ESRF	**Experiment title:** Surface strain in alumina and alumina/silicon carbide nanocomposites	**Experiment number**: ME756
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Report:

High resolution powder diffraction measurements at fixed grazing incidence angle were performed on ground and polished surfaces of alumina and 5%SiC-alumina nanocomposites. Previous measurements undertaken on BM16 had shown that the full width at half height maximum (FWHM) was a function of incidence angle and these data were successfully modelled assuming that the random strain associated with the dislocation density fell exponentially from the surface [1]. However, the prism and pyramidal plane reflections chosen were such that the lattice parameter measurement was insensitive to long range strain. A key aim of the present experiments was, but use of high scattering angle reflections, to determine whether long range and non-random strain existed in the surface.

The results from high scattering angle reflections showed that there was no significant variation in lattice parameter as a function of incidence angle. We conclude that uniform strain does not remain in the surface. Key results were:

1. The rate of fall of damage is similar, but a little slower for the ground nanocomposite compared with the ground alumina. (Fig1)
2. The level of inhomogeneous surface strain is greater in the ground nanocomposite than in the ground alumina. (Fig 1)
3. The rate of fall of this strain is much faster in the ground and annealed alumina than in the ground alumina. That is, the annealing appears to have removed substantial amounts of strain throughout the depth. (Fig1)

4. For the annealed samples, the surface strain level is the same for alumina and the nanocomposite. (Fig 2)
5. For the annealed samples, the rate of fall of strain with depth is slower in the nanocomposite than in the alumina.
6. The residual strains deep in the material are greater for the annealed nanocomposite than for the annealed alumina (Fig2)
7. The inhomogeneous strain at the surface after annealing is the same for both the pure alumina and the nanocomposite, despite them being different in the as-ground state.
8. The 30.0 and the 22.6 data sets (scattering angles of 69º and 96º) give a consistent value for the depth of damage. (Fig 3)

The variation of the Bragg peak FWHM of a many reflections was studied as a function of incidence angle, greatly extending our previous work and enabling us to separate the effects of diffracting domain size from strain via the Williamson-Hall technique (Fig 4). All the data fitted the previous model.

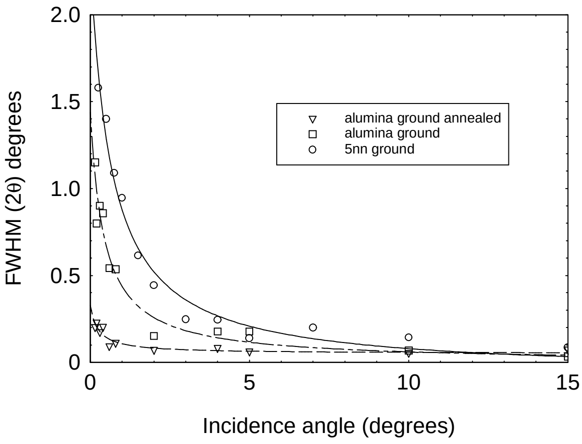

Fig 1

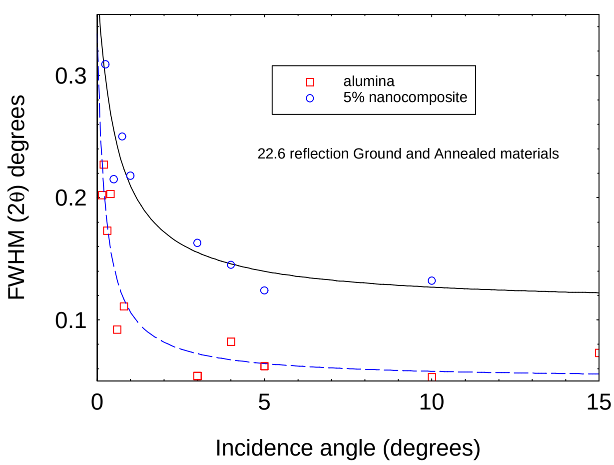

Fig 2

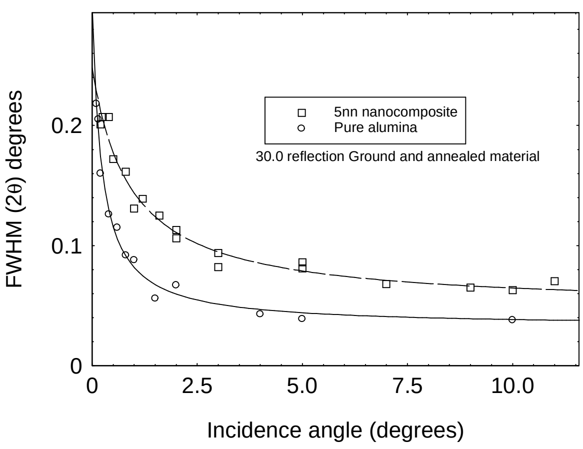

Fig 3

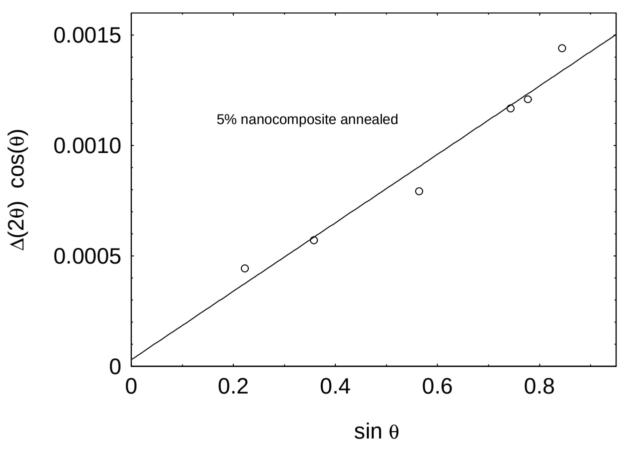

Fig 4

[1] H. Z. Wu, S. G. Roberts and T. P.A. Hase, Phil. Mag. 84 (2004) 1219-1232