



MICROSCOPY & MICROANALYSIS 2011

August 7-11 ★ Nashville Tennessee

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Microscopy & Microanalysis 2011 Meeting

On behalf of the sponsoring societies, we would like to thank all attendees at the M&M 2011 Meeting. We hope you enjoyed your visit to Nashville. Plan to join us in Phoenix, AZ USA for the M&M 2012 Meeting next August.

M&M 2011 Printed Proceedings — Available by Print-On-Demand through Cambridge University Press (\$90).

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All attendees should have received a complimentary DVD version of the proceedings onsite in Nashville. Additional copies are still available through the Society Office by submitting an [order form](#) and \$25.00 USD.

Nashville Convention Center (downtown)

M&M 2011 — EXPO Edition is available!

Click below to see this year's EXPO featuring all program details and other important meeting information.
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Fellow Microscopists/Microanalysts, Colleagues, Students, and Friends,

The M&M conference is the premier meeting, spanning the physical, life and analytical sciences, which brings together delegates from around the globe who report on the latest work and advances in microscopy and microanalysis. Our Program Committee has once again put together a compelling suite of over 30 symposia reflecting the current state-of-the-art, as well as the innovative and emerging fields of research. Whether your interest is in nanotechnology or traditional metallurgy, biology or clinical diagnosis, or the growing field of multifunctional hard/soft materials, you will find a fascinating venue. In addition to our thematic symposia, we also feature a range of educational opportunities ranging from "Back to the Basics" tutorials, to in-depth, multi-day intensive workshops, as well as the chance to network with your peers.

Our meeting will begin with a plenary session featuring Prof. Stefan Hell, who will be discussing super-resolution microscopy, and Dr. Gene Ice, speaking on x-ray micro/nanoprobe characterization using synchrotron sources. We will also honor the winners of our major societal awards for distinguished scientists, professional technical achievement as well as student and post-graduate scholars.

Complementing the symposia is one of the largest exhibitions of microscopy/microanalysis instrumentation and resources in the world, which includes access to our very popular evening vendor tutorials. In addition, the traditional Sunday Short Courses will be joined this year by a Pre-Meeting Specialist Workshop on Opportunities, Artifacts and Interpretation of Aberration-Corrected Electron Microscopy Data.

We encourage all of you, whether newcomers or veterans of M&M, to submit a paper on your latest research for presentation in Nashville. We are looking forward to greeting you at our opening Sunday Reception in the Music City for what we are sure will be an exciting and educational conference for all.

Sincerely,

Nestor J. Zaluzec, President
Microscopy Society of America

John Henry Scott, President
Microanalysis Society

Nat Saenz, President
International Metallographic Society

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Biological Sciences Symposia

B01 Super Resolution Microscopy — Principles and Practice

Jim Galbraith

Invited Speakers:

- Mark Ellisman, UC-San Diego
- Jim Galbraith — National Institutes of Health
- George Patterson — National Institutes of Health
- Vlad Verkhusha — Albert Einstein College of Medicine
- Travis Gould — Yale University
- Erik Jorgensen, University of Utah
- Hesper Rego, Harvard University
- Peter Kner, University of Georgia
- Jeri Timlin, Sandia National Laboratories
- Gleb Shtengel, Janelia Farm

Super resolution microscopy breaks the diffraction barrier imposed in traditional light microscopy. It is now possible to visualize individual molecules within dense ensembles with molecular specificity. Although commercial systems are becoming available, the techniques are still maturing and the field is highly dynamic. This symposium will cover topics ranging from recent technical advances to practical considerations for imaging biological specimens.

B02 Near Field and Single Molecule in Life Sciences

Erik Sánchez, Jordan Gerton

Invited Speakers:

- Reuven Gordon, University of Victoria
- Bennett Goldberg, Boston University
- Laura Estrada, University of California, Irvine
- Derek Nowak, Portland State University
- Markus Raschke, University of Colorado-Boulder

Optical microscopy has developed considerably over the past couple of decades — the normal far-field resolution limit of $\lambda/2$ has been broken by many recently developed techniques. Among these new methods is near-field optical imaging, which offers the ability to image at spatial resolutions on the order of tens of nanometers using optical wavelengths. This super-resolution technique can be applied to biological living organisms in aqueous environments, as well as to inorganic and semiconductor samples. The key mechanism behind this technique involves the manipulation of the propagation of light with the use of plasmons for a localized field enhancement or field confinement. This session will cover the latest techniques being developed which utilize these imaging concepts for the life sciences.

B03 TIRF Microscopy: Imaging Cell Biology and Molecular Dynamics at the Interface

Edward Stuenkel, Christian Merrifield, and David Perrais

Invited Speakers:

- Wolfhard Almers, Oregon Health & Science University
- Ronald Holz, University of Michigan
- Jennifer Ross, University of Massachusetts
- Nancy Thompson, University of North Carolina
- Christien Merrifield, University of Cambridge

Total internal reflection fluorescence (TIRF) imaging provides unparalleled confinement of fluorescent excitation to a near interface region. Its use has provided powerful insight into dynamic interactions of molecules near the substrate surface, provided unmatched resolution of organelle movement and activity at cell membranes, and facilitated direct monitoring of clustering, mobility and activity of integral membrane molecules. This symposium will explore the development and use of TIRF specifically in biological applications, particularly for resolution of single molecule dynamics, vesicle movement and membrane fusion, and cytoskeletal assembly and function. Included is an integration of TIRF with approaches (FRET) defining molecular interactions and mobility towards developing physiological function.

B04 Ciliopathies In Different Organs and Organisms

Surya Nauli and Caroline A. Miller

Invited Speakers:

- Vincent Gattone, Indiana University
- Diego Rodriguez-Gil, Yale University
- Jagesh Shah, Harvard University
- Andrew Resnick, Cleveland State University

This symposium using modern advances in imaging concentrates on those organ systems requiring normal cilia function. These systems include; respiratory tract, ear, eye, reproductive organs, kidney and cerebral ventricles. Dysfunctional cilia or flagella are responsible for several human diseases. Basic research has provided a greater understanding of how cilia function in normal and diseased organs. This symposium will highlight the advances in imaging from light to electron microscopy with the latest techniques being applied to advance our understanding of the role cilia play in cell and organ function.

B05 Visualizing Cancer and Surveillance: Intravital Imaging of Tissue Microenvironment

Alex Y. Huang and David Piston



Invited Speakers:

- David Piston, Vanderbilt University
- Francesco Marangoni, Massachusetts General Hospital
- Bonnie Sloane, Wayne State University
- Alex Huang, Case Western Reserve University
- Roberto Weigert, National Institutes of Health

Cancer develops due to intricate interactions between the tumor cells and surrounding stroma through neo-vascularization, tissue remodeling, and evasion of immune surveillance. Advances in photonic and other imaging techniques have revolutionized how investigators study these processes in vivo. For example, intravital two-photon microscopy provides an important tool for interrogating individual tumor interaction with immune cells and surrounding stroma. Other microscopic methods allow the molecular detection of tumor cell behavior and function. In addition, new imaging agents allow sensitive detection of cancer in vivo. Efforts in the applications of these and other cancer imaging methods will be presented at this symposium.

B06 3D Structure of Macromolecular Assemblies, Cellular Organelles and Whole Cells

Jun Liu, Teresa Ruiz and Phoebe Stewart

Invited Speakers:

- Elizabeth Wright, Emory University
- Melissa Jurica, UC-Santa Cruz
- Peijun Zhang, University of Pittsburgh
- Paula da Fonseca, Institute for Cancer Research
- Montserrat Samsó, Virginia Commonwealth University
- Timothy Baker, UC-San Diego

We are advancing the basic understanding of 3D structures of macromolecular assemblies, viruses and cells, as well as their communication with the host environment, through advanced EM techniques and hybrid methodologies. This symposium will highlight structural studies of macromolecules and macromolecular assemblies using electron tomography; electron crystallography; single-particle EM analysis; EM helical reconstruction; light microscopy; atomic force microscopy and X-ray crystallography. Topics will include cellular metabolism, cell division and protein translation; cellular and bacterial adhesion; flagellar and filopodial motility; secretion systems; cell-cell communication and cell signaling; virus structure and virus-host interactions.

