Electron Energy Loss Spectroscopy*; SA Channagiri, M Canova, DW McComb; The Ohio State University
- 2:15 PM **647** *ETEM Study of Oxygen Activity in LiNi<sub>0.8</sub>Co<sub>0.15</sub>Al<sub>0.05</sub>O<sub>2</sub> (NCA) Cathode Materials at Various States of Charge*; K Karki; Brookhaven National Laboratory; Y Huang, S Whittingham; Binghamton University; E Stach; Brookhaven National Laboratory; G Zhou; Binghamton University
- 2:30 PM **648** (INVITED) *Morphological and Chemical Evolution of Silicon Nanocomposite During Cycling*; YS Meng, M Sina, J Alvarado, H Shobukawa; University of California, San Diego

### P03.2 Combining Simulation, Experiment, and Data Science for Materials Characterization and Design

#### SESSION CHAIR:

Paul Voyles, University of Wisconsin-Madison

#### PLATFORM SESSION

Wednesday 1:30 PM • Room: C210

- 1:30 PM **649** (INVITED) *Probing the Subtleties of Atomic Distortions Through Accurate STEM Imaging and Density Functional Theory*; JM Lebeau, X Sang, JH Dycus, C Nui, DL Irving; North Carolina State University
- 2:00 PM **650 M&M 2016 STUDENT AWARDEE** *Direct Observation of Local Chemistry and Local Cation Displacements in the Relaxor Ferroelectric PMN-PT*; MJ Cabral; North Carolina State University; S Zhang; University of Wollongong, Australia; EC Dickey, JM Lebeau; North Carolina State University
- 2:15 PM **651** (INVITED) *Denoising of Atomic-Scale Images Based on Automatic Grain Segmentation, Unsupervised Primitive Unit Cell Extraction and Periodic Block-Matching*; B Berkels, N Mevenkamp; RWTH Aachen University, Germany

2:45 PM **652** *Combining Non-Rigid Registration with Non-Local Principle Component Analysis for Atomic Resolution EDS Mapping*; C Zhang, A Oh; University of Wisconsin-Madison; A Yankovich; Chalmers University of Technology, Sweden; T Slater, S Haigh; University of Manchester, United Kingdom; R Willett, P Voyles; University of Wisconsin-Madison

## P05.3 Microscopy for Metal, Semiconductor and Insulator Thin Films

### SESSION CHAIRS:

Steven Spurgeon, Pacific Northwest National Laboratory

Q. He, Oak Ridge National Laboratory

### PLATFORM SESSION

Wednesday 1:30 PM • Room: C114

1:30 PM **653** *Atomic and Electronic Structure Study of a  $\text{Co}_2\text{FeAl}_{0.5}\text{Si}_{0.5}$  Half-Metal Thin Film on Si(111)*; D Kepaptsoglou; SuperSTEM Laboratory, United Kingdom; B Kuerbanjiang, Z Nedelkoski, A Ghasemi; University of York, United Kingdom; Q Ramasse; SuperSTEM Laboratory, United Kingdom; V Lazarov; University of York, United Kingdom

1:45 PM **654** *High-Precision Stress Mapping and Defect Characterization of Thin Films of  $\text{LaMnO}_3$  Grown on  $\text{DyScO}_3$  Substrate*; AV Kvit, J Feng, C Zhang, D Morgan, P Voyles; University of Wisconsin-Madison

2:00 PM **655** *Nanobeam Diffraction and Geometric Phase Analysis for Strain Measurements in Si/SiGe Nanosheet Structures*; J Li; IBM; S Reboh; CEA; R Chao, N Loubet, M Guillorn, T Yamashita, J Gaudiello; IBM

2:15 PM **656** *Strain at Coalescence of Patterned (Al)GaN Nanorod Arrays formed by Selective Area Growth for Optoelectronic Devices*; A Pofelski, SY Woo; McMaster University, Canada; BH Le, X Liu, S Zhao, Z Mi; McGill University, Canada; G Botton; McMaster University, Canada

2:30 PM **657** *Application of STEM EELS Quantification Relative Compositional Ratio Mapping to Characterize SiCOH - Ultra Low-k Dielectric Materials in Si-Based Devices*; WW Zhao, M Gribelyuk; GlobalFoundries, Inc.

2:45 PM **658** *Atomic Scale Analysis of Dopants in CMOS Structures by Atom Probe Tomography*; I Martin; CAMECA Instruments, Inc., Åland Islands; R Estivill, M Juhel; STMicroelectronics, France; A Grenier; Université Grenoble Alpes, France; TJ Prosa, DJ Larson; CAMECA Instruments, Inc.

## P10.3 Microscopy and Characterization of Ceramics, Polymers and Composites

### SESSION CHAIRS:

Ronald Parrington, Engineering Systems, Inc.

Richard Chinn, National Energy Technology Laboratory

### PLATFORM SESSION

Wednesday 1:30 PM • Room: C214

1:30 PM **659** *Defects and Strain Accommodation in Epitaxial  $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3/\text{La}_{0.7}\text{Sr}_{0.3}\text{CoO}_3$  Heterostructures*; JP Byers, VK Malik, B Li, Y Takamura; University of California, Davis; ND Browning; Pacific Northwest National Laboratory

1:45 PM **660** *Monochromated Low-Dose Aberration-Corrected Transmission Electron Microscopy of Diamondoid Carbon Nanothreads*; SJ Juhl, X Li, JV Badding, N Alem; The Pennsylvania State University

2:00 PM **661** *Surface Crystal Plane Determination and Strong Metal-Support Interactions in  $\text{CeO}_2$  Nanorod-Supported CuOx Catalysts*; R Wang, SA Mock, E Zell; Youngstown State University

2:15 PM **662** *Understanding Initial Formation Stages of Nanomaterials Using Cryo-TEM*; KA Spoth, K Ma, U Wiesner, LF Kourkoutis; Cornell University

2:30 PM **663** *Electrospray Deposition of Nanoparticles on TEM Grids*; J Mielke; BAM Federal Institute for Materials Research and Testing, Germany; P Dohányosová, S López; Ramem S.A., Spain; V-D Hodoroba; BAM Federal Institute for Materials Research and Testing, Germany

2:45 PM **664** *Self-Catalyzed Epitaxial Growth of Core-Shell Ni@Graphene Nanoparticles from  $\text{Ni}(\text{OH})_2$ -Graphene Composites*; W Liu; University of Michigan; J Wu; University of Electronic Science and Technology of China; S Han, K Sun; University of Michigan

# Scientific Program

P

## PHYSICAL SCIENCES SYMPOSIA—

WEDNESDAY AFTERNOON *continued*

### P11.5 Metallography and Microstructural Characterization of Metals

#### SESSION CHAIRS:

George Vander Voort, Vander Voort Consulting LLC  
Coralee McNee, United Technologies

#### PLATFORM SESSION

Wednesday 1:30 PM • Room: C112

- 1:30 PM **665** (INVITED) *Stereological Techniques for Quantitative Characterization of Microstructures*; AM Gokhale; Georgia Institute of Technology
- 2:00 PM **666** *Understanding the Coarsening Behaviors of Nanoporous Gold via In Situ Heating*; A Elzoka, J Howe, RC Newman; University of Toronto, Canada; S Dogel; Hitachi High-Technologies Canada Inc., M Reynolds, H Hosseinkhannazer; Norcada Inc., Canada; DD Perovic; University of Toronto, Canada
- 2:15 PM **667** *Nondestructive Materials Characterization in 3D by Laboratory Diffraction Contrast Tomography – Applications and Future Directions*; C Holzner, LL Lavery, H Bale, A Merkle; Carl Zeiss X-Ray Microscopy, Inc., S McDonald, P Withers; University of Manchester, United Kingdom; Y Zhang, D Juul Jensen; Technical University of Denmark; et al.
- 2:30 PM **668** *TEM Study of Microstructure Evolution in Novel Environmentally Friendly Si Alloyed Lead-Free Brasses*; S Zormalia, P Tsakiridis, G Fourlaris; National Technical University of Athens, Greece
- 2:45 PM **669** *Characterization of Alpha/Beta Interface Structure in a Titanium Alloy Using Aberration-Corrected Scanning Transmission Electron Microscope*; Y Zheng, RE Williams, WA Clark, HL Fraser; The Ohio State University

### P12.3 Microscopy and Analysis in Forensic Science

#### SESSION CHAIRS:

S. Frank Platek, U.S. Food and Drug Administration Forensic Chemistry Center  
Stefanie L. Heckman, U.S. Food and Drug Administration Forensic Chemistry Center

#### PLATFORM SESSION

Wednesday 1:30 PM • Room: C213

- 1:30 PM **670** (INVITED) *Statistical Aspects of Gunshot Residue (GSR) Analysis*; N Kaplan-Damary, M Mandel; The Hebrew University of Jerusalem, Israel; N Levin; Private forensic scientist, Israel; E Izraeli; Israel Police Headquarters, Israel

- 2:00 PM **671** *Advances in the Analysis of Gunshot Residue and Other Trace Evidence Using EDS and EBSD in the SEM*; C Lang; Oxford Instruments Nanoanalysis, United Kingdom; F Bauer; Oxford Instruments Nanoanalysis, Germany; M Hiscock; Oxford Instruments Nanoanalysis, United Kingdom
- 2:15 PM **672** *Quantitative Metrics for Classifying Candidate Gun-Shot Residue Particles*; NW Ritchie, DE Newbury; National Institute of Standards and Technology
- 2:30 PM **673** *Improving Worker Safety for Handling Nanomaterials at the Benchtop*; B Gates, K Cadieux, M Matt, I Guo, T Hildago Castillo, T Chung, T Ngo, C Bright Davies; Simon Fraser University, Canada
- 2:45 PM **674** *Analysis of Forensic Casework Utilizing Infrared Microspectroscopic Imaging*; A Lanzarotta; U.S. FDA Forensic Chemistry Center

T

## BIOLOGICAL SCIENCES TUTORIAL—

WEDNESDAY AFTERNOON

### X41 Effective Tactics for Getting an Equipment Grant

#### SESSION CHAIR:

Scott Stagg, Florida State University

- 1:30 PM **675** *Effective Tactics for Getting an Equipment Grant*; KA Taylor; Florida State University

O

## MICROSCOPY OUTREACH—

WEDNESDAY AFTERNOON

### X91 A Family Affair

#### ORGANIZERS:

Elaine Humphrey  
Frauke Hogue  
Stuart McKernan

Wednesday 1:30 PM • Room: C121-121

Designed for attendees' families and friends, this fun and exciting session will pique the scientific interest of children of all ages - no previous microscopy experience is necessary!

Attendees interested in developing outreach opportunities at their home institutions are encouraged to attend as well.

A

## ADVANCES IN INSTRUMENTATION POSTER SESSIONS— WEDNESDAY AFTERNOON

### A01.P1 Vendor Symposium

#### POSTER SESSION

Wednesday 3:00 PM • Room: Exhibit Hall

##### POSTER # 207

3:00 PM **676** *Is Sputtering Sufficient for Production of Replicas?*; N Vaskovicova, K Hrubanova, V Krzyzanek; Institute of Scientific Instruments ASCR, Czech Republic

##### POSTER # 208

3:00 PM **677** *Remote Plasma Cleaning and Radical Recombination*; R Vane; E Kosmowka; XEI Scientific, Inc.

##### POSTER # 209

3:00 PM **678** *120kV TEM Equipped with an Ultra High-Resolution Lens and its Application*; K Tamura, T Kubo, H Mise, M Wayama, K Nakano, M Shirai, H Matsumoto, T Yaguchi; Hitachi High-Technologies Corporation, Japan; et al.

##### POSTER # 210

3:00 PM **679** *The First Results of the Low Voltage Cold-FE SEM/STEM System Equipped with EELS*; Y Yamazawa, S Okada, Z Yasenjiang, T Sunaoshi, K Kaji; Hitachi High-Technologies Corporation, Japan

##### POSTER # 211

3:00 PM **680** *Performance Evaluation of Dual Bruker XFlash6 | 100 EDS Detector Integrated in FEI Themis with Analytical Objective Pole Piece*; E Yücelen, M Ovsyanko, D Cats, M Niestadt, M Oosting, V Jongenelen, J van Engelshoven, D Foord; FEI Company, Netherlands; et al.

##### POSTER # 212

3:00 PM **681** *Use Electrons Sparingly but Efficiently, the Battle to get All the Required Information Needed While Minimizing Dose and Maximizing Data Collection at the Highest Resolution*; J Ringnalda, A Genc, E Van Capellen; FEI Company

##### POSTER # 213

3:00 PM **682** *Xe Plasma FIB Delaying of IC Based on 14 nm Node Technology*; JV Obona, T Hrnecir, S Sharang, M Sikula; TESCAN Brno, s.r.o., Czech Republic; A Denisyuk; TESCAN Orsay Holding a.s., Czech Republic

### A13.P1 In Situ Electron Microscopy and Big Data Analytics in 2D and 3D

#### POSTER SESSION

Wednesday 3:00 PM • Room: Exhibit Hall

##### POSTER # 214

3:00 PM **683** *Environment Induced Shape Change of Palladium Nanocrystals*; A Yoon, J-M Zuo; University of Illinois Urbana-Champaign

##### POSTER # 215

3:00 PM **684** *Probing the Oxidation Mechanism of Ta Nanoparticles via In Situ and Ex Situ Ultra-Fast Heating TEM/STEM*; JB DeLisio, GC Egan, S-C Liou, W-A Chiou, MR Zachariah; University of Maryland

##### POSTER # 216

3:00 PM **685** *Ex Situ and In Situ Microscopy Study of ZrO<sub>2</sub>-Stabilized Pd/Al<sub>2</sub>O<sub>3</sub> Catalysts*; S Zhang; University of Michigan; T Onn, R Gorte; University of Pennsylvania; G Graham; University of Michigan; X Pan; University of California, Irvine

##### POSTER # 217

3:00 PM **686** *The Dynamics of Active Metal Catalysts Revealed by In Situ Electron Microscopy*; MG Willinger, J Cao, A Rinaldi, Z-J Wang, R Farra, R Schloegl; Fritz Haber Institute of The Max Planck Society, Germany

##### POSTER # 218

3:00 PM **687** *Investigation of Gas Cooling Effect on the In Situ Heating Stage Inside Environmental TEM*; M Li, D Xie; Xi'an Jiaotong University, China; X Zhang; King Abdullah University of Science & Technology, Saudi Arabia; Z Shan; Xi'an Jiaotong University, China

##### POSTER # 219

3:00 PM **688** *Three Dimensional Parallel Automated Segmentation of Neural Soma in Large KESM Images of Brain Tissue*; L Saadatfard, DM Mayerich; University of Houston

##### POSTER # 220

3:00 PM **689** *Revealing the Working Active Sites of M1 Phase for Ethane Oxidation*; Y Zhu, E Jensen, PV Sushko, L Kovarik; Pacific Northwest National Laboratory; D Melzer, M Sanchez-Sanchez, JA Lercher; Technical University of Munich, Germany, ND Browning; Pacific Northwest National Laboratory

##### POSTER # 221

3:00 PM **690** *Initial Stages of Reduction of  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> Nanoblades*; W Zhu; Binghamton University; JP Winterstein, R Sharma; National Institute of Standards and Technology; G Zhou; Binghamton University

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION POSTER SESSIONS—

WEDNESDAY AFTERNOON *continued*

### A14.P1 Single Atom Electron Microscopy and Spectroscopy

#### POSTER SESSION

Wednesday 3:00 PM • Room: Exhibit Hall

#### POSTER # 222

3:00 PM **691 M&M 2016 STUDENT AWARDEE** *Strain Accommodation and Coherency in Laterally-Stitched WSe<sub>2</sub>/WS<sub>2</sub> Junctions*; Y Han, S Xie, B Savitzky, R Hovden, H Gao, LF Kourkoutis, J Park, DA Muller; Cornell University

#### POSTER # 223

3:00 PM **692** *ZnO Nanowire Supported Metal Single Atoms for CO oxidation*; J Xu, J Liu; Arizona State University

#### POSTER # 224

3:00 PM **693** *Quantification of the Effects of Small Mistilts on Dopant Visibility in Nanocrystals*; JT Held, S Duncan, KA Mkhoyan; University of Minnesota

#### POSTER # 225

3:00 PM **694** *Imaging at the Single-Atom Level in Closed-Cell In Situ Gas Reactions*; LF Allard; Oak Ridge National Laboratory; S Duan, J Liu; Arizona State University

#### POSTER # 226

3:00 PM **695** *Performance of the SALVE-Microscope: Atomic Resolution TEM Imaging at 20kV*; M Linck, P Hartel, S Uhlemann, H Müller; Corrected Electron Optical Systems GmbH, Germany; J Biskupek; Universität Ulm, Germany; M Niestadt; FEI Company, Netherlands; U Kaiser; Universität Ulm, Germany; M Haider; Corrected Electron Optical Systems GmbH, Germany; et al.

#### POSTER # 227

3:00 PM **696** *Engineering the Contrast Transfer Through the CC/CS Corrected 20–80 kV SALVE Microscope*; F Börrnert, J Biskupek, Z Lee; Universität Ulm, Germany; M Linck, P Hartel, H Müller, M Haider; CEOS GmbH, Germany, UA Kaiser; Universität Ulm, Germany

#### POSTER # 228

3:00 PM **697** *Correlation Averaging of Single-Atomic-Column STEM-EDX Images for Sub-Atomic Information*; JS Jeong, KA Mkhoyan; University of Minnesota

#### POSTER # 229

3:00 PM **698** *Atomic Resolution Studies of W Dopants Effect on the Phase Transformation of VO<sub>2</sub>*; H Asayesh-Ardakani; Michigan Technological University; A Nie; University of Illinois, Chicago; Y Zhu; King Abdullah University of Science & Technology, Saudi Arabia; P Phillips; University of Illinois, Chicago; R Klie; University of Illinois, Chicago; S Banerjee; Texas A&M University; G Odegard; Michigan Tech University; R Shahbazian-Yassar; University of Illinois, Chicago

B

## BIOLOGICAL SCIENCES POSTER SESSIONS—WEDNESDAY AFTERNOON

### B03.P1 Super Resolution Visualization of Cellular and Inter-Cellular Processes in Health and Disease

#### POSTER SESSION

Wednesday 3:00 PM • Room: Exhibit Hall

#### POSTER # 230

3:00 PM **699** *Fluorescent Nanodiamonds as Fiducial Markers or Nanodiamonds Are Forever*; VA Barr, JC Yi; National Cancer Institute, NIH; J Hong, KC Neuman; National Heart, Lung, and Blood Institute, NIH

### B04.P1 Microscopy and Morphogenesis

#### POSTER SESSION

Wednesday 3:00 PM • Room: Exhibit Hall

#### POSTER # 231

3:00 PM **700** *Laticifer and Rubber Particle Ontogeny in Taraxacum kok-saghyz (Rubber Dandelion) Roots*; MA Abdul Ghaffar, T Meulia, K Cornish; The Ohio State University

#### POSTER # 232

3:00 PM **701** *Ascospore Topographical Pattern as an Analytical Mycological Resource*; EA Favret, LM Setten; Instituto Nacional de Tecnología Agropecuaria, Argentina; SM Romero; Consejo Nacional de Investigaciones Científicas y Técnicas, Argentina; RM Comerio; Instituto Nacional de Tecnología Agropecuaria, Argentina; AI Romero; Consejo Nacional de Investigaciones Científicas y Técnicas, Argentina

#### POSTER # 233

3:00 PM **702** *Automated GPU-Accelerated Segmentation of Volumetric Fiber Networks Using a Predictor-Corrector Algorithm*; PA Govyadinov, D Mayerich; University of Houston

#### POSTER # 234

3:00 PM **703** *Structural and Biomechanical Study of Clarinet Reeds Made from Arundo donax*; M Kawasaki; JEOL USA, Inc.; T Nobuchi; Kyoto University, Japan; Y Nakafusi, M Nose; University of Toyama, Japan; M Shibata; JEOL USA, Inc.; M Shiojiri; Kyoto Institute of Technology, Japan

#### POSTER # 235

3:00 PM **704** *Quantification of Methylene Blue Exclusion for Tracking of Regenerative Re-Epithelialization*; M Milyavsky, R Dickie; Towson University

#### POSTER # 236

3:00 PM **705** *A Comparative Study of Three Marker Detection Algorithms in Electron Tomography*; P Trampert, S Bogachev, T Dahmen, P Slusallek; German Research Center for Artificial Intelligence GmbH, Germany

## POSTER # 237

3:00 PM **706** *Palynology of Eleven Species of the Genus Tectaria Cav. (Tectariaceae-Polypodiaceae)*; G Gonzalez-Mancera; Universidad Nacional Autónoma de México; L Pacheco, E Velazquez, A Sanchez Morales; Universidad Autónoma Metropolitana, Mexico

## POSTER # 238

3:00 PM **707** *Morphological Characterization from Pollen of Some Species of Genus Echeveria from Mexican Territory*; G Gonzalez-Mancera, J Reyes-Santiago, MD Luna-Islas, NA Sanchez-Luna; Universidad Nacional Autónoma de México

## P

## PHYSICAL SCIENCES POSTER SESSIONS—WEDNESDAY AFTERNOON

### P02.P2 Electron Microscopy of Materials for Electrochemical Power Systems

#### POSTER SESSION

Wednesday 3:00 PM • Room: Exhibit Hall

## POSTER # 239

3:00 PM **708** *In Situ TEM Observation on the Growth and Agglomeration of Propylene Carbonate-Based Electrolytes During Sodiation with Graphene Liquid Cell*; JH Chang; Institute for Basic Science, Republic of Korea; JY Cheong, ID Kim; Korea Advanced Institute of Science and Technology, Republic of Korea; JY Lee; Institute for Basic Science, Republic of Korea

## POSTER # 240

3:00 PM **709** *Structural Integrity of SnO<sub>2</sub> Nanotubes During Sodiation Examined by In Situ TEM Observation with Graphene Liquid Cell*; JY Cheong; Korea Advanced Institute of Science and Technology, Republic of Korea; JH Chang, JY Lee; Institute for Basic Science, Republic of Korea; I-D Kim; Korea Advanced Institute of Science and Technology, Republic of Korea

## POSTER # 241

3:00 PM **710** *In Situ TEM Study on the Growth Process of Amorphous Layer on SnO<sub>2</sub> Nanoparticle During Sodiation on Real Time Scale*; JY Cheong; Korea Advanced Institute of Science and Technology, Republic of Korea; JH Chang, JY Lee; Institute for Basic Science, Republic of Korea; I-D Kim; Korea Advanced Institute of Science and Technology, Republic of Korea

## POSTER # 242

3:00 PM **711** *Real-Time Observation of Two-Phase Separation in LiFePO<sub>4</sub> at Elevated Temperature*; S-Y Chung; Korea Advanced Institute of Science and Technology, Republic of Korea; S-Y Choi; Korea Institute of Materials Science, Republic of Korea

## POSTER # 243

3:00 PM **712** *Case Examination on Volume Expansion of Crystalline Si Nanoparticles under Sodiation: In Situ TEM Study Using Graphene Liquid Cells*; FJ Mweta, SJ Kim, JH Chang;

Institute for Basic Science, Republic of Korea; JY Cheong; Korea Advanced Institute of Science and Technology, Republic of Korea; HK Seo; Institute for Basic Science, Republic of Korea; I-D Kim; Korea Advanced Institute of Science and Technology, Republic of Korea; JY Lee; Institute for Basic Science, Republic of Korea

## POSTER # 244

3:00 PM **713** *Size-Controlled Intercalation to Conversion Transition in Lithiation of Transition Metal Chalcogenides-NbSe<sub>3</sub>*; L Luo; Pacific Northwest National Laboratory; B Zhao, B Xiang; University of Science and Technology of China; C Wang; Pacific Northwest National Laboratory

## POSTER # 245

3:00 PM **714** *Cycling and Aging Studies of Li-Based Cathode Materials via Aberration-Corrected STEM*; P Phillips; University of Illinois, Chicago; D Abraham; Argonne National Laboratory; R Klie; University of Illinois, Chicago

## POSTER # 246

3:00 PM **715** *In Situ TEM Observations of Carbon Deposition on Solid Oxide Fuel Cell Anode Materials*; EL Lawrence, PA Crozier; Arizona State University

## POSTER # 247

3:00 PM **716** *Versatile Fluidic Cell for In Situ Electrochemical Measurements in SEM*; J Velmurugan, A Stevanovic, F Yi, D Lavan, A Kolmakov; National Institute of Standards and Technology

## POSTER # 248

3:00 PM **717** *Study of Stability and Structural Changes Occurring During High Thermal Load of the High Voltage Cathode Material by In Situ Scanning Electron Microscopy*; T Kazda; Brno University of Technology, Czech Republic; L Novák, T Vystavěl, J Stárek; FEI Company, Czech Republic; J Vondrák; Brno University of Technology, Czech Republic

## POSTER # 249

3:00 PM **718** *Effect of Mechanical Stress on Lithiation and Sodiation Process*; H Asayesh-Ardakani; Michigan Technological University; A Nie; University of Illinois, Chicago; Y Yuan; Michigan Technological University; R Shahbazian-Yassar; University of Illinois, Chicago

## POSTER # 250

3:00 PM **719** *In Situ Video Observations of the Lithiation of Single Microcrystal Graphite*; JJ Lodico, E Garcia, BC Regan; University of California, Los Angeles

## POSTER # 251

3:00 PM **720** *Similarities and Differences in Kinetics and Dynamics During Li and Na Transport in MoS<sub>2</sub> Nanostructures*; C Shi, P Gao; Peking University, China

## POSTER # 252

3:00 PM **721** *Electron Microscopy Observations Over the Processes Yielding to Obtaining TiO<sub>2</sub> from Natural Ilmenite Mineral*; LM Caceres Montero, G Solorzano, EA Brocchi; Pontificia Universidade Católica do Rio de Janeiro, Brazil

# Scientific Program

P

## PHYSICAL SCIENCES POSTER SESSIONS— WEDNESDAY AFTERNOON *continued*

### P05.P1 Microscopy for Metal, Semiconductor and Insulator Thin Films

#### POSTER SESSION

Wednesday 3:00 PM • Room: Exhibit Hall

#### POSTER # 253

3:00 PM **722** *Twin-Assisted Growth Mechanism of Heterogeneous Interfaces Between Gold Nanoparticles and Nominally Stable Substrates*; F Liu, DY Xie, Y-S Fu, G-Z Zhu; Shanghai Jiao Tong University, China

#### POSTER # 254

3:00 PM **723** *Nanocharacterization of Strontium Titanate Thin Films and Oxide-Electrode Interfaces in Resistive Switching Devices*; WJ Bowman; Arizona State University; E Sediva; ETH Zürich, Switzerland; PA Crozier; Arizona State University; J Rupp; ETH Zürich, Switzerland

#### POSTER # 255

3:00 PM **724** *Investigation of N-Polar AlGaIn/GaN and InAlN/GaN Thin Films Grown by MBE*; TO McConkie; Arizona State University; MT Hardy, DF Storm, BP Downey, DS Katzer, DJ Meyer; U.S. Naval Research Laboratory; N Nepal; Sotera Defense Solutions, DJ Smith; Arizona State University

#### POSTER # 256

3:00 PM **725** *Local Strain Relaxation by A-Type Dislocation Clusters in In<sub>x</sub>Ga<sub>1-x</sub>N/GaN Film with Indium Compositions of  $x=0.07$  and  $0.12$* ; H Xie, S Wang, AM Fischer; Arizona State University; H McFavilen; Soitec Phoenix Labs; FA Ponce; Arizona State University

#### POSTER # 257

3:00 PM **726** **M&M 2016 STUDENT AWARDEE** *Temperature Dependence of the Silicon Nitride Volume Plasmon*; BT Zutter; University of California, Los Angeles; M Mecklenburg; University of Southern California; BC Regan; University of California, Los Angeles

#### POSTER # 258

3:00 PM **727** *Microstructural Characteristics of GaN/AlN Thin Films Grown on a Si(110) Substrate by Molecular Beam Epitaxy: Transmission Electron Microscopy Study*; YH Kim, JH Lee, SJ Ahn; Korea Research Institute of Standards and Science, Republic of Korea; Y-K Noh; IV Works Co, Ltd., Republic of Korea; M-D Kim; Chungnam National University, Republic of Korea; J-E Oh; Hanyang University, Republic of Korea

#### POSTER # 259

3:00 PM **728** *Bismuth Particle Formation in Annealed Dilute GaAs<sub>1-x-y</sub>PyBi<sub>x</sub> Alloys*; ZR Lingley, Y Sin, B Foran, M Brodie, NP Wells, SC Moss; The Aerospace Corporation; L Mawst, K Forghani; University of Wisconsin-Madison; et al.

#### POSTER # 260

3:00 PM **729** *Interfacial Electrical Conductivity Controlled Crystallization of Amorphous LaAlO<sub>3</sub> Under Electron-Beam Irradiation*; G Lee; Yonsei University, Republic of Korea; J Kim; Seoul National University, Republic of Korea; S-M Moon; Yonsei University, Republic of Korea; SH Baek; Korea Institute of Science and Technology, Republic of Korea; D-H Kim; Yonsei University, Republic of Korea; HJ Chang; Korea Institute of Science and Technology, Republic of Korea

#### POSTER # 261

3:00 PM **730** *High Temperature Stability of Amorphous Zn-Sn-O Transparent Conductive Oxides Investigated by In Situ TEM and X-Ray Diffraction*; Q Jeangros; École Polytechnique Fédérale de Lausanne, Switzerland; M Duchamp; Forschungszentrum Jülich, Germany; E Rucavado, F Landucci, C Spori; École Polytechnique Fédérale de Lausanne, Switzerland; RE Dunin-Borkowski; Forschungszentrum Jülich, Germany; C Hébert, M Morales-Masis; École Polytechnique Fédérale de Lausanne, Switzerland; et al.

#### POSTER # 262

3:00 PM **731** *Dislocation Analysis of Thermal-Cycle-Annealed Mesa-Structured HgCdTe/HgTe/CdTe/ZnTe/Si (211)*; M Vaghayenagar; Arizona State University; S Simingalam, Y Chen; U.S. Army Research Laboratory; DJ Smith; Arizona State University

#### POSTER # 263

3:00 PM **732** *Characterizing InGaAs/GaAs Quantum Dots Using Low-kV FESEM Imaging and EDS Analysis at the Nanometer Scale*; L Han; Carl Zeiss Microscopy GmbH, Germany; S Burgess, X Li; Oxford Instruments Nanoanalysis, United Kingdom; F Zhou; Carl Zeiss Microscopy GmbH, Germany

#### POSTER # 264

3:00 PM **733** *In Situ Atomic-Scale Visualization of CuO Nanowire Growth*; W Zhu; Binghamton University; JP Winterstein, R Sharma; National Institute of Standards and Technology; G Zhou; Binghamton University

#### POSTER # 265

3:00 PM **734** *3D Reconstruction and Separation of Nickel and Zirconia Based Phases from Solid Oxide Fuel Cell Anode Using Backscatter Electron Imaging*; G Wetzal, T Darroudi, L Saraf; Clemson University

#### POSTER # 266

3:00 PM **735** *Annular Bright Field STEM Investigation of the (0001) Stacking Fault in Alumina*; E Tochigi, T Mizoguchi; The University of Tokyo, Japan; A Nakamura; Nagoya University, Japan; N Shibata, Y Ikumura; The University of Tokyo, Japan

#### POSTER # 267

3:00 PM **736** *The Effects of Seeding Strategies on Morphology of Electroless Deposited Pd Thin Film*; T Gutu; University of Zimbabwe; E Minnaar, JE Olivier; Nelson Mandela Metropolitan University, South Africa; J Kurehwatira, K Munjeri, BS Mpofu, MJ Myers; University of Zimbabwe

## POSTER # 268

3:00 PM **737** *Size Effect on Spontaneous Flux-Closure Domains in BiFeO<sub>3</sub> Thin Films*; L Li; University of Michigan; F Xue; Pennsylvania State University; C Nelson; University of Michigan; A Melville; C Heikes; D Schlom; Cornell University; L Chen; Pennsylvania State University; X Pan; University of California, Irvine

## POSTER # 269

3:00 PM **738** *Characterizing Epitaxial Growth of Nd<sub>2</sub>Ir<sub>2</sub>O<sub>7</sub> Pyrochlore Thin Films via HAADF-STEM Imaging and EDX*; BD Esser; JC Gallagher; R Morrow; SR Dunsiger; RE Williams; PM Woodward; F Yang; DW McComb; The Ohio State University

## POSTER # 270

3:00 PM **739** *TEM Studies of TiO<sub>2</sub>-Based Passivated Contacts in c-Si Solar Cells*; H Ali; University of Central Florida; X Yang; Australian National University, Australia; KO Davis; University of Central Florida; K Weber; Australian National University, Australia; WV Schoenfeld; University of Central Florida

## POSTER # 271

3:00 PM **740** *S/TEM Investigation of the Structure of (Bi,Sb)<sub>2</sub>Te<sub>3</sub>/h-BN Heterostructures Grown by Molecular Beam Epitaxy*; D Reifsnnyder Hickey; University of Minnesota; JS Lee; The Pennsylvania State University; RJ Wu; University of Minnesota; N Samarth; The Pennsylvania State University; KA Mkhoyan; University of Minnesota

## POSTER # 272

3:00 PM **741** *Study on Chemical Vapor Deposition Growth and Transmission Electron Microscopy MoS<sub>2</sub>/h-BN Heterostructure*; YT Kim; JB Seol; CM Kwak; CG Park; Pohang University of Science and Technology, Republic of Korea

## POSTER # 273

3:00 PM **742** *Fast Identification of Dislocations in Semiconductor Materials by Electron Channeling Contrast Imaging Using a Scanning Electron Microscope*; L Han; Carl Zeiss Microscopy GmbH, Germany; Y Zhou; Carl Zeiss Microscopy GmbH, Singapore

## POSTER # 274

3:00 PM **743** *Direct Observation of Conducting Path with Highly Reduced Graphene Oxide in Au/GO/Al Resistive Switching Memory*; SK Kim; JY Lee; Korea Advanced Institute of Science and Technology, Republic of Korea; HY Jeong; Ulsan National Institute of Science and Technology, Republic of Korea

## POSTER # 275

3:00 PM **744** *Crystallite Size Evaluation of ZnO Nanoparticles via Transmission Electron Microscopy and X-Ray Powder Diffraction*; JE Cowen; Case Western Reserve University; AE Harris; CC Pena; SC Bryant; AJ Christy; JD Harris; Northwest Nazarene University

## POSTER # 276

3:00 PM **745** *Atomic Arrangement of Contamination on Graphene*; Y Maehara; K Yamazaki; K Gohara; Hokkaido University, Japan

## POSTER # 277

3:00 PM **746** *Refined Phase Imaging by Electron Diffractive Imaging*; J Yamasaki; Y Shimaoka; Osaka University, Japan; H Sasaki; Furukawa Electric Co, Ltd., Japan

## POSTER # 278

3:00 PM **747** *Atomic Structure of Self-Pillared, Single-Unit-Cell Sn-MFI Zeolite Nanosheets*; P Kumar; L Ren; Q Guo; University of Minnesota; X Zhang; The Pennsylvania State University; M Tsapatsis; A Mkhoyan; University of Minnesota

## P10.P1 Microscopy and Characterization of Ceramics, Polymers and Composites

### POSTER SESSION

Wednesday 3:00 PM • Room: Exhibit Hall

## POSTER # 279

3:00 PM **748** *High-Resolution Transmission Electron Microscopy Study of Montmorillonite Subjected to Rapid Compression*; Y Zhang; Center for High Pressure Science and Technology Advanced Research, China; M Wei; Jilin Normal University, China; Y Ma; J Chaudhuri; Texas Technology University

## POSTER # 280

3:00 PM **749** *Characterization of Burnt Clays by X-Ray Diffraction Analysis, Chemical Analysis and Environmental Scanning Electron Microscopy*; E Navrátilová; V Neděla; Institute of Scientific Instruments ASCR, Czech Republic

## POSTER # 281

3:00 PM **750** *Electron Microscopy Study of Nd Doped Misfit Layer Structures in the Pb-Nb-Se System*; LC Otero Diaz; R Varadé-López; D Ávila-Brandé; A Gómez-Herrero; Universidad Complutense de Madrid, Spain

## POSTER # 282

3:00 PM **751** *Direct Observation of Ferroelectric Domain Walls in Improper Ferroelectric (Ca,Sr)<sub>3</sub>Ti<sub>2</sub>O<sub>7</sub>*; K Kurushima; Toray Research Center, Japan; W Yoshimoto; H Tsukasaki; Y Ishii; Osaka Prefecture University, Japan; S-W Cheong; Rutgers University; S Mori; Osaka Prefecture University, Japan

## POSTER # 283

3:00 PM **752** *Structural Anisotropy in a Crustacean Claw Calcified with Amorphous Calcium Phosphate*; M Vittori; University of Ljubljana, Slovenia; V Srot; B Bussmann; PA van Aken; Max Planck Institute for Solid State Research, Germany; J Štrus; University of Ljubljana, Slovenia

## POSTER # 284

3:00 PM **753** *High-Energy Ball-milling of ZrB<sub>2</sub> and HfB<sub>2</sub> Powders: Effect on Particle Size and Crystalline Grain Distribution*; NV Seetala; OL Reedy; Grambling State University; LE Matson; Wright-Patterson Air Force Base; TS Key; H Lee; UES, Inc.

