MONASH University
Engineering

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Reconstructing microstructures in 3D

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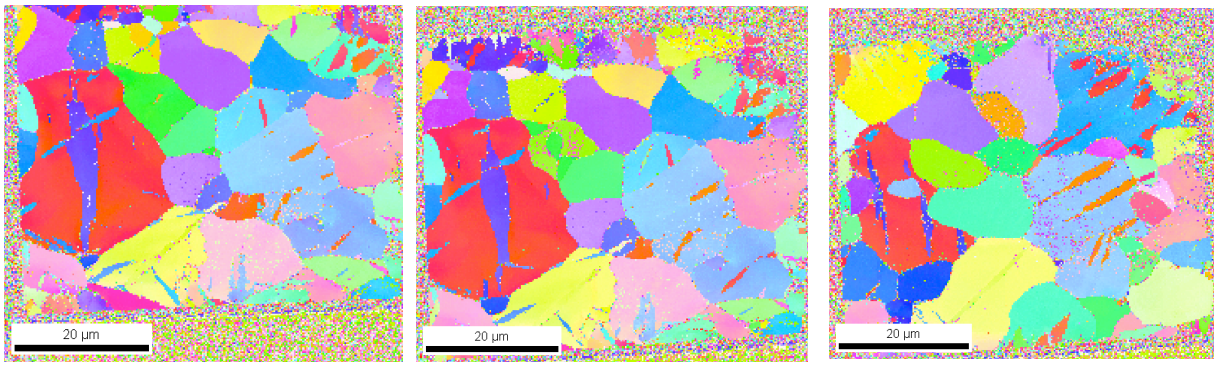
Objective

The aim of this project is to develop computational routines to characterise metal microstructures in three dimensions.

Description

The relationship between microstructure and materials properties is a basic tenet of materials science and engineering and yet there remains a gap in our ability to represent microstructure in unbiased descriptions of materials features. This gap is readily exposed when we try to predict or explain the properties of components in which there are few grains in the cross section: current models do not account for grain structures which have non-uniform distributions of shape and size, with variations in morphology and crystallography, and yet it is precisely these features which govern the performance of small components. In this project we will reconstruct the microstructures of selected aluminium and/or magnesium alloys in three dimensions. The project represents the state-of-the-art in using for the first time the new Dual-Beam FIB-SEM instrument to section a sample repeatedly with the ion beam and collect crystallographic orientation maps for each section using EBSD, allowing unsupervised segmentation of grains and grain boundaries.

Pre-requisites: The successful applicant must have strong computer programming skills, and will be expected to use Matlab coupled with visualisation software as a major component of their research. The student must be familiar with the microstructure of metals.



Raw data serial sections from a pure magnesium sample. Colours indicate crystallographic orientation relative to the sample plane. 3D images are constructed from multiple sections.