New MTEX software for characterising interfaces using electron backscatter diffraction: TrueEBSD distortion correction and grain boundary smoothing

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Abstract

Combining quantitative electron backscatter diffraction (EBSD) data with qualitative images with higher resolution or stronger phase contrast can be useful for interfacial characterisation. However, distortion correction between imaging modes is required for correlative microstructural analysis. A second challenge is in accurate measurement of boundary trace angles and lengths, because interfaces reconstructed from pixellated images naturally follow the shape of the square pixel grid, which leads to a 'staircase' grain boundary artefact.
Analysis software tools exist to address these two challenges: 'TrueEBSD' (1) is a MATLAB (2) tool to automatically measure and correct physically realistic spatial distortions in EBSD maps, but was developed for a limited range of use cases. For boundary angle and length measurements, the iterative smoothing algorithm in MTEX (3) is useful, but inadequate for heterogeneous microstructures, because highly curved features can shrink and disappear before long segments are smooth enough.

We have implemented the TrueEBSD algorithm in MTEX, an open-source MATLAB toolbox for orientation analysis. This simplifies the workflow, enables the the wide range of existing MTEX tools to be used with distortion-corrected EBSD maps, and allows convenient customisation for different imaging modes and distortion types. We have also improved the iterative boundary smoothing algorithm in MTEX using a microstructurally sensitive local stopping criteria. All boundaries in the microstructure can now be optimally smooth and a operator-selected tuning parameter is no longer required. These new tools will be demonstrated on case studies of a WC-Co composite, and copper with voids at grain boundaries.

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