# Scientific Program

P

## PHYSICAL SCIENCES POSTER SESSIONS

WEDNESDAY AFTERNOON *continued*

### POSTER # 285

3:00 PM **754** *Focused Ion Beam (FIB) and Energy Dispersive X-Ray (EDX) Analysis in Adhesive Dentistry*; L Rotkina; Ioffe Physical-Technical Institute of Russian Academy of Science; C Zbaeren; University of Pennsylvania; J Katsoulis; University of Bern, Switzerland; T Takagaki; Tokyo Medical and Dental University, Japan; M Blatz; University of Pennsylvania

### POSTER # 286

3:00 PM **755** *Analysis of H<sub>2</sub> and SiH<sub>4</sub> in the Deposition of pm-Si:H Thin Films by PECVD Process for Solar Cell Applications*; A Garcia-Barrientos; Universidad Autonoma de San Luis Potosí, Mexico; J Plaza-Castillo; Universidad del Atlántico, Barranquilla, Colombia; M Moreno-Moreno; Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico; J Arellano-Jiménez; University of Texas, San Antonio; KY Vizcaíno; Universidad del Atlántico, Barranquilla, Colombia; JL Bernal-Ponce; Universidad Politécnica de Pachuca, Mexico

### POSTER # 287

3:00 PM **756** *Evaluation of Low Temperature Degradation of 3Y-TZP in Artificial Saliva*; MDC Aragon Duarte, A Reyes Rojas, HE Esparza-Ponce; Centro de Investigación en Materiales Avanzados, S.C., Mexico

### POSTER # 288

3:00 PM **757** *EBSO Characterisation of SPSed CeB<sub>6</sub> Thermionic Electron Emitter*; S Baskut, L Koroglu, E Ayas, S Turan; Anadolu University, Turkey

### POSTER # 289

3:00 PM **758** *TEM Characterization of the Deformed Region Beneath Knoop Indents in Boron Carbide*; SD Walck; TKC Global Solutions LLC; JC Lasalvia; U.S. Army Research Laboratory; KD Behler; TKC Global Solutions LLC

### POSTER # 290

3:00 PM **759** *Synthesis of Mg Doped ZnO with Hexagonal Shape by Hydrothermal Method*; A Corral-Aguado, P Martínez-Torres; Universidad Michoacana de San Nicolás de Hidalgo, Mexico; N Gomez-Ortiz; University of California, Riverside; J Pichardo-Molina; Centro de Investigaciones en Óptica A.C., Mexico; S De la Rosa-García; Universidad Juárez Autónoma de Tabasco, Mexico; SE Borjas-García, A Medina; Universidad Michoacana de San Nicolás de Hidalgo, Mexico

### POSTER # 291

3:00 PM **760** *FIB/SEM Tomography of Porous Ceramics*; A Rezikyan; Corning, Inc.

### POSTER # 292

3:00 PM **761** *Electron Microscopy Study on the Effect of Si<sub>3</sub>N<sub>4</sub> Addition to B<sub>4</sub>C-SiC-Al Composites*; P Kaya; Anadolu University, Turkey; A Kalemantas; Bursa Technical University, Turkey; G Arslan, F Kara, S Turan; Anadolu University, Turkey

### POSTER # 293

3:00 PM **762** *Effect of B<sub>4</sub>C Particles Addition on the Microstructure and Mechanical Performance of Some Aluminum-Based Composites*; C Carreño-Gallardo, J Mendoza-Duarte; Centro de Investigación en Materiales Avanzados, S.C., Mexico; C López-Meléndez; Universidad La Salle Chihuahua, Mexico; I Estrada-Guel, JL Reyes-Ronquillo, E Uriza-Vega, R Martínez-Sánchez; Centro de Investigación en Materiales Avanzados, S.C., Mexico

### POSTER # 294

3:00 PM **763** *3D Investigation of the Microstructure Evolution in Hypereutectic Aluminum Silicon Alloy Using High-Resolution Phase Contrast X-Ray Microscopy*; AG Rao; Naval Materials Research Laboratory Ambarnath, India; H Bale, A Merkle; Carl Zeiss X-Ray Microscopy, Inc.; VP Deshmukh; Naval Materials Research Laboratory Ambarnath, India

### POSTER # 295

3:00 PM **764** *Characterization of Micronized/Nanoscale Copper Particles in Wood Dust by TEM/STEM*; C Wang, C Qi, AS Echt, AK Dozier, JE Fernback, ME Birch; National Institute for Occupational Safety and Health

### POSTER # 296

3:00 PM **765** *Characterization by TEM of Pt Nanoparticles Dispersed on TiO<sub>2</sub>Np, TiO<sub>2</sub>Nt and Al<sub>2</sub>O<sub>3</sub>*; C Angeles-Chavez, MA Cortes-Jacome, JA Toledo-Antonio; Mexican Institute of Petroleum

### POSTER # 297

3:00 PM **766** *Study of Dielectric Properties and Morphology of Epoxy Resin with Silicon Dioxide Microparticles and Nanoparticles*; J Hudec, V Neděla; Institute of Scientific Instruments ASCR, Czech Republic

### POSTER # 298

3:00 PM **767** *Cryo-SEM Imaging and Analysis of Frozen-Hydrated PEG-AA Microgels*; J Liang, F Teng, M Libera, T Chou; Stevens Institute of Technology

### POSTER # 299

3:00 PM **768** *Scanning Transmission Electron Microscopy of SiAlON/Graphene Nano Platelets Composites Obtained with a Novel Homogenization Approach*; U Savaci, A Cinar, TA Seyhan, S Turan; Anadolu University, Turkey

### POSTER # 300

3:00 PM **769** *In Situ Transformation of Amorphous Soot into Carbon-Nanostructures by High-Energy Ball Milling*; I Estrada-Guel; Centro de Investigación en Materiales Avanzados, S.C., Mexico; O Anderson-Okonkwo, FC Robles-Hernandez; University of Houston

### POSTER # 301

3:00 PM **770** *Aluminum Mechanical Enhancing with Gr-Cu Nanoparticles Addition via High-Energy Ball Milling*; JM Mendoza-Duarte, R Martínez Sánchez, C Carreño-Gallardo, I Estrada-Guel; Centro de Investigación en Materiales Avanzados, S.C., Mexico

## POSTER # 302

3:00 PM **771** *Interfacial Complexions and the Related Atomic Transport Behaviors in Gold-Oxide Systems*; G-Z Zhu, Y-S Fu, F Liu, A-C Yi, DY Xie, W Zhou; Shanghai Jiao Tong University, China

## POSTER # 303

3:00 PM **772** *Low loss Electron Energy Spectroscopy Characterization of Electronic Structure and Piezo-Response of  $\text{Ba}_{0.9}\text{Ca}_{0.1}\text{Ti}_{0.9}\text{Zr}_{0.1}\text{O}_3$  Nanocrystals*; G Herrera-Perez; Cátedras CONACYT, Mexico; D Morales C., F Paraguay-Delgado, A Hurtado-Macias; Centro de Investigación en Materiales Avanzados, S.C., Mexico; R Borja-Urby; Centro de Nanociencias, IPN, Mexico; G Tapia-Padilla; Cátedras CONACYT, Mexico; A Reyes-Rojas, LE Fuentes-Cobas; Centro de Investigación en Materiales Avanzados, S.C., Mexico

## POSTER # 304

3:00 PM **773** *Workplace Monitoring of Airborne Carbon Nanomaterials by HRTEM*; QT Birch; National Institute for Occupational Safety and Health; C Wang, JE Fernback, HA Feng, ME Birch, AK Dozier; National Institute for Occupational Safety and Health

## POSTER # 305

3:00 PM **774** *Microscale Self-Assembly of Longrange Ordered  $\text{CuS}$  Nanostructures*; S Han, W Liu; University of Electronic Science and Technology of China; K Sun; University of Michigan

## POSTER # 306

3:00 PM **775** *Nano-Particle TEM Sample Preparation Primer*; OM Vierrether, JR TerBush, CA Wisner; Missouri University of Science & Technology

## POSTER # 307

3:00 PM **776** *Synthesis of  $\text{ZnO}$  Crystals Hexagonal Ball Shape*; S Borjas, A Medina, L Bejar; Universidad Michoacana de San Nicolás de Hidalgo, Mexico; C Aguilar; Universidad Técnica Federico Santa María, Chile

## POSTER # 308

3:00 PM **777** *Synthesis of Mesoporous Ceria by Using CTAB as Template*; SE Borjas García, A Medina Flores, L Béjar Gómez, PG Martínez Torres, N Dasgupta-Schubert; Universidad Michoacana de San Nicolás de Hidalgo, Mexico; JL Bernal Ponce; Universidad Politécnica de Pachuca, Mexico

## POSTER # 309

3:00 PM **778** *Synthesis and Characterization of Pure and Mn-doped  $\text{BaTiO}_3$  Nanofibers*; MC Maldonado, F Espinosa, M Ochoa, J Sosa; Centro de Investigación en Materiales Avanzados, S.C., Mexico

## POSTER # 310

3:00 PM **779** *Resolving Difficult Multilayer Film Structure by Transmission Electron Microscopy*; S Qin, H Duan, W Dai; Avery Dennison Corporation

## POSTER # 311

3:00 PM **780** *Combining Post-Specimen Aberration Correction and Direct Electron Detection to Image Molecular Structure in Liquid Crystal Polymers*; EA Stach; Brookhaven National Laboratory; J Li; Stony Brook University; H Xin, DN Zakharov; Brookhaven National Laboratory; YH Kwon, E Reichmanis; Georgia Institute of Technology

## POSTER # 312

3:00 PM **781** *Morphology Study of Phosphonated Peptoid Block Copolymer*; J Sun; Qingsha University of Science and Technology, China; K Downing, R Zuckermann; Lawrence Berkeley National Laboratory; N Balsara; University of California, Berkeley; X Jiang; Lawrence Berkeley National Laboratory

## P12.P1 Microscopy and Analysis in Forensic Science

### POSTER SESSION

Wednesday 3:00 PM • Room: Exhibit Hall

## POSTER # 313

3:00 PM **782** *Transmission Electron Microscopy and X-Ray Photoelectron Spectroscopy Studies of Soot Particles Emitted from a Domestic Cook-Stove*; GA Carabali, TG Castro, OA Peralta; Universidad Nacional Autónoma de México; L Molina; Massachusetts Institute of Technology

## POSTER # 314

3:00 PM **783** *The Application of Scanning Electron Microscopy with Energy Dispersive X-Ray Spectroscopy (SEM-EDX) in Ancient Dental Calculus for the Reconstruction of Human Habits*; D Fialova; Masaryk University, Czech Republic; R Skoupy; Institute of Scientific Instruments ASCR, Czech Republic; E Drozdova; Masaryk University, Czech Republic; V Krzyzanek; Institute of Scientific Instruments ASCR, Czech Republic; L Sin; Archaeological Centre Olomouc, Czech Republic; R Benus; Comenius University, Slovakia; B Klima; Masaryk University, Czech Republic

## POSTER # 315

3:00 PM **784** *Elemental Analysis of Particles  $\text{PM}_{2.5}$  by SEM-EDS*; R Ramirez-Leal, M Valle-Martinez, M Cruz-Campa; Sonora State University, Mexico

## POSTER # 316

3:00 PM **785** *Microscopy Applied to Occupational and Environmental Health Investigations*; AA Havics; pH2, LLC

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION SYMPOSIA—THURSDAY MORNING

### A02.1 TEM Phase Plate Imaging in Biological and Materials Science

#### SESSION CHAIR:

Radostin Danev, Max Planck Institute

#### PLATFORM SESSION

Thursday 8:30 AM • Room: C111

- 8:30 AM **786** (INVITED) *Optimizing the FEI Volta Phase Plate for Efficient and Artefact-Free Data Acquisition*; B Buijsse; FEI Company, Netherlands; R Danev; Max Planck Institute of Biochemistry, Germany; K Sader; FEI Company, United Kingdom; S Welsch; FEI Company, Netherlands
- 9:00 AM **787** (INVITED) *Contrast Enhancement of Long-Range Periodic Structures Using Hole-Free Phase Plate*; H Iijima, Y Konyuba, N Hosogi, Y Ohkura; JEOL, Ltd., Japan; H Jinnai, T Higuchi; Tohoku University, Japan
- 9:30 AM **788** *Contrast Enhancement of Nano-Materials Using Phase Plate STEM*; H Minoda, T Tamai; Tokyo University of Agriculture and Technology, Japan; H Iijima, Y Kondo; JEOL, Ltd., Japan
- 9:45 AM **789** *The Role of Secondary Electron Emission in the Charging of Thin-Film Phase Plates*; M Dries, R Janzen, T Schulze, J Schundelmeier, S Hettler; Karlsruhe Institute of Technology, Germany; U Golla-Schindler, B Jaud, U Kaiser; Ulm University, Germany; et al.

### A07.4 Surface and Subsurface Microscopy and Analysis

#### SESSION CHAIR:

Chanmin Su, Bruker

#### PLATFORM SESSION

Thursday 8:30 AM • Room: C216

- 8:30 AM **790** *High Reproducible Scanning Near-Field Optical Microscopy with a Few Nanometer Lateral Spatial Resolution*; T Tachizaki; Tokai University, Japan; K Zhang, I Yamakawa, S-I Taniguchi; Hitachi, Ltd., Japan
- 8:45 AM **791** (INVITED) *Electronic Behaviors of Individual Defects and Boundaries in 2D Materials: A Spatially Resolved Study with Multi-Probe Scanning Tunneling Microscopy*; A-P Li; Oak Ridge National Laboratory
- 9:15 AM **792** (INVITED) *Surface Phonon Coupling Within Boron Nitride Nanotubes Resolved by a Novel Near-Field Infrared Pump-Probe Imaging Technique*; L Gilburd; University of Toronto, Canada; X Xu; Lehigh University; Y Bando, D Golberg; National Institute for Materials Science, Japan; G Walker; University of Toronto, Canada
- 9:45 AM **793** **MSA POST-DOCTORAL AWARDEE** *Submicron Spatial Resolution in Thermal Desorption Mass Spectrometry via Rapid Heating Functions Using Thermal AFM Probes*; S Somnath, S Jesse, GJ Van Berkel, SV Kalinin, OS Ovchinnikova; Oak Ridge National Laboratory

### A08.4 Quantitative and Qualitative Microanalysis by EPMA and SEM

#### SESSION CHAIR:

Julien Allaz, University of Colorado Boulder

#### PLATFORM SESSION

Thursday 8:30 AM • Room: C113

- 8:30 AM **794** (INVITED) *Microanalytical Standards, Reference and Research Materials: Continuing the Effort Toward Breaking the Accuracy Barrier*; A von der Handt; University of Minnesota; JM Allaz; University of Colorado, Boulder; OK Neill; Washington State University
- 9:00 AM **795** *EPMA WDS Peak Position Analysis of Mineral Chemistry in Fossils*; DC Meier; McCrone Associates, Inc.; KK Foecke; The Pennsylvania State University; EP Vicenzi; Smithsonian Institution; PJ Heaney, R Graham; The Pennsylvania State University
- 9:15 AM **796** *Evaluation of MPI-DING Glasses for Use as Electron Probe Standards*; DK Ross; NASA Johnson Space Center
- 9:30 AM **797** (INVITED) *Iron Speciation Microanalysis: Evaluating Low Overvoltage Wavelength Dispersive Spectrometry Using Natural Reference Materials*; EP Vicenzi; Smithsonian Institution; DC Meier; National Institute of Standards and Technology; PK Carpenter; Washington University in St. Louis

### A10.1 Advances in Image Processing, Display and Analysis

#### SESSION CHAIR:

William Heeschen, Dow Chemical

#### PLATFORM SESSION

Thursday 8:30 AM • Room: C115

- 8:30 AM **798** *Model-Based Super-Resolution of SEM Images of Nano-Materials*; S Sreehari; Purdue University; SV Venkatakrishnan; Lawrence Berkeley National Laboratory; JP Simmons, LF Drummy; U.S. Air Force Research Laboratory, WPAFB; CA Bouman; Purdue University
- 8:45 AM **799** *Self-Organizing Neural Networks: Parallels Between "Big Imaging" and Sparse Imaging in Electron Microscopy*; K Hujsak, VP Dravid; Northwestern University
- 9:00 AM **800** (INVITED) *Automatic Neural Reconstruction from Petavoxel of Electron Microscopy Data*; A Suissa-Peleg, D Haehn, S Knowles-Barley, V Kaynig, TR Jones, A Wilson, R Schalek, JW Lichtman; Harvard University; et al.
- 9:30 AM **801** (INVITED) *High-Throughput, Automated Image Processing for Large-Scale Fluorescence Microscopy Experiments*; AM Goodman, AE Carpenter; Broad Institute of MIT and Harvard

## A12.3 Research and Applications in Atom Probe Tomography

### SESSION CHAIR:

Eric Steel, National Institute of Standards and Technology

### PLATFORM SESSION

Thursday 8:30 AM • Room: C226

- 8:30 AM **802** (INVITED) *The Mystery of Missing Species in Atom Probe Tomography of Composite Materials*; HJ Kreuzer, M Karahka; Dalhousie University, Canada
- 9:00 AM **803** *Impact of Extreme Electrical Fields on Charge Density Distributions in Alloys*; C Loyola, J Peralta; Universidad Andrés Bello, Chile; SR Broderick, K Rajan; University at Buffalo
- 9:15 AM **804** *Dissociation of Molecular Ions During the DC Field Evaporation of ZnO in Atom Probe Tomography*; I Blum, D Zanuttini, L Rigutti, F Vurpillot; Université de Rouen-CNRS, France; J Douady, E Jacquet, P-M Anglade, B Gervais; Université de Caen-CNRS, France; et al.
- 9:30 AM **805** (INVITED) *Approaches for Promoting Accurate Atom Probe Reconstruction*; TJ Prosa, BP Geiser, D Reinhard, Y Chen, DJ Larson; CAMECA Instruments, Inc.

## A13.6 In Situ Electron Microscopy and Big Data Analytics in 2D and 3D

### SESSION CHAIR:

Peter Ercius, Lawrence Berkeley National Laboratory  
Cee See Wee, National University of Singapore

### PLATFORM SESSION

Thursday 8:30 AM • Room: C221

- 8:30 AM **806 M&M 2016 STUDENT AWARDEE** *Quantitative Analysis of Viral Nanomachines in Liquid*; AC Varano; Virginia Polytechnic Institute and State University; MJ Dukes; Protochips Inc.; SM McDonald, S Poelzing, DF Kelly; Virginia Polytechnic Institute and State University
- 8:45 AM **807** *Hopping Diffusion of Gold Nanoparticles Observed with Liquid Cell TEM*; SW Chee, D Loh, Z Baraissov, P Matsudaira, U Mirsaidov; National University of Singapore
- 9:00 AM **808** (INVITED) *In Situ Electrochemical Cell TEM for Battery and Fuel Cell Systems*; ME Holtz, Y Yu, J Rivera, HD Abruña, DA Muller; Cornell University
- 9:30 AM **809** *Building with Ions: Development of In Situ Liquid Cell Microscopy for the Helium Ion Microscope*; V Iberi, I Anton, C Brown, AJ Rondinone, DC Joy, A Belianinov, RR Unocic, OS Ovchinnikova; Oak Ridge National Laboratory
- 9:45 AM **810** *Hydration Layer-Mediated Pairwise Interaction of Nanoparticles Resolved by In Situ TEM*; U Anand, U Mirsaidov; National University of Singapore

## A16.2 New Frontiers in Monochromated EELS

### SESSION CHAIR:

Peter Crozier, Arizona State University

### PLATFORM SESSION

Thursday 8:30 AM • Room: C224-25

- 8:30 AM **811** (INVITED) *High-Resolution Monochromatic EELS Really Is Different!*; P Rez, T Aoki; Arizona State University
- 9:00 AM **812** (INVITED) *Monochromated Electron Energy-Loss Spectroscopy of Organic Photovoltaics*; DW McComb; The Ohio State University
- 9:30 AM **813** *Taking Advantage of Scattering Delocalization to Reduce Radiation Damage in Vibrational or Valence-Loss EELS and Energy-Filtered TEM Images*; R Egerton; University of Alberta, Canada; T Aoki, P Crozier; Arizona State University
- 9:45 AM **814** *Ultra-High Energy Resolution EELS Mapping Using Aberration-Corrected Low-voltage STEM Equipped with Monochromator*; M Masaki, M Shigeyuki, S Hidetaka; JEOL, Ltd., Japan; S Kazu; National Institute of Advanced Industrial Science and Technology, Japan

### P

## PHYSICAL SCIENCES SYMPOSIA—

THURSDAY MORNING

## P03.3 Combining Simulation, Experiment, and Data Science for Materials Characterization and Design

### SESSION CHAIR:

Andreas Thust, Forschungszentrum Jülich

### PLATFORM SESSION

Thursday 8:30 AM • Room: C210

- 8:30 AM **815** (INVITED) *Theory and Parameter Free Calculations of EELS and X-Ray Spectra*; JJ Rehr, JJ Kas; University of Washington; K Jorissen; Amazon Web Services
- 9:00 AM **816** *Low-Loss Imaging of Defect Structures in Two Dimensional Materials Using Aberration Corrected Scanning Transmission Electron Microscopy*; MP Oxley; Oak Ridge National Laboratory; MD Kapetanakis; Vanderbilt University; W Zhou, J-C Idrobo; Oak Ridge National Laboratory; ST Pantelides; Vanderbilt University
- 9:15 AM **817** (INVITED) *Multimodal Acquisition of Properties and Structure with Transmission Electron Reciprocal-Space (MAPSTER) Microscopy*; J Ciston; Lawrence Berkeley National Laboratory
- 9:45 AM **818** *Quantitative Imaging of Probability Current Flow in Real and Momentum Space*; CS Chang, KX Nguyen, MC Cao, DA Muller; Cornell University

# Scientific Program

P

## PHYSICAL SCIENCES SYMPOSIA—

THURSDAY MORNING *continued*

### P04.1 Nuclear and Irradiated Materials

#### SESSION CHAIR:

Khalid Hattar, Sandia National Laboratory

#### PLATFORM SESSION

Thursday 8:30 AM • Room: E160AB

- 8:30 AM **819** (INVITED) *TEM with In Situ Ion Irradiation of Nuclear Materials under In-Service Conditions*; RW Harrison, H Amari, G Greaves, SE Donnelly, JA Hinks; University of Huddersfield, United Kingdom
- 9:00 AM **820** *Microscopy of Plasma-Materials Interactions in Tungsten for Fusion Power*; CM Parish; Oak Ridge National Laboratory; RP Doerner, MJ Baldwin; University of California, San Diego; D Donovan; University of Tennessee; KG Field, Y Katoh; Oak Ridge National Laboratory
- 9:15 AM **821** *Radiation Damage Behavior in Multiphase Ceramics*; KK Ohtaki; University of California, Irvine; M Patel; University of Tennessee; ML McCartney; University of California, Irvine
- 9:30 AM **822** *EFTEM Pre- and Post-Irradiation  $sp^2$  to  $sp^3$  R-Ratio Measurements of SiC/SiC Pyrolytic Carbon Interphases*; L Fave; Paul Scherrer Institute, Switzerland; C Hébert; École Polytechnique Fédérale de Lausanne, Switzerland; MA Pouchon; Paul Scherrer Institute, Switzerland
- 9:45 AM **823** *Cation-Dependent Hierarchical Assembly of  $U_{60}$  Nanoclusters into Blackberries Imaged via Cryogenic Transmission Electron Microscopy*; JA Soltis; University of Minnesota; CM Wallace; University of Notre Dame; RL Penn; University of Minnesota; PC Burns; University of Notre Dame

### P05.4 Microscopy for Metal, Semiconductor and Insulator Thin Films

#### SESSION CHAIRS:

Katherine Junjohann, Sandia National Laboratory

Vladimir P. Oleshko, National Institute of Standards and Technology

#### PLATFORM SESSION

Thursday 8:30 AM • Room: C114

- 8:30 AM **824** (INVITED) *Structure-Properties Relations in III-Nitride Nanostructures for Optoelectronics*; RC Myers, S Carnevale, AG Sarwar, T Kent; Ohio State University; P Phillips; University of Illinois, Chicago; C Selcu; Ohio State University; R Klie; University of Illinois, Chicago, F Yang; Ohio State University; et al.
- 9:00 AM **825** *Advancement of Heteroepitaxial III-V/Si Thin Films Through Defect Characterization*; J Deitz, D McComb; The Ohio State University; T Grassman; The Ohio State University

- 9:15 AM **826** *Characterization of Defects in III-V Semiconductor Materials (InP, GaAs and InGaAs/InP on Si) in Nano-sized Patterns by Transmission Electron Microscopy*; JH Lee, YD Cho, IG Lee, DH Ko; Yonsei University, Republic of Korea; CS Shin, WK Park; Korea Advanced Nano Fab Center, Republic of Korea; DH Kim; Kyungpook National University, Republic of Korea
- 9:30 AM **827** *Imaging Graphene by Field Ion Microscopy*; C Barroo; Harvard University; T Visart de Bocarmé; Université Libre de Bruxelles, Belgium
- 9:45 AM **828** *(S)TEM Characterization of Chemically Exfoliated Black Phosphorus*; A Ng, TE Sutto; U.S. Naval Research Laboratory; Y Deng; Purdue University; R Stroud, TH Brintlinger; U.S. Naval Research Laboratory; PD Ye; Purdue University; ND Bassim; U.S. Naval Research Laboratory

### P08.1 Microscopy of Additive Manufacturing and 3D Printing in Materials and Biology

#### SESSION CHAIR:

Daniel P Dennies, Consulting Metallurgical Engineer

#### PLATFORM SESSION

Thursday 8:30 AM • Room: C213

- 8:30 AM **829** (INVITED) *Microstructure Development in Powder Bed Additive Manufacturing*; JR Porter, M Velez, B Hayes; UES, Inc.; T Hall, H McCrabb; Faraday Technology, Inc.
- 9:00 AM **830** *Microstructural Differences as a Function of Specimen Position on Tube Fabric Additive Manufactured Nickel Based Super Alloy*; Y Idell, C Campbell, L Levine; National Institute of Standards and Technology
- 9:30 AM **831** *Understanding the Thermal Annealing Behaviour of Metal Laser Sintered SUS316L Stainless Steel*; JJ Lim, F Harda, LR Malheiros, MG Burke; The University of Manchester, United Kingdom
- 9:45 AM **832** *Nanoscale Spatio-Temporal Resolution In Situ TEM and Numerical Modeling of Rapid Solidification Microstructure Evolution in Al Alloys After Laser Melting*; JM Wieszorek, C Liu, K Zweieracker; University of Pittsburgh; JT McKeown; Lawrence Livermore National Laboratory; T La Grange; École Polytechnique Fédérale de Lausanne, Switzerland; BW Reed; Integrated Dynamic Electron Solutions, Inc.; GH Campbell; Lawrence Livermore National Laboratory

## P10.4 Microscopy and Characterization of Ceramics, Polymers and Composites

### SESSION CHAIRS:

R Parrington, Engineering Systems, Inc.

Richard Chinn, National Energy Technology Laboratory

### PLATFORM SESSION

Thursday 8:30 AM • Room: C214

- 8:30 AM **833** (INVITED) *Identifying ESC Failures Using Fractography*; DB Edwards; Engineering Systems, Inc.
- 9:00 AM **834** *Knit Line Failure of a Glass-Filled Polysulfone Pipe Fitting and Fractographic Comparison to Laboratory-Produced Fractures*; RJ Parrington; Engineering Systems, Inc.
- 9:15 AM **835** *Quantification of Thermal Aging in Cable Insulation Using Contact Resonances of a U-Shaped Atomic Force Microscope Probe*; E Rezaei; University of Nebraska-Lincoln; P Ramuhalli, SW Glass, LS Fifield; Pacific Northwest National Laboratory; JA Turner; University of Nebraska-Lincoln
- 9:30 AM **836** *Microscopic Characterization of Fracture Mechanisms in Polystyrene Grafted Nanoparticle Assemblies: The Role of Film Thickness and Grafting Density*; M-S Hsiao, Y Jiao, RA Vaia, LF Drummy; U.S. Air Force Research Laboratory, WPAFB
- 9:45 AM **837** *Time-Lapse Observation of the Deformation of Polyethylene Lamellae by AFM*; RC Savage; Exxonmobil Chemical Company; JK Hobbs; University of Sheffield, United Kingdom

A

## ADVANCES IN INSTRUMENTATION

### POSTER SESSIONS—THURSDAY MORNING

## A02.P1 TEM Phase Plate Imaging in Biological and Materials Science

### POSTER SESSION

Thursday 10:00 AM • Room: Exhibit Hall

#### POSTER # 317

10:00 AM **838** (INVITED) **M&M 2016 STUDENT AWARDEE** *Structural Characterization of Mutant Huntingtin Inclusion Bodies by Cryo-Electron Tomography*; FJ Bäuerlein, I Saha, A Mishra, M Hipp, R Klein, UF Hartl, W Baumeister, R Fernández-Busnadiego; Max Planck Institute of Biochemistry, Germany; et al.

#### POSTER # 318

10:00 AM **839** *Single Particle Analysis with the Volta Phase Plate*; R Danev, M Khoshouei, W Baumeister; Max Planck Institute of Biochemistry, Germany

## A07.P1 Surface and Subsurface Microscopy and Analysis

### POSTER SESSION

Thursday 10:00 AM • Room: Exhibit Hall

#### POSTER # 319

10:00 AM **840** *Utilizing Scanning Probe Microscopy to Investigate Preferential Conductive Paths Through Polycrystalline BaTiO<sub>3</sub> Dielectric Layer of MLCCs*; T Ayvazian, G Bersuker, MJ Brodie, ZR Lingley, BJ Foran; The Aerospace Corporation

#### POSTER # 320

10:00 AM **841** *Scanning Electron Microscopy Study of the Activation of Porous Stainless Steel for Pd Electroless Plating*; MJ Myers; University of Zimbabwe

#### POSTER # 321

10:00 AM **842** *Analysis of Thin Phase-Shifter Films Using Surface Analysis Techniques*; VS Smentkowski, L Le Tarte, H Piao; GE Global Research Center; M Marko; Wadsworth Center

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION

### POSTER SESSIONS—

THURSDAY MORNING *continued*

## A08.P1 Quantitative and Qualitative Microanalysis by EPMA and SEM

### POSTER SESSION

Thursday 10:00 AM • Room: Exhibit Hall

#### POSTER # 316

10:00 AM **843** *The Investigation of Chemical Shift of Silicon X-Ray Energy in Different Stoichiometry or Structure with Microcalorimeter EDS*; L Lai; Semiconductor Manufacturing International Corporation, Shanghai, China; R Cantor, M Carpenter; STAR Cryoelectronics; H Naito; HKN, Inc.

#### POSTER # 323

10:00 AM **844** *Oxidation State Determination from Chemical Shift Measurements Using a Cryogen-Free Microcalorimeter X-Ray Spectrometer on a SEM*; R Cantor; STAR Cryoelectronics; MP Croce, GJ Havrilla; Los Alamos National Laboratory; M Carpenter; STAR Cryoelectronics; K McIntosh; Los Alamos National Laboratory; A Hall; STAR Cryoelectronics; SA Kozimor; Los Alamos National Laboratory; H Naito; HKN, Inc.; et al.

#### POSTER # 324

10:00 AM **845** *Standardless Quantification at Trace Elemental (PPM) Levels Using a Novel Attachment within an Electron Microscope and Microprobe*; S Lau, W Yun, SJ Lewis; Sigray, Inc.

#### POSTER # 325

10:00 AM **846** *Combined EDX and Micro XRF Analysis on SEMs*; R Terborg, B Hansen, S Böhm; Bruker, Germany

#### POSTER # 326

10:00 AM **847** *Low Voltage X-Ray Mapping: The Complementary Methods of the Oxford Instruments X-Max Extreme Windowless EDS Detector and the JEOL Soft X-Ray Emission Spectroscopy (SXES)*; G McMahon, G Burke; University of Manchester, United Kingdom; S Burgess; Oxford Instruments Nanoanalysis, United Kingdom; M Takakura, H Takahashi; JEOL, Ltd., Japan

#### POSTER # 327

10:00 AM **848** *Pushing the XEDS Boundaries in Materials Research: Low Voltage XED Spectrum Imaging in the FEG-SEM*; A Janssen, MG Burke; University of Manchester, United Kingdom; S Burgess; Oxford Instruments Nanoanalysis, United Kingdom

#### POSTER # 328

10:00 AM **849** *Comparing the Intensities and Spectral Resolution Achieved by Wavelength-Dispersive Spectrometers on Microprobes and SEMs*; SM Seddio; Thermo Fisher Scientific; JJ Donovan; University of Oregon

#### POSTER # 329

10:00 AM **850** *SEM/EDS-Assisted LAM-ICPMS Analyses of Tourmaline of Tourmalinites Hosted in Serpentinites of the Paso Del Dragón Complex, Northeastern Uruguay*; GM Garda, S Andrade; São Paulo University, Brazil; E Peel-Canabal; The University of the Republic, Uruguay

#### POSTER # 330

10:00 AM **851** *Development of a Reference Material for Image Sharpness Evaluation in Scanning Electron Microscopy*; K Kumagai, A Kurokawa; National Institute of Advanced Industrial Science and Technology, Japan

#### POSTER # 331

10:00 AM **852** *Introducing a New NIST Reference Material: Multiwall Carbon Nanotube Soot*; AN Chiaramonti, RM White, J Holm, E Mansfield; National Institute of Standards and Technology

#### POSTER # 332

10:00 AM **853** *Electrospun CeO<sub>2</sub>-ZnO Nanofibers Analyzed by Electron Probe Microanalyzer*; CH Young, JG Moch, SS Johnson, Z Luo; Fayetteville State University

#### POSTER # 333

10:00 AM **854** *Drainage Integration of the Salt and Verde Rivers in Arizona: Initial Insight from an Electron Microprobe Investigation of Basalts*; A Wittmann, R Dorn; Arizona State University

#### POSTER # 334

10:00 AM **855** *Use of a Laser Engraver in Relocations and Sample Preparation for SEM and Light Microscope Analysis*; AP Lindstrom, NW Ritchie, MJ Mengason; National Institute of Standards and Technology

#### POSTER # 335

10:00 AM **856** *A SXES and CL Spectral Library for the Analysis of Rare Earth Elements*; CM MacRae, NC Wilson, A Torpy; CSIRO, Australia; H Takahashi, M Takaura, T Murano; JEOL, Ltd., Japan; C Lenz; CSIRO, Australia

#### POSTER # 335.1

9:45 AM **482** *Spectral Deconvolution and Quantification in EDS Using Low Energy X-Ray Lines from Steel Spectra*; R Terborg; Bruker, Germany; T Salge; Natural History Museum, United Kingdom; PT Pinard, S Richter; RWTH Aachen University, Germany

## A10.P1 Advances in Image Processing, Display and Analysis

### POSTER SESSION

Thursday 10:00 AM • Room: Exhibit Hall

#### POSTER # 336

10:00 AM **857** *Noise Removal by Crystallographic Averaging and Information Content of an Image with Respect to Detections of Plane Symmetries*; P Moeck, A Dempsey, JC Straton; Portland State University

## POSTER # 337

10:00 AM **858** *Landyne—A Software Suite for Electron Diffraction Simulation and Analysis*; X-Z Li; University of Nebraska-Lincoln

## POSTER # 338

10:00 AM **859** *MIPAR™: 2D and 3D Image Analysis Software Designed for Materials Scientists*, by Materials Scientists; JM Sosa, DE Huber, BA Welk, HL Fraser; The Ohio State University

## POSTER # 339

10:00 AM **860** *Silver Nanowire Diameter and Yield Characterization by High-Throughput SEM and Image Analysis*; CS Todd, WA Heeschen, PY Eastman, EC Keene; The Dow Chemical Company

## POSTER # 340

10:00 AM **861** *Image Processing and Analysis for Characterization of Patterns in Polystyrene Foam*; WA Heeschen, VA Woodcraft; The Dow Chemical Company

## POSTER # 341

10:00 AM **862** *An Evaluation of Image Quality Metrics for Scanning Electron Microscopy*; M Zotta, Y Han; Nanojehm, Inc.; M Bergkoetter; University of Rochester; E Lifshin; SUNY Polytechnic Institute

## A12.P1 Research and Applications in Atom Probe Tomography

### POSTER SESSION

Thursday 10:00 AM • Room: Exhibit Hall

## POSTER # 342

10:00 AM **863** *Collected Data Set Size Considerations for Atom Probe Cluster Analysis*; MJ Swenson; Boise State University; JP Wharry; Purdue University

## POSTER # 343

10:00 AM **864** **M&M 2016 STUDENT AWARDEE** *Comparing Plasma-FIB and Ga-FIB Preparation of Atom Probe Tomography Samples*; KB Fisher, EA Marquis; University of Michigan

## POSTER # 344

10:00 AM **865** *Preparation and Characterization of Eu-Doped Diamond Samples by Atom Probe Tomography*; C Barroo, AP Magyar, AJ Akey, DC Bell; Harvard University

## POSTER # 345

10:00 AM **866** *Application of Atom Probe on Fully Depleted Silicon-On-Insulator (FDSOI) Structures*; D Flatoff, B Fu, AK Kambham; GlobalFoundries, Inc.

