Report on HS2252

Beam-time:
ID19: 1-4/09/2006, in-house time 09/2007
ID11: 8-12/02/2007

In this group of experiments we have performed a number of grain tracking and in-situ stress corrosion cracking measurements.

We have been able to successful analyse these datasets to determine the shapes and orientations of grains in a stainless steel wire, and hence produce the first non-destructive, in-situ 3D visualisation of a crack interacting with a polycrystalline microstructure. This is a very significant achievement in this field of materials science. In the figure, the crack (white) can be seen follow the boundaries of grains (coloured).

For the grain tracking measurements we have adopted the diffraction contrast tomography technique, pioneered at beamline 19 as part of a collaboration with the Risö group. In the most recent beamtime allocation the equipment necessary for this technique was installed at beamline ID11 to benefit from the increase flux available compared to ID19. The software neccessary to analyse such datasets has been developed as part of this project. In the dataset shown, approximately 350 grains have been reconstructed.

Following the acquisition of tracking datasets, samples have been transferred to beamlime ID19 for in-situ observations of stress corrosion cracking. Tomographic datasets have been acquired for a number of increments of crack growth, from initiation to failure. The crack dataset has been combined with the grains found by DCT, and excellent agreement can be seen between the two. Analysis, now in progress, will determine grain boundary characteristics (misorientation between grains, boundary crystallographic planes, identifying special boundaries), and reveal which have failed easily, and which remain bridging the crack in its final stages.