06. PHYSICAL PROPERTIES AND STRUCTURE

06.1-71 INFLUENCE OF MAGNETIC FIELDS ON THE HALF-INTEGER BRAGG REFLECTIONS IN MAGNETITE. By T. Nakajima, S. Suzuki, K. Namikawa, S. Todo, K. Chiba, M. Ando and S. Chikazumi. National Laboratory for High Energy Physics, Oho, Tsukuba, Ibaraki 305, ** Faculty of Science, Tokyo Institute of Technology, Meguro, Tokyo 152, ** The Institute for Solid State Physics, Roppongi, Tokyo 106, + Chiba Institute of Technology, Tsukunm, Narashino 275, ++ Faculty of Engineering, Keio University, Hiyoshi, Yokohama 223

The organizing process of charge ordering associated with the internal lattice deformations due to the simultaneous condensation of a few phonon mode remains unsolved now, since studies on the Verwey transition scheme as originally posed by Verwey (3). In connection with this subject, the field dependence of half-integer reflections (441/2) and (441/2) resulting from Δ mode distortions was investigated by intensity measurements and rapid X-ray topography with use of white SR X-ray in KEK. The crystal used here is a (110) triangle shape plate of several millimeter and 174 μm in thickness. Transmission Laue patterns for hkl series were observed (Fig.1). All spots were indexed by comparing them with computer generated pattern. In order to orientate the crystal to the internal lattice deformations due to characteristic diffuse streaks on diffraction patterns. As the transformation proceeds further, new reflections characteristic of the 6H structure become discernible along the streaked rows. The present investigation was undertaken to study the mechanism of 3C to 6H transformation in SiC by determining the nature and distribution of stacking faults affecting the transformation.

Solid state transformations in SiC can take place either through a non-random insertion of deformation faults emerging from slip of parts of the crystal past each other through partial slip vectors or through a non-random insertion of layer displacement faults involving disruption of normal stacking sequence for a pair of layers leaving distant layers unaffected (Pandey et al., Proc. Roy. Soc. London (1980) A369, 435; ibid 451, ibid 463). The 3C to 6H transformation by the deformation mechanism would require consecutive basal slip through (1/6)[112] vectors on three successive layers followed by no slip on three subsequent layers as depicted below:

Initial Structure (3C) : ABCABCABC...

Resulting Structure (6H) : ABCABCABC...

The desired basal-slip can take place by the passage of Shockley partials in accordance with the suggestion of Ogbuji et al. (J. Am. Cer. Soc. (1981), 64, 91). On the other hand in layer displacement mechanism, the intermediate orientation of a pair of neighbouring layers as a unit process is required after every four layers of the 3C structure in a manner depicted below:

Initial Structure (3C) : ABCABCABC...

Resulting Structure (6H) : ABCABCABC...

The displacement of a pair of layers as a unit process can take place by a diffusional rearrangement of atoms. In order to make a choice between the two possibilities, we have developed the theory of diffraction from 3C crystals undergoing transformation to the 6H structure through a non-random insertion of deformation and layer displacement faults separately. From a comparison of the theoretically predicted diffraction effects with those experimentally observed, it is concluded that the 3C to 6H transformation in SiC takes place by the layer displacement mechanism.