## POSTER # 346

10:00 AM **867** *Modeling Degradation of Metallic Surfaces by First Principles Calculations: A Case Study for Al, Au, Ag, and Pd*; T Carrasco; Universidad andrés Bello, Chile; J Peralta; Universidad andrés Bello, Chile; SR Broderick; University at Buffalo

## POSTER # 347

10:00 AM **868** *Extracting Chemistry – Property Relationships by Mining Atom Probe Evaporation Events*; S Broderick, K Rajan; University at Buffalo

## POSTER # 348

10:00 AM **869** *Atom-Probe Tomography: Detection Efficiency and Resolution of Nanometer-Scale Precipitates in a Ti-5553 Alloy*; D Isheim, JA Coakley; Northwestern University; A Radecka, D Dye; Imperial College London, United Kingdom; TJ Prosa, Y Chen; CAMECA Instruments, Inc.; PA Bagot; University of Oxford, United Kingdom, DN Seidman; Northwestern University

## POSTER # 349

10:00 AM **870** *Direct In Situ Observation of Tempering-Induced Austenite Decomposition and Atom Probe Analyses of k-Carbide Precipitates in Lightweight Fe-Mn-Al-C Steels*; J-B Seol, H-S Park, C-G Park; Pohang University of Science and Technology, Republic of Korea

## A13.P2 In Situ Electron Microscopy and Big Data Analytics in 2D and 3D

### POSTER SESSION

Thursday 10:00 AM • Room: Exhibit Hall

## POSTER # 350

10:00 AM **871** *Inverse Problem Solution for Quantitative Investigations of Nanocrystals Formation and Growth*; AV Ievlev, S Jesse, V Iberi; Oak Ridge National Laboratory; T Cochell; University of Kentucky; R Unocic, O Ovchinnikova, S Kalinin; Oak Ridge National Laboratory

## POSTER # 351

10:00 AM **872** *In Situ Analytical TEM of Asphaltene Formation and Aggregation from Crude Oil*; A Janssen; The University of Manchester, United Kingdom; NJ Zaluzec; Argonne National Laboratory; MA Kulzick; BP Research Centre; T Crosher, G Burke; The University of Manchester, United Kingdom

## POSTER # 352

10:00 AM **873** *Transmission Electron Microscopy Studies of Calcium Phosphate Biomineralization*; K He, E Firlar, A Nie, C Sukotjo, R Shahbazian-Yassar, T Shokuhfar; University of Illinois, Chicago

## POSTER # 353

10:00 AM **874** *Elucidation of Structure and Chemistry of Iron Core in Human Heart Ferritin via Graphene Liquid Cell*; S Narayanan, E Firlar, RS Yassar, T Shokuhfar; University of Illinois, Chicago

## POSTER # 354

10:00 AM **875** *Depth Dependence of the Spatial Resolution in Scanning Transmission Electron Microscopy Experiments*; A Verch, N de Jonge; Leibniz Institute of New Materials, Germany

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION

### POSTER SESSIONS—

THURSDAY MORNING *continued*

#### POSTER # 355

10:00 AM **876** *Fractal Growth of Platinum Electrodeposits Revealed by In Situ Electron Microscopy*; L Wang, J Wen, H Sheng, DJ Miller; Argonne National Laboratory

#### POSTER # 356

10:00 AM **877** *Spatially Resolved Electron Energy Loss Spectroscopy Studies in Graphene Liquid Cell for the Investigation of the Biomineralization Processes in Human Body*; E Firlar, K He, R Shahbazian Yassar, T Shokuhfar; University of Illinois, Chicago

#### POSTER # 357

10:00 AM **878** *Real Time Observation of Gold Nanoparticle Aggregation Dynamics on a 2D Membrane*; X Tian; National University of Singapore; H Zheng; Lawrence Berkeley National Laboratory; PT Matsudaira, U Mirsaidov; National University of Singapore

#### POSTER # 358

10:00 AM **879** *Liquid In Situ Transmission Electron Tomography Using Hitachi HILEM IL1000 Ionic Liquid*; JP Kilcrease, E Voelkl; Hitachi High Technologies America, Inc.

#### POSTER # 359

10:00 AM **880** *The Mechanisms for Preferential Attachment of Nanoparticles in Liquid Determined Using Liquid Cell Electron Microscopy, Machine Learning, and Molecular Dynamics*; TJ Woehl; National Institute of Standards and Technology; DA Welch; University of California, Davis; C Park; Florida State University; R Faller; University of California, Davis; JE Evans, ND Browning; Pacific Northwest National Laboratory

#### POSTER # 360

10:00 AM **881** *In Situ, Real-Time Environmental SEM Imaging System Development for Water Splitting Reaction Using a Dynamic Light Illumination System*; T Daio; Osaka University, Japan; I Narita; Osaka Kyoiku University, Japan; T Gondo; Mel-Build, Japan; K Suganuma; Osaka University, Japan

#### POSTER # 361

10:00 AM **882** *In Situ Cooling and Heating Study of VO<sub>2</sub> Phase Transition*; H Asayesh-Ardakani; Michigan Technological University; A Nie; University of Illinois, Chicago; W Yao; Michigan Technological University; R Klie; University of Illinois, Chicago; S Banerjee; Texas A&M University; R Shahbazian-Yassar; University of Illinois, Chicago

#### POSTER # 362

10:00 AM **883** *In Situ Electrical Testing of Device-Relevant Nanocontacts in the Transmission Electron Microscope*; DH Alsem, S Sood, NJ Salmon; Hummingbird Scientific; TD Jacobs; University of Pittsburgh

#### POSTER # 363

10:00 AM **884** *Thermal Stability Study of Classically Immiscible Rh-Ag Alloy Nanoparticles by In Situ TEM*; CS Bonifacio; University of Pittsburgh; P Kunal, H Wan, SM Humphrey; University of Texas, Austin; JC Yang; University of Pittsburgh

#### POSTER # 364

10:00 AM **885** *In Situ TEM Heating Experiments on PVP-Capped Silver Nano-Cubes*; S Vijayan, S Thota, J Zhao, M Aindow; University of Connecticut

#### POSTER # 365

10:00 AM **886** *In Situ Investigation of Phase Transformation of Anatase into Rutile*; D Li; Pacific Northwest National Laboratory

#### POSTER # 366

10:00 AM **887** *Kinetics of Sodium and Selenium Reactions in Sodium Ion Batteries*; Q Li; Northwestern University; H Liu; Northwestern University, China; Z Yao, J Wu, C Wolverton, VP Dravid; Northwestern University

#### POSTER # 367

10:00 AM **888** *Aluminum Nanoparticles as Fiducials for Nanoscale Temperature Measurements*; M Mecklenburg; University of Southern California; B Zutter, BC Regan; University of California, Los Angeles

#### POSTER # 368

10:00 AM **889** *In Situ Study of Domain Walls Propagation and Pinning in Modulated Magnetic Nanowires*; S Lopatin, Y Ivanov, J Kosel; King Abdullah University of Science & Technology, Saudi Arabia; A Chuvilin; CIC nanoGUNE, Spain

#### POSTER # 369

10:00 AM **890** *Electrical Probing of Silver Nanowires In Situ Transmission Electron Microscopy*; D Alducin, JE Sanchez, M Jose-Yacamán, A Ponce; University of Texas, San Antonio

#### POSTER # 370

10:00 AM **891** *Understanding the Effect of Additives in Li-Sulfur Batteries by Operando ec-(S)TEM*; BL Mehdi, R Cao; Pacific Northwest National Laboratory; C Park; Florida State University; WA Henderson, W Xu, J Zhang, KT Mueller, ND Browning; Pacific Northwest National Laboratory

#### POSTER # 371

10:00 AM **892** *A Xe<sup>+</sup> Plasma FIB Milling and Lift-out Approach for Site-Specific Preparation of Large Volume Blocks for 3D-EBSD*; B Winiarski, TL Burnett, PJ Withers; The University of Manchester, United Kingdom

#### POSTER # 372

10:00 AM **893** *Nucleation and Crystal Growth of Zn<sub>0.3</sub>In<sub>1.4</sub>Sn<sub>0.3</sub>O<sub>3</sub> (ZITO-30) Thin Films Studied by In Situ TEM*; R Li, MM Moghadam, DB Buchholz, PW Voorhees, VP Dravid; Northwestern University

## POSTER # 373

10:00 AM **894** *Nano-Manipulation of Ag/ZnO Nanoantennas for In Situ TEM Electrical Measurements*; JE Sanchez, M Jose Yacaman, A Ponce, U Santiago, D Alducin, JE Ortega; The University of Texas, San Antonio

## POSTER # 374

10:00 AM **895** *In Situ TEM Investigation on Thermal Stability and Oxygen Release Behavior of Charged and Discharged LiCoO<sub>2</sub>*; S Sharifi-Asl; University of Illinois, Chicago; Y Yuan, H Asayesh-Ardakani; Michigan Technological University; A Nie, R Klie, R Shahbazian-Yassar; University of Illinois, Chicago

## A16.P1 New Frontiers in Monochromated EELS

### POSTER SESSION

Thursday 10:00 AM • Room: Exhibit Hall

## POSTER # 375

10:00 AM **896 M&M 2016 STUDENT AWARDEE** *Optimized Damage-Reduction 60 keV Monochromated Electron Energy-Loss Spectroscopy Measurements of Optical Properties at the Donor/Acceptor Interface in Organic Photovoltaic Devices*; JA Alexander, FJ Scheltens; The Ohio State University; LF Drummy, MF Durstock; U.S. Air Force Research Laboratory, WPAFB; JB Gilchrist, SE Heutz; Imperial College London, United Kingdom; DW McComb; The Ohio State University

## POSTER # 376

10:00 AM **897** *Exploring Vibrational and Electronic Structure of Carbon Nitride Powders Using Monochromated Electron Energy-Loss Spectroscopy*; DM Haiber, T Aoki, PA Crozier; Arizona State University

## POSTER # 377

10:00 AM **898** *STEM-EELS Study of Plasmonic Modes in Ag Nanotriangles: Size and Dielectric Dependence*; R Sachan; Oak Ridge National Laboratory; MA Roldan; King Abdullah University of Science & Technology, Saudi Arabia; D Jin; Massachusetts Institute of Technology; WJ Weber; University of Tennessee; NX Fang; Massachusetts Institute of Technology

## POSTER # 378

10:00 AM **899** *Tuning the Resonance Frequency of Surface Plasmons Localized in Au-Ag Bimetallic Hollow Nanorods In Situ in a Transmission Electron Microscope*; S Yazdi, DF Swearer; Rice University; JR Daniel, D Boudreau; Laval University, Canada; E Ringe; Rice University

## POSTER # 379

10:00 AM **900** *Investigating the Spatial Resolution of Vibrational Electron Energy Loss Spectroscopy*; K Venkatraman, Q Liu, T Aoki, P Rez, P Crozier; Arizona State University

## P

## PHYSICAL SCIENCES POSTER SESSIONS—THURSDAY MORNING

### P03.P1 Combining Simulation, Experiment, and Data Science for Materials Characterization and Design

#### POSTER SESSION

Thursday 10:00 AM • Room: Exhibit Hall

## POSTER # 380

10:00 AM **901** *Reducing Electron Dose and Sample Damage with Bayesian Machine Learning and Self-Organizing Neural Networks*; K Hujsak, BD Myers, E Roth, Y Li, VP Dravid; Northwestern University

## POSTER # 381

10:00 AM **902 MSA POST-DOCTORAL AWARDEE** *New Insights into Deformation of Metallic Glasses by Combining Mesoscale Simulation and Fluctuation Electron Microscopy*; P Zhao, S Im, J Hwang, Y Wang; The Ohio State University

## POSTER # 382

10:00 AM **903** *BIM-Sim: Interactive Simulation of Broadband Imaging Using Mie Theory*; S Berisha; University of Houston; TV Dijk; Maxima Medical Centre, Netherlands; R Bhargava, PS Carney; University of Illinois Urbana-Champaign; D Mayerich; University of Houston

## POSTER # 383

10:00 AM **904** *The Power of Electron Diffraction Phase Analysis and Pattern Simulations Using the ICDD<sup>®</sup> Powder Diffraction File<sup>™</sup> (PDF-4+)*; AM Gindhart, T Blanton, J Blanton, S Gates-Rector; International Centre for Diffraction Data

## POSTER # 384

10:00 AM **905** *Single-Slice Nanoworlds Online*; P Fraundorf, DC Osborn, S Wedekind, T Savage; University of Missouri Saint Louis

## POSTER # 385

10:00 AM **906** *Electrical and Structural Properties of In and In + C Doped Ge*; F Kremer, R Feng; The Australian National University; DJ Sprouster; Brookhaven National Laboratory; S Mirzaei; The Australian National University; S Decoster; Instituut Voor Kern-En Stralingsfysica, Belgium; CJ Glover; Australian Synchrotron, Australia; SA Medling, MC Ridgway; The Australian National University; et al.

## POSTER # 386

10:00 AM **907 M&M 2016 STUDENT AWARDEE** *Library-Based Sparse Interpolation and Super-Resolution of S/TEM Images of Biological and Material Nano-Structures*; S Sreehari; Purdue University; SV Venkatakrishnan; Lawrence Berkeley National Laboratory; JP Simmons, LF Drummy; U.S. Air Force Research Laboratory, WPAFB; CA Bouman; Purdue University

# Scientific Program

P

## PHYSICAL SCIENCES POSTER

### SESSIONS—THURSDAY MORNING *continued*

#### POSTER # 387

10:00 AM **908** (INVITED) *Quantifying Ordering Phenomena Through High-Resolution Electron Microscopy, Spectroscopy, and Simulation*; BD Esser, TM Smith; The Ohio State University; AJ Hauser; The University of Alabama; RE Williams, F Yang, MJ Mills, DW McComb; The Ohio State University

#### POSTER # 388

10:00 AM **909** *Considerations and Challenges with Characterizing Si/SiGe Interfaces*; O Dyck, D Leonard, J Poplawsky; Oak Ridge National Laboratory; E Pritchett, AA Kiselev, CA Jackson, LF Edge; Hughes Research Laboratory

#### POSTER # 389

10:00 AM **910** *Phase Determination from Atomically Resolved Images: Physics-Constrained Deep Data Analysis Through an Unmixing Approach*; RK Vasudevan, M Ziatdinov, S Jesse, SV Kalinin; Oak Ridge National Laboratory

#### POSTER # 390

10:00 AM **911** *Structural Properties of SrTiO<sub>3</sub>/GaAs Hetero-Interfaces*; L Hong; University of Illinois, Chicago; R Droopad; Texas State University; S Ogut, RF Klie; University of Illinois, Chicago

#### POSTER # 391

10:00 AM **912** **M&M 2016 STUDENT AWARDEE** *Thickness and Stacking Sequence Determination of Exfoliated Dichalcogenides Using Scanning Transmission Electron Microscopy*; P Liu, R Hovden; Cornell University; AW Tsen; Columbia University; P Kim; Harvard University; AH Pasupathy; Columbia University; LF Kourkoutis; Cornell University

#### POSTER # 392

10:00 AM **913** *Quantitative Phase Imaging of Ba<sub>2</sub>NaNb<sub>5</sub>O<sub>15</sub>*; E Yücelen, I Lazić, E Bosch; FEI Company, Netherlands

## P04.P1 Nuclear and Irradiated Materials

### POSTER SESSION

Thursday 10:00 AM • Room: Exhibit Hall

#### POSTER # 393

10:00 AM **914** *Defects Generation and Surface Evolution of ZnO Nanobelts/Nanowires Under High-Energy Electron Beam Irradiation*; Y Ding, ZL Wang; Georgia Institute of Technology

#### POSTER # 394

10:00 AM **915** *Electron Beam-Irradiation-Induced Annealing of Nanoscale Defects Created by Heavy Ion Beam Bombardment of Indium Phosphide*; AS Khalil; Tabbin Institute for Metallurgical Studies, Egypt

#### POSTER # 395

10:00 AM **916** *Fission Product Distribution in Irradiated TRISO Fuel*; KE Wright, IJ van Rooyen; Idaho National Laboratory

#### POSTER # 396

10:00 AM **917** *Irradiation Induced Defects in YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-d</sub> Coated Conductors*; H Sheng, J Wen, L Wang, DJ Miller; Argonne National Laboratory

#### POSTER # 397

10:00 AM **918** *Electron Probe Microanalysis of a High-Burnup (Th,Pu)O<sub>2</sub> Fuel Section*; P Pöml, S Brémier, J Himbert; European Commission, Germany

#### POSTER # 398

10:00 AM **919** *Multi-Scale Characterization of Oxidized Zirconium Alloys*; Y Dong; University of Michigan; AT Motta; Pennsylvania State University; EA Marquis; University of Michigan

#### POSTER # 399

10:00 AM **920** *Beam Induced Artifacts During In Situ Transmission Electron Microscopy Deformation of Nanocrystalline and Ultrafine-Grained Metals*; R Sarkar; Arizona State University; C Rentenberger; University of Vienna, Austria; J Rajagopalan; Arizona State University

#### POSTER # 400

10:00 AM **921** *Grain Boundary Precipitation in Ni Based Superalloy 690 Investigated via Site-Specific Atom Probe Microscopy*; B Gwalani, T Alam; University of North Texas, Denton; M Kaufman; Colorado School of Mines; R Banerjee; University of North Texas, Denton

## P05.P2 Microscopy for Metal, Semiconductor and Insulator Thin Films

### POSTER SESSION

Thursday 10:00 AM • Room: Exhibit Hall

#### POSTER # 401

10:00 AM **922** *The Influence of Beam Convergence Angle on Channeling Effect during STEM/EDS Quantification of SiGe Concentration*; B Fu, M Gribelyuk, R Scott, E Chen, J Riendeau; GlobalFoundries, Inc.

#### POSTER # 402

10:00 AM **923** *The Growth of Catalyst-Free NiO Nanowires*; W Zhu; Binghamton University; JP Winterstein, R Sharma; National Institute of Standards and Technology; G Zhou; Binghamton University

#### POSTER # 403

10:00 AM **924** *Utilization of Scanning Electron Microscopy to Optimize Electroless Deposition of Pd Thin Film on Porous Stainless Steel*; BS Mpofo; University of Zimbabwe; WE Goosen; Nelson Mandela Metropolitan University, South Africa; J Kurehwatira, MJ Myers, K Munjeri, T Gutu; University of Zimbabwe

## POSTER # 404

10:00 AM **925** *Advanced TEM Characterization of New Electrical Contacts for High Efficiency c-Si Solar Cell*; Q Jeangros; École Polytechnique Fédérale de Lausanne, Switzerland; J Geissbühler; Swiss Center for Electronics and Microtechnology, Switzerland; J Bullock, A Javey; University of California, Berkeley; S De Wolf, A Hessler-Wyser, C Ballif; École Polytechnique Fédérale de Lausanne, Switzerland

## POSTER # 405

10:00 AM **926** *Atomic-Scale Characterization of the Oxygen Vacancy Ordering in  $\text{La}_{0.5}\text{Sr}_{0.5}\text{CoO}_3$  Thin Film Grown on  $\text{SrTiO}_3$  Using In Situ Cooling Experiments*; X Rui; University of Illinois, Chicago; J Walter, C Leighton; University of Minnesota; RF Klie; University of Illinois, Chicago

## POSTER # 406

10:00 AM **927** *Dewetting Transitions of Au/Ni Bilayer Films*; X Cen, AM Thron, X Zhang, K van Benthem; University of California, Davis

## POSTER # 407

10:00 AM **928** *Cadmium Sulfide (CdS) Preparation by High-Energy Ball Milling*; I Estrada-Guel, CD Gómez-Esparza; Centro de Investigación en Materiales Avanzados, S.C., Mexico; L González-Rodelas; Universidad Autónoma de Chihuahua, Mexico; R Martínez-Sánchez; Centro de Investigación en Materiales Avanzados, S.C., Mexico

## POSTER # 408

10:00 AM **929** *Morphological Modulation of Acoustic Phonons Imaged with Ultrafast Electron Microscopy*; D Cremons, D Plemmons, D Flannigan; University of Minnesota

## POSTER # 409

10:00 AM **930** *Observation of MEL Stacking Faults in Two-Dimensional MFI Zeolite Nanosheets*; P Kumar, H Zhang, N Rangnekar, M Tsapatsis, A Mkhoyan; University of Minnesota

## POSTER # 410

10:00 AM **931** *Thickness Analysis of  $\text{TiO}_2$  Thin Films on Quartz by Optical Spectroscopy*; SP Fowler, R Catabay, J Jiao; Portland State University

## POSTER # 411

10:00 AM **932** *Low-Dose Microscopy and Beam Damage Study of Infiltrated Zeolite Y*; P Moradifar, Y Liu, HY Cheng, J Badding, N Alem; Pennsylvania State University

## POSTER # 412

10:00 AM **933** *Study on Chemical Vapor Deposition Growth and Transmission Electron Microscopy  $\text{MoS}_2/\text{h-BN}$  Heterostructure*; F Zhang, M Abu Alsaud, M Hainey, K Wang, JM Redwing, N Alem; Pennsylvania State University

## POSTER # 413

10:00 AM **934** *Aloof Beam Plasmons in Silver Nanoparticles*; BT Zutter; University of California, Los Angeles; M Mecklenburg; University of Southern California; BC Regan; University of California, Los Angeles

## POSTER # 414

10:00 AM **935** *Microscopy of the Deformation of Tantalum*; MT Janish; University of Connecticut; WM Mook; Sandia National Laboratories; SJ Vachhani, EK Cerreta; Los Alamos National Laboratory; CB Carter; University of Connecticut

## POSTER # 415

10:00 AM **936** *Electron Microscopy Investigations of Doped  $\text{ZnS}$  Nanostructures*; CV Solomon; Youngstown State University; J-I Hong; Daegu Gyeongbuk Institute of Science & Technology, Republic of Korea

## POSTER # 416

10:00 AM **937** *Ex Situ TEM: Gaining Fundamental Insights into the Reduction-Oxidation-Reduction (ROR) Process in Small, Bimetallic Particles*; CE Klier, SL Soled, S Miseo; Exxonmobil Research & Engineering

## POSTER # 417

10:00 AM **938** *Practical Use of Scanning Low Energy Electron Microscope (SLEEM)*; I Müllerová, E Mikmeková, Š Mikmeková, I Konvalina, L Frank; Institute of Scientific Instruments ASCR, Czech Republic

## POSTER # 418

10:00 AM **939** *Transmission-EBSD Using High Current Electron Beams*; M Abbasi, D-I Kim; Korea Institute of Science and Technology, Republic of Korea; H-U Guim; Korea Basic Science Institute, Republic of Korea; W-S Jung; Korea Institute of Science and Technology, Republic of Korea

## POSTER # 419

10:00 AM **940** *Work Function of  $\text{Cu}_3\text{Ge}$  Thin Film*; F Wu, N Yao; Princeton University

## POSTER # 420

10:00 AM **941** *TEM Characterization of InAs Quantum Dots with  $\text{GaAsSb}$  Spacer Layers*; A Boley, Y Kim, K-Y Ban, CB Honsberg, DJ Smith; Arizona State University

## POSTER # 421

10:00 AM **942** *Resolving Atomic Scale Chemistry and Structure at NO and Ba Passivated  $\text{SiC}/\text{SiO}_2$  Interfaces*; JH Dycus, W Xu; North Carolina State University; DJ Lichtenwalner, B Hull, JW Palmour; Wolfspeed, A Cree Company; JM Lebeau; North Carolina State University

## POSTER # 422

10:00 AM **943** *ELNES Analysis of  $\gamma\text{-Al}_2\text{O}_3/\text{SrTiO}_3$  and  $\text{LaTiO}_3/\text{SrTiO}_3$  Interfaces*; S Lu; Arizona State University; K Kormondy, T Ngo, E Ortman; University of Texas, Austin; T Aoki; Arizona State University; A Posadas, J Ekerdt, A Demkov; University of Texas, Austin; et al.

## POSTER # 423

10:00 AM **944** *Imaging Photoinduced Structural and Morphological Dynamics of a Single  $\text{MoS}_2$  Flake with Ultrafast Electron Microscopy*; AJ McKenna, JK Eliason, DJ Flannigan; University of Minnesota

# Scientific Program

P

## PHYSICAL SCIENCES POSTER SESSIONS—THURSDAY MORNING *continued*

### POSTER # 424

10:00 AM **945** *Liquid Cell TEM Studies of Galvanic Displacement Reactions in Aqueous Solutions*; JH Park; IBM Thomas J Watson Research Center; DA Steingart; Princeton University; L Deligianni; IBM Thomas J Watson Research Center; S Kodambaka; University of California, Los Angeles; FM Ross; IBM Thomas J Watson Research Center

### POSTER # 425

10:00 AM **946** *Suspended and Bilayer Graphene Growth at Cu Grain Boundaries on Thin Film Cu*; LF Lampert, J Jiao; Portland State University

### POSTER # 426

10:00 AM **947** *Spectroscopic Investigations of the Structure of Graphitic Carbon Nitrides for H<sub>2</sub> Storage*; D Stalla, T Lam, M Lee, P Pfeifer; University of Missouri

### POSTER # 427

10:00 AM **948** *Supersonic Nanoparticle Interaction with Suspended CVD Graphene*; JL Swett; Lockheed Martin Advanced Technology Center; DA Cullen; Oak Ridge National Laboratory; PV Bedworth; Lockheed Martin Advanced Technology Center; JA Schultz; Ionwerks, Inc.; BE Brinson; Rice University; M McCully; Ionwerks, Inc.; SE Heise; Lockheed Martin Advanced Technology Center, RH Hauge; Rice University; et al.

## P08.P1 Microscopy of Additive Manufacturing and 3D Printing in Materials and Biology

### POSTER SESSION

Thursday 10:00 AM • Room: Exhibit Hall

### POSTER # 428

10:00 AM **949** *Electron Microscopy Investigation of Binder Saturation and Microstructural Defects in Functional Parts Made by Additive Manufacturing*; M Caputo, CV Solomon; Youngstown State University; P-K Nguyen, AE Berkowitz; University of California, San Diego

### POSTER # 429

10:00 AM **950** *Crystallographic Orientation Relationships of Grain Boundary Alpha in Additively Manufactured Ti-6Al-4V*; SD Sitzman, DB Witkin, PM Adams, TD McLouth; The Aerospace Corporation

### POSTER # 430

10:00 AM **951** *Microstructural Evaluation of Magnetocaloric Ni-Co-Mn-Sn Produced by Directed Energy Deposition*; E Stevens, J Toman, K Kimes; University of Pittsburgh; V Chernenko; BC Materials, Spain; A Wojcik, W Maziarz; Polish Academy of Sciences; M Chmielus; University of Pittsburgh

A

## ADVANCES IN INSTRUMENTATION SYMPOSIA—THURSDAY AFTERNOON

### A02.2 TEM Phase Plate Imaging in Biological and Materials Science

#### SESSION CHAIR:

Radostin Danev, Max Planck Institute

#### PLATFORM SESSION

Thursday 1:30 PM • Room: C111

1:30 PM **952** (INVITED) *Structure of the Ebola Virus Nucleocapsid Core by Single Particle Cryo-Electron Microscopy*; Y Sugita; Okinawa Institute of Science and Technology Graduate University, Japan; Y Kawaoka; University of Wisconsin-Madison; T Noda; Kyoto University, Japan; M Wolf; Okinawa Institute of Science and Technology Graduate University, Japan

2:00 PM **953** (INVITED) *High-Resolution Imaging of Reconstituted Protein-DNA Complexes Using Phase Plate Electron Cryo-Microscopy*; S Sandin; Nanyang Technological University, Singapore; R Danev, JM Plitzko; Max Planck Institute of Biochemistry, Germany; EY Dao, VK Vogirala, ASW Wong; Nanyang Technological University, Singapore

2:30 PM **954** (INVITED) *Solution Conformations of Peroxiredoxins Visualised by Volta Phase Plates*; M Radjainia; Monash University, Australia; M Khoshouei; Max Planck Institute of Biochemistry, Germany; M Belousoff; Monash University, Australia; R Danev; Max Planck Institute of Biochemistry, Germany

### A07.5 Surface and Subsurface Microscopy and Analysis

#### SESSION CHAIR:

John A. Chaney, Aerospace Corp

#### PLATFORM SESSION

Thursday 1:30 PM • Room: C216

1:30 PM **955** (INVITED) *Making Light Work: Enhancing Surface and Thin Film Analysis Through In Situ Complementary Spectroscopies*; TS Nunney, P Mack; C Deeks; C Stephens, J Treacy; Thermo Fisher Scientific, United Kingdom

2:00 PM **956** *High Speed, Large Scan Area, Distortion Free Operation of a Single-Chip Scanning Probe Microscope*; N Sarkar, G Lee, D Strathearn, M Olfat, RR Mansour; University of Waterloo, Canada

2:15 PM **957** *Innovative Applications of Raman Microscopy*; P Wang; Bruker; J Sawatzki; Bruker, Germany; TJ Tague; Bruker

2:30 PM **958** *Full Information Acquisition and Analysis of Reflection High Energy Electron Diffraction Data for Epitaxial Growth Processes*; RK Vasudevan, AG Gianfrancesco, AP Baddorf, SV Kalinin; Oak Ridge National Laboratory

2:45 PM **959** *Field Ion Microscopy and Pulsed Field Desorption Mass Spectrometry: Unique Tools for Surface and Subsurface Analysis*; C Barroo; Harvard University; T Visart de Bocarmé; Université Libre de Bruxelles, Belgium

## A10.2 Advances in Image Processing, Display and Analysis

### SESSION CHAIR:

Kevin Eliceiri, University of Wisconsin-Madison

### PLATFORM SESSION

Thursday 1:30 PM • Room: C115

- 1:30 PM **960** (INVITED) *Measuring and Visualizing Clonal Development in Live Cell and Tissue Microscopy*; AR Cohen; Drexel University
- 2:00 PM **961** *Interactive Web-Based Spatio-Statistical Image Modeling from Gigapixel Images to Improve Discovery and Traceability of Published Statistical Models*; P Bajcsy, A Vandecreme, M Brady; National Institute of Standards and Technology
- 2:15 PM **962** *Image Texture Analysis and Application to Acicular Mullite Porous Ceramic Microstructure*; CS Todd, WA Heesch; The Dow Chemical Company
- 2:30 PM **963** *Studying The Atomic Structures By Aberration-Corrected and Conventional Electron Microscopy*; Y Wang; Institute of Physics Chinese Academy of Sciences
- 2:45 PM **964** *A Precise Description of Inorganic Nanoparticles in HRTEM Micrographs*; DJ Groom, A Bovik, P Ferreira, K Yu, S Rasouli; University of Texas, Austin

## A12.4 Research and Applications in Atom Probe Tomography

### SESSION CHAIR:

Frederick Meisenkothen, National Institute of Standards and Technology

### PLATFORM SESSION

Thursday 1:30 PM • Room: C226

- 1:30 PM **965** *A Round Robin Experiment: Analysis of Solute Clustering from Atom Probe Tomography Data*; EA Marquis, V Araullo-Peters; University of Michigan; A Etienne; Université de Rouen, France; S Fedotova; National Research Centre "Kurchatov Institute", Russian Federation; K Fujii, K Fukuya; Institute of Nuclear Safety System, Inc., Japan; E Kuleshova; National Research Centre "Kurchatov Institute", Russian Federation, A Legrand; CEA, France; et al.
- 1:45 PM **966** *Characterizing Alnico Alloy by Correlative STEM-EDS Tomography and Atom Probe Tomography*; W Guo, S Brian; Oak Ridge National Laboratory; L Zhou, W Tang, MJ Kramer; Ames Laboratory; DA Cullen, JD Poplawsky; Oak Ridge National Laboratory
- 2:00 PM **967** *Spinodal Decomposition in Alnico Alloy*; L Zhou, W Tang; Ames Laboratory; W Guo, JD Poplawsky; Oak Ridge National Laboratory; IE Anderson, MJ Kramer; Ames Laboratory
- 2:15 PM **968** *Designing and Characterizing a Complex Concentrated Gamma/Gamma Prime 'Superalloy'*; B Gwalani, V Soni, T Alam, R Banerjee; University of North Texas, Denton

- 2:30 PM **969** *Grain Boundary Segregation and Core/Shell Structured Nanostructures in Oxide-Dispersion Strengthened Fe-Cr alloys*; J-B Seol; Pohang University of Science and Technology, Republic of Korea; J-H Kim; Hanbat National University, Republic of Korea
- 2:45 PM **970** *Mechanisms of Particle Coarsening and Phase Transformation in Oxide Dispersion Strengthened Steels During Friction Stir Welding*; KE Knipling; U.S. Naval Research Laboratory; BW Baker; U.S. Naval Academy; DK Schreiber; Pacific Northwest National Laboratory

## A13.7 In Situ Electron Microscopy and Big Data Analytics in 2D and 3D

### SESSION CHAIRS:

Kai He, Northwestern University

Reza Shahbazian Yassa, University of Illinois, Chicago

### PLATFORM SESSION

Thursday 1:30 PM • Room: C221

- 1:30 PM **971** (INVITED) *In Situ TEM for Rechargeable Batteries*; R Shahbazian-Yassar; University of Illinois, Chicago
- 2:00 PM **972** *Direct Visualization of Lithium Intercalation in Spinel Iron Oxide by In Situ Bright-Field Scanning Transmission Electron Microscopy*; K He, J Li, Q Meng, E Stach, Y Zhu, D Su; Brookhaven National Laboratory
- 2:15 PM **973** **MSA PTSA Awardee** *Atomic Resolution In Situ TEM Studies of Lithium Electrochemistry in Co<sub>3</sub>O<sub>4</sub>-Carbon Nanotube Nanocomposite*; J Wu, Q Li, Z Yao, CM Wolverton; Northwestern University; MM Thackeray; Argonne National Laboratory; VP Dravid; Northwestern University
- 2:30 PM **974** *Temperature-Controlled Fluidic-Cell Scanning Electron Microscopy*; BD Myers, Q-Y Lin, M O'Brien, CA Mirkin, VP Dravid; Northwestern University
- 2:45 PM **975** *In Situ Observation of Pt Icosahedral Nanoparticles Transformation into FCC Single Crystal*; W Gao, J Wu, H Park, J Mabon, B Wilson, H Yang, J-M Zuo; University of Illinois Urbana-Champaign

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION SYMPOSIA—THURSDAY AFTERNOON *continued*

### A16.3 New Frontiers in Monochromated EELS

#### SESSION CHAIR:

Ian MacLaren, University of Glasgow

#### PLATFORM SESSION

Thursday 1:30 PM • Room: C224-25

- 1:30 PM **976** (INVITED) *Recent Applications of Sub-20meV Monochromated STEM-EELS: From Phonon to Core Losses in Real and Momentum Spaces*; QM Ramasse, FS Hage, DM Kepaptsoglou, P Abellan; SuperSTEM Laboratory, United Kingdom; HC Nerl, V Nicolosi; Trinity College Dublin, Republic of Ireland; K Winther, K Thygesen; Denmark Technical University; et al.
- 2:00 PM **977** *The Low-Loss Spectrum of Individual Carbon Nanotubes Revisited at High Energy Resolution in Real and Momentum Space*; FS Hage, QM Ramasse; SuperSTEM Laboratory, United Kingdom
- 2:15 PM **978** *Monochromated Low-Voltage EELS of Optical Resonances in Quantum Materials*; DC Bell, F von Cube; Harvard University; P Rez, T Aoki; Arizona State University
- 2:30 PM **979** *Bandgap State Mapping via Valence-Loss EELS at Grain Boundaries in Non-Stoichiometric  $\text{Pr}_x\text{Ce}_{1-x}\text{O}_{2-\delta}$* ; WJ Bowman; Arizona State University; E Sediva, JL Rupp; ETH Zürich, Switzerland; PA Crozier; Arizona State University
- 2:45 PM **980** *Nanoscale Probing of Bandgap States on Oxide Particles Using Electron Energy-Loss Spectroscopy*; Q Liu; Arizona State University; K March; Université Paris-Sud, France; P Crozier; Arizona State University

P

## PHYSICAL SCIENCES SYMPOSIA— THURSDAY AFTERNOON

### P03.4 Combining Simulation, Experiment, and Data Science for Materials Characterization and Design

#### SESSION CHAIR:

Matthew Weyland, Monash University

#### PLATFORM SESSION

Thursday 1:30 PM • Room: C210

- 1:30 PM **981** (INVITED) *Big, Deep, and Smart Data from Atomically Resolved Images: Exploring the Origins of Materials Functionality*; SV Kalinin, RK Vasudevan, A Borisevich, A Belianinov, RK Archibald, C Symons, EJ Lingerfelt, BG Sumpter; Oak Ridge National Laboratory; et al.
- 2:00 PM **982** *Deep Data Mining in a Real Space: Application to Scanning Probe Microscopy Studies on a "Parent" State of a High Temperature Superconductor*; M Ziatdinov, A Maksov, A Sefat, P Maksymovich, S Kalinin; Oak Ridge National Laboratory

- 2:15 PM **983** *Automated Data Acquisition and Indexing of Electron Channeling Patterns Using the Dictionary Approach*; S Singh, M De Graef; Carnegie Mellon University
- 2:30 PM **984** *EELS Mapping with Random Scan*; S Wang, D Li; Micron Technology, Inc.
- 2:45 PM **985** *Alloying in Flexible Transition Metal Chalcogenide Nanowires*; J Lin; National Institute of Advanced Industrial Science and Technology, Japan; Y Zhang; Vanderbilt University; W Zhou; Oak Ridge National Laboratory; S Pantelides; Vanderbilt University

### P04.2 Nuclear and Irradiated Materials

#### SESSION CHAIR:

Sam Briggs, University of Wisconsin-Madison

#### PLATFORM SESSION

Thursday 1:30 PM • Room: E160AB

- 1:30 PM **986** (INVITED) **M&M 2016 STUDENT AWARDEE** *Complementary Techniques for Quantification of  $\alpha'$  Phase Precipitation in Neutron-Irradiated Fe-Cr-Al Model Alloys*; SA Briggs; University of Wisconsin-Madison; PD Edmondson, KG Field, Y Yamamoto, KC Littrell, CR Daily; Oak Ridge National Laboratory; K Sridharan; University of Wisconsin-Madison
- 2:00 PM **987** *In Situ TEM Self-Ion Irradiation and Thermal Aging of Optimized Zirco*; B Muntifer; Northwestern University; P-A Juan; Sandia National Laboratory; R Dingreville; Sandia National Laboratories; J Qu; Tufts University; K Hattar; Sandia National Laboratories
- 2:15 PM **988** (INVITED) *In Situ TEM Investigation of Interactions Between Irradiation Defects and Crystal Defects in Austenitic Stainless Steels*; B Cui, F Wang, Q Lu; University of Nebraska-Lincoln
- 2:45 PM **989** *TEM Identification of Phases in Metallic Pu-Based Fuels*; A Aitkaliyeva, JW Madden, CA Papesch; Idaho National Laboratory

### P05.5 Microscopy for Metal, Semiconductor and Insulator Thin Films

#### SESSION CHAIRS:

Roberto Myers, The Ohio State University

Amy Ng, U.S. Navel Research Laboratory

#### PLATFORM SESSION

Thursday 1:30 PM • Room: C114

- 1:30 PM **990** *Thin Films of  $\text{SnSe}_2$  Grown by Molecular Beam Epitaxy on GaAs (111)B Substrates*; BD Tracy; Arizona State University; X Liu, JK Furdyna; University of Notre Dame; DJ Smith; Arizona State University
- 1:45 PM **991** *Observation of a Quasi-Ordered Structure in Monolayer  $\text{W}_x\text{Mo}_{(1-x)}\text{S}_2$  Alloys*; A Azizi, Y Wang, Z Lin, K Wang, M Terrones, VH Crespi, N Alem; The Pennsylvania State University

2:00 PM **992 MSA POST-DOCTORAL AWARDEE** *Mapping Periodic Lattice Distortions in Exfoliated Dichalcogenides with Atomic Resolution STEM*; R Hovden; Cornell University; A Tsen; University of Waterloo; P Liu, BH Savitzky; Cornell University; Y Liu, W Lu, Y Sun; Chinese Academy of Sciences, L Kourkoutis; Cornell University; et al.

