Optimisation of scattered electron imaging in the scanning electron microscope

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Microstructural imaging of polycrystalline samples is greatly enhanced using scattered electron imaging, typically using backscatter diodes mounted within a scanning electron microscope, or through an electron backscatter diffraction (EBSD) detector. Modern electron microscopes are well equipped with back and fore scatter diodes, and the EBSD detector can be also be used to provide 'virtual detectors'. In a highly tilted configuration, it is possible to obtain topographical, phase, and orientation contrast in a semi-quantitative manner using direct electron detection with diodes. In this presentation, we will explore the relative merits different sample and electron diode configurations to highlight the imaging of phase, grain shape, sub-grain structure, and surface topography. We have adjusted the placement of diodes to optimise microstructural contrast using the ARGUS imaging system, and we explore the relationship between scattered electron imaging, virtual imaging using the EBSD detector, orientation & phase analysis using full EBSD maps, and high-resolution EBSD analysis of sub-structure. Optimisation of the scattered electron contrast imaging is subsequently used to provide quantitative microstructural information which complements the microstructural information revealed using EBSD mapping. We will explore microstructural contrast though the analysis of a two-phase Gibeon meteorite, where microstructural imaging is complicated through the presence of low angle grain boundaries and the Kamaceite-Taenite (i.e. austenite-ferrite) orientation relationship.