B07 Multi-scale Approach to Amyloid Diseases

Martin Muschol, Helen McNally and George Perry

Invited Speakers:

- Yuri Chernoff, Georgia Tech
- Chad Dickey, University of South Florida
- Vladimir Kepe, UCLA
- Yuri Lyubchenko, University of Nebraska

Topics will include:

- Monitoring amyloid self-assembly at the molecular level
- Regulation of amyloid formation and degradation in cells
- Amyloid formation in animal models
- In vitro detection of amyloid formation
- New approaches towards characterizing amyloids and their intermediates
- Mechanisms of cell and tissue toxicity in amyloidosis

B08 Imaging Mitochondria and other Organelles in Health and Disease

Heide Schatten

Invited Speakers:

- George Perry, University of Texas — San Antonio
- Xiongwei Zhu, University of Texas — San Antonio
- Heide Schatten, University of Missouri
- Paul Walther, Universität Ulm
- Michael Davidson, Florida State University
- Shadi Zahedi, University of Toledo

This symposium will cover:

- Advances in imaging organelle dynamics (mitochondria, peroxisomes, Golgi, centrosomes and others) with TEM, SEM, AFM and various forms of light microscopy, including confocal and multiphoton microscopy
- Novel imaging techniques including live cell imaging with molecular markers
- Organelle abnormalities in various diseases of the immune system, reproduction, cancer, neurological disorders and others

Physical Sciences Symposia**P01 A.V. Crewe Memorial Symposium: From Images of Single Atoms to Single Atom Spectroscopy and Beyond**

Mike Isaacson and Ondrej Krivanek

Invited Speakers:

- Mike Isaacson, UC Santa Cruz
- Elmar Zeitler
- Vernon Beck
- Joe Wall, Brookhaven National Laboratory
- Steve Pennycook, Oak Ridge National Laboratory
- Akira Tonomura, Hitachi
- David Muller, Cornell University
- Ondrej Krivanek, NION

The Crewe symposium will commemorate the work of Albert Victor Crewe (1927-2009), whose influence on electron microscopy has been profound. The revolutionary scanning transmission electron microscope (STEM) with a bright cold field emission gun (CFEG) was invented by Crewe and designed and built in his laboratory at the University of Chicago. It is now the instrument of choice for detailed explorations of the nano-world. The work in Crewe's laboratory on STEM and aberration correction will be remembered, and the way these techniques are pushing today's research towards new frontiers will be showcased.

P02 Structural and Physical properties of Thin Films, Interfaces, and Grain Boundaries*Klaus van Benthem and Naoya Shibata***Invited Speakers:**

- Yuchi Ikuhara, University of Tokyo
- Gerhard Dehm, University of Leoben
- Xiaoxing Pan, University of Michigan
- D.L. Medlin, Sandia National Laboratories
- Rafal Dunin-Borkowski, TU Denmark
- Knut Urban, FZ Juelich
- Wayne Kaplan, Technion
- Andrew Thron, UC-Davis

This symposium will focus on microscopy of structural and functional thin films, including multi-layers and intergranular films. Invited and contributed presentations will report latest results for characterization of wetting/dewetting behavior, fundamental structural properties of homophase and heterophase grain boundaries and interfaces. The goal of this symposium is to stimulate a detailed discussion about the current understanding of the correlation of atomic interface structures and the corresponding macroscopic physical properties of the associated microstructures. Reports about in situ characterizations of the evolution of thin films and interface properties under various experimental conditions, such as modified temperatures, electrical fields, mechanical stress, etc. are especially encouraged.

P03 Microanalysis of Cement and Concrete Materials: State of the Art, Methodologies and Standardization*Luisa Amelia Dempere and Jeff Davis***Invited Speakers:**

- Paul Stutzman, NIST
- Bernd Moeser, Bauhaus-Universitaet Weimar
- Willenberg Bradley, University of Florida
- Karl Peterson, University of Toronto

Analysis of cement and concrete represents a unique microanalytical challenge, replete with multiple phases in semi-ordered formations at spatial ranges from nanometers to centimeters. Advancement of microanalytical methods and techniques to characterize the evolving and complex chemistry of cement and concrete has significant practical implications. This symposium will focus on the analysis of cement/concrete systems, as well as the presentation of new techniques, instruments and methods that can assist researchers working with cement and concrete microanalysis. The organizers welcome contributions from researchers using optical and electron microscopy, microanalysis, X-ray and synchrotron methods. Contributions from students are welcomed and encouraged.

P04 Imaging and Spectroscopy of Carbon-based Nano-materials and Devices*Moon Kim and Ray Carpenter***Invited Speakers:**

- Ute Kaiser, University of Ulm
- Seongyong Park, Samsung Advanced Institute of Technology
- Renu Sharma, NIST
- Rhonda Stroud, Naval Research Laboratory
- David Muller, Cornell University
- Jianyu Huang, Sandia National Laboratory

Microelectronics and functional device research have clearly evolved to nanoscience. With reductions in device scaling, the use of new materials such as carbon nanotubes and graphene is bringing enormous new challenges to characterization required to bring systems to production. This symposium solicits papers on high resolution characterization of carbon-based materials and devices engineered for future and current cutting edge generation electronic and opto-electronic devices.

P05 Imaging and Spectroscopy of Energy-related Nanomaterials*Frederic Cosandey and Jason Graetz***Invited Speakers:**

- Daniel Abraham, Argonne National Laboratories
- Loic Dupont, Universite Picardie
- Shirley Meng, UC San Diego
- Shunsuke Muto, Nagoya University
- Ian Robertson, University of Illinois
- Chongmin Wang, Pacific Northwest Laboratory
- Yimei Zhu, Brookhaven National Laboratory

This symposium will focus on recent developments in microscopy (high resolution imaging and diffraction) and spectroscopy (EDS and EELS) applied towards understanding structure-property relationships in energy related nanomaterials. Topics of interest include novel energy storage and Li-ion battery materials, fuel cell and hydrogen storage materials, photovoltaic and solar cell materials and thermoelectric materials. Submission of papers on these topics using novel spectroscopy instrumentation or in-situ techniques is especially encouraged.

P06 Failure Analysis: Applications of Electron and Optical Microscopy*Michael He, Gabe Lucas, and Dave Norfleet***Invited Speakers:**

- George Vander Voort, Stuers, Inc.
- Rich Schreiman, Rexnord
- Clara Wright, NASA
- Alexander Karakov, Thixomet
- Chirag Shah, Exova
- Arun Gokhale, Georgia Tech

Microscopy is an essential tool for the failure analyst. From simple low magnification "macros" for documentation to the most sophisticated electron microscopy and spectroscopy techniques, microscopy plays a vital role in revealing the root cause of component failures. This symposium will cover all aspects of failure analysis including metallography, SEM fractography, and other forensic techniques (including NDE) for the interpretation of failures. Individual case studies as well as ongoing materials research are encouraged for submission. Failures and forensic analyses can be submitted from any field including transportation, energy, microelectronics, defense, etc.

P07 Microscopy and Microanalysis Applications in Cultural Heritage Research*John F. Mansfield, Ed Vicenzi, and Cathy Selvius DeRoo***Invited Speakers:**

- Nahoko Sugioka, Tokyo University of the Arts

- Joris Dik, Delft University of Technology
- Ainslie Harrison, Smithsonian Institute
- Patrick Rivines, Buffalo State University
- Andrew Lins, Philadelphia Museum of Art
- Alex Ball, National History Museum (U.K.)

In recent years, the maintenance and preservation of cultural historical artifacts has become increasingly important as governments around the globe have recognized that mankind has, in general, failed to take sufficient care of the world's historical artifacts. Millions of visitors every year are attracted to historical cities, archeological sites, museums and libraries and there has long been an awareness of the importance of cultural heritage. However, the concept of actively maintaining and restoring artifacts did not take hold until the 19th century and the technological advances of the 20th century have provided new tools to study the materials, manufacture and deterioration of historical artifacts due to age and wear. This symposium will focus on where the application of microscopy and microanalysis techniques can aid cultural heritage research, principally in the areas of conservation, maintenance, provenance and restoration. Materials of study may include: Metals; ceramics (porcelain and pottery); building materials (stone, brick and mortar); glass; textiles; paper; paint and pigments; mineralogy; coinage and jewelry.

