

## **PRACTICAL DESIGN CONSIDERATIONS OF EBSD SYSTEMS**

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There are a number of hardware and software parameters that must be considered when designing an EBSD system: SEM attachment, geometry of operation, required analysis information, speed of operation, measurement precision, and ease of use. Usually there is a balance of these parameters to obtain the optimum results from the analysis.

The high-angle diffraction pattern produced by the EBSD technique greatly benefits both mapping or spot-mode analysis. However, without lenses between the sample and detector, the detector geometry must be designed to collect as much of the available signal as necessary. Because an EBSD system is really an attachment on an existing analysis system, the SEM, special consideration must also be included in the system design to permit uninhibited use of the original instrument. The use of a bellows for the movable vacuum seal ensures atmospheric integrity while reproducibility of the positioning is crucial in maintaining the identical analysis geometry from sample to sample.

Once the geometry is set, the software is informed of the geometry through auto-calibration methods which assist the user who typically has limited crystallographic experience. Once diffraction patterns are collected, optimized Radon transforms are performed to extract Kikuchi band angles and d-spacings at the accuracy necessary for the analysis under consideration. Indexing routines use as many Kikuchi bands as possible for the most accurate analysis possible.

Spot-mode analysis of unknown samples is called “phase identification”. It requires the acquisition of the highest quality pattern, input of the elemental species contributing to the pattern, and the search of a the ICDD crystal database to characterize the unknown material. The only result is the unique identification by the crystal card.

Area analysis quantifies the orientations of individual pixels in the sample to about 1 degree. To maintain this precision throughout the map, dynamic calibration, beam focus, and image quality must be controlled. The main analysis requirements are selection of the expected crystal structure(s) by the user, and fast pattern acquisition and measurement. From this information, any number of display and analyses options are available including orientation maps, grain and boundary statistics, and traditional texture measurements.