Measurement of the Strain Response to Applied Uniaxial Stress in Annealed Mild Steel

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This Poster will summarise some of the experimental data taken over the period 1986-1990 using the Pluto 3-axis instrument at Harwell, the HRPD at ISIS, and D1A at ILL. The measurements were made on B3970 mild steel samples which had been annealed in vacuum at 850°C for 15 min, followed by a slow, ~2°C/min., linear cool. Using the Harwell stress rig, one of the first such devices for measurements on stressed samples *in situ* on a diffractometer, the samples 6 cm long and 3 mm diameter were subjected to tensile and compressive uniaxial loading. The lattice strain component was measured parallel and perpendicular to the applied load direction at stress levels between 0 and 400 MPa.

The aim of the measurements was to provide data leading to a thorough understanding of the response of various lattice planes *hkl* to applied stress into the plastic regime. In the elastic regime the elastic constants can be accounted for quite well by the Kröner model. As the applied stress increases, it is found that a co-operative relaxation of lattice plane strain for all *hkl* takes place at about 240-250 MPa, with the amount of relaxation varying with *hkl*. After relaxation the lattice strain increases linearly with stress, but generally with somewhat higher elastic constants. The diffraction peak widths are resolution limited in the elastic regime, but broaden rapidly and slightly asymmetrically as the plastic strain increases.

The data have been characterised in terms of parameters for the lattice strain Vs stress behaviour of each reflection *hkl*. A theoretical analysis of the data in collaboration with M R Daymond has been initiated.

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