P08 Microscopy and Microanalysis Methods Applied to Joining Technologies

Paul Vianco and David Hillman

Invited Speakers:

- Charles Walker, Sandia National Labs

Joining technologies provide many opportunities to apply non-destructive and destructive microanalysis tools to a wide range of materials challenges. Besides the microstructures of bulk materials, there are interface structures, diffusion regions, and heat affected zones that are critical to the mechanical performance of the overall system. This symposium will address the application of microscopy and microanalysis techniques to joining applications. Papers are sought that exemplify the use of such methods towards furthering our understanding of the roles of base materials, solidification microstructures, and interface reactions on the immediate as well as long-term performance of joining structures. This symposium will address joining technologies that include soldering, brazing, diffusion bonding, anodic bonding, and transient liquid phase bonding as well as all types of welded joints. Papers that describe new, innovative joining technologies are also welcomed. The organizers encourage the submission of results from research and development activities as well as from case studies and failure analyses. Topical areas will include commercial and military products as well as energy generation and conversion systems.

Instrumentation & Techniques Symposia

A01 EBSD Data Collection and Analysis on Challenging Materials and Applications

David Field, Steven Claves, and Scott Sitzman

Invited Speakers:

- Natasha Erdman, JEOL
- Carl Necker, Los Alamos National Labs
- Greg Rohrer, Carnegie Mellon University
- Pat Trimby, University of Sydney
- Angus Wilkingson, Oxford University

Electron backscatter diffraction (EBSD) has been used as a commercially available analysis technique for over two decades and is increasingly common in physical science laboratories throughout the world. In spite of a growing population of expert practitioners there continues to be a number of materials for which performing EBSD measurements is particularly difficult. This arises either because of the nature of the crystallographic phases in the specimen or because of challenging specimen preparation such as is common in multi-phase or reactive materials. Additionally, advancements in instrumentation have enabled analyses approaching the resolution limits of the technique. As more investigators are encountering such difficult problems, this symposium offers an opportunity to come together to share experiences that can advance the current state of applications using EBSD.

A02 Opportunities and Advances for In-situ Experiments in Electron-Optical Instruments

Blythe Clark, Thomas Hansen, and Nestor Zaluzec

Invited Speakers:

- Ian Robertson, UIUC
- Daniel Gianola, U Penn
- Charlotte Appel, Haldor Topsoe
- Peter Crozier, Arizona State University
- Dean Miller, Argonne National Labs

There is an ever-increasing demand for studying the properties of material and matter in their natural environment or when exposed to extreme conditions. Accomplishing this requires continual instrumental as well as technical advancements. The aim of this symposium is to consider and explore the pros and cons of innovative electron optical techniques for studying materials properties during in situ investigations, including exposure to elevated temperatures, ion irradiation, force, gas, liquids, or photons in both scanning and transmission instruments. Exemplified with problems from all sciences, the invited speakers will set the tone for pushing the capabilities of the experiments and instruments to the next level. This symposium is also open to contributed papers dealing with creative or pioneering in-situ studies in both hard and soft materials.

A03 Microanalysis at 60 Years: A Symposium Dedicated to Raimond Castaing

Paul Carpenter, Raynald Gauvin, Edward Vicenzi, and John Fournelle

Invited Speakers:

- Claude Merlet, Montpellier University
- Xavier Llovet, University of Barcelona
- Janos Labar, Hungarian Academy of Sciences
- Ma Chi, Cal Tech
- Gareth Seward, UC Santa Barbara
- Karsten Goemann, University of Tasmania
- Carl Henderson, University of Michigan
- John Armstrong, Carnegie Institute of Washington
- John Donovan, University of Oregon
- Dale Newbury, NIST
- Nicholas Richie, NIST
- David Snoyenbos, Cameca Instruments
- Hideke Takahashi, JEOL

Raimond Castaing defined the fields of microanalysis and microscopy by building the first electron-probe microanalyzer with wavelength-dispersive spectrometers, and made fundamental contributions to electron microscopy, an analysis of physics and the development of quantitative analysis, x-ray correction theory, electron-backscatter diffraction, SIMS, and applications of these instruments and concepts to real world samples. We celebrate these accomplishments within the framework of current

and promising developments in these fields. We welcome contributed presentations by all those interested in microanalysis and microscopy, including researchers and students, and promise exciting and inspiring invited presentations by leaders in the field of microanalysis.

A04 Focused Ion Beam Symposium

Lucille Giannuzzi and Noel Smith

Invited Speakers:

- Michael Phaneuf, JEOL
- Frank Altmann, Fraunhofer Institute
- Bruno Humbel, Université de Lausanne
- Richard Livengood, Intel Corporation
- Shan Xu, Howard Hughes Medical Institute

Abstracts on all aspects of focused ion beams to further the understanding of the physical and life sciences are encouraged. Theoretical or experimental work on ion-solid interactions is appropriate. 2D or 3D FIB-based specimen preparation, applications, and analyses are welcome. New FIB-based nano and micro fabrication and prototyping techniques, software, or patterning topics also fit the symposium. Advances in new FIB instrumentation or methods such as light ion sources, high current ion sources, mass filtered ion sources or low energy ion milling are suitable for this session.

A05 Advancing Data Collection and Analysis for Atom Probe Tomography

Brian P. Gorman and Karen T. Henry

Invited Speakers:

- Tom Kelly, Cameca
- Micheal Moody, University of Sydney
- Satya Kuchibhatla, Oak Ridge National Laboratories
- Sergej Mutas, GLOBALFOUNDRIES Dresden, Germany
- Greg Thompson, University Alabama
- David Diercks, University of North Texas

Atom probe tomography is a rapidly advancing area of materials characterization. Hardware advancements in the recent past have allowed data acquisition of organic and insulating materials, but also difficulties in data interpretation and reconstruction. Reconstruction improvements through image analysis, finite element modeling, and cross-correlative techniques are beginning to improve the tomographic spatial resolution. Software based analysis techniques have opened up new avenues for small volume chemistry observations beyond traditional voxel summation methods. This symposium seeks contributions related to both software and hardware improvements to atom probe tomography data acquisition as well as data analysis techniques.

A06 Advances in EELS and EFTEM

Gianluigi Botton and Peter A. van Aken

Invited Speakers:

- Koh Saitoh, Nagoya University
- Vicki Keast, University of Newcastle
- Wilfried Sigle, Max-Planck Institute
- David Muller, Cornell University
- Maria Varela del Arco, Oak Ridge

As nanoscale phenomena and structures become increasingly important for understanding the chemical and physical properties of ceramics, composites, geological materials, biomaterials and biological structures, careful integration of new characterization techniques and multidisciplinary approaches have become essential. Hence, this symposium aims to attract researchers to showcase contributions covering methods, theory and applications, both in materials and biological sciences, where recent improvements in electron energy loss spectroscopy and energy filtered TEM have been made in terms of energy and spatial resolution for chemical analysis, near-edge structures work, application of low-loss spectroscopy and instrumentation.

A07 Microanalysis Standards

Heather Lowers, Eric Steel, and Paul Carpenter

Invited Speakers:

- Allen Kennedy, Curtin University of Technology
- Tim Rose, Smithsonian
- John Fournelle, University of Wisconsin, Madison
- Axel Renno, Institute of Mineralogy, TU
- Brian Gorman, Colorado School of Mines

Microanalysis standards are central to quantitative microscopy and microanalysis and are important in the fields of EPMA, SEM, EDS, WDS, optical, and atom-probe microscopy. Informal conversations with scientists reveal a general lack of knowledge concerning available standards and how they can be used in the modern laboratory. Many laboratories utilize commercial standard mounts with unknown provenance and are commonly up to 25 years old. Analysts may not be able to demonstrate the accuracy of microanalytical techniques used in their lab due to use of inappropriate standards or insufficient use of secondary standards. This session will highlight the availability of standard reference materials, ongoing studies of these and other microscopy and microanalysis standards, and issues related to their use in the laboratory. Discussions will also determine the needs of the scientific community for new standards for existing technologies as well as those needed for emerging technologies. This session forms the initial evaluation of topical materials which will be expanded in the planned MAS 2012 Topical Conference on Standards. A proposed round-robin analytical program will be initiated during 2011 with results presented at the MAS Standards TC in 2012.

