Introducing the reflection Kikuchi diffraction technique (RKD)

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Abstract

Electron backscattered diffraction is performed at an approximately 70◦ specimen tilt to increase the diffraction contrast. Here, we have decided for another approach by utilizing an electron detection technology originally developed at CERN by the Medipix collaboration. These so-called hybrid pixelated detectors have a much-reduced footprint in comparison to indirect electron detection methods, which require a scintillator, coupling optic an CCD or CMOS camera. This allows us to fit the detector directly below the SEM pole piece. We call this geometry reflected Kikuchi diffraction (RKD) (1) and here we describe several advantages of this configuration. This geometry brings isotropic and higher resolution, arising from the reduced interaction and excellent low kV performance. The patter center is well defined, and the risk of collision is much reduced, while allowing for analysis of much larger specimens. Finally, direct detection enables additional possibilities such as counting exact numbers of electrons, thresholding of electrons above a cutoff energy and virtual segmenting of the detector for specific imaging conditions. Here, we describe a systematic comparison of EBSP‘s acquired in conventional and RKD geometries for different materials and describe the optimization work for the RKD geometry for both imaging and analytical applications.
(1) Marshall, A. L., Holzer, J., Stejskal, P., Stephens, C. J., Vystavěl, T., & Whiting, M. J. (2021). The EBSD spatial resolution of a Timepix-based detector in a tilt-free geometry. Ultramicroscopy, 226, 113294.

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