2:15 PM **993** *Nanoscale Mapping of Interfacial Electrical Transport in Graphene-MoS<sub>2</sub> Heterostructures with STEM-EBIC*; ER White; Imperial College London, United Kingdom; A Kerelsky, WA Hubbard; University of California, Los Angeles; R Dhall, SB Cronin, M Mecklenburg; University of Southern California; BC Regan; University of California, Los Angeles

2:30 PM **994 (INVITED)** *Correlative and Multiplexed Microscopy for 2D Chalcogenide Semiconductors*; VP Dravid; Northwestern University

## P08.2 Microscopy of Additive Manufacturing and 3D Printing in Materials and Biology

### SESSION CHAIR:

Manuel Garcia-Leiner, Exponent

### PLATFORM SESSION

Thursday 1:30 PM • Room: C213

1:30 PM **995 (INVITED)** *Computed X-Ray Tomography of Powder Metallurgy Product for Rapid, Quantitative Size and Shape Distribution Analysis*; DP Dennies, D Wong, J Tucker, J Forman, ND Budiansky; Exponent, Inc.

2:00 PM **996 (INVITED)** *Enhancing Part Properties in Additive Manufacturing Through Material Design and Print Process Optimization*; MA Aubart, S Jain, D Liu, A Pedicini, S Serpe; Arkema, Inc.

2:30 PM **997** *In Situ Synchrotron X-Ray Tomographic Imaging of 3D Printed Materials During Uniaxial Loading*; BM Patterson, NL Cordes, K Henderson, M Herman, JC Mertens; Los Alamos National Laboratory; X Xiao; Argonne National Laboratory; J Williams, N Chawla; Arizona State University; et al.

A

## ADVANCES IN INSTRUMENTATION SYMPOSIA—THURSDAY AFTERNOON

### A02.3 TEM Phase Plate Imaging in Biological and Materials Science

#### SESSION CHAIR:

Radostin Danev, Max Planck Institute

#### PLATFORM SESSION

Thursday 3:30 PM • Room: C111

3:30 PM **998 (INVITED)** *Cryo-FIB Sample Preparation for Cryo-ET with the Volta Phase Plate*; M Schaffer, BD Engels, M Wehmer, S Albert, E Sakata; Max Planck Institute of Biochemistry, Germany; A Rast, J Nickelsen; Ludwig-Maximilians-Universität, München, Germany, W Baumeister; Max Planck Institute of Biochemistry, Germany; et al.

4:00 PM **999 (INVITED)** *In Situ Structure of Viral RNA by Cryo-Electron Tomography with Volta Phase Plate, Energy Filtering and Direct Electron Counting*; ZH Zhou, WH Hui, J Zhang, I Atanasov; University of California, Los Angeles; CC Celma, P Roy; London School of Hygiene & Tropical Medicine, United Kingdom

4:30 PM **1000** *Phase Contrast Subtomogram Averaging at Sub-nm Resolution*; M Khoshouei, S Pfeffer, R Danev, F Förster, W Baumeister; Max Planck Institute of Biochemistry, Germany

4:45 PM **1001** *Towards Understanding of Charging Effects of Conductive Thin-Film Based Phase Plates*; R Janzen, J Schundelmeier, S Hettler, M Dries, D Gerthsen; Karlsruhe Institute of Technology, Germany

### A07.6 Surface and Subsurface Microscopy and Analysis

#### SESSION CHAIR:

Vincent Smentkowski, General Electric

#### PLATFORM SESSION

Thursday 3:30 PM • Room: C216

3:30 PM **1002 (INVITED)** *XPS Spectromicroscopy as an Optimized Technique for Materials Characterization*; D Surman, C Moffitt; Kratos Analytical, Inc.; J Counsell, S Coultas, A Roberts, C Blomfield; Kratos Analytical Ltd., United Kingdom

4:00 PM **1003** *Observation of Moiré-like Fringes in HAADF-STEM Images of Heterostructures of Two-Dimensional Materials*; D Reifsnyder Hickey, KA Mkhoyan; University of Minnesota

4:15 PM **1004** *Differentiation of Surface and Bulk Conductivities via Four-Probe Spectroscopy*; SM Hus, C Durand; Oak Ridge National Laboratory; X Zhang; University of Florida; C Ma, MA McGuire; Oak Ridge National Laboratory; Y Xu, YP Chen; Purdue University, A-P Li; Oak Ridge National Laboratory; et al.

4:30 PM **1005** *Atomistic Exploration of the Surface-Sensitive Oriented Attachment Growth of  $\alpha$ -MnO<sub>2</sub> Nanowires and the formation of Defective Interface with 2×3 and 2×4 Tunnel Intergrowth*; Y Yuan; Michigan Technological University; S Wood; University of Bath, United Kingdom; K He; Shandong University, China; W Yao; Michigan Technological University; D Tompsett; University of Bath, United Kingdom; J Lu; Argonne National Laboratory; S Islam; University of Bath, United Kingdom, R Shahbazian-Yassar; University of Illinois, Chicago; et al.

4:45 PM **1006** *Correlating Substrate Properties with Pressure Sensitive Adhesive Performance*; T Powell, M Pacholski, B Griffith, D Keely; The Dow Chemical Company

# Scientific Program

A

## ADVANCES IN INSTRUMENTATION SYMPOSIA—THURSDAY AFTERNOON *continued*

### A10.3 Advances in Image Processing, Display and Analysis

#### SESSION CHAIR:

Clifford Todd, Dow Chemical

#### PLATFORM SESSION

Thursday 3:30 PM • Room: C115

- 3:30 PM **1007** *Unambiguous Detections of the Plane Symmetries That Noisy Experimental Images from Naturally Formed 2D Periodic Arrays of Physical Objects Most Likely Possess*; P Moeck; Portland State University
- 3:45 PM **1008** *Advances in Mapping Periodic Structural Modulations of Atomic Lattices*; I El Baggari, R Hovden, DJ Baek; Cornell University; AS Admasu, J Kim, S-W Cheong; Rutgers University; LF Kourkoutis; Cornell University
- 4:00 PM **1009** *Dictionary-Based Filling of the Missing Wedge in Electron Tomography*; P Trappert; German Research Center for Artificial Intelligence GmbH, Germany; D Chen; The Institute of Nanoscience, Netherlands; S Bogachev, T Dahmen, P Slusallek; German Research Center for Artificial Intelligence GmbH, Germany
- 4:15 PM **1010** *An "Extra Dimension" in Electron Tomography: Automatic Parameter Determination for Next-Generation Reconstruction Methods*; Y Jiang, N Andrejevic, E Padgett, DA Muller; Cornell University
- 4:30 PM **1011** *Practical Implementation of Compressive Sensing for High-Resolution STEM*; D Muecke-Herzberg, P Abellan; SuperSTEM Laboratory, United Kingdom; M Sarahan; Continuum Analytics; I Godfrey; SuperSTEM Laboratory, United Kingdom; Z Zaghi, RK Leary; University of Cambridge, United Kingdom; A Stevens; Pacific Northwest National Laboratory, J Ma; Technische Universität Berlin, Germany; et al.
- 4:45 PM **1012** **M&M 2016 STUDENT AWARDEE** *Compressive STEM-EELS*; A Stevens, L Kovarik; Pacific Northwest National Laboratory; H Yang; Lawrence Berkeley National Laboratory; Y Pu, L Carin; Duke University; N Browning; Pacific Northwest National Laboratory

### A12.5 Research and Applications in Atom Probe Tomography

#### SESSION CHAIR:

Eric Steel, National Institute of Standards and Technology

#### PLATFORM SESSION

Thursday 3:30 PM • Room: C226

- 3:30 PM **1013** *Field Evaporation Behavior of Metal Oxide/Metal Interfaces*; M Bachhav; University of Michigan
- 3:45 PM **1014** *Using Mass Resolving Power as a Performance Metric in the Atom Probe*; F Meisenkothen; National Institute of Standards and Technology; TF Kelly, E Oltman, JH Bunton; CAMECA Instruments, Inc.; L Renaud; CAMECA SAS, France; DJ Larson; CAMECA Instruments, Inc.
- 4:00 PM **1015** *Correlative t-EBSD Tomography and Atom Probe Tomography Analysis*; KP Rice, Y Chen, TJ Prosa; CAMECA Instruments, Inc.; MM Nowell, S Wright; EDAX, Inc.
- 4:15 PM **1016** *Correlative Analysis Using FIB-ToF-SIMS and Atom Probe Tomography on Geological Materials*; WD Rickard, SM Reddy, DW Saxey, D Fourgerouse, A van Riessen; Curtin University, Australia
- 4:30 PM **1017** *The Nanolathe - a Dedicated Two-axis Positioner for Concentric Sample Rotation*; AJ Smith, K Schock, S Kleindiek; Kleindiek Nanotechnik, Germany; S Gerstl; ETH Zürich, Switzerland
- 4:45 PM **1018** *The Effect of Group 5 (V, Nb, Ta) Additions on Precipitation in Al-Sc Alloys*; KE Knippling; U.S. Naval Research Laboratory

### A13.8 In Situ Electron Microscopy and Big Data Analytics in 2D and 3D

#### SESSION CHAIR:

Kai He, Northwestern University

#### PLATFORM SESSION

Thursday 3:30 PM • Room: C221

- 3:30 PM **1019** (INVITED) *Nanoscale Size Effects on Crystallization Kinetics of Metallic Glass Nanorods by In Situ TEM*; SW Sohn; Yale University; Y Jung; University of Central Florida; Y Xie, C Osuji, J Schroers, JJ Cha; Yale University
- 4:00 PM **1020** *In Situ Thermal Testing on Nanostructures in TEM*; H Guo, WJ Hardy, P Zhou, DN Natelson, J Lou; Rice University
- 4:15 PM **1021** *Asymmetric Temperature Profiles in Joule-Heated in Aluminum Nanowires*; BC Regan, B Zutter, WA Hubbard; University of California, Los Angeles; S Aloni; Lawrence Berkeley National Laboratory; M Mecklenburg; University of California, Los Angeles
- 4:30 PM **1022** *In Situ-by-Ex Situ: FIB-less Preparation of Bulk Samples on Heating Membranes for Atomic Resolution STEM Imaging*; W Xu, ED Grimley, JM Lebeau; North Carolina State University

4:45 PM **1023** *A Variable-Temperature Continuous-Flow Liquid-Helium Cryostat Inside a (Scanning) Transmission Electron Microscope*; F Börrnert; Universität Ulm, Germany; A Horst; Leibniz-Institut für Festkörper- und Werkstoffforschung, Dresden, Germany; MA Krzyzowski; CryoVac GmbH & Co KG, Germany; B Büchner; Leibniz-Institut für Festkörper- und Werkstoffforschung, Dresden, Germany

## A16.4 New Frontiers in Monochromated EELS

### SESSION CHAIR:

Peter Crozier, Arizona State University

### PLATFORM SESSION

Thursday 3:30 PM • Room: C224-25

- 3:30 PM **1024** (INVITED) *Very High-Resolution Electron Energy Loss Spectroscopy: Application in Plasmonics*; EP Bellido, IC Bicket, J McNeil, GA Botton; McMaster University, Canada
- 4:00 PM **1025** *Accessing High Spatial Resolution Low-Loss EELS Information Without Čerenkov Radiation*; JI Deitz, TJ Grassman, DW McComb; The Ohio State University
- 4:15 PM **1026** *Advances in Momentum-Resolved Dispersion Investigations via Monochromated Electron Energy-Loss Spectroscopy*; PA van Aken; Max Planck Institute for Solid State Research, Germany
- 4:30 PM **1027** *High Performance in Low Voltage HR-STEM Applications Enabled by Fast Automatic Tuning of the Combination of a Monochromator and Probe Cs-Corrector*; S Lazar, P Tiemeijer, A Henstra, T Dennemans; FEI Company, Netherlands; J Ringnalda; FEI Company; B Freitag; FEI Company, Netherlands
- 4:45 PM **1028** *Improvement of TEM Spatial Resolution at Low Accelerating Voltages (15 - 30 kV) with Monochromator*; S Morishita, M Mukai; JEOL, Ltd., Japan; K Suenaga; National Institute of Advanced Industrial Science and Technology, Japan; H Sawada; JEOL, Ltd., United Kingdom

P

## PHYSICAL SCIENCES SYMPOSIA—

THURSDAY AFTERNOON

## P03.5 Combining Simulation, Experiment, and Data Science for Materials Characterization and Design

### SESSION CHAIR:

Mark Oxley, Oak Ridge National Laboratory

### PLATFORM SESSION

Thursday 3:30 PM • Room: C210

- 3:30 PM **1029** (INVITED) *Multidisciplinary Approach to Nanostructure Determination*; C Dwyer; Arizona State University
- 4:00 PM **1030** *Determination of Core/Double-Shell Architecture of a Single Tetragonal Bipyramidal Nanophosphor for Intense Dual-Mode Luminescence*; JS Jeong; University of Minnesota; SY Kim; Korea Institute of Science and Technology, Republic of Korea; HS Jang; Korea Institute of Science and Technology; KA Mkhoyan; University of Minnesota
- 4:15 PM **1031** (INVITED) *Making Every Electron Count: Materials Characterization by Quantitative Analytical Scanning Transmission Electron Microscopy*; M Weyland, Z Chen, Y Zhu, NV Medhekar; Monash University, Australia; C Dwyer; Arizona State University; DJ Taplin, SD Findlay; Monash University, Australia, LJ Allen; University of Melbourne, Australia; et al.
- 4:45 PM **1032** *Atomic Resolution Composition Mapping in EDS STEM*; NR Lugg, A Kumamoto, R Ishikawa, B Feng; The University of Tokyo, Japan; G Kothleitner; Graz University of Technology, Austria; N Shibata, Y Ikuhara; The University of Tokyo, Japan

## P04.3 Nuclear and Irradiated Materials

### SESSION CHAIR:

Peter Hosemann, University of California, Berkeley

### PLATFORM SESSION

Thursday 3:30 PM • Room: E160AB

- 3:30 PM **1033** (INVITED) *In Situ TEM Mechanical Testing: An Emerging Approach for Characterization of Polycrystalline, Irradiated Alloys*; JP Wharry; Purdue University; KH Yano, MJ Swenson, Y Wu; Boise State University
- 4:00 PM **1034** (INVITED) *Measuring Interfacial Shear Strength of CuxNi-Nb Alloys*; SJ Dillon, S Mao; University of Illinois Urbana-Champaign
- 4:30 PM **1035** *Heavy Ion Irradiation-Induced Microstructural Evolution in the Next Generation Nuclear Material – Alloy 800H*; JJ Lim, MG Burke; The University of Manchester, United Kingdom
- 4:45 PM **1036** *Microstructural Evolution of High-Strain-Rate Severe Plastic Deformation Processed 316L during Kr Ion Irradiation and Elevated Temperature Exposures*; JM Wiezorek, MA Gordillo; University of Pittsburgh; MA Kirk, PM Baldo; Argonne National Laboratory

# Scientific Program

P

## PHYSICAL SCIENCES SYMPOSIA—

THURSDAY AFTERNOON *continued*

### P05.6 Microscopy for Metal, Semiconductor and Insulator Thin Films

#### SESSION CHAIRS:

Demie Kepaptsoglou, SuperSTEM Laboratory

Barry Carter, University of Connecticut

#### PLATFORM SESSION

Thursday 3:30 PM • Room: C114

- 3:30 PM **1037** *Study of Direct Lithiation of Thin Si Membranes with Spatially-Correlative Low Energy Focused Li Ion Beam and Analytical Electron Microscopy Techniques*; VP Oleshko; National Institute of Standards and Technology; KA Twedt; University of Maryland; CL Soles, JJ McClelland; National Institute of Standards and Technology
- 3:45 PM **1038** *In Situ Dislocation Imaging During Deformation in High Entropy Alloys*; Y Hu, J-M Zuo; University of Illinois Urbana-Champaign
- 4:00 PM **1039** *Nanoscale Characterization of L10-ordered FePt Granular Films for Heat-Assisted Magnetic Recording Devices*; B Ozdol, Y Zhang, J Zhu, S Myers, A Greene; Western Digital Corporation
- 4:15 PM **1040** *Modification of Grain Boundary and Interfacial Structure in Al<sub>2</sub>O<sub>3</sub> Coatings*; S Tan; University of Pittsburgh
- 4:30 PM **1041** (INVITED) *Steel Corrosion Mechanisms During Pipeline Operation: In Situ Characterization*; KL Jungjohann; Sandia National Laboratories; SC Hayden, JT O'Brien; Aramco Services Company; WM Mook, C Chisholm, AG Ilgen, DC Bufford, K Hattar; Sandia National Laboratories; et al.

### P08.3 Microscopy of Additive Manufacturing and 3D Printing in Materials and Biology

#### SESSION CHAIR:

Michael Yost, Medical University of South Carolina

#### PLATFORM SESSION

Thursday 3:30 PM • Room: C213

- 3:30 PM **1042** *Recent Advancements in 3D X-Ray Microscopes for Additive Manufacturing*; L Lavery, W Harris, H Bale, A Merkle; Carl Zeiss X-Ray Microscopy, Inc.
- 3:45 PM **1043** (INVITED) *Alginate Hydrogel for 3D Bioprinting*; Y Mei; Clemson University
- 4:15 PM **1044** *Design and Fabrication of a Three-Dimensional In Vitro Model of Vascular Stenosis*; RS Jones; University of South Carolina; PH Chang; University of Michigan; T Perahia, KA Harmon, L Junor; University of South Carolina; MJ Yost; Medical University of South Carolina; D Fan, JF Eberth; University of South Carolina; et al.
- 4:45 PM **1045** *Electron Microscopy Analysis of 17-4 PH Powder for Additive Manufacturing*; Y Sun, M Aindow, RJ Hebert; University of Connecticut

| Name                | Presentation #                     | Name                 | Presentation #                       | Name                | Presentation #              |
|---------------------|------------------------------------|----------------------|--------------------------------------|---------------------|-----------------------------|
| Aagesen, LK         | 424                                | Ando, K              | 461                                  | Baldwin, PR         | 339                         |
| Abbott, A           | 151                                | Andrade, S           | 850                                  | Baldwin, S          | 40                          |
| Abellan, P          | 1011, 976                          | Andrei, C            | 633                                  | Bale, H             | 616, 763, 667,<br>1042, 594 |
| Abraham, D          | 714                                | Andrejevic, N        | 178, 1010                            | Bali, R             | 119, 387                    |
| Abrahão, JS         | 166                                | Andrews, J           | 508                                  | Ballarini, R        | 434                         |
| Abreu, NM           | 190                                | Angert, I            | 535                                  | Ballif, C           | 925                         |
| Acehan, D           | 580, 808                           | Anglade, P-M         | 804                                  | Balsara, NP         | 486, 781                    |
| Abu Alsaoud, M      | 933                                | Anton, I             | 809                                  | Bammes, B           | 530                         |
| Acehan, D           | 90                                 | Aoki, T              | 512, 811, 813, 897,<br>900, 978, 943 | Ban, K-Y            | 941                         |
| Acosta, DR          | 99                                 | Appathurai, N        | 251                                  | Bando, Y            | 792                         |
| Adams, PM           | 950                                | Arai, S              | 426                                  | Banerjee, R         | 921, 968                    |
| Admasu, AS          | 1008                               | Araullo-Peters, V    | 965                                  | Banerjee, S         | 508, 882, 698               |
| Aebersold, AB       | 645                                | Archibald, RK        | 154, 292, 294, 981                   | Baraissov, Z        | 807                         |
| Agarwal, G          | 82, 410, 169                       | Arellano-Jiménez, J  | 755                                  | Barbi, NC           | 59, 217                     |
| Agbandje-McKenna, M | 86                                 | Arenas-Esteban, D    | 103                                  | Barnabas, AD        | 642                         |
| Agredano-Moreno, L  | 399                                | Arey, B              | 288                                  | Barnard, AS         | 582                         |
| Aguilar-Tapia, A    | 571                                | Arlinghaus, H        | 475                                  | Barnard, E          | 585                         |
| Aguilar, C          | 776                                | Aronova, MA          | 168, 28                              | Barnum, A           | 53                          |
| Ahmed, M            | 288                                | Arslan, G            | 761                                  | Bartelt, N          | 323                         |
| Ahn, SJ             | 727                                | Asahina, S           | 625                                  | Barth, T            | 629                         |
| Aindow, M           | 100, 1045, 595,<br>597, 885, 31    | Asayesh-Ardakani, H  | 396, 895                             | Barthel, J          | 581                         |
| Akashi, T           | 112                                | Asif, SAS            | 262, 264                             | Bassim, ND          | 636, 828                    |
| Akbashev, A         | 510                                | Atanasov, I          | 999                                  | Bassiri-Gharb, N    | 226                         |
| Aken, PA            | 19, 71, 471, 517,<br>545, 588, 752 | Atre, SV             | 514                                  | Batson, JS          | 162, 602                    |
| Akey, AJ            | 865, 619                           | Audhya, A            | 389                                  | Batson, PE          | 640                         |
| Al-Jassim, M        | 561                                | Audinot, J-N         | 280                                  | Bauchan, G          | 371                         |
| Al-Sharab, JF       | 70                                 | August, A            | 405                                  | Bauer, D            | 188                         |
| Alam, T             | 921, 968                           | August, B            | 389                                  | Bauer, F            | 671, 465                    |
| Alarcon, A          | 415                                | Austin, BF           | 574                                  | Baumeister, W       | 839, 238, 1000,<br>838, 998 |
| Albert, B           | 410                                | Ávila-Brande, D      | 103, 750                             | Bayle-Guillemaud, P | 177                         |
| Albert, S           | 998, 299                           | Avishai, A           | 554                                  | Béché, A            | 298                         |
| Aldrich, DS         | 160, 602                           | Ayas, E              | 757                                  | Bechteler, A        | 611, 612                    |
| Alducin, D          | 386, 894                           | Ayasse, P            | 531                                  | Bedworth, PV        | 948                         |
| Alem, N             | 660, 228, 932, 933,<br>991         | Azough, F            | 137                                  | Bedzyk, M           | 507                         |
| Allard, LF          | 572                                | Babick, F            | 74                                   | Behler, KD          | 758                         |
| Allaz, JM           | 794                                | Backer, A            | 152                                  | Beigmohamadi, M     | 270                         |
| Allen, FI           | 130                                | Backman, V           | 365                                  | Béjar Gómez, L      | 777                         |
| Allen, LJ           | 214, 1031                          | Badding, JV          | 660, 932                             | Bejar, L            | 776                         |
| Almaral-Sánchez, JL | 438                                | Baddorf, AP          | 225, 958                             | Bele, M             | 97                          |
| Almasi, H           | 183                                | Baek, DJ             | 1008                                 | Belianinov, A       | 81, 294, 981, 809           |
| Almassalha, L       | 365                                | Baek, SH             | 729                                  | Bell, DC            | 865, 619                    |
| Aloni, S            | 1021                               | Bagot, PA            | 869                                  | Bellis, SL          | 22                          |
| Alvarado, J         | 648                                | Bailon, J-P          | 58                                   | Belousoff, M        | 954                         |
| Alvarez Ramirez, F  | 420                                | Bair, M              | 435, 455                             | Benalla, M          | 70                          |
| Amari, H            | 819                                | Baiutti, F           | 140                                  | Bennett, A          | 86                          |
| Amatucci, G         | 327                                | Baker, A             | 455                                  | Bentham, K          | 518, 927                    |
| Amish, TE           | 91                                 | Baker, BW            | 970                                  | Bentham, MH         | 297                         |
| Anand, M            | 330                                | Baker, TS            | 86                                   | Bentley, J          | 599                         |
| Andersen, A         | 286                                | Baki, A              | 357                                  | Bentley, MS         | 38                          |
| Anderson-Okonkwo, O | 769                                | Balachandran, J      | 226                                  | Benus, R            | 783                         |
| Anderson, IE        | 967                                | Balaghi, SE          | 31                                   | Berejnov, V         | 251                         |
| Anderson, LA        | 411                                | Baldenebro López, FJ | 444, 445                             | Berger, B           | 373                         |
| Anderson, P         | 197                                | Baldenebro-López, JA | 436, 437, 438                        | Berger, C           | 300                         |
|                     |                                    | Baldo, PM            | 1036                                 | Berggren, KK        | 283                         |
|                     |                                    | Baldwin, MJ          | 820                                  |                     |                             |

| Name                  | Presentation #            | Name             | Presentation #              | Name                   | Presentation #                |
|-----------------------|---------------------------|------------------|-----------------------------|------------------------|-------------------------------|
| Bergkoetter, M        | 862                       | Bosgra, J        | 276                         | Burkart, I             | 464                           |
| Bergmann, J           | 553                       | Bottino, MC      | 23                          | Burke, MG              | 285, 354, 847, 872, 848, 1035 |
| Berkel, GJ            | 793                       | Botton, GA       | 570, 656, 1024              | Burnett, T             | 135                           |
| Berkowitz, AE         | 949                       | Boudreau, D      | 899                         | Burnett, TL            | 892                           |
| Bermudez-Hernandez, K | 503                       | Bouman, CA       | 184, 798, 907               | Burnley, P             | 265                           |
| Bernal-Ponce, JL      | 755, 777                  | Bovik, A         | 964, 33                     | Burns, PC              | 823                           |
| Bernard, S            | 191                       | Bowden, M        | 286                         | Burrell, AK            | 508                           |
| Bernatova, S          | 92                        | Bowers, ML       | 176, 273                    | Buse, B                | 622, 623                      |
| Berry, D              | 1                         | Bowser, CT       | 217                         | Busse, B               | 616                           |
| Bersuker, G           | 840                       | Boyce, BL        | 262                         | Bussmann, B            | 588, 752                      |
| Bertram, F            | 300                       | Bradley, SA      | 635                         | Bustillo, KC           | 125, 559                      |
| Betancourt, I         | 259                       | Brady, M         | 961                         | Butkevich, NA          | 196                           |
| Bevis, CS             | 345                       | Brako, L         | 89                          | Cabin-Flaman, A        | 369                           |
| Bewick, A             | 466                       | Brearely, A      | 191                         | Cacho-Nerin, F         | 205                           |
| Bharat, TA            | 93                        | Brémier, S       | 918                         | Cadieux, K             | 673                           |
| Bhardwaj, V           | 398                       | Brenden, B       | 108                         | Calco, GN              | 28                            |
| Bhargava, R           | 903                       | Brett, D         | 326                         | Calderon-Dominguez, GH | 125                           |
| Bhowmick, S           | 434, 470                  | Brian, S         | 966                         | Calderon, HA           | 125                           |
| Bibby, C              | 261                       | Bright Davies, C | 673                         | Calleja, E             | 299                           |
| Bicket, IC            | 1024                      | Brinsko, KM      | 604                         | Calomeni, E            | 169, 410                      |
| Biener, J             | 619                       | Brinson, BE      | 948                         | Camacho-Montes, H      | 436, 437, 445                 |
| Bigelow, GS           | 524                       | Brintlinger, TH  | 49, 828                     | Camargo, A             | 126                           |
| Birch, ME             | 231, 773, 764             | Brister, K       | 279                         | Camp, CH               | 233                           |
| Biskupek, J           | 21, 696, 695              | Britton, B       | 271                         | Campbell, C            | 830                           |
| Biswas, SK            | 89                        | Britz, D         | 42                          | Campbell, GH           | 485, 587, 832                 |
| Blackburn, AM         | 116                       | Brocchi, EA      | 721                         | Canova, M              | 105, 646                      |
| Blancett, CD          | 241                       | Broderick, SR    | 803, 867                    | Cantoni, C             | 36                            |
| Blanchard, PT         | 600                       | Broderick, TF    | 65                          | Cantor, R              | 843                           |
| Blanton, J            | 904                       | Broderick, W     | 594                         | Cantu-Valle, J         | 259                           |
| Blanton, T            | 904                       | Brodie, M        | 728                         | Cantwell, PR           | 247                           |
| Blatz, M              | 754                       | Brodie, MJ       | 840                         | Cao, J                 | 686, 568                      |
| Blavette, D           | 626                       | Brodusch, N      | 469, 480                    | Cao, M                 | 295                           |
| Bleher, R             | 365, 308                  | Brongersma, HH   | 620                         | Cao, MC                | 818                           |
| Blissett, A           | 169                       | Brooks, CJ       | 85                          | Cao, R                 | 891                           |
| Blomfield, C          | 1002                      | Brown, A         | 199                         | Capellen, E            | 681                           |
| Blukis, R             | 290                       | Brown, C         | 809                         | Capoglu, I             | 308                           |
| Blum, I               | 626                       | Browning, N      | 606, 1012                   | Cappillino, PD         | 351                           |
| Boccabella, M         | 358                       | Browning, ND     | 78, 118, 659, 880, 689, 891 | Carin, L               | 1012                          |
| Bochiechio, MP        | 597                       | Bruinen, AL      | 549                         | Carlo, F               | 368                           |
| Bock, DD              | 94                        | Bruna, A         | 386                         | Carlsson, A            | 428                           |
| Boegli, V             | 150                       | Bryan, SR        | 548, 549                    | Carmona, A             | 204                           |
| Boer, P               | 132                       | Bryant, SC       | 744                         | Carnevale, S           | 824                           |
| Bogachev, S           | 705, 1009                 | Brydson, R       | 473                         | Carney, PS             | 903                           |
| Böhm, S               | 846                       | Buchholz, DB     | 507, 893                    | Carpenter, AE          | 801                           |
| Bonvallet, PP         | 22                        | Büchner, B       | 1023                        | Carpenter, M           | 843, 844                      |
| Boona, IN             | 135                       | Budiansky, ND    | 188, 955                    | Carpenter, PK          | 797                           |
| Boothroyd, CB         | 582                       | Bueso-Ramos, C   | 388                         | Carragher, B           | 315                           |
| Borg, TK              | 643                       | Bufford, DC      | 1041                        | Carreño-Gallardo, C    | 770                           |
| Borinstein, SC        | 575                       | Bugnet, M        | 570                         | Carroll, LJ            | 424                           |
| Borisevich, AY        | 8, 81, 156, 294, 510, 981 | Bullock, J       | 925                         | Carroll, MC            | 424                           |
| Borisov, P            | 422                       | Bunday, B        | 57, 149                     | Carter, CB             | 174, 935                      |
| Borja-Urby, R         | 772                       | Bunton, JH       | 1014                        | Carter, J              | 391                           |
| Borjas-García, SE     | 759                       | Burdet, P        | 290                         |                        |                               |
| Bosch, EG             | 609, 913                  | Burgess, S       | 732, 613, 847, 848          |                        |                               |
|                       |                           | Burkart, E       | 464                         |                        |                               |