A08 Remote & Collaborative Instrument Operation for Research, Teaching and Maintenance

John F. Mansfield and Gary M. Brown

Invited Speaker:

- Sébastien Gautsch, École Polytechnique Fédérale de Lausanne

Since the mid-1990s, remote microscope control or remote collaboration has been attempted by many researchers. Initially, full computer control of microscope systems was in its infancy and remote operation systems required considerable specialized hardware, a suite of custom software applications, or both together. Nevertheless, these early pioneers were successful in laying the foundation for laboratories, telepresence operation and remote teaching and learning. As we enter the second decade of the 21st century, microscope manufacturers have been able to take advantage of the advancements in computer technology, principally raw processor speed, to produce complex and sophisticated applications for instrument control. The much improved speed of the commodity Internet, in the past decade, has meant that remote operations and collaborations are now much easier for those early practitioners. However, there is still a certain degree of reticence exhibited by other members of the microscope community to embrace implementation of remote and collaborative systems. This symposium will highlight examples of research, teaching, training, service and maintenance by remote operation and

collaboratory systems in a series of invited and contributed presentations. All are welcome to present their latest activities in remote control and collaboration.

A09 Optimizing Imaging for Microanalysis: Realizing the Benefits of the New Detector Options

Brendan Griffin, David Joy, and Dale Newbury

Invited Speakers:

- David Joy, Oak Ridge
- Peter Statham, Oxford Instruments
- Ralf Terborg, Bruker
- Cornelia Rodenburg, University of Sheffield
- Heiner Jaksch, Carl Zeiss
- Raynald Gauvin, McGill University

This symposium will cover:

- Developments in conventional and in-lens secondary electron detectors
- Comparisons between conventional and angular-selective backscattered electron detectors
- Imaging with x-rays using Silicon Drift Detectors
- X-ray image resolution with field emission sources
- Energy-filtered SE imaging applications for microanalysis

A10 Advances in 3D Electron Microscopy

Niels de Jonge, Christian Kuebel, and Alioscka Sousa

Invited Speakers:

- Joost Batenburg, CWI
- Mark Ellisman, UC-San Diego
- Heiner Friedrich, Eindhoven Univ. of Technology
- Werner Kuhlbrandt, Max Planck Institute of Biophysics
- Richard Leapman, NIBIB, NIH
- Andrew Lupini, Oak Ridge
- Jens Mieler, Vanderbilt University
- Paul Midgley, University of Cambridge
- Jurgen Plitzko, Max Planck Institute

Three-dimensional electron microscopy (3D EM) is used both in biology and materials science to gain insight into structure-function relationships. This symposium aims to address forefront scientific and technological developments in the field of 3D EM, including tilt-series tomography, and single particle reconstruction. Several novel methodologies have been introduced in the past decade, including, for example, the use of phase-plate technology for 3D cryo-EM, scanning transmission electron microscopy (STEM) tomography, focal-series STEM, atom probe tomography, focused ion beam (FIB) sectioning combined with scanning electron microscopy (SEM). This symposium will also explore novel computational approaches for 3D reconstruction, segmentation and visualization as well as for the multi-scale merging of 3D data sets.

A11 Effects of Metallographic and Other Preparation Techniques on Microstructural Characterization

George Vander Voort, Sidney Paciornick, and James Martinez

Invited Speakers:

- Victoria Long, NASA
- Tom Murphy, Hoeganaes Corp.
- Alexander Kazakov, St. Petersburg State Polytechnical Univ

The realm of materials science offers many challenges for revealing and characterizing microstructures. The art and science of metallography continues to advance to meet these challenges with new automated techniques for new materials and traditional engineering alloys. This symposium will cover all aspects of specimen preparation for metals, ceramics, composites, polymers, microelectronics, and virtually any other material, as they influence characterization techniques. Contributions are welcome for all specimen preparation methods, not only mechanical grinding/polishing, such as ion-beam techniques. The effects of sample preparation on revealing and characterizing microstructure will be highlighted in this symposium including applications of light microscopy, image analysis, micro- and nano-indentation hardness, SEM imaging, EBSD or EDS, and any other relevant method.

A12 Advances in Electron Crystallography for Materials Research

Sergei Rouvimov, Wolfgang Neumann, Chongmin Wang and Peter Moeck.

Invited Speakers:

- Jim Ciston, BNL
- Paulo Ferreira, University of Texas at Austin
- Angus Kirkland, Univ of Oxford
- Thomas Lagrange, LLNL
- Laurence Marks, Northwestern Univ.
- Edgar Rauch, CNRS, Grenoble
- John Spence, Arizona State Univ.
- Amish Shah, Arizona State Univ.
- Petra Specht, UCB
- Jim Zuo, Univ of Illinois

Electron crystallography experiences a rapid growth due to increased demands for structure analysis of nano-crystals and advances in instrumentation. Aberration-corrected and computer controlled microscopes allow for automation while maintaining high resolution and high precision measurements and, thus, yield new exciting opportunities for crystallographic applications. This symposium will focus on advances in electron crystallography, its applications to organic and inorganic crystals, automated acquisition and handling of 3-dimensional electron diffraction data, nano crystallographic fingerprinting, precession electron diffraction, 3D diffraction tomography in real and reciprocal space and crystallographic data processing. The symposium will provide an opportunity to present papers on both metrology development and materials applications and feature a keynote talk on electron crystallography by Laurence Marks.

A13 Microscopy, Microanalysis, and Image Analysis in the Pharmaceutical Sciences and Diagnostic Microscopy

Andrew Vogt, Cindy Smith, Phoebe Stewart, and Karen Weidenheim

Invited Speakers:

- Carolyn Larabell, UC-San Francisco
- Beverly Maleef, GlaxoSmithKline
- Rekha Panchal, US Army Medical Research Institute of Infectious Diseases
- Robert Weaver, Sandoz inc.
- Ty Abel, Vanderbilt Univ
- Agnes Fogo, Vanderbilt University

Microscopy is playing an increasingly important role in both diagnostics and in drug discovery. The role of diagnostic microscopy in human, animal and plant disorders retains critical importance in today's world. Pharmaceutical research and development laboratories are at the forefront of science and have developed specialized technologies. This symposium will present a variety of biological and materials science applications of significance to the microscopy community. An informal forum will be provided for sharing of thoughts and strategies related to regulatory and other issues faced in our laboratories in addition to talks and posters by contributed and invited speakers.

A14 Equipment Funding Opportunities & Strategies for Success

Owen Mills and Christopher Gilpin

Invited Speakers:

- Debby Sherman, Purdue Univ.
- Shahbazian Yassar Reza, Michigan Technological Univ.

This symposium will cover:

- Major research instrumentation funding opportunities
- Grant application guidelines: follow the rules!
- Strategies for success: increasing funding prospects
- Do's and don'ts in proposal preparation
- Lessons from successful and unsuccessful proposals

A15 Vendor Symposium: Tools for Science

Thomas Nuhfer and Stephen Mick

This symposium is designed for manufacturers and instrument vendors to showcase their new and improved products. Topics include:

- New developments and technologies
- Improvements for existing instrumentation
- Breakthroughs and new instruments.

A16, A17, A18 Self-Assembled Sessions

Self-assembled sessions, organized among colleagues within a particular area of interest not addressed in the current slate of symposia, will be accepted depending on scientific interest as reflected by the quality and quantity of the contributed papers, and space and time availability during the meeting. Proposals for, or questions regarding Self-Assembled Sessions should be directed to:

Program Chair, David Giovannucci at MM2011ProgramChair@microscopy.org *no later than February 15, 2011.*

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Topic List for Contributed Papers

Organizers: Executive Program Committee

Potential contributed session topics in the three (3) categories (Biological Sciences, Physical Sciences, and Instrumentation & Techniques) are listed below. Papers submitted to a topic that corresponds to an organized symposium will automatically be moved to that session. If a sufficient number of submissions on a topic are received, the Executive Program Group will organize a contributed session on that topic; if not, the papers will be redirected to the closest regular symposium.

