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Characterization of dislocations in deformation-induced planar boundaries of aluminium

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During plastic deformation of metals the gliding dislocations interact to give work-hardening and also to form dislocation boundaries, which develop into a regular deformation microstructure within each grain. Morphologically, dislocation boundaries fall in two main categories, one being extended planar boundaries with specific crystallographic alignments and the other being a three-dimensional arrangement of shorter boundaries forming a fairly equiaxed cell structure.

A thorough experimental transmission electron microscopy study of the dislocations in the extended planar boundaries (also termed GNBs) is presented. The Burgers vectors, \mathbf{b} , were determined using two-beam diffraction contrast experiments where a range of diffractions vectors, \mathbf{g} , which is sufficient to identify the \mathbf{b} 's using the $\mathbf{g} \cdot \mathbf{b} = 0$ invisibility criterion, was employed.

The Burgers vectors and line directions of the dislocations are determined for eight slip-plane-aligned GNBs coming from three grains of near 45° ND rotated Cube orientation in rolled pure aluminium. An example is presented in Fig. 1.

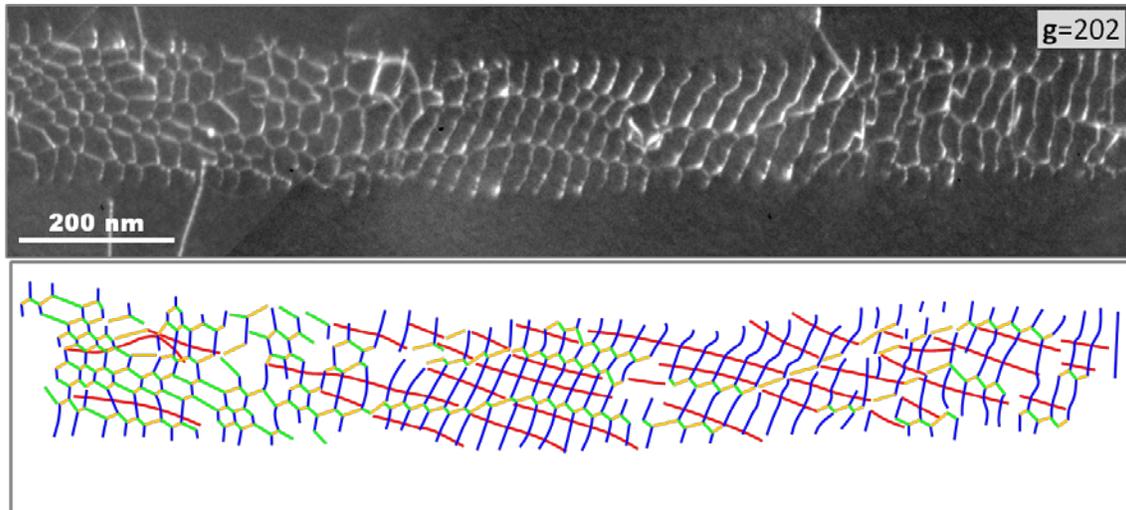


Figure 1 – Identification of dislocations in a GNB observed in a cold rolled Al sample. The colors in the sketch (bottom) designate the identity of the determined \mathbf{b} .