3D Imaging and Analysis

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A compact solution for Eucentric Positioning inside the FIB/SEM

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Recently, more and more emphasis has been placed on 3D reconstructions from data obtained by scanning electron microscopy (SEM) methods. Various detectors are used to gather different types of information. In combination with a focussed ion beam (FIB), layers of the sample are removed in order to investigate the next "slice" of the sample. Often it is necessary to tilt the sample to different angles for milling and data collection - even more so if multiple data collection methods are to be utilized in parallel (EDX, EBSD, etc.).

Although the sample stages built in to typical FIB/SEM systems allow eucentric tilting, these stages are large and cumbersome and often do not deliver the precision necessary to reliably image a large number of slices at different tilt angles. Using the Eucentric 5-Axis Table (E5AT), it is possible to address any tilt angle between ±90° quickly and reproducibly with an absolute accuracy of 0.2°.

Any feature within the substage's XY travel range (10 mm x 10 mm) can be addressed; the additional rotation axis allows (re-)orienting the sample to align a given feature to the viewers preference. Once the feature of interest is positioned at the eucentric hight, the substage can tilt to the desired angle while keeping the feature in focus.

One application for this is a new imaging method developed at the Max Planck Institut für Eisenforschung in Düsseldorf, Germany: Electron Channeling Contrast Imaging (ECCI). This method requires the sample to be repositioned two times for each image. The first position is facing the EBSD camera in order to map the area of interest. Subsequently, the sample must be oriented in such a fashion that the crystallographic planes of the sample are facing the electron column at a small working distance for back scatter imaging. The correct tilt and rotation for this orientation are derived from a custom built software and the data from the EBSD map. The method allows visualizing features in the material’s structure that could previously only be detected in TEM.

1. I. Gutierrez-Urrutia, S. Zaefferer, D. Raabe Scripta Materialia, Volume 61, Issue 7, October 2009, Pages 737-740,

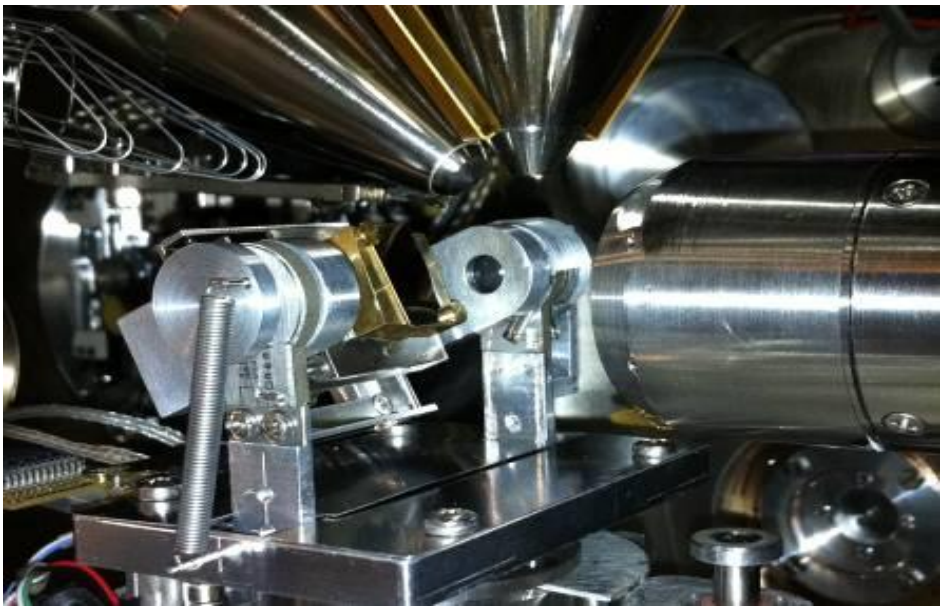

Figure 1. Five axis stage in a Zeiss 1540 XB.

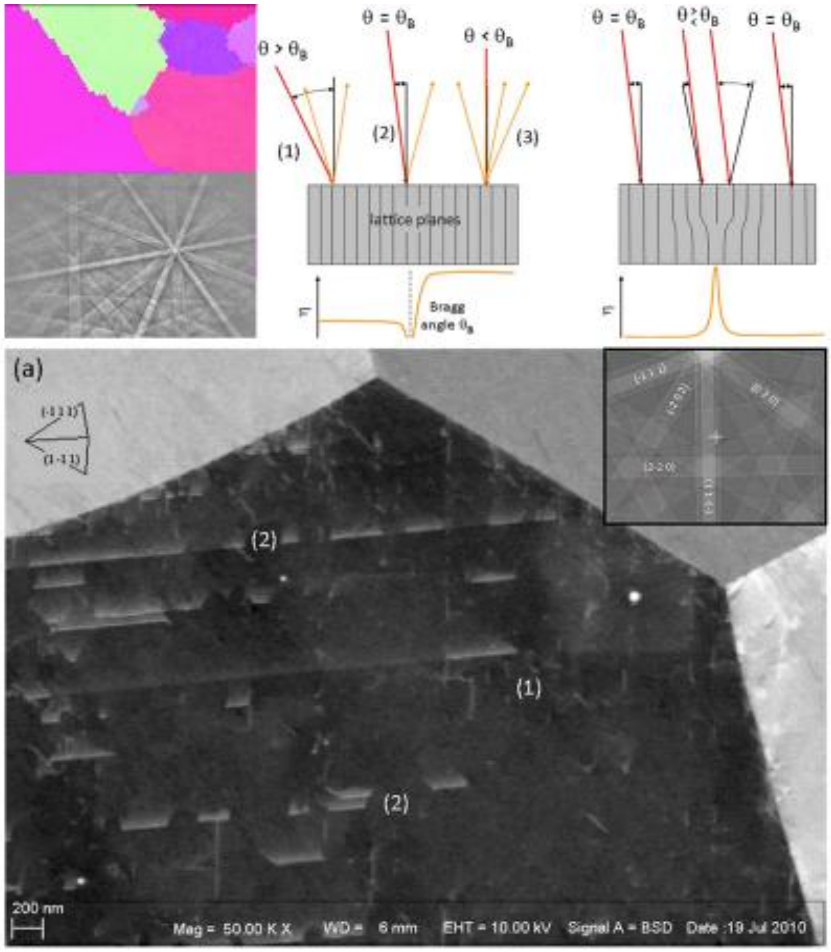

Figure 2. EBSD, ECCI