Biological Sciences

C01 — Biological Sciences — General
 C02 — Biological Sciences — Specimen Preparation
 C03 — Biomaterials
 C04 — Biomedical Applications
 C05 — Botany
 C06 — Cell Biology
 C07 — Cytochemistry (Histochemistry, Immunocytochemistry, In-Situ Hybridization)
 C08 — Cytoskeleton
 C09 — Developmental / Reproductive Biology
 C10 — Entomology
 C11 — Histology
 C12 — Live Cell/In-vivo Imaging
 C13 — Macromolecules
 C14 — Microbiology
 C15 — Molecular Biology
 C16 — Pathology
 C17 — Structural Biology
 C18 — Ultrastructure (Cells, Tissues, & Organ Systems)

Physical Sciences

C19 — Physical Sciences — General
 C20 — Physical Sciences — Specimen Preparation
 C21 — Catalysts
 C22 — Ceramics
 C23 — Films & Coatings
 C24 — Geology / Mineralogy
 C25 — Magnetic & Superconducting Materials
 C26 — Metals, Alloys, Composites
 C27 — Nanostructured Materials
 C28 — Pharmaceuticals
 C29 — Polymers
 C30 — Semiconductors

Instrumentation & Techniques

C31 — Advances in Instrumentation and Technique — General
 C32 — Electron Optics and Aberration Correction
 C33 — Transmission/Scanning Transmission Electron Microscopy
 C34 — Electron Diffraction (Transmission)
 C35 — Electron Holography
 C36 — Electron Tomography
 C37 — Electron Spectroscopy/Imaging in the TEM/STEM
 C38 — X-ray Spectroscopy/Imaging in the TEM/STEM
 C39 — Scanning Electron Microscopy
 C40 — Variable Pressure / Environmental SEM
 C41 — Electron Backscatter Diffraction (EBSD)
 C42 — X-ray Spectrometry / Quantitative X-ray Microanalysis (Bulk)
 C43 — Cathodoluminescence
 C44 — Spectral Imaging
 C45 — In-situ / Environmental Experiments
 C46 — Focused Ion Beam
 C47 — Atom Probe Field Ion Microscopy
 C48 — Scanning Ion Microscopy
 C49 — X-ray Microscopy (TXM/STXM)
 C50 — Scanning Probe Microscopy
 C51 — Optical (Light) Microscopy
 C52 — Confocal Microscopy
 C53 — Multi Photon Excitation Microscopy
 C54 — Optical Fluorescence Microscopy
 C55 — Infrared and Raman Microscopy and Microanalysis
 C56 — Correlative Microscopy
 C57 — Digital Image Acquisition, Processing, and Analysis
 C58 — Education in Microscopy and Microanalysis
 C59 — Metallography and Metallographic Specimen Preparation
 C60 — Failure Analysis
 C61 — Forensic Science
 C62 — Industrial "Real World" Microscopy

C63 — Core/User Facility Management
C64 — Corporate Session

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Other Educational Opportunities

X-90 Microscopy in the Classroom: How to Use it and How to Teach It

Organizers: Donovan N. Leonard and Sherry Cady

Local educators, school administrators, and registered conference attendees are invited to participate.

Microscopy is an exciting, hands-on, active learning resource for students that can inspire a lifelong interest in science. Those who seek careers in microscopy find that it encompasses many interrelated techniques relevant to work in both physical and life sciences. In this session, presentations and instrument demonstrations will illustrate how microscopy can be incorporated into classroom curricula and outreach programs to engage students in cutting-edge science learning. Microscopy teachers will present best practices for training students of all ages and backgrounds to work in the field. Local educators, school administrators, and registered conference attendees are invited to participate.

X-91 It's A Family Affair – CSI Nashville

Organizers: Elaine Humphrey and Jaret Frafjord

This exciting session is designed to pique the scientific interest of children of all ages. It is intended for delegates' families and friends to have a fun, hands-on experience with microscopic explorations. Using clues left at the scene of the crime, solve the mystery and help capture the criminal! Prepare samples and compare the evidence with known samples using light microscopes and scanning electron microscopes. While examining the clues, learn more about microscopes and the extremely fine details of items such as sand, plants, bugs, and metals. This session includes a tour of the exhibition hall to see and use a variety of microscopes.



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In-Week Intensive Workshops

Organizer: Mike Marko

- These In-depth courses will be held Monday-Thursday from 1:00 PM - 5:00 PM
- A certificate of participation will be issued to each participant.
- The course fee includes a discounted full meeting registration to M&M 2011.
- Additional registration fees apply; see online registration form for details.
- Afternoon coffee breaks included each day.

X-23: Introduction to SEM Imaging and X-ray Compositional Analysis



David Joy
*Distinguished Professor,
 University of
 Tennessee, Knoxville and
 Distinguished Scientist,
 Oak Ridge National
 Laboratory.*



Brad Thiel
*Associate Professor of
 Nanoscience Research,
 UAlbany College of
 Nanoscale Science &
 Engineering*



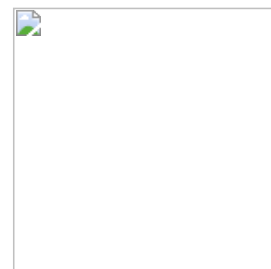
This introductory level workshop will involve classroom lectures and live demonstrations. The SEM topics will be taught by David Joy and will cover basic instrument operation and imaging modes. The EDS topics will be taught by Brad Thiel and will cover basic compositional analysis using an SEM with energy dispersive x-ray spectrometer. The lessons in the lectures will be complemented with demonstrations of SEM operation and x-ray microanalysis. Demonstrated topics will include the effects of working distance, accelerating voltage, probe size, imaging detector, detector bias, probe current, dead time, detector choice, sample geometry, etc.

Topics to be covered:

- Instrument features
- Operation basics
- Sample preparation
- Spectral optimization
- Qualitative and quantitative analysis

David Joy has joint appointments as a Distinguished Professor at the University of Tennessee, Knoxville and as Distinguished Scientist at Oak Ridge National Laboratory. He has written and edited nine books and 400 papers in the areas of Scanning Electron Microscopy, X-ray microanalysis, Monte Carlo modeling of electron interactions with solids, and associated topics. He has lectured at the Lehigh Electron Microscopy Schools every year since 1975 and conducted short courses in SEM in more than a dozen countries world wide. He is a past-President of MSA, and is current Editor in Chief of SCANNING.

Brad Thiel is a Professor at the College of Nanoscale Science and Engineering at the University at Albany. Additionally, he is the Director of the Advanced Metrology Program at SEMATECH. As devices, structures, and particularly defects approach the nanometer scale, it becomes more and more critical to understand and measure structure — property relationships on atomic dimensions. Accordingly, his research centers on the development of new characterization and metrology techniques using electron and ion beams, x-rays and optical methods. He has authored over 120 papers related to microscopy and is a lecturer at the Lehigh Microscopy School.



NaCl recrystallized in the ESEM, overlaid with an EDX spectrum of Pt.

X-24 – Nanomaterial Microscopy and Microanalysis: Tools and Preparation



Phillip E. Russell
*Distinguished Professor of
 Science Education and
 Physics at Appalachian
 State University, a
 Director of MSA, Education
 Chair for MAS, and
 President of the
 Appalachian Regional
 Microscopy Society.*



Donovan N. Leonard
*Electron microscopist
 affiliated with both the
 University of Tennessee,
 Knoxville, Dept. of
 Materials Science &
 Engineering and the STEM
 group, Materials Science
 Division, Oak Ridge
 National Laboratory.*

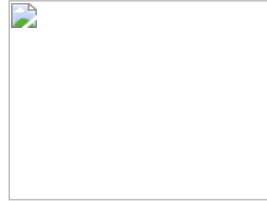
With the wide variety of analytical instrumentation available, the selection of the correct "tool" for analysis of nanomaterials is critical. By introducing various microscopy and microanalysis methods this workshop should provide a solid foundation for nanomaterial characterization for the beginning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

Topics to be covered:

- Choosing the proper preparation technique
- Minimizing the introduction of artifacts
- Ensuring that representative samples are identified for subsequent analysis
- Tools to be discussed:
- SEM, ESEM, and EBSD; FESEM: X-ray Microanalysis
- TEM and HRTEM; STEM/EELS: Nanoanalysis
- FIB: Sample Prep and Nanofabrication
- AFM: Imaging and Nanofabrication

Phillip E. Russell is the Distinguished Professor of Science Education and Physics at Appalachian State University. He spent 21 years of his career at NC State University where he was Professor of Materials Science and Engineering, and funding Director of the Analytical Instrumentation Facility. He has been actively teaching both University and specialty short courses in microscopy and microanalysis for the past 25 years. He is a Director of MSA, Education Chair for MAS, and President of the Appalachian Regional Microscopy Society.