| Name                   | Presentation #               | Name                 | Presentation #                                   | Name                 | Presentation #      |
|------------------------|------------------------------|----------------------|--------------------------------------------------|----------------------|---------------------|
| Castner, DG            | 547                          | Chisholm, MF         | 79, 583                                          | Cruz-Campa, M        | 784                 |
| Castorena-González, JH | 438                          | Chmielus, M          | 951                                              | Cuadros-Lugo, E      | 442, 441            |
| Castro, TG             | 782                          | Cho, YD              | 826                                              | Cube, F              | 978                 |
| Catabay, R             | 931                          | Choi, E-M            | 590                                              | Cullen, DA           | 180, 948, 179, 966  |
| Cats, D                | 680                          | Choi, H-K            | 117                                              | Curran, C            | 373                 |
| Celma, CC              | 999                          | Choi, S-Y            | 711                                              | Currens, E           | 593                 |
| Cerreta, EK            | 935                          | Chollangi, S         | 394                                              | Cyrus, Y             | 365                 |
| Cha, JJ                | 1019                         | Chou, T              | 767                                              | Czarnik, C           | 9, 143              |
| Chakravadhanula, VSK   | 254                          | Christen, J          | 299, 300                                         | Czymmek, K           | 535                 |
| Chambers, SA           | 210, 591                     | Christoffersen, R    | 267                                              | D. Findlay, S        | 374                 |
| Chamorro Ceballos, GA  | 125                          | Christy, AJ          | 744                                              | D'Alfonso, AJ        | 214                 |
| Chan, M                | 585                          | Chueh, W             | 323                                              | Dadgar, A            | 300                 |
| Chanda, A              | 403                          | Chung, T             | 317, 673                                         | Dahmen, T            | 63, 705, 1009       |
| Chandler, J            | 365                          | Chuvilin, A          | 37, 113, 889                                     | Dahmen, U            | 176, 223, 212       |
| Chang, C               | 295                          | Cianciolo, RE        | 170                                              | Dai, S               | 496                 |
| Chang, C-C             | 25                           | Ciferri, C           | 314                                              | Dai, W               | 779                 |
| Chang, CS              | 153, 213                     | Cigarros-Mayorga, OE | 421                                              | Daily, CR            | 986                 |
| Chang, HJ              | 729                          | Cinar, A             | 768                                              | Dalou, C             | 124                 |
| Chang, JH              | 709, 710, 712                | Ciston, J            | 143, 383, 212, 559, 222                          | Damania, D           | 308                 |
| Chang, PH              | 1044                         | Clark, WA            | 669                                              | Damjanovic, D        | 519                 |
| Channagiri, SA         | 105                          | Clarke, ML           | 7                                                | Dan, Y               | 461                 |
| Chanona Perez, JJ      | 125                          | Cloud, JE            | 595                                              | Danev, R             | 786, 953, 1000, 954 |
| Chao, R                | 655                          | Coakley, JA          | 869                                              | Daniel, JR           | 899                 |
| Chatterjee, S          | 584                          | Cochell, T           | 871                                              | Dao, ECY             | 953                 |
| Chaudhuri, J           | 748                          | Cohen-Gould, L       | 275                                              | Darbal, A            | 522, 381            |
| Chawla, N              | 539, 997                     | Cohen, MR            | 236                                              | Darroudi, T          | 734                 |
| Chen, D                | 1009                         | Cole, DA             | 234                                              | Das, J               | 40                  |
| Chen, E                | 922, 50                      | Colijn, HO           | 43                                               | Dasgupta-Schubert, N | 777                 |
| Chen, L                | 109, 737                     | Comerio, RM          | 701                                              | Daulton, TL          | 628                 |
| Chen, M                | 339                          | Comes, RB            | 591                                              | Davidson, R          | 139                 |
| Chen, X                | 133, 258                     | Compton, KA          | 575                                              | Davidson, WB         | 404                 |
| Chen, XC               | 486                          | Conroy, MA           | 584                                              | Davilla, S           | 16                  |
| Chen, Y                | 75, 1015, 629, 731, 805, 869 | Consoni, DR          | 440                                              | Davis, BD            | 376                 |
| Chen, YP               | 1004                         | Corbin, GJ           | 608                                              | Davis, BG            | 146                 |
| Chen, Z                | 1031                         | Cordes, NL           | 997                                              | Davis, BH            | 231                 |
| Cheng, H-Y             | 587                          | Cornish, K           | 700                                              | Davis, KO            | 739                 |
| Cheng, HY              | 932                          | Cortes-Jacome, MA    | 765                                              | Davut, K             | 333                 |
| Cheng, N               | 164                          | Cortines, JR         | 166                                              | De Andrade, V        | 368                 |
| Cheng, Y               | 328                          | Cosandey, F          | 327                                              | Decoster, S          | 906                 |
| Chennareddy, S         | 400                          | Cottom, J            | 473                                              | Deeks, C             | 955                 |
| Cheong, JY             | 578, 708, 712                | Coughlin, DR         | 524                                              | Deelman, P           | 509                 |
| Cheong, S-W            | 751, 1008                    | Coultas, S           | 1002                                             | Deligianni, L        | 945                 |
| Cherkezyan, L          | 308                          | Counsell, J          | 1002                                             | Deljoo, B            | 31                  |
| Chernenko, V           | 951                          | Cox, D               | 147                                              | Dellby, N            | 639, 608            |
| Chess, JJ              | 143, 375                     | Coyle, S             | 151                                              | Demers, H            | 253, 469, 480, 613  |
| Chi, M                 | 8, 294, 328, 32              | Crespi, VH           | 991                                              | Demkov, AA           | 512, 9              |
| Chica-Szot, R          | 541                          | Cristiani, G         | 545                                              | Demopoulos, GP       | 253                 |
| Chin, Y-HC             | 567                          | Croce, MP            | 844                                              | Demos, S             | 157                 |
| Chincilla, L           | 570                          | Cronin, SB           | 993                                              | Dempsey, A           | 857                 |
| Chiou, W-A             | 448, 684                     | Crosher, T           | 872                                              | den Broek, WR        | 309                 |
| Chipman, PR            | 86                           | Crowe, D             | 185                                              | Deng, B              | 135, 169            |
| Chisholm, C            | 1041                         | Crowe, JB            | 605                                              | Deng, J              | 279                 |
| Chisholm, M            | 139                          | Crozier, PA          | 381, 569, 715, 565, 723, 813, 897, 900, 980, 979 | Deng, Y              | 222, 828            |
|                        |                              |                      |                                                  | Denisyuk, A          | 682                 |
|                        |                              |                      |                                                  | Dennemans, T         | 1027                |

| Name                | Presentation #                            | Name                 | Presentation #                                    | Name                       | Presentation #    |
|---------------------|-------------------------------------------|----------------------|---------------------------------------------------|----------------------------|-------------------|
| Dennies, DP         | 995                                       | Dunne, F             | 271                                               | Etienne, A                 | 965               |
| der Handt, A        | 124                                       | Dunsiger, SR         | 738                                               | Evans, JE                  | 880               |
| Desai, TM           | 27                                        | Durand, C            | 1004                                              | Evmenenko, G               | 507               |
| DeSario, PA         | 49                                        | Durmaz, T            | 339                                               | Facsco, S                  | 492, 119          |
| Deshmukh, VP        | 763                                       | Durstock, MF         | 896                                               | Falke, M                   | 171               |
| DesOrmeaux, J-P     | 48                                        | Duscher, G           | 79                                                | Faller, R                  | 880               |
| Deutchman, H        | 142                                       | Dwyer, C             | 17, 582, 1031                                     | Fan, D                     | 1044              |
| Devaraj, A          | 210                                       | Dyck, D              | 283                                               | Fancher, CM                | 516               |
| Dhall, R            | 993                                       | Dyck, O              | 509                                               | Fang, C                    | 50                |
| Di Russo, E         | 626                                       | Dycus, JH            | 649                                               | Fang, J                    | 109               |
| Dickey, EC          | 650, 516                                  | Dye, D               | 869                                               | Fang, NX                   | 898               |
| Dickie, R           | 704                                       | Eastman, PY          | 860                                               | Farra, R                   | 686               |
| Dickinson, ME       | 576                                       | Eberle, AL           | 148                                               | Fassbender, J              | 387, 119          |
| Dieing, T           | 360                                       | Eberth, J            | 313                                               | Fautsch, MP                | 409               |
| Dietrich, P         | 285                                       | Eberth, JF           | 230, 1044                                         | Fedotova, S                | 965               |
| Dijk, TV            | 903                                       | Ebner, C             | 384                                               | Feng, B                    | 98, 1032          |
| Dillard, RS         | 134, 27, 167                              | Echlin, MP           | 131, 260                                          | Feng, HA                   | 773               |
| Dingreville, R      | 987                                       | Echt, AS             | 764                                               | Feng, J                    | 155, 654          |
| Ditto, J            | 78                                        | Eckhardt, R          | 611, 612                                          | Feng, R                    | 906               |
| Dobashi, T          | 607                                       | Economos, RC         | 481                                               | Feng, T                    | 484               |
| Doerner, RP         | 820                                       | Edge, L              | 509                                               | Fenyo, D                   | 503               |
| Dogel, S            | 666, 567                                  | Edge, LF             | 909                                               | Fereidouni, F              | 157               |
| Dohányosová, P      | 663                                       | Ediger, MD           | 483                                               | Ferguson, RM               | 118               |
| Domanik, K          | 39                                        | Edmondson, PD        | 986, 52                                           | Fernández-Busnadiego, R    | 838               |
| Dong, S             | 586                                       | Edwards, E           | 133                                               | Fernantdez, IS             | 93                |
| Donnelly, SE        | 819                                       | Edwards, JK          | 30                                                | Fernback, JE               | 773, 231, 764     |
| Donovan, BF         | 511                                       | Edwards, RJ          | 29                                                | Ferraz, J                  | 266               |
| Donovan, D          | 820                                       | Effinger, K          | 400                                               | Ferreira, PJ               | 33, 107, 385, 964 |
| Donovan, JJ         | 849                                       | Egan, GC             | 684                                               | Fetter, RD                 | 94                |
| Dorn, R             | 854                                       | Einsle, JF           | 266, 2                                            | Fetterer, DP               | 240               |
| Doskocil, E         | 285                                       | Ekerdt, J            | 943                                               | Field, KG                  | 986, 820          |
| Douady, J           | 804                                       | El Gabaly, F         | 323                                               | Fifield, LS                | 835               |
| Downey, BP          | 724                                       | El-Khoury, PZ        | 473,                                              | Findlay, SD                | 224, 214, 1031    |
| Downing, K          | 781                                       | Eliason, JK          | 944,                                              | Findley, K                 | 599               |
| Dowsett, D          | 280, 289                                  | Eliceiri, KW         | 337,                                              | Finegan, D                 | 326               |
| Dozier, AK          | 764, 773                                  | Elizalde-Galindo, JT | 436, 437, 444                                     | Firlar, E                  | 396, 873, 874     |
| Dravid, VP          | 429, 507, 799, 893,<br>901, 974, 887, 973 | Elser, V             | 178                                               | Fischer, AM                | 725               |
| Drazic, G           | 97, 519                                   | Endeve, E            | 292, 294, 154                                     | Fischer, ER                | 91                |
| Dries, M            | 1001                                      | Endo, N              | 45                                                | Fischer, P                 | 34                |
| Droopad, R          | 911                                       | Engelhardt, H        | 238                                               | Fischione, P               | 358, 463          |
| Droubay, T          | 210                                       | Engels, BD           | 998                                               | Fisher, GL                 | 548               |
| Drouin, LM          | 86                                        | Engelshoven, J       | 680                                               | Flannigan, DJ              | 929, 944          |
| Drozдова, E         | 783                                       | Engstler, M          | 42, 63                                            | Flicker, P                 | 530               |
| Drummy, LF          | 896, 798, 836,<br>907, 83                 | Ercius, P            | 144, 212, 222                                     | Floss, C                   | 628               |
| Du, Y               | 210                                       | Erdman, N            | 643, 67                                           | Flytzani-Stephanopoulos, M | 572               |
| Duan, H             | 779                                       | Ernst, F             | 457                                               | Foecke, KK                 | 795               |
| Duan, S             | 573, 694                                  | Escribano, S         | 177                                               | Foord, D                   | 680               |
| Duchamp, M          | 730, 298, 10                              | Esmann, M            | 471                                               | Foran, BJ                  | 728, 840          |
| Dudney, N           | 328                                       | Esparza-Ponce, HE    | 756                                               | Forghani, K                | 728               |
| Dukes, MJ           | 806                                       | Espinosa, F          | 778                                               | Forman, J                  | 995               |
| Dumas, L            | 50                                        | Esser, BD            | 274                                               | Förster, F                 | 1000              |
| Duncan, S           | 693                                       | Estivill, R          | 658                                               | Fourgerouse, D             | 1016              |
| Dunin-Borkowski, RE | 10, 378, 645, 730                         | Estrada-Guel, I      | 420, 436, 437,<br>441, 442, 444,<br>445, 762, 770 | Fourlaris, G               | 668               |
| Dunn, TL            | 41                                        | Eswara, S            | 289, 280                                          | Franceschini, DF           | 449, 453          |

| Name               | Presentation #          | Name                | Presentation #     | Name             | Presentation #   |
|--------------------|-------------------------|---------------------|--------------------|------------------|------------------|
| Franchi, IA        | 330                     | Geiser, BP          | 805                | Graef, M         | 121, 983, 184    |
| Frank, L           | 938                     | Geiss, R            | 9                  | Graham, G        | 32, 496, 685     |
| Fraser, H          | 428, 599                | Geissbühler, J      | 925                | Graham, R        | 795              |
| Fraser, HL         | 430, 129, 669, 859, 65  | Gelb, J             | 266, 541           | Graham, UM       | 231              |
| Fraundorf, P       | 127, 77                 | Genc, A             | 681, 350, 428      | Grandfield, K    | 633              |
| Freakley, S        | 30                      | Georg, C            | 140                | Grassman, T      | 825              |
| Freer, R           | 137                     | George, EP          | 274                | Grassman, TJ     | 1025             |
| Freitag, B         | 206, 1027               | Gerberich, W        | 434                | Gray, J          | 136              |
| Freitag, C         | 186                     | Gerczak, TJ         | 52                 | Grazulis, L      | 349              |
| Freitag, S         | 51                      | Gerstl, S           | 1017               | Greaves, G       | 819              |
| Freria, CM         | 135                     | Gerthsen, D         | 1001               | Greene, A        | 1039, 122        |
| Freyer, PD         | 5                       | Gervais, B          | 804                | Gregori, G       | 140              |
| Friedman, A        | 209                     | Ghasemi, A          | 653                | Gregorio, BT     | 190              |
| Friedman, HI       | 230                     | Ghazisaeidi, M      | 274                | Grehl, T         | 620              |
| Friend, CM         | 619                     | Ghosh, S            | 156                | Greiner, M       | 568              |
| Frindt, N          | 540                     | Ghoshroy, S         | 403                | Grenier, A       | 658              |
| Fu, B              | 50, 866, 209            | Gianfrancesco, AG   | 958                | Gribelyuk, M     | 50, 54, 657, 922 |
| Fu, Y-S            | 771, 722                | Giannuzzi, LA       | 4, 433, 351        | Griffin, B       | 515              |
| Fuchs, GD          | 120                     | Gibson, JH          | 234                | Griffith, B      | 1006             |
| Fuentes-Cabrera, M | 510                     | Giepmans, BN        | 132                | Grillo, V        | 115              |
| Fuentes-Cobas, LE  | 772                     | Gilchrist, JB       | 896                | Grimley, ED      | 1022             |
| Fuhrer, MS         | 214                     | Ginwalla, A         | 234                | Grocke, G        | 258              |
| Fujigaya, T        | 107                     | Glaeser, AM         | 323                | Gröger, R        | 272              |
| Fujii, K           | 965                     | Glass, PJ           | 240                | Gronsky, R       | 172, 323         |
| Fukunaga, K-I      | 45                      | Glass, SW           | 835                | Groom, D         | 33               |
| Fukuya, K          | 965                     | Glenn, D            | 266                | Gross, J         | 41               |
| Furdyna, JK        | 586, 990                | Glover, CJ          | 906                | Gruner, SM       | 120, 213, 295    |
| Gaberscek, M       | 97                      | Gluch, J            | 284                | Gu, J            | 347              |
| Gaetani, GA        | 329                     | Gobeljic, D         | 292                | Guarín-Zapata, N | 470              |
| Gainsforth, Z      | 123, 189                | Godfrey, I          | 1011               | Guavin, R        | 265              |
| Gallagher, JC      | 738                     | Godoy, A            | 33                 | Gubbens, S       | 58               |
| Gallagher, JR      | 165                     | Goduguchinta, RK    | 4                  | Guetaz, L        | 177              |
| Galloway, BR       | 278                     | Gohara, K           | 745                | Guillorn, M      | 655              |
| Gammer, C          | 195, 222, 383, 486, 487 | Golberg, D          | 792                | Guim, H-U        | 939              |
| Ganesh, P          | 226                     | Goldfarb, DJ        | 393                | Gujral, A        | 483              |
| Ganguly, K         | 47                      | Golemis, D          | 604                | Gulsoy, EB       | 368              |
| Gao, BZ            | 643                     | Golla-Schindler, U  | 789                | Gumbsch, P       | 131              |
| Gao, H             | 691                     | Gómez-Barraza, IK   | 441                | Guo, I           | 317, 673         |
| Gao, P             | 18, 720                 | Gómez-Esparza, CD   | 436, 437, 438, 928 | Guo, Q           | 747              |
| Gao, S             | 145                     | Gómez-Herrero, A    | 750                | Guo, S           | 471              |
| Gao, W             | 32                      | Gomez-Ortiz, N      | 759                | Guo, W           | 562, 967         |
| Gao, Y             | 277                     | Gondo, T            | 881                | Gupta, R         | 411              |
| Garay-Reyes, CG    | 450                     | Gong, Y             | 634                | Gupte, KN        | 432              |
| Garcia-Meitin, EI  | 187                     | Gonzales, S         | 136                | Gurcan, MN       | 158              |
| Garcia, E          | 719                     | González-Rodelas, L | 928                | Gürsoy, D        | 368              |
| Garcia, R          | 6                       | Goodman, SL         | 24, 241            | Gury, M          | 196              |
| Gardner, DF        | 278, 345                | Goodwin, RL         | 230                | Gutu, T          | 924              |
| Garvey, C          | 314                     | Goosen, WE          | 924                | Habermeier, H-U  | 517              |
| Gates-Rector, S    | 904                     | Gopalan, V          | 228                | Hachtel, J       | 139              |
| Gates, BD          | 108                     | Gordillo, MA        | 1036               | Haehn, D         | 800              |
| Gaudiello, J       | 655                     | Goris, B            | 206                | Hage, FS         | 976, 473         |
| Gautam, A          | 176                     | Gorman, B           | 561                | Haglund, R       | 139              |
| Gauvin, R          | 480, 253, 469, 552, 613 | Gorman, BP          | 563                | Hahn, D          | 462              |
|                    |                         | Gorte, R            | 685                | Haider, M        | 21, 696, 695     |
|                    |                         | Gourdie, RG         | 644                | Haigh, S         | 652              |
|                    |                         |                     |                    | Haigh, SJ        | 285              |

| Name              | Presentation #      | Name                | Presentation #  | Name                | Presentation #               |
|-------------------|---------------------|---------------------|-----------------|---------------------|------------------------------|
| Hainey, M         | 933                 | Hauser, AJ          | 908             | Hodoroaba, V-D      | 554, 663, 741                |
| Hall, A           | 844                 | Havelka, M          | 60, 15          | Hoffman, MV         | 639                          |
| Hall, GB          | 584                 | Havrilla, GJ        | 844             | Hoffmann, A         | 181                          |
| Hall, T           | 829                 | Hay, R              | 515             | Holl, P             | 537                          |
| Hallstein, R      | 201                 | Hayashida, T        | 390             | Holland, J          | 614, 610                     |
| Hallsteinsen, I   | 215                 | Hayden, SC          | 1041            | Hollricher, O       | 531, 360                     |
| Hammel, PC        | 256                 | Hayes, B            | 829             | Holm, J             | 852                          |
| Hammond, JS       | 549                 | He, K               | 877, 1005       | Holtz, ME           | 153, 11                      |
| Hamp, ME          | 598                 | He, L               | 483             | Hong, J             | 699                          |
| Hampikian, H      | 455, 435            | He, Q               | 88, 156, 30, 81 | Hong, J-I           | 936                          |
| Hampton, C        | 134                 | Healy, OE           | 59, 217         | Hong, L             | 109                          |
| Hampton, CM       | 27, 167             | Heaney, PJ          | 795             | Honsberg, CB        | 941                          |
| Han, CW           | 571                 | Hébert, C           | 822, 645, 730   | Hooshmand, MS       | 274                          |
| Han, KH           | 443                 | Hebert, RJ          | 1045            | Hopkins, PE         | 511                          |
| Han, L            | 495                 | Heck, PR            | 192             | Horne, TE           | 574                          |
| Han, M            | 64                  | Heeren, RM          | 549             | Horning, S          | 475                          |
| Han, S            | 664                 | Heeschen, WA        | 860, 962        | Horst, A            | 1023                         |
| Han, Y            | 862                 | Heikes, C           | 737             | Hosman, TC          | 151                          |
| Handjiev, VG      | 420                 | Heise, SE           | 948             | Hosogi, N           | 787                          |
| Hanrath, T        | 20                  | Heller, R           | 492             | Hosseinkhannazer, H | 666, 567                     |
| Hans, C           | 410                 | Henderson, K        | 539, 997        | House, SD           | 75, 76                       |
| Hansen, B         | 846                 | Henderson, WA       | 891             | Hovden, R           | 20, 912, 1008, 691, 153, 458 |
| Hansen, BT        | 91                  | Henry, R            | 76, 391         | Hovington, P        | 552                          |
| Hansen, TW        | 645                 | Henstra, A          | 1027            | Howard, KT          | 190                          |
| Hanssen, E        | 95                  | Herle, J            | 645             | Howe, B             | 349                          |
| Hanwell, MD       | 458                 | Herman, M           | 997             | Howe, J             | 133, 666                     |
| Hao, S            | 429                 | Hermenau, K         | 611, 612        | Howe, JY            | 269                          |
| Harada, K         | 114, 182            | Hernandez-          |                 | Hoyle, D            | 567                          |
| Harda, F          | 831                 | Maldonado, D        | 137, 590        | Hoyne, JD           | 28                           |
| Hardy, MT         | 724                 | Hernandez, F        | 99              | Hrnčif, T           | 359                          |
| Hardy, WJ         | 1020                | Hesjedal, T         | 588             | Hrncir, T           | 682                          |
| Harmany, Z        | 157                 | Hess, WP            | 473             | Hrubanova, K        | 92, 366, 676                 |
| Harmer, MP        | 141                 | Hessler-Wyser, A    | 925, 645        | Hsiao, VM           | 83                           |
| Harmon, KA        | 1044                | Hessler, K          | 185             | Hu, J               | 286                          |
| Haronikova, A     | 92                  | Hettler, S          | 1001, 789       | Hu, X               | 44                           |
| Harris, AE        | 744                 | Heuer, A            | 457             | Hu, Z               | 29                           |
| Harris, AK        | 165                 | Heutz, SE           | 896             | Hua, M              | 435, 455                     |
| Harris, JD        | 744                 | Heymann, B          | 164             | Huang, JW           | 200                          |
| Harris, W         | 367, 594, 1042      | Hidetaka, S         | 814             | Huang, R            | 164                          |
| Harrison, R       | 290                 | Higuchi, T          | 787             | Huang, X            | 372                          |
| Harrison, SE      | 588                 | Hikita, Y           | 589             | Huang, Y            | 647                          |
| Harrison, SL      | 4                   | Hildago Castillo, T | 673             | Hubbard, WA         | 993, 1021                    |
| Hart, JL          | 55                  | Hill, J             | 221             | Huber, D            | 129, 355                     |
| Hartel, P         | 695, 21, 696        | Himbert, J          | 918             | Huber, DE           | 106, 859                     |
| Hartfield, C      | 465                 | Hiner, MC           | 337             | Hubert, M           | 394                          |
| Hartl, UF         | 838                 | Hinks, JA           | 819             | Hufschmid, R        | 118                          |
| Hartmann, R       | 537, 378, 538       | Hintsala, E         | 470             | Hui, WH             | 999                          |
| Harvey, TR        | 115, 375            | Hipp, M             | 838             | Hujak, K            | 308                          |
| Harvey, TT        | 143                 | Hirayama, Y         | 607             | Hull, B             | 942                          |
| Hashimoto, Y      | 461                 | Hirsch, PB          | 272             | Humphrey, SM        | 884                          |
| Hashizume, T      | 102, 490            | Hisada, A           | 363             | Hunt, J             | 58                           |
| Hassel-Shearer, M | 151                 | Hiscock, M          | 341, 671        | Hunt, JA            | 151                          |
| Hattar, K         | 385, 987, 262, 1041 | Hlawacek, G         | 119, 492        | Hunter, K           | 344                          |
| Hauge, RH         | 948                 | Hobbs, JK           | 837             | Hurtado-Macias, A   | 772                          |
| Hauri, EH         | 329                 | Hobbs, R            | 283             | Hussaini, ZA        | 306                          |
|                   |                     | Hodgkins, L         | 50              |                     |                              |

| Name          | Presentation #                 | Name               | Presentation #                                 | Name            | Presentation #                      |
|---------------|--------------------------------|--------------------|------------------------------------------------|-----------------|-------------------------------------|
| Hutchings, GJ | 30                             | Jede, R            | 150                                            | Juul Jensen, D  | 667                                 |
| Huth, M       | 10, 538, 378,<br>537, 298, 376 | Jena, D            | 586                                            | K C, P          | 184                                 |
| Huynh, KW     | 236                            | Jensen, E          | 689                                            | Kaang, B-K      | 406                                 |
| Hwang, HY     | 589                            | Jensen, J          | 129                                            | Kadhim, A       | 515                                 |
| Hwang, J      | 73, 902, 227                   | Jeong, HY          | 743                                            | Kaepfel, A      | 171                                 |
| Iberi, V      | 202, 871                       | Jeong, JS          | 47                                             | Kahn, H         | 457                                 |
| Idrobo, J-C   | 816                            | Jesse, S           | 510, 793, 871,<br>630, 910, 81, 8,<br>202, 292 | Kaiser, U       | 695, 21, 789                        |
| Idrobo, JC    | 36, 8, 634                     | Jeszenszky, H      | 38                                             | Kaiser, UA      | 696                                 |
| Ievlev, AV    | 630                            | Jezek, E           | 277                                            | Kaji, K         | 301, 679                            |
| Iezzi, EB     | 128                            | Ji, G              | 372                                            | Kakoulli, I     | 370                                 |
| Ihle, S       | 10, 537, 378, 538              | Jia, C-L           | 581                                            | Kalaga, S       | 576                                 |
| Iijima, H     | 788                            | Jiang, H           | 334                                            | Kalemtas, A     | 761                                 |
| Ikuhara, Y    | 98, 735, 18, 374,<br>1032, 224 | Jiang, J           | 236                                            | Kalinin, S      | 225, 287, 982,<br>510, 871          |
| Ikuta, T      | 296, 56                        | Jiang, W           | 459, 181                                       | Kalinin, SV     | 793, 910, 958,<br>294, 81, 630, 292 |
| Ilgen, AG     | 1041                           | Jiang, X           | 781                                            | Kallinin, SV    | 8                                   |
| Im, S         | 73, 902                        | Jiang, Y           | 178                                            | Kalyuzhnyy, NA  | 423                                 |
| Imazono, T    | 555                            | Jiao, J            | 946, 931, 53                                   | Kamasawa, N     | 194, 364                            |
| Irving, DL    | 649                            | Jiao, Y            | 836                                            | Kambham, AK     | 866                                 |
| Isheim, D     | 627, 628                       | Jimbo, Y           | 46                                             | Kanatzidis, MG  | 429                                 |
| Ishida, T     | 56, 296                        | Jiménez-García, LF | 399                                            | Kanazawa, T     | 625                                 |
| Ishii, Y      | 114, 182, 751                  | Jimenez-Garcia, LF | 415                                            | Kaneko, A       | 461                                 |
| Ishikawa, R   | 18, 1032, 374                  | Jin, D             | 898                                            | Kanngießer, B   | 537                                 |
| Ishikawa, T   | 546                            | Jin, Q             | 279                                            | Kapetanakis, MD | 583, 816, 634                       |
| Ishizuka, K   | 543                            | Jin, R             | 75                                             | Kaplan, MA      | 597                                 |
| Islam, S      | 1005                           | Jin, Y-L           | 111                                            | Kapteyn, HC     | 345                                 |
| Isley, WC     | 584                            | Jinnai, H          | 787                                            | Kapur, MM       | 187                                 |
| Ivanov, I     | 113                            | Jiruše, J          | 15, 60                                         | Kara, F         | 761                                 |
| Ivanov, Y     | 889                            | Johnson, DC        | 78                                             | Karageorge, V   | 237                                 |
| Ivanov, YP    | 37                             | Johnson, JM        | 73                                             | Karahka, M      | 802                                 |
| Iwasawa, Y    | 46                             | Johnson, K         | 199                                            | Karl, R         | 278                                 |
| Izraeli, E    | 670                            | Johnson, SS        | 853                                            | Karl, RM        | 345                                 |
| Izumi, H      | 390                            | Joly, AG           | 473                                            | Karnesky, RA    | 273                                 |
| J. Taplin, D  | 374                            | Jones, L           | 152, 376, 146,<br>272, 591, 378                | Kas, JJ         | 815                                 |
| Jackson, C    | 509                            | Jones, T           | 147                                            | Kashyap, I      | 121                                 |
| Jackson, CA   | 909                            | Jones, TR          | 800                                            | Kasinathan, D   | 35                                  |
| Jackson, E    | 9                              | Jonge, N           | 63, 875                                        | Kasthuri, J     | 77                                  |
| Jacobs, TD    | 883                            | Jongelen, V        | 680                                            | Kasthuri, N     | 147                                 |
| Jacobsen, C   | 279                            | Jorissen, K        | 815                                            | Kate, KH        | 514                                 |
| Jacobson, SC  | 198                            | Jose Yacaman, M    | 894, 259                                       | Kathmann, SM    | 584                                 |
| Jacquet, E    | 804                            | Jose-Yacaman, M    | 890, 386                                       | Katoh, Y        | 820                                 |
| Jafari, T     | 31                             | Joshi, T           | 422                                            | Katsoulis, J    | 754                                 |
| Jain, S       | 996                            | Jovanovic, P       | 97                                             | Katzer, DS      | 724                                 |
| Jalan, B      | 47                             | Joy, D             | 202                                            | Kaufman, M      | 921                                 |
| James, CC     | 501                            | Joy, DC            | 302, 809                                       | Kaushik, A      | 398                                 |
| Jancar, B     | 519                            | Ju, T              | 339                                            | Kawanami, Y     | 490                                 |
| Jang, D-J     | 406                            | Juan, P-A          | 987                                            | Kawaoka, Y      | 952                                 |
| Jang, HS      | 1030                           | Juhel, M           | 658                                            | Kawasaki, M     | 102                                 |
| Janish, MT    | 577                            | Jun, Y-W           | 406                                            | Kawasaki, T     | 56                                  |
| Janssen, M    | 86                             | Jung, HJ           | 288                                            | Kaya, P         | 431                                 |
| Janvelyan, N  | 619                            | Jung, W-S          | 939                                            | Kaynig, V       | 800                                 |
| Janzen, R     | 789                            | Jung, Y            | 1019                                           | Kazu, S         | 814                                 |
| Jaud, B       | 789                            | Jungjohann, KL     | 577                                            | Ke, Z           | 167, 87                             |
| Javey, A      | 925                            | Junor, L           | 313, 1044                                      | Kearns, SL      | 623                                 |
| Jayant, RD    | 398                            |                    |                                                | Keegan, S       | 503                                 |

| Name             | Presentation #          | Name              | Presentation #                         | Name              | Presentation #           |
|------------------|-------------------------|-------------------|----------------------------------------|-------------------|--------------------------|
| Keely, D         | 1006                    | Kleibeuker, J     | 590                                    | Krizek, B         | 641                      |
| Keene, DR        | 136                     | Klein, AN         | 440                                    | Kruit, P          | 13                       |
| Keene, EC        | 860                     | Klein, R          | 838                                    | Krzyzanek, V      | 69, 366, 676, 783, 92    |
| Kehayias, P      | 266                     | Kleindiek, S      | 1017                                   | Krzyzowski, MA    | 1023                     |
| Keller, LP       | 267                     | Klie, R           | 44, 714, 882, 698, 895, 824, 585       | Kuang, ZZ         | 83                       |
| Kelley, R        | 350                     | Klie, RF          | 911, 926, 508                          | Kübel, C          | 484, 254                 |
| Kelly, DF        | 237, 806                | Klima, B          | 783                                    | Kubo, T           | 678                      |
| Kelly, TF        | 1014                    | Klocke, V         | 464                                    | Kuerbanjiang, B   | 653, 110                 |
| Kelsch, M        | 517                     | Kmita, K          | 84                                     | Kuipers, J        | 132                      |
| Kennouche, D     | 504                     | Knipl, C          | 471                                    | Kukreja, R        | 178                      |
| Kent, T          | 824                     | Knipling, KE      | 598                                    | Kuleshova, E      | 965                      |
| Kepaptsoglou, D  | 137, 110, 590           | Knowles-Barley, S | 800                                    | Kulzick, MA       | 872                      |
| Kepaptsoglou, DM | 591, 976                | Ko, DH            | 826                                    | Kumamoto, A       | 18, 1032, 98             |
| Kerelsky, A      | 993                     | Kobler, A         | 254                                    | Kunal, P          | 884                      |
| Kersten, K       | 340                     | Kodama, T         | 56, 296                                | Kuo, BC           | 28                       |
| Keskinbora, K    | 346                     | Kodambaka, S      | 945                                    | Kuo, C-H          | 179                      |
| Key, TS          | 753                     | Koh, AL           | 318                                    | Kurehwatira, J    | 924, 736                 |
| Khayat, R        | 163                     | Kohno, Y          | 224                                    | Kurokawa, A       | 851                      |
| Khoshouei, M     | 839, 954                | Koike, M          | 555                                    | Kvit, A           | 155                      |
| Khushaim, M      | 520                     | Koistinen, KA     | 240                                    | Kwak, CM          | 741                      |
| Kiely, C         | 373                     | Kollmer, F        | 475                                    | Kwak, J-H         | 286                      |
| Kiely, CJ        | 30                      | Kolmakov, A       | 550, 104, 252, 716                     | Kwon, S           | 136                      |
| Kiely, IJ        | 453                     | Kološová, J       | 60                                     | Kwon, YH          | 780                      |
| Kikuchi, H       | 607                     | Kondo, Y          | 138, 45, 788, 378                      | L'Esperance, G    | 58                       |
| Kikuchi, N       | 67                      | Konomi, M         | 364                                    | La Grange, T      | 832                      |
| Kim, C-S         | 283                     | Konstantinova, T  | 221                                    | la Rosa-García, S | 759                      |
| Kim, D-H         | 729                     | Konvalina, I      | 938                                    | Lacy, DB          | 232                      |
| Kim, D-I         | 939                     | Konyuba, Y        | 787                                    | Lam, T            | 947                      |
| Kim, D-Y         | 117                     | Korman, CE        | 150                                    | Lamanque, N       | 50                       |
| Kim, DH          | 826                     | Kormondy, K       | 943                                    | Lancon, F         | 176                      |
| Kim, HJ          | 515                     | Koroglu, L        | 757                                    | Landucci, F       | 730                      |
| Kim, I-D         | 578, 708, 709, 710, 712 | Kortshagen, UR    | 344                                    | Lane, BA          | 230                      |
| Kim, J           | 729, 205, 1008          | Kosel, J          | 37, 113, 889                           | Lang, AC          | 55                       |
| Kim, J-H         | 969                     | Koshiya, S        | 543                                    | Lang, C           | 465                      |
| Kim, JS          | 61                      | Kosmowka, E       | 677                                    | Laokawee, V       | 102                      |
| Kim, M-D         | 727                     | Kotani, A         | 182, 114                               | Laquerre, A       | 356                      |
| Kim, MJ          | 3                       | Kothleitner, G    | 1032                                   | Larson, DJ        | 476, 369, 805, 658, 1014 |
| Kim, NY          | 96                      | Kotula, PG        | 323, 210                               | Larson, PE        | 548                      |
| Kim, P           | 912                     | Kotwal, N         | 594                                    | Lasalvia, JC      | 758                      |
| Kim, S           | 61, 207, 83             | Kourkoutis, L     | 238, 992                               | Laughlin, GJ      | 604                      |
| Kim, S-J         | 117                     | Kourkoutis, LF    | 282, 662, 20, 120, 589, 691, 912, 1008 | Lautar, A         | 97                       |
| Kim, SJ          | 712                     | Kovarik, L        | 534, 1012, 606, 288, 689               | Lavan, D          | 252, 716                 |
| Kim, SY          | 1030                    | Kozimor, SA       | 844                                    | Lavery, L         | 616, 594                 |
| Kim, Y           | 941                     | Krajnak, M        | 387                                    | Lavery, LL        | 667                      |
| Kimes, K         | 951                     | Kramer, MJ        | 966, 967                               | Lawrence, SK      | 273                      |
| Kimoto, K        | 533, 543                | Krause, FF        | 298, 19                                | Lawrie, B         | 139                      |
| King, A          | 370                     | Kravchenko, M     | 81                                     | Lazar, S          | 544, 609                 |
| King, MB         | 604                     | Krekeler, M       | 454                                    | Lazarov, V        | 653                      |
| Kirk, MA         | 1036                    | Kriewall, CS      | 596                                    | Lazarov, VK       | 110                      |
| Kirkland, A      | 205, 310                | Krishnan, KM      | 118                                    | Lazić, I          | 544, 913                 |
| Kirkland, AI     | 145                     | Krivaneck, OL     | 175, 608                               | Le                | Guillou, C 191           |
| Kisailus, D      | 470                     |                   |                                        | Le, BH            | 656                      |
| Kiselev, AA      | 909                     |                   |                                        | Lead, J           | 403                      |
| Kisielowski, CF  | 421                     |                   |                                        |                   |                          |
| Kiss, G          | 530                     |                   |                                        |                   |                          |

