E3 spectrometer demonstration

Texture measurement in structural alloys

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Due to the high penetration power of neutrons in most structural alloys, neutron diffraction is a very powerful technique for measuring bulk texture.

The technique is of great practical significance as crystallographic texture plays an important role in determining the mechanical and physical properties of structural metallic alloys which are of paramount importance in the automotive, aerospace, and power generation industries.

In this demonstration:

Students will be introduced to the practical aspects of bulk texture measurement, including wavelength selection, beam collimation, and specimen orientation in the beam. The data will be used to plot stereographic pole figures. The orientation density function will also be generated and used to reconstruct pole figures, including those that were not acquired experimentally.

Figure 1(a) shows a typical stereographic pole figure for an extruded round bar of a hexagonal-close-packed magnesium alloy. Extrusion is a process by which a metal is forced through a die to give a bar having a desired cross-section. The centre of the pole figure corresponds to the extrusion (bar) axis, while points on the circumference of the pole figure correspond to radial directions. The contours show that the c - axis of the hexagonal-close-packed unit cell is aligned with a radial direction for the majority of grains. The effect of this strong texture on the uniaxial stress-strain behaviour in tension and compression of the alloy is shown in Figure 1(b).

Figure 1(a)

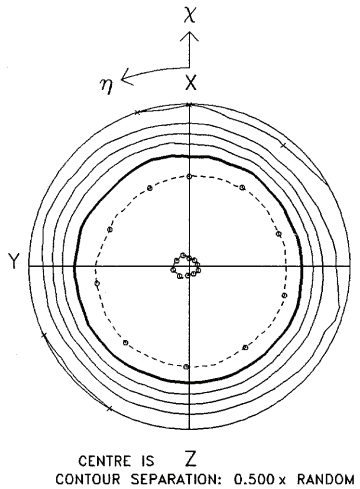

Figure 1(b)