Orientation maps for copper cathodes with defect growth: an EBSD study

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Copper cathodes can develop defect growth associated with incorporation of impurities during unexpected variation in the electrorefining process. High-quality grain orientation maps provide insights into the growth mechanisms. Samples from the Olympic Dam refinery, South Australia, were studied at the µm-scale using SEM and electron backscatter diffraction (EBSD) mapping on a FIB platform. Defective cathodes show sequences of layers from 'good growth' (quasi-parallel aggregates) to abnormal, nodular growth, host to most µm-scale impurities. Large voids separate intermediate layers with fan-like and chaotic growth. EBSD maps show dissimilar but repeating grain orientation, particularly in areas of fan-like growth, suggesting disruption of normal growth patterns and cross-cutting relationships (Fig. 1). We suggest that slime infiltration has initiated new growth cycles, placed pressure on existing growth, or induced recrystallization with impurity inclusions deposited or dissolved out.

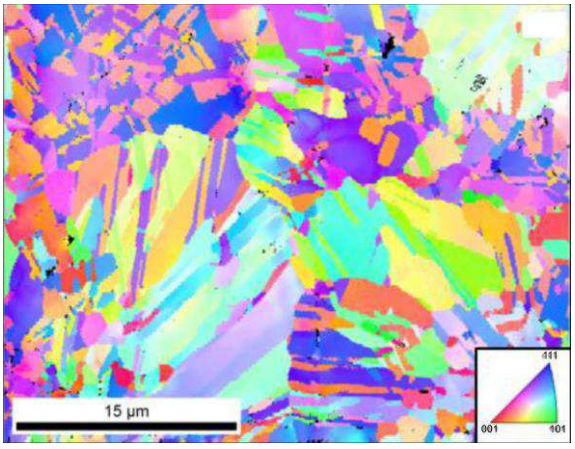

Fig. 1. Inverse pole figure map obtained from fan-like growth. Domain orientation is related to standard stereographic triangle (inset). EBSD on Helios NanoLab, Adelaide Microscopy.

This study shows that changes in copper orientation track superimposed, multiple growth cycles. The data may inspire analogue EBSD studies of other electrodeposited metals.