| Name            | Presentation #               | Name                  | Presentation #   | Name                  | Presentation #       |
|-----------------|------------------------------|-----------------------|------------------|-----------------------|----------------------|
| Leapman, RD     | 28, 88, 168                  | Li, X                 | 660, 732         | Lou, J                | 1020                 |
| Leary, R        | 290                          | Li, X-Z               | 111              | Lou, Y                | 573                  |
| Leary, RK       | 1011                         | Li, Y                 | 404, 901, 394    | Loubet, N             | 655                  |
| Lebeau, JM      | 1022, 650, 511, 942          | Li, Z                 | 21, 109          | Lovejoy, TC           | 639                  |
| Lechner, L      | 367                          | Liakakos, N           | 564              | Lozano-Perez, S       | 610                  |
| Lederman, D     | 422                          | Liao, H-G             | 631              | Lu, D                 | 589                  |
| Ledwith, P      | 188                          | Libera, M             | 347, 767         | Lu, J                 | 1005                 |
| Lee, CH         | 227                          | Lichte, H             | 257              | Lu, Q                 | 988                  |
| Lee, D          | 147                          | Lichtenwalner, DJ     | 942              | Lu, W                 | 992                  |
| Lee, G          | 65, 956                      | Lichtman, JW          | 147, 800         | Lubieniecki, J        | 238                  |
| Lee, H          | 753                          | Liebel, A             | 611, 612         | Lubk, A               | 257                  |
| Lee, HN         | 154                          | Lienau, C             | 471              | Ludtke, SJ            | 339                  |
| Lee, IG         | 826                          | Lifshin, E            | 862              | Lugg, N               | 374, 18              |
| Lee, J-A        | 406                          | Lima, EA              | 266              | Luhrs, CC             | 126                  |
| Lee, JH         | 727                          | Lin, J                | 634              | Luna-Islas, MD        | 707                  |
| Lee, JS         | 740                          | Lin, P                | 306              | Luo, F                | 133                  |
| Lee, JY         | 743, 709, 710, 578, 708, 712 | Lin, Q-Y              | 974              | Luo, L                | 579                  |
| Lee, LS         | 198                          | Lin, Y                | 621              | Luo, Z                | 853                  |
| Lee, M          | 947                          | Lin, Z                | 991              | Lupini, A             | 510                  |
| Lee, S-H        | 117                          | Linck, M              | 21, 696          | Lupini, AR            | 8, 154, 634, 156, 36 |
| Lee, SB         | 506                          | Lincoln, J            | 574              | Lutz, G               | 219, 611             |
| Lee, SC         | 318                          | Linden, S             | 541              | Lv, D                 | 142                  |
| Lee, V          | 251                          | Lingerfelt, EJ        | 292, 981         | Lyden, T              | 24                   |
| Lee, Y-K        | 406                          | Lingley, ZR           | 840              | Ma, C                 | 1004                 |
| Lee, YJ         | 233                          | Lins, B               | 86               | Ma, J                 | 1011                 |
| Lee, Z          | 96, 696                      | Liou, S-C             | 684              | Ma, K                 | 662                  |
| Lefebvre, W     | 626                          | Lipinska-Chwalek, M   | 270              | Ma, Y                 | 523, 748             |
| Legrand, A      | 965                          | Lipp, M               | 127              | Mabon, J              | 975                  |
| Leighton, C     | 47, 926                      | Littrell, KC          | 986              | Mace, EL              | 575                  |
| Leite, B        | 440                          | Liu, C                | 832, 506         | Mack, P               | 955                  |
| Leite, MS       | 104                          | Liu, D                | 996              | MacLaren, I           | 331, 427, 215, 387   |
| Lenthe, WC      | 131                          | Liu, F                | 771              | MacManus Driscoll, JL | 590                  |
| Lenz, C         | 856                          | Liu, H                | 887, 570         | MacRae, CM            | 552                  |
| Leonard, D      | 909                          | Liu, J                | 692, 358, 694    | Madabhushi, A         | 159                  |
| Leonardi, D     | 418                          | Liu, L                | 453              | Madden, JW            | 989                  |
| Lercher, JA     | 689                          | Liu, M                | 128              | Magaña, CR            | 99                   |
| Leseman, ZC     | 520                          | Liu, P                | 992, 261         | Magna, V              | 39                   |
| Lesniak, G      | 541                          | Liu, Q                | 900              | Magyar, AP            | 865, 619             |
| Levenson, R     | 157                          | Liu, W                | 360, 774         | Mahalingam, K         | 349                  |
| Levin, B        | 11                           | Liu, X                | 990, 586, 656    | Maiden, AM            | 377                  |
| Levin, N        | 670                          | Liu, Y                | 6, 932, 258, 992 | Maier, J              | 140                  |
| Levine, L       | 830                          | Liu, Z                | 178, 504, 634    | Makarov, A            | 475                  |
| Lewandowski, JJ | 432                          | Livengood, R          | 201              | Maksov, A             | 225, 982             |
| Lewis, SJ       | 617, 845                     | Lo, W-K               | 89               | Maksymovich, P        | 982                  |
| Li, A-P         | 1004                         | Lodowski, DT          | 236              | Maksymovych, P        | 287                  |
| Li, B           | 659                          | Löffler, S            | 35, 298          | Maldonado-Orozco, MC  | 450, 442, 441        |
| Li, C           | 435, 562                     | Logvenov, G           | 545, 140         | Malheiros, LR         | 831                  |
| Li, D           | 984, 435, 455                | Loh, D                | 807              | Malic, B              | 519                  |
| Li, J           | 221, 780, 972                | Longo, P              | 12, 210          | Malik, VK             | 659                  |
| Li, L           | 64                           | Lopatin, S            | 37, 113          | Malloy, M             | 57, 149              |
| Li, Q           | 507, 973                     | López Díaz-De-León, C | 445              | Mamak, M              | 355                  |
| Li, R           | 379                          | Lopez-Haro, M         | 177              | Mancini, GF           | 278, 345             |
| Li, S           | 109                          | López-Meléndez, C     | 762              | Mancini, L            | 626                  |
| Li, W-J         | 24                           | López, CS             | 136              | Mandel, M             | 670                  |
|                 |                              | López, S              | 663              | Mangler, C            | 608                  |
|                 |                              | Lorenz, U             | 521              | Manktelow, J          | 610                  |

| Name                | Presentation #                              | Name               | Presentation #                                            | Name          | Presentation #                              |
|---------------------|---------------------------------------------|--------------------|-----------------------------------------------------------|---------------|---------------------------------------------|
| Mannel, T           | 38                                          | McComb, D          | 825, 428, 169                                             | Meulia, T     | 700                                         |
| Mansfield, E        | 852                                         | McComb, DW         | 43, 105, 646, 1025, 106, 65, 355, 135, 274, 896, 908, 738 | Mevenkamp, N  | 651                                         |
| Mansour, RR         | 956                                         |                    |                                                           | Meyer, DJ     | 724                                         |
| Mao, S              | 1034                                        | McCrabb, H         | 829                                                       | Meyer, JC     | 608                                         |
| Maqableh, MM        | 259                                         | McCulloch, W       | 227                                                       | Meyer, T      | 154                                         |
| March, K            | 980                                         | McCully, M         | 948                                                       | Mi, Z         | 656                                         |
| Marcus, MA          | 189                                         | McDonald, KL       | 244                                                       | Michael, JR   | 302                                         |
| Mareš, P            | 60                                          | McDonald, S        | 667                                                       | Michalička, J | 359                                         |
| Maria, J-P          | 511                                         | McDonald, SM       | 806                                                       | Midgley, P    | 290                                         |
| Maric, R            | 100                                         | McFavilen, H       | 725                                                       | Mielke, J     | 74                                          |
| Mariella, RP        | 126                                         | McGrouther, D      | 387                                                       | Mieritz, D    | 128                                         |
| Marin, M            | 27                                          | McGuire, M         | 287                                                       | Migunov, V    | 10, 378                                     |
| Marko, M            | 842                                         | McGuire, MA        | 36, 202, 1004                                             | Mikmeková, E  | 938                                         |
| Marks, LD           | 621                                         | McIlwrath, KJ      | 207                                                       | Mikmeková, Š  | 938                                         |
| Marova, I           | 92                                          | McIntosh, K        | 844                                                       | Milkie, D     | 94                                          |
| Marquis, EA         | 864, 919, 629                               | McIntosh, S        | 373                                                       | Miller, DJ    | 208, 876, 917, 621                          |
| Marschall, HR       | 329                                         | McKenna, K         | 110                                                       | Miller, J     | 209                                         |
| Marsh, JM           | 355                                         | McKeown, JT        | 832, 323                                                  | Miller, SL    | 600                                         |
| Marsh, M            | 541                                         | McLouth, TD        | 950                                                       | Mills, M      | 142                                         |
| Martin, I           | 369                                         | McMorran, BJ       | 115, 375, 143                                             | Mills, MJ     | 456, 908, 524, 274                          |
| Martínez Sánchez, R | 445, 444                                    | McNeil, J          | 1024                                                      | Mindich, L    | 164                                         |
| Martínez-Sánchez, R | 770, 450, 928, 436, 437, 438, 442, 762, 441 | McSwiggen, P       | 625                                                       | Minnaar, E    | 736                                         |
|                     |                                             | McTigue, D         | 169                                                       | Minor, AM     | 130, 223, 383, 513, 559                     |
| Martínez-Torres, P  | 759                                         | McVitie, S         | 387                                                       | Mintairov, S  | 423                                         |
| Martínez, AI        | 439                                         | Mecartney, ML      | 821                                                       | Mintz, KP     | 85                                          |
| Martinez, G         | 310                                         | Mecklenburg, M     | 726, 934, 1021, 993                                       | Miodownik, M  | 2                                           |
| Martinez, GT        | 146                                         |                    |                                                           | Mirkin, CA    | 974                                         |
| Martone, ME         | 26                                          | Medhekar, NV       | 1031                                                      | Mirsaidov, U  | 810, 878, 807                               |
| Marvel, CJ          | 141, 247                                    | Medina Flores, A   | 777                                                       | Mirzaei, S    | 906                                         |
| Masi, L             | 134                                         | Medina, A          | 776, 759                                                  | Mise, H       | 678                                         |
| Masiel, DJ          | 220, 291                                    | Medlin, DL         | 78                                                        | Miseo, S      | 937                                         |
| Mason, K            | 340                                         | Medling, SA        | 906                                                       | Mishra, A     | 838                                         |
| Mašová, Š           | 401                                         | Medrano-Prieto, HM | 442, 441                                                  | Mishra, RK    | 173                                         |
| Mass, JL            | 11                                          | Meduri, K          | 53                                                        | Mitchell, JF  | 181                                         |
| Mastronarde, D      | 9                                           | Mehnert, K         | 334                                                       | Mitchson, G   | 78                                          |
| Matson, LE          | 753                                         | Meier, DC          | 797                                                       | Miyaki, A     | 361                                         |
| Matsudaira, P       | 807                                         | Mele, L            | 353                                                       | Miyatake, K   | 46                                          |
| Matsudaira, PT      | 878                                         | Melikian, G        | 27                                                        | Mizoguchi, T  | 500, 735                                    |
| Matsumoto, H        | 678                                         | Melville, A        | 737                                                       | Mkhoyan, A    | 930, 747                                    |
| Matsumoto, T        | 224                                         | Melzer, D          | 689                                                       | Mkhoyan, KA   | 697, 1003, 80, 693, 183, 344, 1030, 47, 740 |
| Matsutani, T        | 56                                          | Mendoza-Duarte, J  | 76                                                        |               |                                             |
| Matsuzaki, K        | 110                                         | Meneghesso, G      | 263                                                       | Moch, JG      | 853                                         |
| Matt, M             | 673                                         | Meneghini, M       | 263                                                       | Mock, SA      | 661                                         |
| Mawst, L            | 728                                         | Meng, Q            | 972                                                       | Moellers, R   | 475                                         |
| Maximov, M          | 423                                         | Mengason, MJ       | 855                                                       | Moffitt, C    | 1002                                        |
| May, S              | 156                                         | Menon, SK          | 126                                                       | Moghadam, MM  | 893                                         |
| Mayani, M           | 394                                         | Menon, V           | 313                                                       | Mohan, KA     | 184                                         |
| Mayerich, D         | 702, 388, 903                               | Merkle, A          | 763, 367, 667, 1042, 594                                  | Molina, L     | 782                                         |
| Mayerich, DM        | 688                                         |                    |                                                           | Molina, SA    | 502                                         |
| Maziarz, W          | 951                                         | Merkulov, A        | 476                                                       | Monniger, MK  | 240                                         |
| McAllister, D       | 142                                         | Merrill, DR        | 78                                                        | Mook, WM      | 935, 262, 1041                              |
| McCarthy, C         | 614                                         | Mertens, JC        | 539, 997                                                  | Moon, EJ      | 156                                         |
| McCartney, MR       | 512                                         | Metcalfe, MG       | 404                                                       |               |                                             |
| McClelland, JJ      | 1037                                        | Metzner, S         | 300                                                       |               |                                             |

| Name              | Presentation #                                              | Name                   | Presentation #             | Name               | Presentation #                            |
|-------------------|-------------------------------------------------------------|------------------------|----------------------------|--------------------|-------------------------------------------|
| Moon, K           | 585                                                         | Nagano, T              | 555                        | Nocera, T          | 169                                       |
| Moon, SY          | 729                                                         | Nagoshi, M             | 451                        | Noda, T            | 952                                       |
| Morales C., D     | 772                                                         | Nair, M                | 398                        | Noebe, RD          | 524                                       |
| Morales-Masis, M  | 730                                                         | Naito, H               | 843, 844                   | Noh, Y-K           | 727                                       |
| Moran, K          | 615                                                         | Najafpour, MM          | 31                         | Noked, M           | 506                                       |
| Morazzani, EM     | 240                                                         | Nakafusi, Y            | 703                        | Nokuo, T           | 67                                        |
| More, K           | 328, 32                                                     | Nakajima, H            | 114, 182                   | Nolan, CT          | 84                                        |
| More, KL          | 180, 509,<br>630, 562                                       | Nakamura, A            | 735                        | Nolze, G           | 64                                        |
| Moreno-Moreno, M  | 755                                                         | Nakamura, T            | 546                        | Norby, P           | 254                                       |
| Morgan, D         | 155, 654                                                    | Nakano, K              | 678                        | Norman, MR         | 181                                       |
| Mori, S           | 114, 182, 751                                               | Nakashima, N           | 107, 33                    | Norton, MG         | 577                                       |
| Morimoto, Y       | 390                                                         | Narita, I              | 881                        | Nose, M            | 703                                       |
| Morin, A          | 177                                                         | Narva, KE              | 416                        | Novák, L           | 717, 566                                  |
| Morita, H         | 67                                                          | Nashed, Y              | 279                        | Nowell, MM         | 1015                                      |
| Morita, M         | 46                                                          | Natarajan, B           | 306                        | Nui, C             | 649                                       |
| Moritani, H       | 491                                                         | Natelson, DN           | 1020                       | Nunes, WC          | 453                                       |
| Moriyama, K       | 178                                                         | Nebesaro, V            | 69                         | O'Brien Johnson, G | 53                                        |
| Morrow, R         | 738                                                         | Neděla, V              | 401, 749, 766              | O'Brien, JT        | 1041                                      |
| Moss, SC          | 728                                                         | Nedelkoski, Z          | 653, 110                   | O'Brien, M         | 974                                       |
| Mott, RB          | 218, 59                                                     | Neill, OK              | 794                        | Oberdoester, G     | 231                                       |
| Motta, AT         | 919                                                         | Neilly, J              | 601                        | Oboňa, JV          | 359                                       |
| Mousazadeh, Y     | 31                                                          | Neilly, JP             | 161                        | Ochoa, M           | 778                                       |
| Moutanabbir, O    | 627                                                         | Nellist, P             | 310                        | Odegard, G         | 698                                       |
| Moyer, JA         | 153                                                         | Nellist, PD            | 146, 152,<br>144, 272      | Odlyzko, ML        | 80                                        |
| Moyon, F          | 626                                                         | Nelson, C              | 737                        | Oelsner, A         | 382                                       |
| Mpofu, BS         | 736                                                         | Nemecek, D             | 164                        | Ogrinc Potocnik, N | 549                                       |
| Mücklich, F       | 63                                                          | Nepal, N               | 724                        | Ogut, S            | 911                                       |
| Muecklich, F      | 42                                                          | Neri-Torres, EE        | 125                        | Oh, A              | 652                                       |
| Mueller, KT       | 891                                                         | Nerl, HC               | 976                        | Oh, I-S            | 61                                        |
| Mukai, M          | 1028                                                        | Netherland-Van Dyke, C | 311                        | Oh, J-E            | 727                                       |
| Mukhtar, M        | 57, 149                                                     | Neuman, KC             | 699                        | Ohkura, Y          | 787                                       |
| Müller-Caspary, K | 19                                                          | Newbury, DE            | 479                        | Ohnishi, I         | 46                                        |
| Muller, DA        | 818, 1010, 458,<br>580, 808, 11, 120,<br>153, 178, 213, 691 | Newman, RC             | 666                        | Ohta, S            | 426                                       |
| Müller, H         | 695, 21, 696                                                | Newnbury, DE           | 672                        | Okada, S           | 679                                       |
| Müller, M         | 299                                                         | Ng, A                  | 562                        | Okunishi, E        | 138, 46                                   |
| Müller, P         | 74                                                          | Ngo, T                 | 943, 673                   | Olfat, M           | 956                                       |
| Mulligan, SK      | 315                                                         | Ngo, Y                 | 83                         | Olivier, JE        | 736                                       |
| Mundy, JA         | 153                                                         | Nguessan, CA           | 241                        | Ollander, B        | 169                                       |
| Munjeri, K        | 736, 924                                                    | Nguyen, DN             | 443                        | Oltman, E          | 1014                                      |
| Mura, G           | 263                                                         | Nguyen, KX             | 120, 11, 295,<br>818       | Olvera, M          | 151                                       |
| Muralidharan, K   | 39                                                          | Nguyen, P-K            | 949                        | Ominami, Y         | 363                                       |
| Murano, T         | 555, 856                                                    | Nicholls, RJ           | 582                        | On, K              | 315                                       |
| Muray, LP         | 16                                                          | Nickelsen, J           | 998                        | Ong, P-V           | 591                                       |
| Murphy, T         | 342                                                         | Nicolosi, V            | 976                        | Onler, R           | 514                                       |
| Muto, A           | 303, 361                                                    | Niculae, A             | 219                        | Onn, T             | 685                                       |
| Muto, H           | 607                                                         | Nie, A                 | 698, 718, 882,<br>873, 895 | Oosting, M         | 680                                       |
| Muzyczka, N       | 86                                                          | Niehuis, E             | 620, 475                   | Ophus, C           | 143, 212, 223, 487,<br>144, 273, 176, 222 |
| Myers, A          | 7                                                           | Nielsen, SG            | 329                        | Orai, Y            | 301                                       |
| Myers, BD         | 901                                                         | Niese, S               | 284                        | Orsborn, J         | 65, 447                                   |
| Myers, D          | 107, 33                                                     | Niestadt, M            | 680, 695                   | Ortega-Ramirez, LG | 415                                       |
| Myers, MJ         | 924, 736                                                    | Niitsu, K              | 112                        | Ortega, E          | 259                                       |
| Myers, S          | 1039, 122                                                   | Nishiyama, T           | 451                        | Ortega, JE         | 894                                       |
| Nadtochy, A       | 423                                                         | Nobuchi, T             | 703                        | Ortega, R          | 395                                       |
| Naes, BE          | 362                                                         |                        |                            | Ortmann, E         | 943                                       |
|                   |                                                             |                        |                            | Osadebe, LU        | 404                                       |

| Name                | Presentation #    | Name                         | Presentation #     | Name                | Presentation #             |
|---------------------|-------------------|------------------------------|--------------------|---------------------|----------------------------|
| Osawa, E            | 582               | Paudel, NR                   | 562                | Pinard, PT          | 482                        |
| Osborn, D           | 77                | Paul, MT                     | 108                | Piper, AE           | 240                        |
| Osborn, DC          | 905               | Pauly, C                     | 63                 | Pitek, AS           | 316                        |
| Osuji, C            | 1019              | Pavlisic, A                  | 97                 | Pitters, J          | 489                        |
| Otero-Díaz, LC      | 103               | Pearse, AJ                   | 506                | Pitters, JL         | 491                        |
| Otto, F             | 274               | Peden, CH                    | 286                | Plascencia-Villa, G | 386                        |
| Ovchinnikova, O     | 871               | Pedicini, A                  | 996                | Platek, SF          | 162, 527, 602              |
| Ovchinnikova, OS    | 793, 809          | Peel-Canabal, E              | 850                | Plaza-Castillo, J   | 755                        |
| Ovsyanko, M         | 680               | Pegna, J                     | 4                  | Plemmons, D         | 929                        |
| Oxley, MP           | 634               | Pejchal, T                   | 566                | Plemper, RK         | 87                         |
| Ozakaya, D          | 205               | Pekin, TC                    | 130                | Plitzko, J          | 238                        |
| Ozdoganler, OB      | 514               | Peleg, A                     | 147                | Plitzko, JM         | 953                        |
| Ozdol, B            | 122               | Pellegrini-<br>Cervantes, MD | 438                | Poelzing, S         | 806                        |
| Özdöl, BV           | 559               | Pena, CC                     | 744                | Poepplmeier, KR     | 621                        |
| Ozkaya, D           | 152               | Pence, HE                    | 416                | Pohl, D             | 35                         |
| Pacheco, L          | 706               | Pengtao, C                   | 348                | Poling, W           | 599                        |
| Pacholski, M        | 1006              | Penn, RL                     | 823                | Pollock, TM         | 260, 424, 131              |
| Padgett, E          | 178, 458, 1010    | Pennington, RS               | 309                | Polster, J          | 15                         |
| Padgett, ES         | 153               | Pennycook, SJ                | 583, 562           | Ponath, P           | 512                        |
| Pakzad, A           | 9                 | Pennycook, TJ                | 376, 146           | Ponce, A            | 4, 890, 386, 259           |
| Palenik, CS         | 525               | Perahia, T                   | 1044               | Ponce, FA           | 725                        |
| Palmour, JW         | 942               | Peralta, J                   | 803, 867           | Poozhikunnath, A    | 100                        |
| Pan, X              | 32, 145, 685, 737 | Peralta, OA                  | 782                | Poplawsky, J        | 509, 909                   |
| Panis, G            | 134               | Peralta, P                   | 522                | Poplawsky, JD       | 967, 966                   |
| Panova, O           | 486               | Pereira, N                   | 327                | Popovich, PG        | 135                        |
| Pantelides, S       | 985, 156, 139     | Peres, P                     | 476                | Popratiloff, A      | 150                        |
| Pantelides, ST      | 583, 816          | Pérez-Willard, F             | 356                | Porter, CR          | 278                        |
| Panzenboeck, M      | 186               | Perez, A                     | 99                 | Posadas, A          | 943                        |
| Papesch, CA         | 989               | Pergolizzi, R                | 397                | Postolski, M        | 356                        |
| Paraguay-Delgado, F | 772               | Perlman, E                   | 94                 | Potapov, P          | 382                        |
| Pareddy, D          | 400               | Perovic, D                   | 133                | Potter, CS          | 315                        |
| Parent, KN          | 166               | Perovic, DD                  | 666                | Pouchon, MA         | 822                        |
| Parise, J           | 277               | Perrin, L                    | 204                | Poulter, CP         | 68                         |
| Parish, CM          | 52                | Peterka, T                   | 279                | Pouzoulet, F        | 395                        |
| Park, B-K           | 117               | Peterson, B                  | 142                | Powers, AS          | 631                        |
| Park, BC            | 61                | Petford-Long, A              | 258                | Prakash, A          | 47                         |
| Park, C             | 880, 891          | Petrenec, M                  | 359                | Presley, M          | 129                        |
| Park, C-G           | 870               | Pfaltzgraff, ER              | 575                | Prestat, E          | 285                        |
| Park, CG            | 741               | Pfannmoeller, M              | 206                | Prezado, Y          | 395                        |
| Park, D-Y           | 261               | Pfeffer, S                   | 1000               | Price, J            | 94                         |
| Park, H             | 975               | Pfeif, E                     | 600                | Pritchett, E        | 909                        |
| Park, H-S           | 870               | Pfeifer, P                   | 947                | Pritchett, E        | 509                        |
| Park, J             | 691               | Pfister, H                   | 147                | Prosa, TJ           | 1015, 658, 869             |
| Park, ST            | 220, 291          | Phatak, C                    | 181, 184, 368, 258 | Prozorov, T         | 632                        |
| Park, WK            | 826               | Pheil, M                     | 601                | Przybylowicz, WJ    | 642                        |
| Parker, J           | 205               | Phillips, P                  | 44, 698, 824       | Pu, Y               | 1012                       |
| Parsi, A            | 5                 | Phillips, PJ                 | 508                | Pullan, L           | 534                        |
| Parsons, AD         | 276               | Piao, H                      | 842                | Purohit, P          | 120, 213, 295              |
| Parvaneh, H         | 488               | Picard, YN                   | 101                | Pyczak, F           | 521                        |
| Passarelli, M       | 475               | Pichardo-Molina, J           | 759                | Qi, C               | 764                        |
| Passmore, LA        | 93                | Pierce, D                    | 599                | Qi, Y               | 414                        |
| Pasupathy, AH       | 912               | Pierce, J                    | 143                | Qiao, B             | 573                        |
| Patala, S           | 516               | Pierce, JS                   | 375                | Qiao, J             | 164                        |
| Patel, M            | 821               | Pietron, JJ                  | 49                 | Qu, J               | 987                        |
| Patel, RM           | 187               | Pilapil, BK                  | 108                | Queenan, C          | 397, 407, 408,<br>417, 419 |
| Paterson, GW        | 387               |                              |                    |                     |                            |

| Name                 | Presentation #                    | Name                       | Presentation # | Name                 | Presentation #          |
|----------------------|-----------------------------------|----------------------------|----------------|----------------------|-------------------------|
| Quispe, J            | 315                               | Riendeau, J                | 922            | Ryll, H              | 297                     |
| Quoi, K              | 57, 149                           | Riessen, A                 | 1016           | Sa, N                | 508                     |
| Raabe, D             | 599                               | Righter, K                 | 329            | Sachet, E            | 511                     |
| Rackel, M            | 521                               | Rigutti, L                 | 804            | Sader, K             | 786                     |
| Radecka, A           | 869                               | Rijssenbeek, J             | 277            | Sagar, J             | 610                     |
| Radermacher, M       | 85, 84                            | Rinaldi, A                 | 568, 686       | Saha, I              | 838                     |
| Radetic, T           | 176                               | Ringe, E                   | 899            | Sakamoto, N          | 519                     |
| Rafaelsen, J         | 66                                | Ringnald, J                | 534, 1027      | Sakata, E            | 998                     |
| Rafailovich, M       | 25                                | Ritchie, NW                | 478, 855       | Sakaue, M            | 461                     |
| Rajagopalan, J       | 920, 384, 522                     | Ritz, R                    | 10             | Sakuda, Y            | 625                     |
| Rajan, K             | 868, 803                          | Rivera, J                  | 580, 808       | Sala, B              | 590                     |
| Rajan, S             | 227                               | Roberts, A                 | 1002           | Salamon, M           | 540                     |
| Rakovan, J           | 454                               | Roberts, JC                | 77             | Sales, BC            | 583                     |
| Rakow, JF            | 593                               | Robertson, V               | 625            | Salge, T             | 482                     |
| Ramasse, Q           | 487, 137, 653, 110                | Robinson, CG               | 94             | Salmeron, M          | 564                     |
| Ramasse, QM          | 977, 591, 272, 473                | Robinson, DB               | 351            | Salmon, NJ           | 883                     |
| Ramesh, R            | 213                               | Robles-Hernandez, FC       | 769, 420       | Salomons, M          | 489                     |
| Ramirez, AJ          | 447, 65                           | Röder, F                   | 119            | Salvador, PA         | 101                     |
| Ramuhalli, P         | 835                               | Rodríguez-González, CA     | 436, 444, 445  | Salzberger, U        | 71, 140                 |
| Rangnekar, N         | 930                               | Roess, AA                  | 404            | Samanta, A           | 236                     |
| Ranieri, N           | 162                               | Rojac, T                   | 519            | Samarth, N           | 740                     |
| Rasche, M            | 150                               | Roldan, MA                 | 898            | Samek, O             | 92                      |
| Rasouli, S           | 33, 107, 964                      | Rolison, DR                | 49             | Sanabia, JE          | 150                     |
| Rast, A              | 998                               | Romer, CE                  | 311            | Sanchez Morales, A   | 706                     |
| Rau, C               | 276                               | Romero, AI                 | 701            | Sanchez-Luna, NA     | 707                     |
| Ray, M               | 463                               | Romero, SM                 | 701            | Sanchez-Sanchez, M   | 689                     |
| Reboh, S             | 655                               | Romo, SA                   | 65             | Sánchez-Santolino, G | 224                     |
| Reddy, SM            | 1016                              | Romstedt, J                | 38             | Sánchez-Viveros, G   | 415                     |
| Redwing, JM          | 933                               | Rondinone, AJ              | 809, 202       | Sanchez, JE          | 890                     |
| Reed, BW             | 832                               | Rooyen, IJ                 | 916            | Sanchez, SI          | 635                     |
| Reedy, MK            | 29                                | Rose, H                    | 21             | Sandu, A             | 462                     |
| Reedy, OL            | 753                               | Rosenauer, A               | 19, 298        | Sandu, AM            | 14                      |
| Regan, BC            | 472, 719, 726, 888, 934, 422, 993 | Rosenbloom, SN             | 185            | Sang, X              | 154, 226, 649, 630, 210 |
| Reichmanis, E        | 780                               | Rosenkranz, R              | 284            | Sanli, UT            | 346                     |
| Reifsnyder Hickey, D | 183                               | Ross, A                    | 215            | Santala, MK          | 587                     |
| Reinhard, D          | 805                               | Ross, FM                   | 945            | Santi, C             | 263                     |
| Rellinghaus, B       | 35                                | Rossouw, D                 | 570            | Santiago, U          | 386, 894                |
| Remusat, L           | 191                               | Roth, E                    | 901, 308       | Saraf, L             | 734                     |
| Ren, L               | 747                               | Roth, J                    | 161, 601       | Sarafian, E          | 329                     |
| Ren, Y               | 13                                | Rothenberg, E              | 503            | Sarahan, M           | 1011                    |
| Renaud, L            | 1014                              | Roudeau, S                 | 204, 395       | Sarakonsri, T        | 102                     |
| Rensing, KH          | 193                               | Roussie, J                 | 48             | Sarwar, AG           | 824                     |
| Rentenberger, C      | 920, 384                          | Rouvimov, S                | 423, 586       | Sasai, H             | 555                     |
| Reyes Rojas, A       | 756                               | Roy, P                     | 999            | Sasajima, M          | 361                     |
| Reyes-Rojas, A       | 772                               | Rubloff, GW                | 506            | Sasaki, H            | 746                     |
| Reyes-Ronquillo, JL  | 762                               | Rucavado, E                | 730            | Sasaki, T            | 46                      |
| Reyes-Santiago, J    | 707                               | Ruiz-Esparza-Rodríguez, MA | 442, 441       | Savage, T            | 127, 905                |
| Reynolds, M          | 666                               | Ruiz, T                    | 84, 85         | Savenko, A           | 350                     |
| Reynolds, RK         | 405                               | Rupp, J                    | 723            | Savitzky, B          | 691                     |
| Rez, P               | 978, 900                          | Rupp, JL                   | 979, 381       | Savitzky, BH         | 20, 992                 |
| Rhoads, B            | 209                               | Russo, CJ                  | 93             | Sawada, H            | 1028, 46, 224           |
| Richter, S           | 482                               | Rusz, J                    | 36, 35         | Sawatzki, J          | 957                     |
| Rickert, R           | 200                               | Rutte, RN                  | 376, 146       | Saxey, DW            | 1016                    |
| Ridgway, MC          | 906                               | Rykaczewski, K             | 128            | Schalek, R           | 800                     |
|                      |                                   |                            |                | Schalek, RL          | 147                     |

| Name               | Presentation # | Name                 | Presentation #                     | Name            | Presentation #                   |
|--------------------|----------------|----------------------|------------------------------------|-----------------|----------------------------------|
| Schamp, CT         | 76             | Shahbazian Yassar, R | 877                                | Skrotzki, B     | 425                              |
| Schamp, T          | 301            | Shahbazian-Yassar, R | 396, 718, 873, 882, 895, 698, 1005 | Slater, T       | 652                              |
| Schattschneider, P | 35             |                      |                                    | Slusallek, P    | 705, 1009, 63                    |
| Scheltens, FJ      | 106, 896       | Shakesheff, KM       | 357                                | Smath, L        | 199                              |
| Scheres, SH        | 239            | Shan, Z              | 687                                | Smith, DJ       | 72, 731, 990, 453, 941, 512, 724 |
| Schiebertová, P    | 402            | Shanblatt, ER        | 345, 278                           |                 |                                  |
| Schlenker, J       | 463            | Shangguan, J         | 567                                | Smith, TM       | 908                              |
| Schlingmann, B     | 502            | Shapiro, D           | 251                                | Smith, ZD       | 539                              |
| Schloegl, R        | 686            | Sharang, S           | 682                                | Smulders, J     | 340                              |
| Schlögl, R         | 568            | Sharma, R            | 690, 733, 923                      | Smyth, JW       | 501                              |
| Schlom, D          | 737            | Sharon-Frilling, R   | 233                                | Sneed, BT       | 179, 180                         |
| Schlom, DG         | 153            | Sharp, ID            | 498                                | Sobolewski, A   | 435, 455                         |
| Schmid, M          | 219            | Shearing, P          | 326                                | Solanki, KN     | 128                              |
| Schmidt, G         | 299            | Sheng, H             | 621, 876                           | Soled, SL       | 937                              |
| Schmidt, J         | 538, 537       | Sheng, Z             | 237                                | Soles, CL       | 1037, 506                        |
| Schmied, R         | 38             | Sheppard, L          | 470                                | Soleymani, L    | 633                              |
| Schmitz, B         | 192            | Shibata, M           | 364, 703                           | Solomon, CV     | 949                              |
| Schneider, MM      | 248            | Shibata, N           | 735, 18, 98, 1032, 374             | Solórzano, G    | 453                              |
| Schneider, SG      | 35             |                      |                                    | Solorzano, G    | 721                              |
| Schneiter, JL      | 4              | Shichi, H            | 490                                | Solórzano, IG   | 452, 449                         |
| Schock, K          | 1017           | Shield, JE           | 111                                | Soltau, H       | 10, 297, 219, 538, 611, 612, 376 |
| Schoenfeld, WV     | 739            | Shigeyuki, M         | 814                                |                 |                                  |
| Schönherr, P       | 588            | Shim, I-B            | 117                                | Somerday, B     | 273                              |
| Schöning, A        | 612            | Shimaoka, Y          | 746                                | Son, J-I        | 117                              |
| Schowalter, M      | 298            | Shin, CS             | 826                                | Soni, V         | 968                              |
| Schrad, JR         | 166            | Shin, K              | 446                                | Sood, S         | 883                              |
| Schreiber, DK      | 970            | Shindo, D            | 112                                | Soplop, NH      | 90                               |
| Schroeder, MA      | 506            | Shiojiri, M          | 102, 703                           | Sosa, J         | 428, 778, 599                    |
| Schroers, J        | 1019           | Shirai, M            | 678                                | Sosa, JM        | 524                              |
| Schubbe, JJ        | 598            | Shirazi Amin, A      | 31                                 | Sousa, AA       | 168                              |
| Schultheiss, H     | 119            | Shiu, HW             | 251                                | Spallas, JP     | 16                               |
| Schultz, JA        | 948            | Shobukawa, H         | 648                                | Spanier, J      | 510                              |
| Schultz, L         | 35             | Shoji, M             | 363                                | Specht, P       | 498                              |
| Schulze, T         | 789            | Shokuhfar, T         | 874, 877, 396, 873                 | Speir, JA       | 315                              |
| Schumacher, J      | 391            |                      |                                    | Spiegelberg, J  | 36                               |
| Schundelmeier, J   | 1001, 789      | Shvartsman, VV       | 292                                | Spori, C        | 730                              |
| Schutsky, E        | 394            | Sigle, W             | 140, 517, 19, 71, 545              | Sprouster, DJ   | 906                              |
| Schütz, G          | 346            |                      |                                    | Sridharan, K    | 986                              |
| Schwarzerová, K    | 402            | Šikola, T            | 566                                | Srot, V         | 752                              |
| Schweiger, S       | 381            | Sikula, M            | 682                                | Stach, E        | 647, 972                         |
| Scott, K           | 7              | Simingalam, S        | 731                                | Stach, EA       | 76                               |
| Scott, R           | 922            | Simmons, JP          | 798, 907                           | Stadler, BJ     | 259                              |
| Sediva, E          | 723, 979       | Simon, M             | 25                                 | Stambula, S     | 570                              |
| Sefat, A           | 982            | Simpson, M           | 297                                | Standke, Y      | 284                              |
| Seidman, DN        | 627, 628, 869  | Simson, M            | 10, 376, 146                       | Stannard, T     | 539                              |
| Seki, T            | 374, 224       | Sin, L               | 783                                | Starek, J       | 353                              |
| Selcu, C           | 824            | Sin, Y               | 728                                | Stárek, J       | 717                              |
| Sellmyer, DJ       | 111            | Sina, M              | 648                                | Stark, A        | 521                              |
| Semisalova, A      | 119            | Sing, K              | 394                                | Statham, P      | 614, 613, 465                    |
| Sen, F             | 585            | Sioui-Latulippe, O   | 58                                 | Staufer, D      | 262                              |
| Seo, D-            | 128            | Sivalingham, S       | 585                                | Steigenhöfer, D | 538                              |
| Seo, HK            | 712            | Sjollema, KA         | 132                                | Steinbach, A    | 541                              |
| Seol, JB           | 741            | Skalický, J          | 536                                | Steiner, D      | 540                              |
| Serpe, S           | 996            | Skomski, R           | 111                                | Steingart, DA   | 945                              |
| Setten, LM         | 701            | Skoupy, R            | 69, 783                            | Steinmetz, D    | 360                              |
| Seyhan, TA         | 768            |                      |                                    |                 |                                  |