Donovan N. Leonard is an electron microscopist affiliated with the Dept. of Materials Science & Engineering at University of Tennessee, Knoxville and working closely with the STEM group at Oak Ridge National Laboratory. He holds a Ph.D., M.S. and B.S. degree in Materials Science & Engineering from North Carolina State University in Raleigh, NC and researched bio-related nanotechnologies for his dissertation using state-of-the-art electron microscopy techniques. He is also currently an instructor for the Duke University Talent Identification Program and teaches both classroom and online Nanotechnology courses for high school students.



Thin film of ZnO containing Au nanodots (bright contrast hexagons), prepared for 360° STEM Z-contrast imaging by FIB milling

X-25 Theory and Techniques of Aberration-Corrected Microscopy

Harald Rose, Mike O'Keefe, Andy Lupini, and Edgar Voekl

Each day of four days of the course will cover a different topic. (1) Aberration correction: Origin and classification of aberrations; effects on contrast and resolution; correction of axial and field aberrations; design of aberration correctors and aplanats. (2) Atomic-resolution TEM: Image formation and focal-series reconstruction to correct aberrations and extend resolution to the information limit. (3) Introduction to STEM: Aberrations, imaging modes in STEM, reciprocity, coherence, Ronchigrams and measuring aberrations. (4) Electron Holography: History and key elements of holography; holographic reconstruction—challenges, data acquisition, processing, and selected applications.

Topics to be covered:

- Theory of aberration correction and design of correctors
- Atomic-resolution TEM: image formation and focal-series reconstruction
- Atomic-resolution STEM: theory and practice
- Holographic reconstruction methods and applications

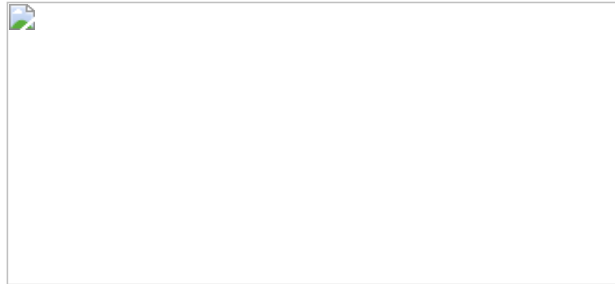
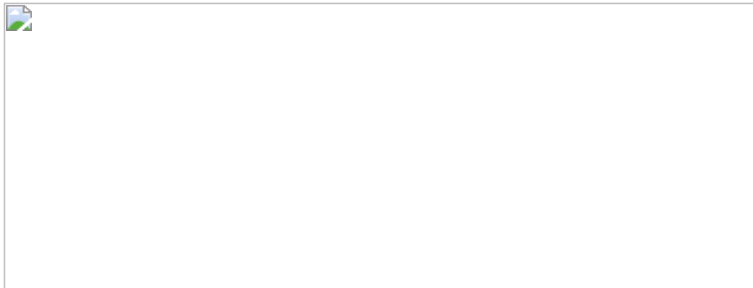
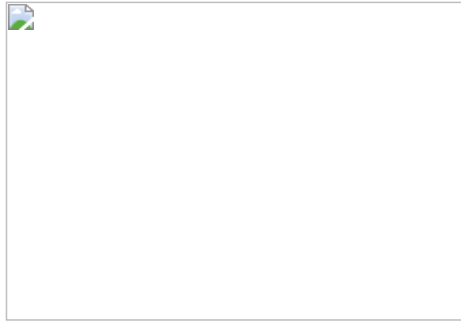


Diagram of sextupole corrector for spherical aberration





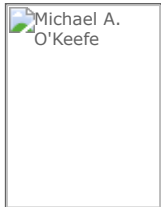
Hologram of MgO particles with interference fringes indicating the image phase

Instructors



Harald H. Rose

Harald H. Rose is an emeritus professor of the Technical University Darmstadt, Germany. His work on theoretical electron optics, started under the supervision of Otto Scherzer, led to the design of the aberration correctors now realized by his students, led by Max Haider at CEOS GmbH. He has 105 patents on scientific instruments and electron optical components. He received his Ph.D. degree in 1964 from this University with a thesis on theoretical electron optics under the supervision of Professor Otto Scherzer. From 1976-1980 he was a Principal Research Scientist at The New York State Department of Health and spend sabbaticals at in 1973-74 at the E. Fermi Institute, University of Chicago, and 1995-96 at both Cornell University and the University of Maryland. From 1980-2000 he was Professor in the Department of Physics of the University of Darmstadt. After his retirement he was a Research Fellow in the Materials Science and Technology Division, Oak Ridge National Laboratory (2000-01), Department of Materials Science, Argonne National Laboratory (2001-02), and at the Advanced Light Source, Lawrence Berkeley National Laboratory (2003-05). His main research activities are in theoretical electron optics, especially aberration correction, theory of electron scattering and image formation in EM. He has published more than 200 reviewed articles in scientific journals, 10 major review articles and is inventor of 105 patents on scientific instruments and electron optical components partly manufactured by various companies.



Michael A. O'Keefe

Michael A. O'Keefe (Mike) is a physicist well-known for his work in materials science and electron microscopy. He is perhaps best recognized for his creation of the seminal computer code for the modeling of high-resolution transmission electron microscope (HRTEM) images. Mike designed and developed the one-Ångström microscope (OÅM) for the National Center for Electron Microscopy at Lawrence Berkeley National Laboratory, and was successful in breaking the "one-Ångström barrier" to HRTEM resolution by a combination of hardware and software correction of microscope aberrations. He produced the first HRTEM images to show carbon atoms separated by less than one Ångström in diamond (0.89 Å) and silicon atoms in crystalline silicon (0.78 Å). His OÅM is the only HRTEM that has successfully imaged the smallest metal atoms (lithium, in lithium battery materials.) Mike was MSA President in 2007.



Andrew R. Lupini

Andrew R. Lupini (Andy) earned his PhD at the Cavendish Laboratory, working under Dr. A.L. Bleloch (currently director of the UK SuperSTEM facility) and Prof L.M. Brown (F.R.S.). His method to measure aberrations developed with Drs. N. Dellby and O.L. Krivanek of Nion Co. is widely used in STEM aberration correctors. He was one of the first workers to obtain direct sub-Ångström high-angle annular dark-field (HA-ADF) images on an aberration-corrected STEM, and is now part of the DOE TEAM project to develop the next generation of aberration corrector. Andy is currently a staff member in Dr. S.J. Pennycook's group at Oak Ridge National Laboratory.



Edgar Voelkl

Edgar Voelkl is a leading expert in electron-optical and light-optical holography, is editor of "Introduction to Electron Holography," author of the software "HoloWorks", and holds several patents in the area of holography and specifically for a design of a dedicated electron holography microscope.

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Pre-Meeting Workshop

- Sunday, August 7; 8:30 AM - 5:00 PM
- Additional registration fees apply; see M&M 2011 website for details.
- A certificate of participation will be issued to each participant.

Z09: Opportunities, Artifacts and Interpretation of Aberration-Corrected Electron Microscopy Data

Organizers: Philip Batson, David Muller, Lawrence Allard, Paul Voyles, Mifang Chi, and Mike O'Keefe

Description: This one-day pre-meeting workshop, organized by the MSA Aberration-Corrected Electron Microscopy (ACEM) FIG, will be a forum for the discussion of the latest advances and solutions to problems associated with application of aberration correction technology in transmission/scanning electron microscopy. The format will consist of platform presentations by both invited and contributed speakers, together with a working lunch - poster session. Invited speakers will introduce innovations and issues, while contributors (both platform and poster) are sought to highlight practical experiences and solutions to problems encountered during the application of ACEM to on-going experimental studies. The topical areas for this workshop include: new corrector designs, image collection/interpretation, and innovations in spectroscopies or new signal types, artifacts and practical experiences in applications of ACEM to difficult situations such as hard/soft materials and in-situ experiments. All platform presentations will be intentionally kept short (~15-20 minutes) to allow the maximum amount of interaction and information flow among attendees.



