**Introduction**

Interactions between dislocations and grain boundaries are poorly understood and crucial to mesoscale plasticity modeling. Much of our understanding of dislocation-grain boundary interaction comes from atomistic simulations and TEM studies, both of which are extremely limited in scale. High angular resolution EBSD-based continuum dislocation microscopy provides a way of measuring dislocation activity at length scales and accuracies relevant to crystal plasticity, but it is limited as a two-dimensional technique, meaning the character of the grain boundary and the complete dislocation activity is difficult to recover. However, the commercialization of plasma FIB dualbeam microscopes have made 3D EBSD studies all the more feasible. The objective of this work is to apply high angular resolution cross correlation EBSD to a 3D EBSD data set collected by serial sectioning in a FIB to characterize dislocation interaction with a grain boundary.

**HR-EBSD**

High angular resolution EBSD (HR-EBSD) is a method of post processing collected EBSD patterns to extract higher levels of detail. Shifts between regions of interest (ROIs) on two patterns are calculated using cross correlation, which may then be related to the relative distortion between the two patterns with a high degree of accuracy. While conventional EBSD has an accuracy of around a quarter degree under ideal circumstances, HR-EBSD is accurate to within approximately 0.006°.

**Material and Microscopy**

An AlCu (6% Cu) copper oligocrystal was used for this study. The sample was precipitation hardened and deformed to 11% elongation as measured by digital image correlation. A grain boundary with a high degree of dislocation activity was selected. Due to its curvature, the grain boundary character is highly variable along the boundary.

**Alignment**

Efforts to align the layers using a physical feature (the edge of the block) were unsatisfactory. Instead, the slices were aligned to the nearest pixel by minimizing the average misorientation between corresponding points of each slice, as in Konijnepen, et al., 2015. The resulting measured distortion gradient was calculated.

**Results**

Distortion gradients and dislocation content were calculated using a modified version of OpenXY, an open source HR-EBSD code available on GitHub. The total dislocation content is about 3.52 times higher with the inclusion of the out of plane distortion derivative, much higher than expected, suggesting that there are still significant alignment issues.

**Conclusions and Future Work**

- Three dimensional high angular resolution cross correlation EBSD analysis was applied to an AlCu oligocrystal to measure dislocation densities around a grain boundary.
- Distortion derivatives associated with the plasma FIB serial sectioning were higher than expected, possibly due to geometric uncertainty between layers.
- Future work will focus on mitigating the geometric uncertainty and examining more regions of interest along the grain boundary to glean information on dislocation-grain boundary interaction.

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**Further Information**

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For further information on EBSD dislocation microscopy, see: T. Ruggles, D. Fullwood, J. Kelley and Bryan Majkrzak.