| Name            | Presentation # | Name               | Presentation #         | Name                | Presentation # |
|-----------------|----------------|--------------------|------------------------|---------------------|----------------|
| Steinmetz, NF   | 316            | Taheri, ML         | 55                     | Tomioka, Y          | 112            |
| Stephens, C     | 955            | Takagaki, T        | 754                    | Tomita, M           | 56             |
| Stevanovic, A   | 716            | Takagi, O          | 371                    | Tompsett, D         | 1005           |
| Steven, AC      | 164            | Takahashi, H       | 67, 555, 856, 553, 847 | Torkar, K           | 38             |
| Stevens, A      | 1011           | Takakura, M        | 555, 67, 847           | Torpy, A            | 553, 856       |
| Stevie, FA      | 6              | Takamura, Y        | 659                    | Torrens, O          | 94             |
| Stewart, PL     | 316            | Takaura, M         | 856                    | Torres Figueredo, N | 125            |
| Stinville, J-C  | 260            | Takeuchi, S        | 361                    | Torres, PG          | 777            |
| Stone, GA       | 228            | Talebi, N          | 471                    | Tóth, F             | 391            |
| Storm, DF       | 724            | Talin, AA          | 104                    | Trail, D            | 40             |
| Storms, RE      | 134, 167       | Tamai, T           | 788                    | Trampert, P         | 63             |
| Strader, T      | 389            | Tamura, N          | 189                    | Tratnyek, PG        | 53             |
| Strathearn, D   | 956            | Tan, EL            | 342                    | Treacy, J           | 955            |
| Straton, JC     | 857            | Tan, G             | 429                    | Trevor, C           | 55             |
| Strauss, JD     | 87, 167        | Tan, H             | 17                     | Trigg, EB           | 486            |
| Straw, M        | 131            | Tan, SY            | 416                    | Trompenaars, PH     | 62             |
| Strittmatter, A | 300            | Tang-Siegel, G     | 85                     | Troy, T             | 288            |
| Strodahs, A     | 290            | Tang, W            | 967, 966               | Trudeau, M          | 253            |
| Stroud, R       | 268, 828       | Tanigaki, T        | 112                    | Tsakiridis, P       | 668            |
| Stroud, RM      | 190, 49        | Taniguchi, S-I     | 790                    | Tsapatsis, M        | 930, 747       |
| Strüder, L      | 611, 612       | Taniguchi, Y       | 607                    | Tselev, A           | 202            |
| Strueder, L     | 538            | Tanji, T           | 296                    | Tsen, A             | 992            |
| Štrus, J        | 752            | Tanksalvala, MD    | 345                    | Tsen, AW            | 912            |
| Su, D           | 327, 76, 972   | Tao, J             | 221                    | Tsujikawa, H        | 461            |
| Subramanian, H  | 365            | Tapia-Padilla, G   | 772                    | Tsukasaki, H        | 751            |
| Suenaga, K      | 1028           | Taplin, DJ         | 1031                   | Tu, W               | 567            |
| Suganuma, K     | 881            | Tarte, L           | 842                    | Tucker, J           | 995            |
| Sugar, JD       | 351            | Tate, MW           | 295, 120, 213          | Tüma, L             | 536, 14        |
| Sugawara, A     | 112            | Taylor, DW         | 29                     | Turan, S            | 757, 768, 761  |
| Suh, J          | 513            | Taylor, KA         | 29                     | Turchi, AM          | 416            |
| Suib, SL        | 595, 31        | te Velthuis, SG    | 181                    | Turgut, E           | 120            |
| Sukotjo, C      | 873            | Teeman, E          | 118                    | Turner, JA          | 835            |
| Sumpter, BG     | 981            | Teng, F            | 767                    | Turner, S           | 206            |
| Sun, C          | 585            | Terauchi, M        | 625                    | Tveit, ES           | 11             |
| Sun, F          | 372            | Terborg, R         | 171                    | Twedt, KA           | 1037           |
| Sun, K          | 774, 664       | Terbush, JR        | 775                    | Twesten, R          | 55             |
| Sun, L          | 372            | Terrani, KA        | 52                     | Twesten, RD         | 12             |
| Sun, MG         | 241, 240       | Terrones, M        | 991                    | Tybell, T           | 215            |
| Sun, Y          | 992            | Thackeray, MM      | 973                    | Tyliszczak, T       | 251            |
| Sunaoshi, T     | 361, 679       | Thaler, M          | 535                    | Uchiyama, T         | 305            |
| Sung, JJ        | 315            | Thamm, C           | 537                    | Uhlemann, S         | 695            |
| Susaki, T       | 110            | Thibault, P        | 276                    | Uhlmann, N          | 540            |
| Sushko, PV      | 689, 591       | Thiel, B           | 149, 57                | Um, S-M             | 406            |
| Susner, M       | 287            | Thomas, MG         | 11                     | Unocic, R           | 871            |
| Susner, MA      | 202            | Thomsen, K         | 334                    | Unocic, RR          | 154, 226, 809  |
| Sutto, TE       | 828            | Thota, S           | 885                    | Urban, R            | 489            |
| Suvorova, AA    | 302            | Thron, AM          | 927                    | Uriza-Vega, E       | 762            |
| Suyolcu, YE     | 71             | Thygesen, K        | 976                    | Urones-Garrote, E   | 103            |
| Suzuki, M       | 45             | Tiemeijer, P       | 1027                   | Ursic, H            | 519            |
| Swearer, DF     | 899            | Tihlaříková, E     | 402                    | Uryu, K             | 90             |
| Swenson, MJ     | 1033           | Timoshevskii, V    | 613, 552               | Uusimäki, T         | 74             |
| Symons, C       | 981            | Titus, MS          | 131                    | Vaaler, EG          | 4              |
| Symons, CT      | 36, 294        | Tokura, Y          | 112                    | Vachhani, SJ        | 935            |
| Szanyi, J       | 286            | Toledo-Antonio, JA | 765                    | Vaia, RA            | 836            |
| Szleifer, I     | 365            | Toman, J           | 951                    | Valle-Martinez, M   | 784            |
| Tague, TJ       | 957            |                    |                        | Van Aert, S         | 152            |

| Name                | Presentation #          | Name           | Presentation #              | Name            | Presentation #               |
|---------------------|-------------------------|----------------|-----------------------------|-----------------|------------------------------|
| Vandecreme, A       | 961                     | Wang, D        | 255, 713                    | Williams, J     | 997                          |
| Vanzi, M            | 263                     | Wang, F        | 484                         | Williams, JJ    | 539                          |
| Varadé-López, R     | 750                     | Wang, F        | 988, 309                    | Williams, KL    | 4                            |
| Varambhia, A        | 152                     | Wang, H        | 109                         | Williams, RE    | 355, 430, 669, 106, 908, 738 |
| Vargas-Ortiz, RA    | 438                     | Wang, J        | 3, 208                      | Willinger, M-G  | 568                          |
| Vašina, R           | 14                      | Wang, K        | 228, 933, 991               | Willingham, D   | 362                          |
| Vasudevan, RK       | 981                     | Wang, L        | 455, 917, 621, 435          | Wilson, A       | 800                          |
| Vatsavai, RR        | 36                      | Wang, LP       | 128                         | Wilson, B       | 975                          |
| Veit, P             | 299                     | Wang, M-Y      | 111                         | Wilson, N       | 553                          |
| Velazquez, E        | 706                     | Wang, P        | 145                         | Wilson, NC      | 856, 552                     |
| Velez, M            | 829                     | Wang, Q        | 3, 523                      | Winey, KI       | 486                          |
| Velmurugan, J       | 252, 550                | Wang, RY       | 128                         | Winterstein, JP | 690, 733, 923                |
| Venkatakrishnan, SV | 798, 907                | Wang, S        | 504, 725                    | Winther, K      | 976                          |
| Vera, EE            | 439                     | Wang, W        | 183                         | Winton, CE      | 237                          |
| Verghese, P         | 188                     | Wang, X        | 379, 221                    | Wirix, M        | 609                          |
| Verleysen, E        | 74                      | Wang, Y        | 71, 140, 545, 991, 902, 142 | Wirtz, T        | 289                          |
| Verma, V            | 388                     | Wang, Z        | 643, 584                    | Wisner, CA      | 775                          |
| Veron, M            | 558                     | Wang, Z-J      | 686                         | Withers, P      | 354, 667                     |
| Vesseur, EJ         | 14                      | Wang, ZL       | 914                         | Withers, PJ     | 892, 135                     |
| Vicenzi, EP         | 795                     | Ward, TZ       | 154                         | Witkin, DB      | 950                          |
| Villarrubia, J      | 303                     | Washton, N     | 286                         | Wittig, JE      | 270                          |
| Vinci, RP           | 427                     | Watanabe, K    | 607                         | Wojcik, A       | 951                          |
| Vine, D             | 279                     | Watanabe, M    | 452, 427                    | Wolf, M         | 952                          |
| Vinogradoff, V      | 191                     | Waters, KE     | 469                         | Wolf, S         | 925                          |
| Viollier, PH        | 134                     | Watson, A      | 85                          | Wolkow, R       | 489                          |
| Visart de Bocarmé   | 827, 959                | Wayama, M      | 678                         | Wolkow, RA      | 491                          |
| Vishwanath, S       | 586                     | Weber, K       | 739                         | Wolters, AG     | 132                          |
| Vizcaíno, KY        | 755                     | Weber, U       | 219                         | Wolverton, C    | 887                          |
| Vladar, AE          | 303                     | Weber, WJ      | 898                         | Wolverton, CM   | 429, 973                     |
| Voelkl, E           | 879, 301                | Wedekind, S    | 905                         | Wong, ASW       | 953                          |
| Vogelgesang, R      | 471                     | Wehmer, M      | 998                         | Wong, D         | 995                          |
| Vogirala, VK        | 953                     | Wei, M         | 748                         | Wong, L         | 576                          |
| von Borany, J       | 492                     | Weiss, BP      | 266                         | Woo, P          | 133                          |
| Vondrák, J          | 717                     | Welch, DA      | 880                         | Woo, SY         | 656                          |
| Voorhees, PW        | 893                     | Welk, BA       | 859                         | Wood, S         | 1005                         |
| Vora, NM            | 404                     | Wellmerling, J | 82                          | Woodcraft, VA   | 861                          |
| Voyles, P           | 155, 654, 652           | Wells, NP      | 728                         | Woodward, PM    | 738                          |
| Voyles, PM          | 483                     | Welsch, S      | 786                         | Wright, ER      | 87, 27, 167, 134             |
| Vurpillot, F        | 804, 626                | Wen, C         | 72                          | Wright, S       | 1015                         |
| Vystavel, T         | 353                     | Wen, J         | 208, 876, 917               | Wu, J           | 251, 664, 975, 513, 887, 507 |
| Vystavěl, T         | 717, 566                | Westphal, AJ   | 189                         | Wu, L           | 221                          |
| Wadron, A           | 407                     | Weyland, M     | 214                         | Wu, RJ          | 80, 740                      |
| Wagner, JB          | 645                     | Wharry, JP     | 863                         | Wu, X           | 488                          |
| Wagner, K           | 119                     | Whetten, RL    | 386                         | Wu, Y           | 1033, 227                    |
| Wagner, UH          | 276                     | White, RM      | 852                         | Wu, Z           | 32, 621                      |
| Waldon, S           | 458                     | Whitham, K     | 20                          | Wuhrer, R       | 467, 342, 470                |
| Waldron, A          | 418, 397, 408, 417, 419 | Whittingham, S | 647                         | Xiang, B        | 713                          |
| Walker, G           | 792                     | Wiegmann, A    | 541                         | Xiao, X         | 997, 539                     |
| Wall, M             | 343                     | Wiesner, U     | 662                         | Xie, D          | 687                          |
| Wallace, CM         | 823                     | Wiggins, MB    | 11                          | Xie, DY         | 722, 771                     |
| Walsh, M            | 388                     | Wiktor, C      | 570                         | Xie, S          | 691                          |
| Walter, J           | 926                     | Wilkins, K     | 404                         | Xie, Y          | 1019                         |
| Wan, H              | 884                     | Wille, G       | 369                         | Xin, H          | 780                          |
| Wandrol, P          | 14, 462                 | Willett, R     | 652                         | Xin, HL         | 17, 495                      |
| Wang, C             | 82, 505, 773, 231,      | Williams, DB   | 172                         |                 |                              |

| Name             | Presentation #                          | Name           | Presentation #                | Name          | Presentation #           |
|------------------|-----------------------------------------|----------------|-------------------------------|---------------|--------------------------|
| Xinai, Z         | 348                                     | Yotsuji, T     | 607                           | Zhou, C       | 207                      |
| Xing, HG         | 586                                     | Young, R       | 536                           | Zhou, D       | 19                       |
| Xing, L          | 83                                      | Yu, J-J        | 361                           | Zhou, F       | 732                      |
| Xing, Y          | 449                                     | Yu, K          | 33, 964                       | Zhou, G       | 690, 733, 923, 647       |
| Xu, J            | 573                                     | Yu, T-M        | 590                           | Zhou, L       | 966                      |
| Xu, W            | 942, 891, 372                           | Yu, X          | 112                           | Zhou, P       | 1020                     |
| Xu, X            | 792                                     | Yu, Y          | 580, 808                      | Zhou, W       | 225, 816, 985, 771       |
| Xu, Y            | 1004                                    | Yuan, RL       | 493                           | Zhou, Y       | 742                      |
| Xue, F           | 737                                     | Yuan, Y        | 895, 718                      | Zhou, Z       | 258                      |
| Yadav, AK        | 213                                     | Yücelen, E     | 609                           | Zhou, ZH      | 236                      |
| Yaguchi, T       | 678                                     | Yulaev, A      | 104                           | Zhu, G-Z      | 722                      |
| Yakal-Kremski, K | 504                                     | Yun, H         | 47                            | Zhu, J        | 122, 1039                |
| Yamakawa, I      | 790                                     | Yun, W         | 845                           | Zhu, P        | 221                      |
| Yamamoto, Y      | 67, 625, 986                            | Zachariah, MR  | 684                           | Zhu, W        | 306                      |
| Yamaoka, T       | 361, 461                                | Zaghi, Z       | 1011                          | Zhu, Y        | 698, 1031, 17, 972       |
| Yamashita, T     | 655                                     | Zaghib, K      | 253, 552, 613                 | Zhu, Z        | 288                      |
| Yamazaki, K      | 745                                     | Zajicová, I    | 402                           | Zhukov, A     | 423                      |
| Yan, J           | 583                                     | Zak Fang, Z    | 207                           | Ziatdinov, M  | 910                      |
| Yan, L           | 486                                     | Zakharov, DN   | 780                           | Zickermann, V | 84                       |
| Yan, M           | 101                                     | Zaluzec, NJ    | 48, 872, 285                  | Zlotnick, A   | 198                      |
| Yan, P           | 255                                     | Zanaga, D      | 206                           | Zuckermann, R | 781                      |
| Yan, Y           | 562                                     | Zanella, R     | 571                           | Zugic, B      | 619                      |
| Yang, F          | 524, 908, 738, 824                      | Zanoni, E      | 263                           | Zuo, J-M      | 380, 557, 683, 1038, 975 |
| Yang, H          | 144, 146, 272, 310, 606, 143, 1012, 975 | Zanuttini, D   | 804                           | Zuo, JM       | 493                      |
| Yang, J          | 633, 498                                | Zavattieri, PD | 470                           | Zutter, B     | 472, 888, 1021           |
| Yang, JC         | 75, 564, 884, 76                        | Zbaeren, C     | 754                           | Zweiacker, K  | 832                      |
| Yang, X          | 739                                     | Zega, TJ       | 39, 269                       |               |                          |
| Yang, Y          | 567                                     | Zeidler, D     | 148                           |               |                          |
| Yankovich, A     | 652                                     | Zell, E        | 661                           |               |                          |
| Yano, KH         | 1033                                    | Zemanek, P     | 92                            |               |                          |
| Yao, J           | 288                                     | Zhang, C       | 155, 654                      |               |                          |
| Yao, N           | 940                                     | Zhang, D       | 308                           |               |                          |
| Yao, W           | 882, 1005                               | Zhang, F       | 145                           |               |                          |
| Yao, Z           | 887, 973                                | Zhang, G       | 28                            |               |                          |
| Yasenjiang, Z    | 679                                     | Zhang, H       | 12, 930                       |               |                          |
| Yassar, RS       | 874                                     | Zhang, J       | 999, 372, 891                 |               |                          |
| Yasuda, R        | 364                                     | Zhang, K       | 790                           |               |                          |
| Ye, PD           | 828                                     | Zhang, L       | 25, 565                       |               |                          |
| Ye, T            | 643                                     | Zhang, P       | 483                           |               |                          |
| Yen, T           | 24                                      | Zhang, R       | 122                           |               |                          |
| Yeung, D         | 82                                      | Zhang, S       | 181, 496, 650                 |               |                          |
| Yi, A-C          | 771                                     | Zhang, T       | 271                           |               |                          |
| Yi, F            | 252, 716                                | Zhang, X       | 108, 687, 927, 1004, 747, 278 |               |                          |
| Yi, JC           | 699                                     | Zhang, Y       | 985, 1039, 122, 667           |               |                          |
| Yin, D           | 141                                     | Zhao, B        | 713                           |               |                          |
| Yin, Y           | 503                                     | Zhao, J        | 885                           |               |                          |
| Yokoi, T         | 98                                      | Zhao, S        | 656                           |               |                          |
| Yoreo, JJ        | 584                                     | Zhao, WW       | 54                            |               |                          |
| Yoshida, H       | 305                                     | Zheng, C       | 214                           |               |                          |
| Yoshida, T       | 390                                     | Zheng, H       | 878, 181                      |               |                          |
| Yoshihara, M     | 363                                     | Zheng, Y       | 109                           |               |                          |
| Yoshimoto, W     | 751                                     | Zheng, Z       | 94                            |               |                          |
| Yoshiya, M       | 98                                      | Zhiwei, S      | 348                           |               |                          |
| Yost, MJ         | 230, 1044                               | Zhong, H       | 277                           |               |                          |

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## **Stefan Mayer Instruments #407**

Mr. Stefan Mayer  
Wallstr. 7  
Dinslaken 46535  
Germany  
Phone: 49 2064 479762  
Fax: 49 2064 479763  
Email: mail@stefan-mayer.com  
www.stefan-mayer.com

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**The Ohio State University - Center for Electron Microscopy and Analysis (CEMAS) #1219**

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www.evactron.com

## **YXLON**

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# Product & Services Index

## Accessories (miscellaneous)

|                               |      |
|-------------------------------|------|
| IDES, Inc.                    | 2002 |
| iLab Solutions                | 1820 |
| Microscopy Innovations, LLC   | 1205 |
| Synergy Systems Corporation   | 1920 |
| Technotrade International Inc | 1603 |
| Thorlabs                      | 1824 |
| Tousimis                      | 909  |

## AFM / STM Accessories

|                                 |      |
|---------------------------------|------|
| aBeam Technologies, Inc.        | 1605 |
| Bruker Corporation              | 1602 |
| Herzan LLC                      | 1106 |
| Integrated Dynamics Engineering | 613  |
| JPK Instruments AG              | 520  |
| Nanosurf, Inc                   | 1918 |
| NT-MDT America, Inc.            | 2004 |
| Oxford Instruments              | 714  |
| Park Systems Inc                | 1226 |
| Renishaw Inc                    | 304  |

## Anti-Contamination Systems

|                     |     |
|---------------------|-----|
| ibss Group, Inc.    | 514 |
| PIE Scientific, LLC | 419 |

## Atom Probe

|                          |      |
|--------------------------|------|
| CAMECA Instruments, Inc. | 1114 |
|--------------------------|------|

## Atomic Force Microscopes

|                                         |      |
|-----------------------------------------|------|
| Angstrom Scientific, Inc.               | 513  |
| Bruker Corporation                      | 1602 |
| Digital Surf                            | 1223 |
| Hitachi High Technologies America, Inc. | 1801 |
| JPK Instruments AG                      | 520  |
| Keysight Technologies                   | 1718 |
| Kleindiek Nanotechnik                   | 515  |
| Nanosurf, Inc                           | 1918 |
| NT-MDT America, Inc.                    | 2004 |
| Park Systems Inc                        | 1226 |
| WITec Instruments Corp.                 | 417  |

## Auger Microscopes

|                      |      |
|----------------------|------|
| Physical Electronics | 1916 |
|----------------------|------|

## Backscatter Detectors

|                 |      |
|-----------------|------|
| Coxem Co., Ltd  | 416  |
| Evex Global LLC | 1102 |
| PNDetector GmbH | 1823 |
| PulseTor LLC    | 401  |

## Books

|                             |      |
|-----------------------------|------|
| Royal Microscopical Society | 615  |
| Springer                    | 1207 |

## Calibration and Reference Standards / Reference Materials

|                                                                            |      |
|----------------------------------------------------------------------------|------|
| aBeam Technologies, Inc.                                                   | 1605 |
| IfG - Institute for Scientific Instruments GmbH / Fischer Technology, Inc. | 314  |
| SPI Supplies                                                               | 1201 |

## Camera / Digital Camera Systems - CDC, CMOS, Megapixel

|                                             |      |
|---------------------------------------------|------|
| Advanced Microscopy Techniques Corp.        | 1601 |
| Aven, Inc.                                  | 302  |
| Carl Zeiss Microscopy, LLC                  | 902  |
| Direct Electron, LP                         | 614  |
| Gatan, Inc.                                 | 702  |
| Keyence Corporation of America              | 1902 |
| Scientific Instruments & Applications, Inc. | 1224 |
| Seiwa Optical America, Inc.                 | 1917 |
| Thorlabs                                    | 1824 |
| TVIPS GmbH                                  | 1624 |

## Cold Sputtering Equipment

|                                     |      |
|-------------------------------------|------|
| Leica Microsystems                  | 1302 |
| Quorum/Electron Microscopy Sciences | 1814 |

## Confocal Microscopes

|                                |      |
|--------------------------------|------|
| Carl Zeiss Microscopy, LLC     | 902  |
| Digital Surf                   | 1223 |
| Keyence Corporation of America | 1902 |
| Leica Microsystems             | 1302 |
| NanoFocus AG                   | 2007 |
| NT-MDT America, Inc.           | 2004 |
| Renishaw Inc                   | 304  |

## Consulting

|                               |      |
|-------------------------------|------|
| Objects Research Systems      | 1908 |
| SPI Supplies                  | 1202 |
| Synergy Systems Corporation   | 1920 |
| Vitatech Electromagnetics LLC | 407  |

# Product & Services Index *continued*

## Courses / Workshops

|                              |      |
|------------------------------|------|
| Electron Microscopy Sciences | 1813 |
| RMC-Boeckeler                | 524  |
| Royal Microscopical Society  | 615  |

## Critical Point Dryers

|                                     |      |
|-------------------------------------|------|
| Quorum/Electron Microscopy Sciences | 1814 |
| Tousimis                            | 909  |

## Cryoequipment

|                                                                                 |      |
|---------------------------------------------------------------------------------|------|
| E. A. Fischione Instruments, Inc.                                               | 1614 |
| Quorum/Electron Microscopy Sciences                                             | 1814 |
| Synergy Systems Corporation                                                     | 1920 |
| The Ohio State University - Center for Electron Microscopy and Analysis (CEMAS) | 1219 |

## Crystallographic Mapping

|               |      |
|---------------|------|
| EDAX/Ametek   | 1114 |
| NanoMEGAS USA | 1124 |

## Databases

|                                                  |      |
|--------------------------------------------------|------|
| International Centre for Diffraction Data (ICDD) | 1714 |
|--------------------------------------------------|------|

## Detectors

|                     |      |
|---------------------|------|
| Bruker Corporation  | 1602 |
| Direct Electron, LP | 614  |
| EDAX/Ametek         | 1114 |
| IXRF Systems, Inc   | 710  |
| PNDetector GmbH     | 1823 |
| PNSensor GmbH       | 1724 |
| TVIPS GmbH          | 1624 |

## Diamond Knives

|               |      |
|---------------|------|
| Diatome U.S.  | 1816 |
| Ladd Research | 1310 |
| RMC-Boeckeler | 524  |
| SPI Supplies  | 1201 |

## Dual Beam FIB/SEM

|                                                                                 |      |
|---------------------------------------------------------------------------------|------|
| Applied Physics Technologies, Inc.                                              | 720  |
| FEI Company                                                                     | 1314 |
| Hitachi High Technologies America, Inc.                                         | 1801 |
| Raith America, Inc                                                              | 1323 |
| The Ohio State University - Center for Electron Microscopy and Analysis (CEMAS) | 1219 |

## E Beam Lithography

|                                    |      |
|------------------------------------|------|
| Applied Physics Technologies, Inc. | 720  |
| JEOL USA, Inc.                     | 502  |
| Raith America, Inc                 | 1323 |

## EDS Detector Repairs and Upgrades

|                   |     |
|-------------------|-----|
| IXRF Systems, Inc | 710 |
|-------------------|-----|

## EDS Detectors & Systems

|                                                                                 |      |
|---------------------------------------------------------------------------------|------|
| Bruker Corporation                                                              | 1602 |
| CAMECA Instruments, Inc.                                                        | 1114 |
| Coxem Co., Ltd                                                                  | 416  |
| EDAX/Ametek                                                                     | 1114 |
| Evex Global LLC                                                                 | 1102 |
| IXRF Systems, Inc                                                               | 710  |
| JEOL USA, Inc.                                                                  | 502  |
| Oxford Instruments                                                              | 714  |
| Phenom-World                                                                    | 1924 |
| PNDetector GmbH                                                                 | 1823 |
| STAR H.K.N. Inc.                                                                | 825  |
| The Ohio State University - Center for Electron Microscopy and Analysis (CEMAS) | 1219 |
| Thermo Fisher Scientific                                                        | 1402 |

## Electrical Characterization

|                            |      |
|----------------------------|------|
| Barnett Technical Services | 413  |
| Park Systems Inc           | 1226 |

## Electron Backscattered Diffraction (EBSD)

|                          |      |
|--------------------------|------|
| Bruker Corporation       | 1602 |
| EDAX/Ametek              | 1114 |
| Oxford Instruments       | 714  |
| Thermo Fisher Scientific | 1402 |

## Electron Microprobe Automation Systems

|                    |      |
|--------------------|------|
| HREM Research Inc. | 1303 |
| SmarAct Inc.       | 726  |

## Electron Microprobes / EPMA

|                          |      |
|--------------------------|------|
| CAMECA Instruments, Inc. | 1114 |
| JEOL USA, Inc.           | 502  |

## EMI Cancellation

|                                 |      |
|---------------------------------|------|
| Herzan LLC                      | 1106 |
| Integrated Dynamics Engineering | 613  |
| Spicer Consulting               | 1925 |
| Vitatech Electromagnetics LLC   | 407  |



## Failure Analysis

|                             |      |
|-----------------------------|------|
| Applied Beams LLC           | 423  |
| Barnett Technical Services  | 413  |
| CAMECA Instruments, Inc.    | 1114 |
| Filmetrics, Inc.            | 1526 |
| Kleindiek Nanotechnik       | 515  |
| Park Systems Inc            | 1226 |
| Seiwa Optical America, Inc. | 1917 |
| YXLON                       | 1716 |

## FIB Accessories

|                        |      |
|------------------------|------|
| Applied Beams LLC      | 423  |
| EXpressLO LLC          | 724  |
| Hummingbird Scientific | 1326 |
| Hysitron, Inc.         | 1206 |
| Kleindiek Nanotechnik  | 515  |
| Ted Pella Inc.         | 1502 |

## Filaments and Filament Rebuilding - Field Emission Sources, Lab6 Sources

|                                    |      |
|------------------------------------|------|
| Applied Physics Technologies, Inc. | 720  |
| Electron Microscopy Sciences       | 1813 |

## Fluorescence Microscopy

|                                |      |
|--------------------------------|------|
| Keyence Corporation of America | 1902 |
| Laxco Inc.                     | 517  |
| Newport Corporation            | 1225 |
| Rigaku Americas Corp.          | 1723 |
| Siskiyou Corporation           | 425  |
| Thorlabs                       | 1824 |

## Focused Ion Beam Systems / Workstations

|                                    |      |
|------------------------------------|------|
| Applied Beams LLC                  | 423  |
| Applied Physics Technologies, Inc. | 720  |
| Leica Microsystems                 | 1302 |
| Raith America, Inc                 | 1323 |
| SPI Supplies                       | 1202 |

## FT-IR Microscopy

|                             |      |
|-----------------------------|------|
| Seiwa Optical America, Inc. | 1917 |
| Siskiyou Corporation        | 425  |

## Glow Discharge Cleaning

|                                   |      |
|-----------------------------------|------|
| E. A. Fischione Instruments, Inc. | 1614 |
| ibss Group, Inc.                  | 514  |
| PIE Scientific LLC                | 419  |

|                                     |      |
|-------------------------------------|------|
| Quorum/Electron Microscopy Sciences | 1814 |
| Ted Pella Inc.                      | 1502 |

## Image Analysis and Processing

|                                      |      |
|--------------------------------------|------|
| 3Scan                                | 1923 |
| aBeam Technologies, Inc.             | 1605 |
| Advanced Microscopy Techniques Corp. | 1601 |
| Carl Zeiss Microscopy, LLC           | 902  |
| Digital Surf                         | 1223 |
| HREM Research Inc.                   | 1303 |
| Objects Research Systems             | 1908 |
| Phenom-World                         | 1924 |
| Thorlabs                             | 1824 |
| TVIPS GmbH                           | 1624 |
| YXLON                                | 1716 |

## Immuno-Labeling

|                              |      |
|------------------------------|------|
| Electron Microscopy Sciences | 1813 |
| Microscopy Innovations LLC   | 1205 |

## Ion Pumps New and Rebuilding

|                         |      |
|-------------------------|------|
| Duniway Stockroom Corp. | 1210 |
|-------------------------|------|

## Journals

|                             |      |
|-----------------------------|------|
| Physics Today               | 1915 |
| Royal Microscopical Society | 615  |
| Springer                    | 1207 |

## Knife Resharpener / Resharpener Services

|              |      |
|--------------|------|
| Diatome U.S. | 1816 |
|--------------|------|

## Knives

|               |      |
|---------------|------|
| Diatome U.S.  | 1816 |
| RMC-Boeckeler | 524  |

## Light Microscopes

|                                |      |
|--------------------------------|------|
| 3Scan                          | 1923 |
| Aven, Inc.                     | 302  |
| Carl Zeiss Microscopy, LLC     | 902  |
| HIROX-USA, Inc.                | 810  |
| Keyence Corporation of America | 1902 |
| Laxco Inc.                     | 517  |
| Leica Microsystems             | 1302 |
| Seiwa Optical America, Inc.    | 1917 |
| Siskiyou Corporation           | 425  |

# Product & Services Index *continued*

## Metallography Equipment

|                              |      |
|------------------------------|------|
| Electron Microscopy Sciences | 1813 |
|------------------------------|------|

## Micro-CT Scanning

|                       |      |
|-----------------------|------|
| FEI Company           | 1314 |
| Rigaku Americas Corp. | 1723 |
| YXLON                 | 1716 |

## Micromanipulators

|                            |     |
|----------------------------|-----|
| Angstrom Scientific, Inc.  | 513 |
| Barnett Technical Services | 413 |
| EXpressLO LLC              | 724 |
| Kleindiek Nanotechnik      | 515 |
| Oxford Instruments         | 714 |
| Siskiyou Corporation       | 425 |
| SmarAct Inc.               | 726 |

## Microtomes and Ultramicrotomes

|                    |      |
|--------------------|------|
| 3Scan              | 1923 |
| Diatome U.S.       | 1816 |
| Leica Microsystems | 1302 |
| RMC-Boeckeler      | 524  |

## Microwave Tissue Processing

|                              |      |
|------------------------------|------|
| Electron Microscopy Sciences | 1813 |
| Ladd Research                | 1301 |
| Ted Pella Inc.               | 1502 |

## Nano Indentation

|                                                                            |      |
|----------------------------------------------------------------------------|------|
| Hysitron, Inc.                                                             | 1206 |
| IfG - Institute for Scientific Instruments GmbH / Fischer Technology, Inc. | 314  |
| Keysight Technologies                                                      | 1718 |
| Kleindiek Nanotechnik                                                      | 515  |
| Rigaku Americas Corp.                                                      | 1723 |

## Nanoprobes / Mechanical Microprobes

|                                                      |      |
|------------------------------------------------------|------|
| Angstrom Scientific, Inc.                            | 513  |
| Hummingbird Scientific                               | 1326 |
| ICSPI: Integrated Circuit Scanning Probe Instruments | 1919 |

## Nanopositioners & Stages

|                       |      |
|-----------------------|------|
| EXpressLO LLC         | 724  |
| Kleindiek Nanotechnik | 515  |
| Newport Corporation   | 1225 |
| Raith America, Inc    | 1323 |
| SmarAct Inc.          | 726  |

## New and Used Equipment

|                               |      |
|-------------------------------|------|
| Duniway Stockroom Corp.       | 1210 |
| Filmetrics, Inc.              | 1526 |
| Synergy Systems Corporation   | 1920 |
| Technotrade International Inc | 1603 |
| YXLON                         | 1716 |

## Optical Filters, Fluorescence Filters

|                                                                            |      |
|----------------------------------------------------------------------------|------|
| IfG - Institute for Scientific Instruments GmbH / Fischer Technology, Inc. | 314  |
| Newport Corporation                                                        | 1225 |
| Thorlabs                                                                   | 1824 |

## Osmium Coaters

|              |      |
|--------------|------|
| SPI Supplies | 1202 |
|--------------|------|

## Other

|                         |      |
|-------------------------|------|
| 3Scan                   | 1923 |
| Duniway Stockroom Corp. | 1210 |
| iLab Solutions, LLC     | 1820 |

## Phase Identification

|                                                  |      |
|--------------------------------------------------|------|
| International Centre for Diffraction Data (ICDD) | 1714 |
| NanoMEGAS USA                                    | 1124 |

## Photography Supplies

|                              |      |
|------------------------------|------|
| Electron Microscopy Sciences | 1813 |
|------------------------------|------|

## Plasma Cleaners

|                                   |      |
|-----------------------------------|------|
| E. A. Fischione Instruments, Inc. | 1614 |
| ibss Group, Inc.                  | 514  |
| PIE Scientific LLC                | 419  |
| SPI Supplies                      | 1202 |