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Sunday Short Courses

Organizer: Mike Marko

- These full-day courses run from 8:30 AM to 5:00 PM on Sunday, August 7.
- Additional registration fees apply; see M&M 2011 website for details.
- A certificate of participation will be issued to each participant.
- Morning and afternoon coffee breaks are included in your registration fee. Lunch is on your own.

SUNDAY SHORT COURSES IN BIOLOGICAL SCIENCES

X-10 Cryo-Preparation for Biological EM

Kent McDonald

In this course we will briefly review why cryo-techniques for specimen preparation are superior to conventional methods. We will discuss some low-cost-alternative cryo-methods, as well as demonstrate some of the latest equipment and techniques for high pressure freezing, plunge freezing and cryosectioning. CryoSEM, and freeze fracture. The Tokuyasu method for immunolabeling will also be covered briefly. Persons taking this course should leave with a better understanding of these cryotechniques and their role in different applications such as EM tomography, vitreous cryosectioning, EM immunolabeling, as well as routine use for the best available preservation of cellular fine structure.

X-11 Immunolabeling Technology for Light and Electron Microscopy

Caroline Miller

The requirements for successful immunohistochemical and immunocytochemical labeling vary widely with different biological systems. The optimal techniques for light-microscope labeling often differ greatly from those needed for electron microscopy. The basics of immunolabeling at the light and electron microscope level will be presented, illustrated with examples from several different biological systems. The course will cover specimen preparation, multiple labeling, immunogold labeling and enhancement methods, and correlative LM/EM techniques.

X-12 Live Cell Imaging Using Fluorescence Methods

Simon Watkins and Claudette St. Croix

Microscopic imaging tools are one of the principal methodologies applied to the living system. This day-long workshop concentrates on live cell imaging using fluorescence methods, focusing on optimization of the entire microscope system. The goal is to collect the highest quality, most robust quantitative data without perturbing the cells being imaged. Lectures on the fluorescent proteins will be presented as well as discussions of the merits of newer methods such as TIRF and multiphoton imaging.

X-13 Basic Confocal Light Microscopy

Jay Jerome and Bob Price

Confocal microscopy has become a primary method for visualizing structure in three dimensions. The technology is rapidly evolving with new instruments, lasers, detectors, and spectral imaging capabilities. Bob and Jay will instruct beginning and intermediate researchers on carrying out successful biological confocal microscopy experiments. Emphasis will be on practical aspects of specimen preparation, instrument setup and operation and enhancement and analysis of the digital images collected by confocal microscopy. A general knowledge of optical microscopy is helpful, but no prior knowledge of confocal microscopy is necessary to benefit from the workshop.

X14 3D Electron Microscopy of Macromolecular Assemblies

Teresa Ruiz, Michael Radermacher, and Stefan Birmanns

This short course will provide a comprehensive description of the methods used for 3D structure determination of macromolecular complexes from electron micrographs. First specimen preparation techniques for single particles (deep stain, vitreous ice), will be presented and the selection of imaging conditions including low-dose imaging. This will be followed by a detailed explanation of image processing techniques with special emphasis on the random conical reconstruction technique. In the last part structure interpretation and docking of X-ray structures to 3D EM densities will be demonstrated. The techniques described have application in both biological and materials science.

MULTI-DISCIPLINARY SUNDAY SHORT COURSES

X-15 Advanced Topics in the Theory and Use of Focused Ion Beam Tools

Joe Michael and Lucille Giannuzzi

The use of single platform FIB and dual platform FIB/SEM instruments in materials and biological science laboratories is growing rapidly. The versatility and the capabilities of these tools are also rapidly improving. This course will first cover ion/solid interactions that are so important for a user of FIB instrumentation to understand. We will then discuss techniques of sample preparation for SEM and TEM. The course will conclude with discussions of 3D applications and nanofabrication.

X-16 Electron Tomography in Life and Material Sciences

Ilke Arslan and Andy Hoenger

This short course will explain the basics of tomography, the experimental setups, and the instrumental prerequisites, illustrated by application examples. Bright-field, energy-filtered, and STEM tomographic methods will be discussed, emphasizing high resolution for materials applications, and low-dose cryo imaging for biological applications. A variety of reconstruction algorithms will be covered, as well as a survey of 3-D analysis and visualization methods. We intend the course to be of interest to both beginners and already-experienced users of electron tomography.

X-17 Imaging and Analysis with Variable Pressure or Environmental SEM*Brendan J. Griffin and Matthew Phillips*

This short course aims to take the challenge out of imaging in variable pressure SEM mode. We will sequentially address VPSEM column components and operation, electron (SE and BSE), light (CL) imaging and x-ray analysis strategies and detectors for both biological and materials samples. Procedures for monitoring instrument performance and optimizing image quality will then be presented. Examples of the novel charge-related contrasts available in VPSEM will also be discussed. The appropriate use of hot, cool and cold stages is included. The course will conclude with invited manufacturer presentations on new developments. A CD with lecture PDFs is provided.

X-18 An Introduction to Atomic Force and Scanned Probe Microscopies*Lou Germinario*

Atomic Force Microscopy (AFM) has widespread application in all fields of science. Scanning Probe Microscopy techniques have become the workhorse of nanoscience and nanotechnology research, with resolution from atomic to millimeter scale and the ability to perform under air, liquid, or vacuum and on soft or hard materials. AFM provides topographic information and can measure mechanical, electrical and magnetic, as well as performing near-field probing of thermal and chemical properties. A description of AFMs in commonly-used and advanced modes of operation will be provided. Examples from materials and life sciences will illustrate the capabilities and limitations of SPM techniques.

X-19 Scientific Digital Imaging: Ethics and Execution*John Mackenzie*

There is a need for standardization in scientific digital imaging in order to ensure proper ethical manipulation. This newly designed course will include a new Handbook for Scientific Digital Imaging. This handbook presents a standardized workflow with relevant theory to help kick start the standardization discussion. Topics covered include: The proper optimization of digital images; preparation of images for Powerpoint, posters, and publication including newer enhanced on-line versions; selection of the top-rated and most affordable printers, scanners, and software; best practices for archiving scientific digital images. Step by step demonstrations of the best strategy for reproducible image optimization using Photoshop.

SUNDAY SHORT COURSES IN PHYSICAL SCIENCES**X20 Microscopy and Nanomechanical Characterization***Julia Nowak*

Nanomechanical testing is a versatile technique used for measuring and evaluating the mechanical properties of materials including modulus, hardness, fracture toughness, wear resistance, adhesion, and friction coefficient. This type of characterization can provide crucial information concerning the performance of materials. Nanomechanical testing is often combined with scanning probe microscopy and in recent years is being performed in conjunction with both transmission electron microscopy and scanning electron microscopy. In this course we will explain the fundamentals of nanomechanical testing and its role in the microscopy arena, illustrated by application examples.

X-21 Advanced Electron Crystallography and Automated Crystal Mapping for Materials Applications*Wolfgang Neumann, Peter Moeck, Alwyn Eades, Edgar Rauch, Stavros Nicolopoulos, and Sergei Rouvimov*

The development of novel electronic materials and nano-structures requires reliable metrology for an identification of crystal phases and orientations at nano-scale. Recent progress in automated acquisition and handling of 3-dimensional electron diffraction data opens new exciting opportunities for structure analysis in fast and reliable fashion. Course will cover basic principles of electron diffraction and crystallography as well as advances in automated data acquisition, crystal orientation and phase mapping, nano crystallographic fingerprinting, crystallographic image processing and their applications for materials research. Both lectures and exercises on structure analysis based on the electron diffraction and electron crystallography will be included.

X-22 How to Organize and Run a Failure Investigation*Daniel Dennis*

The initial steps of a failure investigation set the direction and either ensures a successful investigation or dooms it to failure. This course provides the steps to organize a failure investigation and ensure success. Failure investigation is an integral component of any design or manufacturing business, large or small. However, a poorly organized failure investigation may not provide the necessary information to solve a manufacturing problem or assist a redesign. This course teaches a proven systematic approach to failure investigation, utilizing examples from industry. It is a learning platform for personnel from all disciplines; materials, design, manufacturing, quality and management.

