Electron backscatter diffraction (EBSD) has found extensive use in the field of materials science. For example, EBSD has been used to examine microstructure and texture evolution of structural metallic materials during various stages of production including primary hot working \cite{1}, forging \cite{2,3}, and rolling \cite{4}. Recent software and hardware advances have led to an increase in the rate of EBSD data acquisition. This increase in speed has allowed researchers to measure grain orientations from regions as large as tens of millimeters with resolution on the order of a few micrometers. Some commercially available EBSD data acquisition software packages \cite{5} allow the user to collect combination stage and beam scan data. However, these packages are closed source, such that researchers are unable to modify the software to meet their individual needs. Custom programs were developed to address this problem.

The program named EBSD BatchScan \cite{6} was written in LabVIEW™ \cite{7} and AutoIT© \cite{8} to combine stage movements and beam scans for the collection of large scale data sets. This program is open source and is documented to allow researchers the ability to modify the program to meet their research needs. The program was developed using TSL Data Collection® version 5.3 and a FEI –XL-30 Scanning Electron Microscope (SEM). EBSD BatchScan \cite{6} has four unique operating modes: (1) EBSD BatchScan, (2) EBSD BatchScan with Image, (3) BatchScan with multiple image magnifications, and (4) EBSD with user-defined positions. While each of these modes are different, the core program remains the same. The software builds an array of stage positions based on the upper left corner (start x, start y), and the lower right corner (end x, end y) of the entire area to be scanned, tile size (x, y) of the individual scans, and a tile overlap specified in microns. This stage array contains the x and y coordinates to position the stage for the individual scan tiles. The x and y positions stored in the stage array correspond to the center location on the SEM display screen. The beginning and ending locations used to build the stage array can be input automatically or manually. To build the stage array, the user moves the SEM stage to the upper left corner of the entire area to be scanned and subsequently repeats the process for the lower right corner. It is important that the user checks that the images are in focus at both locations to ensure that the sample is parallel with the stage. The user then inputs the tile size (x, y) and step size for the individual scans, or alternatively just the tile size if the software is being used to collect images rather than EBSD data. Finally, the user has the option to specify the amount of tile overlap in the individual scan tiles. Using EBSD BatchScan \cite{6}, researchers have been able to collect EBSD data from regions with dimensions as large as a centimeter.

Another custom program was developed, named AnyStitch \cite{9}, which acts to stitch individual tiles of secondary electron images, backscattered electron images, or EBSD data collected using EBSD BatchScan \cite{6} into a single data file. This software places the scan tiles according to a user defined overlap and correspondingly modifies the x and y coordinates of the individual tiles in the resultant data file. Figure 1 shows a montage of secondary electron images from a Ti-6Al-4V(wt%) sample measuring 6.6 by 1.7 mm, which was acquired with EBSD BatchScan \cite{6} and stitched together using AnyStitch \cite{9}. Figure 2 shows a montage of 1377 individual EBSD tiles from a Ti-6Al-4V(wt%) sample comprising a total area of 12.3mm by 6.1 mm. This data was also stitched together using AnyStitch \cite{9}. Additionally, another program named CrossStitch \cite{10} was
developed, which finds optimal tile locations based on a custom algorithm involving calculation of misorientation values, performing a corresponding cross-correlation, and subsequently stitches the data into a single file.

FIG. 1. Ti-6Al-4V(wt%) plane-strain compression sample measuring 6.6mm x 1.7mm and consisting of 350 tiles (35 columns, 10 rows) at a magnification of 500x collected using EBSD BatchScan [6] and a 4PI Universal Spectral Engine® [11] and stitched together using AnyStitch [9].

FIG. 2. Ti-6Al-4V(wt%) collected using EBSD BatchScan [6] comprising an area of 12.3mm x 6.1mm scan tiles and stitched together using AnyStitch [9].

References
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