## Publishers

|                                             |      |
|---------------------------------------------|------|
| BioPhotonics, a Photonics Media Publication | 2012 |
| Cambridge University Press                  | 1305 |
| Physics Today                               | 1915 |
| Royal Microscopical Society                 | 615  |
| Wiley/ Microscopy & Microanalysis           | 424  |

## Raman Spectroscopy / Microscopy

|                       |      |
|-----------------------|------|
| Evex Global LLC       | 1102 |
| NT-MDT America, Inc.  | 2004 |
| Renishaw Inc          | 304  |
| Rigaku Americas Corp. | 1723 |

|                          |      |
|--------------------------|------|
| Thermo Fisher Scientific | 1402 |
| WITec Instruments Corp.  | 417  |

### Scanning Electron Microscopes (SEM)

|                                                                                 |      |
|---------------------------------------------------------------------------------|------|
| Applied Beams LLC                                                               | 423  |
| Applied Physics Technologies, Inc.                                              | 720  |
| Carl Zeiss Microscopy, LLC                                                      | 902  |
| Coxem Co., Ltd                                                                  | 416  |
| Digital Surf                                                                    | 1223 |
| Evex Global LLC                                                                 | 1102 |
| FEI Company                                                                     | 1314 |
| Hitachi High Technologies America, Inc.                                         | 1801 |
| JEOL USA, Inc.                                                                  | 502  |
| Keysight Technologies                                                           | 1718 |
| Phenom-World                                                                    | 1924 |
| SEC Co., Ltd.                                                                   | 1120 |
| The Ohio State University - Center for Electron Microscopy and Analysis (CEMAS) | 1219 |

### Scanning Probe Microscope Accessories

|                       |      |
|-----------------------|------|
| Herzan LLC            | 1106 |
| Keysight Technologies | 1718 |
| Nanosurf, Inc         | 1918 |
| NT-MDT America, Inc.  | 2004 |
| Park Systems Inc      | 1226 |

### Scanning Transmission Electron Microscopes (STEM)

|                                         |      |
|-----------------------------------------|------|
| Coxem Co., Ltd                          | 416  |
| FEI Company                             | 1314 |
| Hitachi High Technologies America, Inc. | 1801 |
| HREM Research Inc.                      | 1303 |
| JEOL USA, Inc.                          | 502  |
| NanoMEGAS USA                           | 1124 |
| Nion Co.                                | 824  |

### Scanning Tunneling Microscopes

|                       |      |
|-----------------------|------|
| Keysight Technologies | 1718 |
| Nanosurf, Inc         | 1918 |

### Secondary Ion Mass Spectrometer (SIMS)

|                          |      |
|--------------------------|------|
| CAMECA Instruments, Inc. | 1114 |
|--------------------------|------|

### SEM / STEM Digital Imaging Systems

|                    |      |
|--------------------|------|
| HREM Research Inc. | 1303 |
| Nanojehm           | 405  |
| Protochips         | 1408 |
| PulseTor LLC       | 401  |

|            |      |
|------------|------|
| TVIPS GmbH | 1624 |
|------------|------|

### SEM Accessories

|                                      |      |
|--------------------------------------|------|
| aBeam Technologies, Inc.             | 1605 |
| Advanced Microscopy Techniques Corp. | 1601 |
| Applied Beams LLC                    | 423  |
| Gatan, Inc.                          | 702  |
| Herzan LLC                           | 1106 |
| Hummingbird Scientific               | 1326 |
| Hysitron, Inc.                       | 1206 |
| ibss Group, Inc.                     | 514  |
| Integrated Dynamics Engineering      | 613  |
| IXRF Systems, Inc                    | 710  |
| Keysight Technologies                | 1718 |
| Ladd Research                        | 1310 |
| Nanosurf, Inc                        | 1918 |
| PIE Scientific LLC                   | 419  |
| PNDetector GmbH                      | 1823 |
| PulseTor LLC                         | 401  |
| Quorum/Electron Microscopy Sciences  | 1814 |
| SPI Supplies                         | 1201 |
| Spicer Consulting                    | 1925 |
| Ted Pella Inc.                       | 1502 |
| Tousimis                             | 909  |

### SEM Stages, Mounts and Holders

|                                     |      |
|-------------------------------------|------|
| aBeam Technologies, Inc.            | 1605 |
| Hummingbird Scientific              | 1326 |
| Hysitron, Inc.                      | 1206 |
| IXRF Systems, Inc                   | 710  |
| Quorum/Electron Microscopy Sciences | 1814 |
| SmarAct Inc.                        | 726  |

### Service & Repair

|                               |      |
|-------------------------------|------|
| Duniway Stockroom Corp.       | 1210 |
| Spicer Consulting             | 1925 |
| Synergy Systems Corporation   | 1920 |
| Technotrade International Inc | 1603 |

### Service Laboratories

|                               |      |
|-------------------------------|------|
| Applied Beams LLC             | 423  |
| Barnett Technical Services    | 413  |
| FOM Networks, Inc.            | 1725 |
| iLab Solutions                | 1820 |
| Park Systems Inc              | 1226 |
| SPI Supplies                  | 1202 |
| Vitatech Electromagnetics LLC | 407  |

# Product & Services Index *continued*

## Software

|                                                  |      |
|--------------------------------------------------|------|
| aBeam Technologies, Inc.                         | 1605 |
| Digital Surf                                     | 1223 |
| Direct Electron, LP                              | 614  |
| FEI Company                                      | 1314 |
| FOM Networks, Inc.                               | 1725 |
| Gatan, Inc.                                      | 702  |
| HREM Research Inc.                               | 1303 |
| IDES, Inc.                                       | 2002 |
| iLab Solutions                                   | 1820 |
| International Centre for Diffraction Data (ICDD) | 1714 |
| Nanojehm                                         | 405  |
| Objects Research Systems                         | 1908 |

## Specimen Preparation & Handling

|                                                                                 |      |
|---------------------------------------------------------------------------------|------|
| 3Scan                                                                           | 1923 |
| Diatome U.S.                                                                    | 1816 |
| E. A. Fischione Instruments, Inc.                                               | 1614 |
| EXpressLO LLC                                                                   | 724  |
| Gatan, Inc.                                                                     | 702  |
| Leica Microsystems                                                              | 1302 |
| Microscopy Innovations, LLC                                                     | 1205 |
| RMC-Boeckeler                                                                   | 524  |
| SCIENION US, Inc.                                                               | 1626 |
| SPI Supplies                                                                    | 1201 |
| Technotrade International Inc                                                   | 1603 |
| Ted Pella Inc.                                                                  | 1502 |
| The Ohio State University - Center for Electron Microscopy and Analysis (CEMAS) | 1219 |

## Specimen Storage

|                             |      |
|-----------------------------|------|
| Microscopy Innovations, LLC | 1205 |
|-----------------------------|------|

## Spectrometers

|                                                                            |      |
|----------------------------------------------------------------------------|------|
| Filmetrics, Inc.                                                           | 1526 |
| Gatan, Inc.                                                                | 702  |
| IfG - Institute for Scientific Instruments GmbH / Fischer Technology, Inc. | 314  |
| Newport Corporation                                                        | 1225 |
| Renishaw Inc                                                               | 304  |

## SQUID / Superconducting Quantum Interference Devices

|                  |     |
|------------------|-----|
| STAR H.K.N. Inc. | 825 |
|------------------|-----|

## Stage Automation

|                     |      |
|---------------------|------|
| 3Scan               | 1923 |
| Siskiyu Corporation | 425  |

|              |     |
|--------------|-----|
| SmarAct Inc. | 726 |
|--------------|-----|

## Stage Micrometers

|                     |      |
|---------------------|------|
| Diatome U.S.        | 1816 |
| Siskiyu Corporation | 425  |

## Stereoscopic Viewing Systems

|                             |      |
|-----------------------------|------|
| Laxco Inc.                  | 517  |
| Seiwa Optical America, Inc. | 1917 |

## Supplies

|                               |      |
|-------------------------------|------|
| Duniway Stockroom Corp.       | 1210 |
| Ladd Research                 | 1310 |
| Microscopy Innovations, LLC   | 1205 |
| Technotrade International Inc | 1603 |
| Tousimis                      | 909  |

## Surface Analysis

|                                                      |      |
|------------------------------------------------------|------|
| Digital Surf                                         | 1223 |
| Filmetrics, Inc.                                     | 1526 |
| ICSPI: Integrated Circuit Scanning Probe Instruments | 1919 |
| Keyence Corporation of America                       | 1902 |
| NanoFocus AG                                         | 2007 |
| NT-MDT America, Inc.                                 | 2004 |
| Phenom-World                                         | 1924 |
| Physical Electronics                                 | 1916 |
| Thermo Fisher Scientific                             | 1402 |
| Zygo Corporation                                     | 1114 |

## Surface Profiling

|                                |      |
|--------------------------------|------|
| Filmetrics, Inc.               | 1526 |
| Keyence Corporation of America | 1902 |
| NanoFocus AG                   | 2007 |
| Zygo Corporation               | 1114 |

## Tabletop SEM/TEM

|                                         |      |
|-----------------------------------------|------|
| Angstrom Scientific, Inc.               | 513  |
| Applied Physics Technologies, Inc.      | 720  |
| Coxem Co., Ltd                          | 416  |
| Evex Global LLC                         | 1102 |
| Hitachi High Technologies America, Inc. | 1801 |
| Phenom-World                            | 1924 |
| SEC Co., Ltd.                           | 1120 |

## TEM Accessories

|                                      |      |
|--------------------------------------|------|
| Advanced Microscopy Techniques Corp. | 1601 |
| Barnett Technical Services           | 413  |

|                                             |      |
|---------------------------------------------|------|
| Direct Electron, LP                         | 614  |
| EXpressLO LLC                               | 724  |
| Herzan LLC                                  | 1106 |
| Hummingbird Scientific                      | 1326 |
| Hysitron, Inc.                              | 1206 |
| ibss Group, Inc.                            | 514  |
| IDES, Inc.                                  | 2002 |
| Integrated Dynamics Engineering             | 613  |
| Ladd Research                               | 1310 |
| NanoMEGAS USA                               | 1124 |
| PIE Scientific LLC                          | 419  |
| PNDetector GmbH                             | 1823 |
| SCIENION US, Inc.                           | 1626 |
| Scientific Instruments & Applications, Inc. | 1224 |
| SPI Supplies                                | 1201 |
| Spicer Consulting                           | 1925 |
| Ted Pella Inc.                              | 1502 |
| Tousimis                                    | 909  |
| TVIPS GmbH                                  | 1624 |

### TEM Specimen Holders

|                                   |      |
|-----------------------------------|------|
| E. A. Fischione Instruments, Inc. | 1614 |
| EXpressLO LLC                     | 724  |
| Gatan, Inc.                       | 702  |
| Hummingbird Scientific            | 1326 |
| Hysitron, Inc.                    | 1206 |
| Protochips                        | 1408 |

### Testing Equipment

|                               |      |
|-------------------------------|------|
| Aven, Inc.                    | 302  |
| Barnett Technical Services    | 413  |
| Laxco Inc.                    | 517  |
| NanoFocus AG                  | 2007 |
| Newport Corporation           | 1225 |
| Seiwa Optical America, Inc.   | 1917 |
| SmarAct Inc.                  | 726  |
| Spicer Consulting             | 1925 |
| Vitatech Electromagnetics LLC | 407  |
| YXLON                         | 1716 |
| Zygo Corporation              | 1114 |

### Transmission Electron Microscopes (TEM)

|                                         |      |
|-----------------------------------------|------|
| FEI Company                             | 1314 |
| Hitachi High Technologies America, Inc. | 1801 |
| HREM Research Inc.                      | 1303 |
| IDES, Inc.                              | 2002 |
| JEOL USA, Inc.                          | 502  |

|                                                                                 |      |
|---------------------------------------------------------------------------------|------|
| The Ohio State University - Center for Electron Microscopy and Analysis (CEMAS) | 1219 |
|---------------------------------------------------------------------------------|------|

### Vacuum Equipment

|                                                                            |      |
|----------------------------------------------------------------------------|------|
| Denton Vacuum, LLC                                                         | 1301 |
| Duniway Stockroom Corp.                                                    | 1210 |
| ibss Group, Inc.                                                           | 514  |
| IfG - Institute for Scientific Instruments GmbH / Fischer Technology, Inc. | 314  |
| PIE Scientific LLC                                                         | 419  |
| SPI Supplies                                                               | 1201 |
| Synergy Systems Corporation                                                | 1920 |
| Technotrade International Inc                                              | 1603 |

### Vacuum Evaporators

|               |      |
|---------------|------|
| Ladd Research | 1310 |
| SPI Supplies  | 1202 |

### Vibration Isolation Systems

|                                 |      |
|---------------------------------|------|
| Herzan LLC                      | 1106 |
| Integrated Dynamics Engineering | 613  |
| Newport Corporation             | 1225 |
| Thorlabs                        | 1824 |
| TMC                             | 1114 |

### WDS Detectors & Systems

|                          |      |
|--------------------------|------|
| Bruker Corporation       | 1602 |
| CAMECA Instruments, Inc. | 1114 |
| EDAX/Ametek              | 1114 |
| Oxford Instruments       | 714  |
| PNDetector GmbH          | 1823 |
| PNSensor GmbH            | 1724 |
| Rigaku Americas Corp.    | 1723 |
| Thermo Fisher Scientific | 1402 |

### X-ray Analysis Equipment

|                                                                            |      |
|----------------------------------------------------------------------------|------|
| Carl Zeiss Microscopy, LLC                                                 | 902  |
| Coxem Co., Ltd                                                             | 416  |
| EDAX/Ametek                                                                | 1114 |
| Evex Global LLC                                                            | 1102 |
| IfG - Institute for Scientific Instruments GmbH / Fischer Technology, Inc. | 314  |
| IXRF Systems, Inc                                                          | 710  |
| Oxford Instruments                                                         | 714  |
| Phenom-World                                                               | 1924 |
| PulseTor LLC                                                               | 401  |
| Rigaku Americas Corp.                                                      | 1723 |
| YXLON                                                                      | 1716 |

# Exhibitor List by Booth

| BOOTH | EXHIBITOR NAME                                                               |
|-------|------------------------------------------------------------------------------|
| 302   | Aven Inc.                                                                    |
| 304   | Renishaw Inc                                                                 |
| 310   | Pace Technologies                                                            |
| 313   | Nanoscience Instruments                                                      |
| 314   | IfG - Institute for Scientific Instruments / GmbH / Fischer Technology, Inc. |
| 401   | PulseTor LLC                                                                 |
| 405   | Nanojehm                                                                     |
| 407   | Vitatech Electromagnetics LLC                                                |
| 413   | Barnett Technical Services                                                   |
| 414   | Analitex                                                                     |
| 416   | Coxem Co., Ltd                                                               |
| 417   | WITec Instruments Corp.                                                      |
| 419   | PIE Scientific LLC                                                           |
| 423   | Applied Beams LLC                                                            |
| 424   | Wiley / Microscopy + Analysis                                                |
| 425   | Siskiyou Corporation                                                         |
| 502   | JEOL USA, Inc.                                                               |
| 513   | Angstrom Scientific Inc.                                                     |
| 514   | ibss Group, Inc.                                                             |
| 515   | Kleindiek Nanotechnik                                                        |
| 517   | Laxco Inc.                                                                   |
| 518   | Olympus                                                                      |
| 520   | JPK Instruments AG                                                           |
| 524   | RMC - Boeckeler                                                              |
| 613   | Integrated Dynamics Engineering                                              |
| 614   | Direct Electron, LP                                                          |
| 615   | Royal Microscopical Society                                                  |
| 620   | Tescan USA                                                                   |
| 702   | Gatan, Inc.                                                                  |
| 710   | IXRF Systems, Inc.                                                           |
| 714   | Oxford Instruments                                                           |
| 720   | Applied Physics Technologies, Inc.                                           |
| 724   | EXpressLO LLC                                                                |
| 726   | SmarAct Inc.                                                                 |
| 810   | HIROX-USA, Inc.                                                              |
| 819   | ResAlta Research Technologies                                                |
| 823   | E. Fjeld Co, Inc.                                                            |
| 824   | Nion Co.                                                                     |
| 825   | STAR H.K.N. Inc.                                                             |

| BOOTH | EXHIBITOR NAME                                                                  |
|-------|---------------------------------------------------------------------------------|
| 902   | Carl Zeiss Microscopy, LLC                                                      |
| 909   | Tousimis                                                                        |
| 914   | Microscopy Society of America MegaBooth                                         |
| 1102  | Evex Global LLC                                                                 |
| 1106  | Herzan LLC                                                                      |
| 1108  | XEI Scientific, Inc.                                                            |
| 1114  | CAMECA Instruments, Inc.                                                        |
| 1114  | EDAX/Ametek                                                                     |
| 1114  | TMC                                                                             |
| 1114  | Zygo Corporation                                                                |
| 1120  | SEC Co., Ltd.                                                                   |
| 1124  | NanoMEGAS USA                                                                   |
| 1201  | SPI Supplies                                                                    |
| 1205  | Microscopy Innovations, LLC                                                     |
| 1206  | Hysitron, Inc.                                                                  |
| 1207  | Springer                                                                        |
| 1210  | Duniway Stockroom Corp.                                                         |
| 1219  | The Ohio State University - Center for Electron Microscopy and Analysis (CEMAS) |
| 1223  | Digital Surf                                                                    |
| 1224  | Scientific Instruments & Applications, Inc.                                     |
| 1225  | Newport Corporation                                                             |
| 1226  | Park Systems                                                                    |
| 1301  | Denton Vacuum, LLC                                                              |
| 1302  | Leica Microsystems                                                              |
| 1303  | HREM Research Inc.                                                              |
| 1305  | Cambridge University Press                                                      |
| 1310  | Ladd Research                                                                   |
| 1314  | FEI Company                                                                     |
| 1323  | Raith America, Inc                                                              |
| 1326  | Hummingbird Scientific                                                          |
| 1402  | Thermo Fisher Scientific                                                        |
| 1408  | Protochips, Inc.                                                                |
| 1409  | Amptek Inc.                                                                     |
| 1502  | Ted Pella Inc.                                                                  |
| 1526  | Filmetrics, Inc.                                                                |
| 1601  | Advanced Microscopy Techniques Corp.                                            |
| 1602  | Bruker Corporation                                                              |
| 1603  | Technotrade International Inc                                                   |

| BOOTH | EXHIBITOR NAME                                   |
|-------|--------------------------------------------------|
| 1605  | aBeam Technologies, Inc.                         |
| 1607  | South Bay Technology Inc.                        |
| 1614  | E. A. Fischione Instruments, Inc.                |
| 1624  | TVIPS GmbH                                       |
| 1626  | SCIENION US, Inc.                                |
| 1714  | International Centre for Diffraction Data (ICDD) |
| 1716  | YXLON                                            |
| 1718  | Keysight Technologies                            |
| 1723  | Rigaku Americas Corp.                            |
| 1724  | PNSensor GmbH                                    |
| 1725  | FOM Networks, Inc.                               |
| 1801  | Hitachi High Technologies America, Inc.          |
| 1813  | Electron Microscopy Sciences                     |
| 1814  | Quorum / Electron Microscopy Services            |
| 1816  | Diatome U.S.                                     |
| 1819  | HORIBA Instruments Incorporated                  |
| 1820  | iLab Solutions                                   |
| 1823  | PNDetector GmbH                                  |
| 1824  | Thorlabs                                         |
| 1902  | Keyence Corporation of America                   |
| 1908  | Objects Research Systems                         |
| 1913  | Norcada, Inc.                                    |
| 1914  | UES, Inc.                                        |
| 1915  | Physics Today                                    |
| 1916  | Physical Electronics                             |
| 1917  | Seiwa Optical America, Inc.                      |
| 1918  | Nanosurf, Inc.                                   |
| 1919  | ICSPI University of Waterloo                     |
| 1920  | Synergy Systems Corporation                      |
| 1923  | 3Scan                                            |
| 1924  | Phenom-World                                     |
| 1925  | Spicer Consulting                                |
| 2002  | IDES, Inc.                                       |
| 2004  | NT-MDT America, Inc.                             |
| 2007  | NanoFocus AG                                     |
| 2012  | BioPhotonics, a Photonics Media Publication      |
| 2014  | Oxford Nanoimaging Ltd.                          |

# Exhibitor List by Name

| EXHIBITOR NAME                              | BOOTH |
|---------------------------------------------|-------|
| 3Scan                                       | 1923  |
| aBeam Technologies, Inc.                    | 1605  |
| Advanced Microscopy Techniques Corp.        | 1601  |
| Amptek Inc.                                 | 1409  |
| Analitex                                    | 414   |
| Angstrom Scientific Inc.                    | 513   |
| Applied Beams LLC                           | 423   |
| Applied Physics Technologies, Inc.          | 720   |
| Aven Inc.                                   | 302   |
| Barnett Technical Services                  | 413   |
| BioPhotonics, a Photonics Media Publication | 2012  |
| Bruker Corporation                          | 1602  |
| Cambridge University Press                  | 1305  |
| CAMECA Instruments, Inc.                    | 1114  |
| Carl Zeiss Microscopy, LLC                  | 902   |
| Coxem Co., Ltd                              | 416   |
| Denton Vacuum, LLC                          | 1301  |
| Diatome U.S.                                | 1816  |
| Digital Surf                                | 1223  |
| Direct Electron, LP                         | 614   |
| Duniway Stockroom Corp.                     | 1210  |
| E. A. Fischione Instruments, Inc.           | 1614  |
| E. Fjeld Co, Inc.                           | 823   |
| EDAX/Ametek                                 | 1114  |
| Electron Microscopy Sciences                | 1813  |
| Evex Global LLC                             | 1102  |
| EXpressLO LLC                               | 724   |
| FEI Company                                 | 1314  |
| Filmetrics, Inc.                            | 1526  |
| FOM Networks, Inc.                          | 1725  |
| Gatan, Inc.                                 | 702   |
| Herzan LLC                                  | 1106  |
| HIROX-USA, Inc.                             | 810   |
| Hitachi High Technologies America, Inc.     | 1801  |
| HORIBA Instruments Incorporated             | 1819  |
| HREM Research Inc.                          | 1303  |
| Hummingbird Scientific                      | 1326  |
| Hysitron, Inc.                              | 1206  |

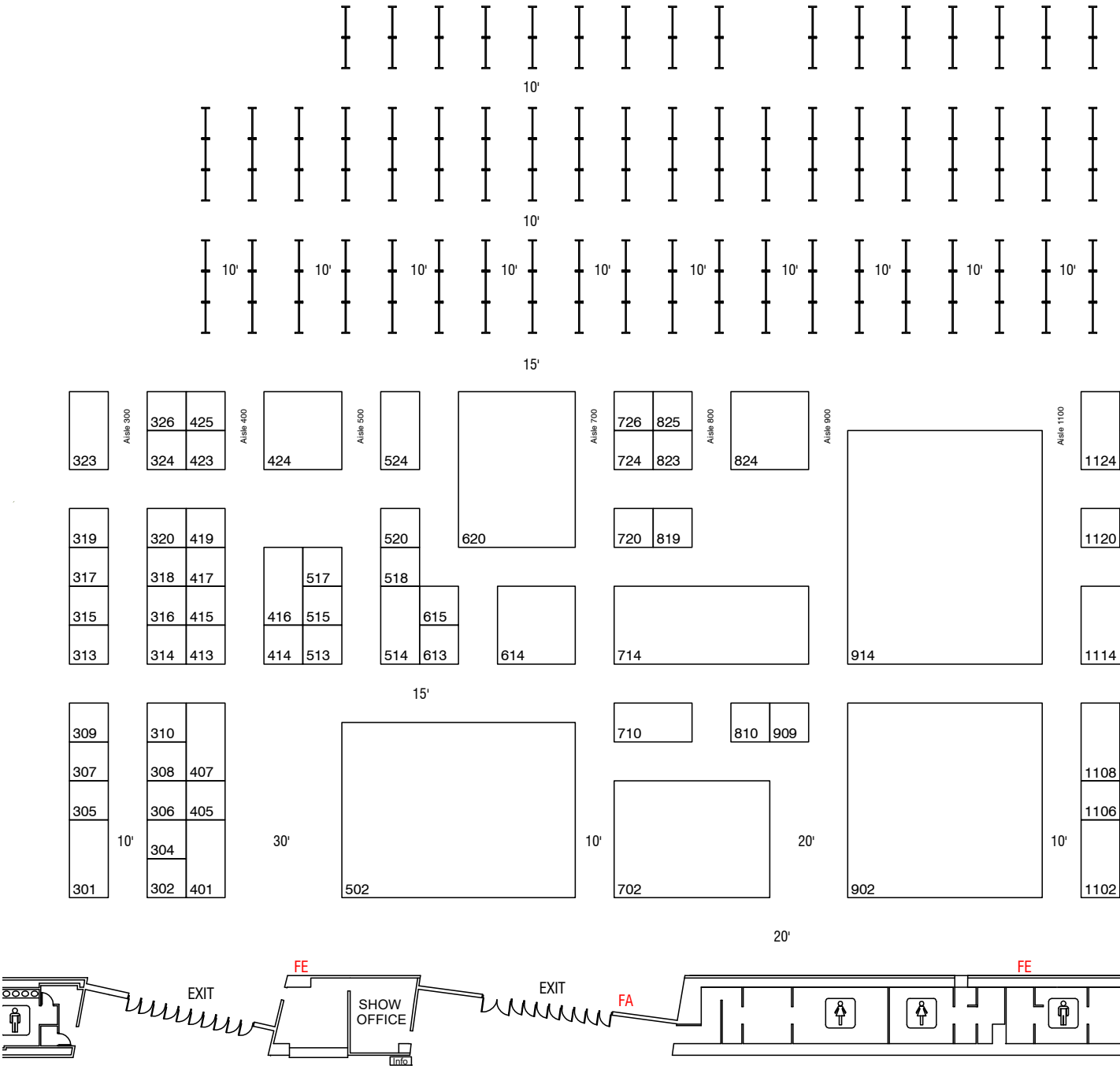
| EXHIBITOR NAME                                                               | BOOTH |
|------------------------------------------------------------------------------|-------|
| ibss Group, Inc.                                                             | 514   |
| ICSPI University of Waterloo                                                 | 1919  |
| IDES, Inc.                                                                   | 2002  |
| IfG - Institute for Scientific Instruments / GmbH / Fischer Technology, Inc. | 314   |
| iLab Solutions                                                               | 1820  |
| Integrated Dynamics Engineering                                              | 613   |
| International Centre for Diffraction Data (ICDD)                             | 1714  |
| IXRF Systems, Inc.                                                           | 710   |
| JEOL USA, Inc.                                                               | 502   |
| JPK Instruments AG                                                           | 520   |
| Keyence Corporation of America                                               | 1902  |
| Keysight Technologies                                                        | 1718  |
| Kleindiek Nanotechnik                                                        | 515   |
| Ladd Research                                                                | 1310  |
| Laxco Inc.                                                                   | 517   |
| Leica Microsystems                                                           | 1302  |
| Microscopy Innovations, LLC                                                  | 1205  |
| Microscopy Society of America MegaBooth                                      | 914   |
| NanoFocus AG                                                                 | 2007  |
| Nanojehm                                                                     | 405   |
| NanoMEGAS USA                                                                | 1124  |
| Nanoscience Instruments                                                      | 313   |
| Nanosurf, Inc.                                                               | 1918  |
| Newport Corporation                                                          | 1225  |
| Nion Co.                                                                     | 824   |
| Norcada, Inc.                                                                | 1913  |
| NT-MDT America, Inc.                                                         | 2004  |
| Objects Research Systems                                                     | 1908  |
| Olympus                                                                      | 518   |
| Oxford Instruments                                                           | 714   |
| Oxford Nanoimaging Ltd.                                                      | 2014  |
| Pace Technologies                                                            | 310   |
| Park Systems                                                                 | 1226  |
| Phenom-World                                                                 | 1924  |
| Physical Electronics                                                         | 1916  |
| Physics Today                                                                | 1915  |
| PIE Scientific LLC                                                           | 419   |
| PNDetector GmbH                                                              | 1823  |

| EXHIBITOR NAME                                                                  | BOOTH |
|---------------------------------------------------------------------------------|-------|
| PNSensor GmbH                                                                   | 1724  |
| Protochips, Inc.                                                                | 1408  |
| PulseTor LLC                                                                    | 401   |
| Quorum / Electron Microscopy Services                                           | 1814  |
| Raith America, Inc                                                              | 1323  |
| Renishaw Inc                                                                    | 304   |
| ResAlta Research Technologies                                                   | 819   |
| Rigaku Americas Corp.                                                           | 1723  |
| RMC - Boeckeler                                                                 | 524   |
| Royal Microscopical Society                                                     | 615   |
| SCIENION US, Inc.                                                               | 1626  |
| Scientific Instruments & Applications, Inc.                                     | 1224  |
| SEC Co., Ltd.                                                                   | 1120  |
| Seiwa Optical America, Inc.                                                     | 1917  |
| Siskiyou Corporation                                                            | 425   |
| SmarAct Inc.                                                                    | 726   |
| South Bay Technology Inc.                                                       | 1607  |
| SPI Supplies                                                                    | 1201  |
| Spicer Consulting                                                               | 1925  |
| Springer                                                                        | 1207  |
| STAR H.K.N. Inc.                                                                | 825   |
| Synergy Systems Corporation                                                     | 1920  |
| Technotrade International Inc                                                   | 1603  |
| Ted Pella Inc.                                                                  | 1502  |
| Tescan USA                                                                      | 620   |
| The Ohio State University - Center for Electron Microscopy and Analysis (CEMAS) | 1219  |
| Thermo Fisher Scientific                                                        | 1402  |
| Thorlabs                                                                        | 1824  |
| TMC                                                                             | 1114  |
| Tousimis                                                                        | 909   |
| TVIPS GmbH                                                                      | 1624  |
| UES, Inc.                                                                       | 1914  |
| Vitatech Electromagnetics LLC                                                   | 407   |
| Wiley / Microscopy + Analysis                                                   | 424   |
| WITec Instruments Corp.                                                         | 417   |
| XEI Scientific, Inc.                                                            | 1108  |
| YXLON                                                                           | 1716  |
| Zygo Corporation                                                                | 1114  |



# Exhibit Hall Diagram

## POSTERS

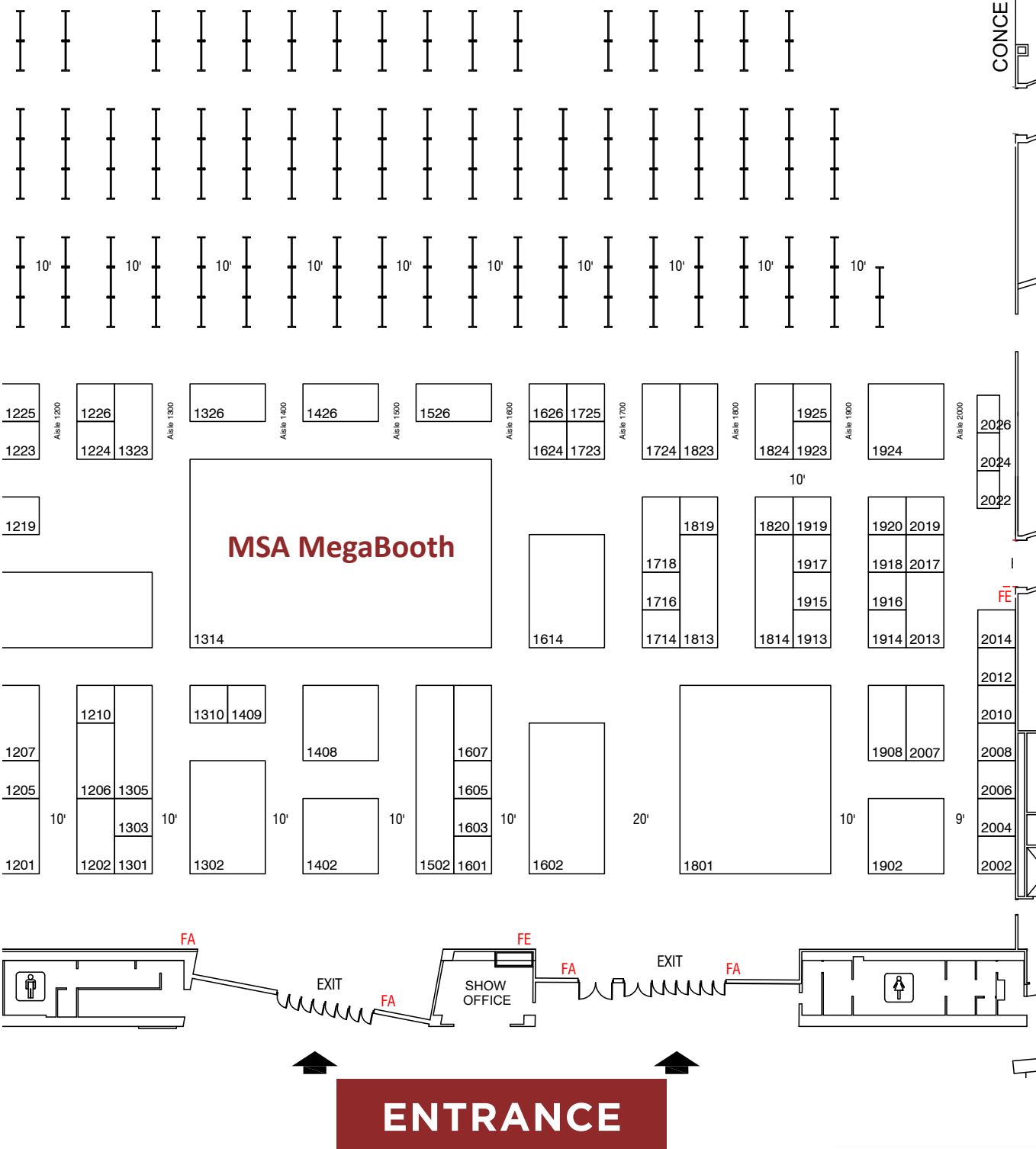


# POSTERS

CONCESSIONS



## EXHIBITOR DIRECTORY





# Notes

172

[illegible]



# 75<sup>th</sup> Anniversary of



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DATE

Stop by for advance information on the 2017 M&M Meeting in St. Louis, MO! The 2017 booth is staffed with a St. Louis representative, and located in the main registration area.

**It's the 75<sup>th</sup> anniversary of the Microscopy Society of America and the 50<sup>th</sup> anniversary of the Microanalysis Society, and big things are planned!**

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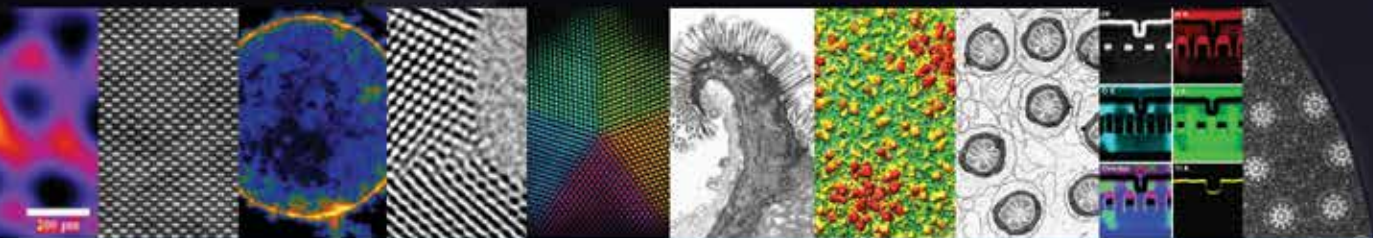
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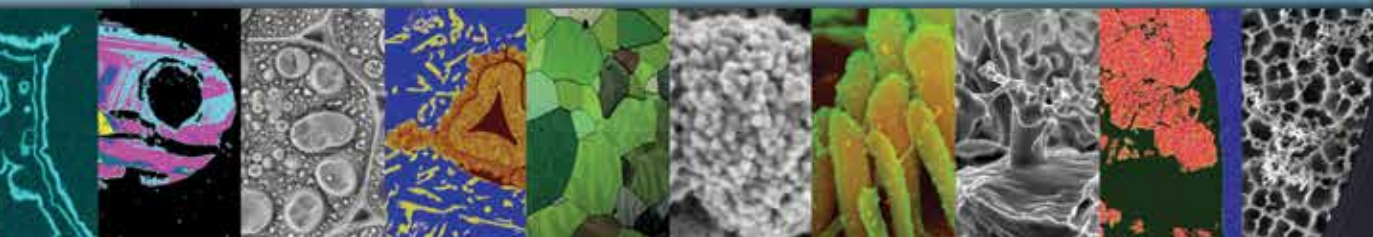
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