New Pattern Matching Workflows for EBSD Data Analysis

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Abstract

Pattern matching approaches using EBSD Kikuchi patterns have been shown to enable high-resolution measurements of lattice orientations, while also reliably discriminating between very similar phases (1). When combined with dynamical electron diffraction simulations, pattern matching approaches also provide qualitatively new possibilities for the microstructural analysis of non-centrosymmetric and chiral phases in the SEM (2). A flexible combination of the long-established Hough/Radon-transform based indexing approaches with the more recent advanced pattern matching techniques is expected to provide a powerful tool for routine EBSD analyses.
Using an optimized hybrid analysis approach implemented in the AztecCrystal MapSweeper software (Oxford Instruments), we measured lattice rotations and distortions due to crystal defects, phase transformations, and mechanical deformations. We find that the approach enables us to obtain high-resolution microstructural information with reduced requirements on the collected pattern resolution, thus optimizing the available analysis speed and reducing the data storage requirements.

As a qualitatively new application, the influence of dynamical electron diffraction effects on the formation of EBSD Kikuchi patterns makes it possible to carry out an improved texture analysis for non-centrosymmetric and chiral phases, i.e. dynamical diffraction enables us to obtain the orientation distribution function for proper rotations of crystallites as well as for rotations combined with inversions (3).

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