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Awards & Scholarships

All Awards and Scholarships for M&M 2011 have been awarded. Awards & scholarship information for the M&M 2012 meeting will be available in the 2012 Call for Papers, which will be distributed in Oct/Nov. 2011. Watch your mail and email for information!

[Download complete Awards Information here](#) (pdf)

Awards Information

Please see below and scroll down for details regarding each specific award, criteria and prize(s). In order to be considered for the MAS Distinguished Scholar Awards or MSA Presidential Student Awards, the appropriate box must be checked on the paper submission site. The email address of the person providing the supporting letter must be provided as well. (That person will be contacted via email and asked to submit their support letter via email.) All support letters must be received no later than February 22, 2011. All applicants will be notified of their awards status by March 31, 2011. Unsuccessful applicants are permitted to withdraw their papers by April 8, 2011.

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[Eric Samuel Scholarship](#)
[Raleigh & Clara Miller Scholarship Award](#)
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[MSA Student Poster Awards](#)
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[IMS International Metallographic Contest](#)
[MSA Micrograph Competition](#)



MSA Presidential Student Awards (PSA)

Criteria:

- Applicants must be bona fide students (undergraduate or graduate) at a recognized college or university at the time of the meeting (August 2011). *(Please note — post-doctoral appointees are not considered students.)*
- Awards are based on the quality of the paper submitted for presentation at the meeting.
- Applicant must be the first author of the submitted paper.
- Paper must be submitted for platform presentation.
- Successful applicants must present their papers personally at the meeting in order to receive their award.
- Awardees are expected to attend and participate in the entire meeting.
- Please note: Former winners are ineligible for another award. This category also includes the Raleigh and Clara Miller Awards.

Successful applicants will receive:

- Complimentary full-meeting registration to M&M 2011 (includes proceedings and social event ticket);
- Invitation to the Presidential Reception;
- Up to \$1,000 for travel (lowest roundtrip domestic USA airfare);
- Complimentary student housing accommodations;

Robert P. Apkarian Memorial Scholarship

- Will provide support for two (2) post-doctoral appointees to attend M&M 2011.
- One (1) award designated for biological sciences.
- One (1) award designated for materials science, education or instrumentation.

Criteria (In addition to satisfying all criteria above):

- Applicant must be a full-time, post-doctoral student (open to both domestic U.S. and international candidates).
- Submission procedures must be followed as indicated above for Presidential Student Awards.
- A supporting letter must be received from a member of MSA, preferably the director or supervisor, attesting to the applicant's status.
- Applicant must be a current member of MSA (dues paid through 2011).

Successful applicants will receive:

- Complimentary full registration for M&M 2011 (including proceedings & social event ticket)
- Invitation to the Presidents' Reception
- Award plaque designating the Robert P. Apkarian Memorial Scholarship
- Limited travel and lodging support will be made available

Eric Samuel Scholarship — Sponsored by Oxford Instruments

Criteria:

- Satisfy all criteria for Presidential Student Awards
- Open to all bona-fide graduate and undergraduate students, as well as post-doctoral appointees.



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Successful applicants will receive:

- Complimentary full-meeting registration to M&M 2011 (includes proceedings and social event ticket);
- Invitation to the Presidential Reception;
- Up to \$1,500 for travel (lowest roundtrip domestic USA airfare);
- Complimentary student (or equivalent) housing accommodations.

Raleigh & Clara Miller Scholarship Award**Criteria:**

- Applicant must be the first author of a paper submitted for platform presentation.
- Applicant must have been a student (undergraduate or graduate) or post-doctoral appointee when work to be presented was done.
- Preference is for biological topics, but materials and technical projects will be considered.

Successful applicants will receive:

- \$1,000 to attend the meeting.

MSA Professional Technical Staff Awards (PTSA)

(up to 4 awards given)

Criteria:

- Awards are designated for professional technical staff.
- Applicants must be regular, current members of MSA (dues fully paid for 2011);
- Awards are based on the quality of the paper submitted and are judged by the MSA Technologists' Forum;
- Applicant must be the first author of the submitted paper.
- Successful applicants must present their papers personally at the meeting in order to receive their award.
- Awardees are expected to attend and participate in the entire meeting.

Please note: Former winners are ineligible for another award. This category also includes the Raleigh and Clara Miller Awards.

Successful applicants will receive:

- Complimentary full-meeting registration to M&M 2011 (includes proceedings and social event ticket);
- Up to \$600 for travel/lodging/meeting expenses.

MAS Distinguished Scholar Awards (DSA)**Criteria:**

- Applicants must be bona fide students at a recognized college or university at the time of the meeting (August 2011). This must be confirmed by a current member of MAS.
- Awards are based on the quality of the paper submitted for presentation at the meeting.
- Applicant must be the first author of the submitted paper.
- Paper must be submitted for platform presentation.
- Successful applicants must present their papers personally at the meeting in order to receive their award.
- Awardees are expected to attend and participate in the entire meeting.

Successful applicants will receive:

- Complimentary full-meeting registration to M&M 2011 (includes proceedings and social event ticket);
- Invitation to the Presidential Reception;
- Monetary contribution towards travel and lodging expenses.

Diatome Awards — Sponsored by DiATOME**Criteria:**

Presented for the posters illustrating the best use of diamondknife ultramicrotomy in either biological or physical sciences.

First Prize: One week, all-expense-paid trip to Switzerland

Second Prize & Third Prize: Swiss watches

IMS International Metallographic Contest**Criteria:**

- The contest embraces 11 classes representing various materials and methods revealing structure such as microphotography, optical and electron microscopy, and unique techniques.
- In general, an exhibit should tell a story about a problem and how it was solved.
- For complete requirements, detailed rules, and submission procedures, visit <http://www.internationalmetallographicsociety.org/contest.html> or contact the contest chair, Alice Kilgo (ackilgo@sandia.gov).

Prizes will be awarded in each category.

First Prize: \$200;

Second Prize: \$100;

Third Prize: \$50;

Best in Show Prize: \$3,000

All entries must be received by July 21, 2011 and should be sent to:

James Wittig
Vanderbilt University
5617 Stevenson Center
Nashville, TN 37232

MSA Student Poster Awards**Criteria:**

- Presented for best posters in categories of 1) Instrumentation & Techniques; 2) Applications of Microscopy & Microanalysis — Biological; 3) Applications of Microscopy & Microanalysis — Physical.
- The first author of each awarded paper must be a student (contact information must be provided for someone who can verify student status);
- Awardees' posters must be displayed at the meeting from Monday through Thursday.

There will be one award in each category per day (Monday, Tuesday, Wednesday and Thursday). It will be presented each day to a student presenting their poster on that day.

MSA Micrograph Competition — Sponsored by MSA

Held at the M&M Meeting each year, this micrograph competition promotes the innovative blending of art and science. Open to all forms of microscopic imaging, winners of this competition are selected on the basis of artistic merit and general audience appeal. A maximum of three (3) awards will be presented.

Criteria:

- Entries must be scientifically significant
- Entries must contain novel information useful in resolving a scientific issue, and/or
- Present established information in a way that dramatically enhances its comprehension or interpretation.

Rules:

1. Any individual may submit a maximum of two (2) entries (one award per entrant).
2. Entries must have overall dimensions of 11" x 14" (horizontal or vertical), and be affixed to a stiff lightweight support (e.g. ¼" foam board). Micrographs may be mounted so that they have borders.
3. Each entry must have a separate text sheet with the title and a 200-word (max) description of the image, including the technique and its scientific significance. Text is recommended to be printed in 14-pt Times New Roman font on a separate 8 ½" x 11" sheet. Entrant's name, address and image title shall be posted on the back of the mounted entry(ies).
4. Entries must be brought to the meeting and mounted on the display boards by 12:00 noon on Monday, August 8, 2011. Non-winning entries must be removed Thursday afternoon by 3:00 PM. Micrographs remaining after that time will be discarded. Winning micrographs will be incorporated into the MSA Traveling Poster Exhibit for 2011-2012, and will be returned to the owner during the summer of 2012. Winners will be announced at the meeting. Submitted micrographs remain the property of the entrants subject to the conditions above.

First Prize = \$200;
Two Second Prizes = \$50 each.

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