

Precise Measurements of Lattice Parameter Mismatch between γ and γ' Phases In Ni Base Alloy

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Single crystal X-ray diffraction experiments of Nickel base alloy, CMSX-4, were carried out from RT to 1100K at BL02B1. Fig.1 shows the superlattice peak obtained at room temperature which comes from ordered phase (γ' phase), with excellently high resolution (FWHM = 0.04 degree) up to high indices. Superlattice peak profile kept sharp at any temperature, and the lattice parameter of γ' phase was determined as a function of temperature from RT to 1100K(Fig.2).

On the other hand, fundamental peak profiles which come from both γ' and γ phases consist of a main peak and a wide plateau neighboring on the lower angle side(Fig.3). The position of the main peak is consistent with that calculated from the lattice parameter of γ' phase, but the intensity indicates that it definitely includes the contribution from the mother lattice γ phase. One of the possibilities is that the diffuse scattering as plateau at lower angle side is deduced to be diffraction from γ phase, but this consideration is inconsistent with the current model in which the lattice parameter of γ phase is shorter than that of γ' phase. We conjecture that lattice matching of both phases in a single crystal plays an important role for the characteristics of this substance.

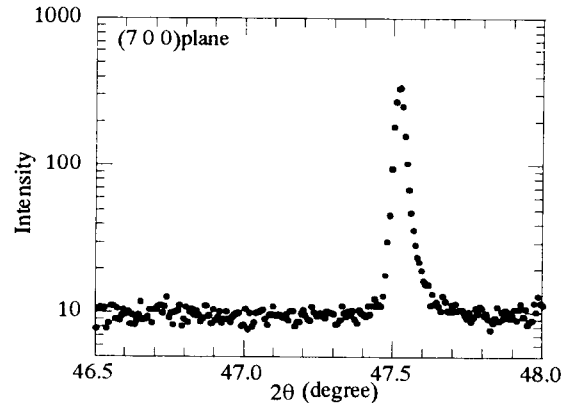


Fig.1 Peak profile of (7 0 0) superlattice diffraction

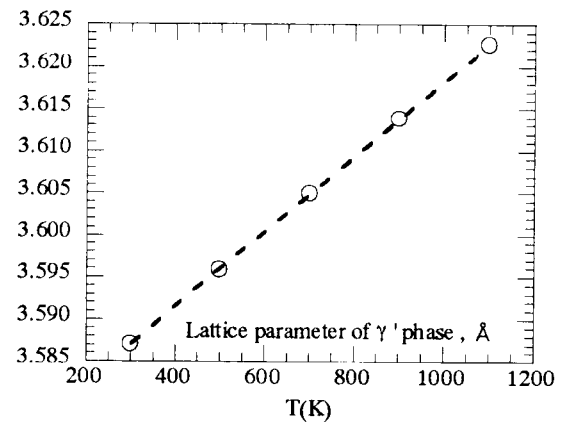


Fig.2 Temperature dependency of γ' lattice parameter

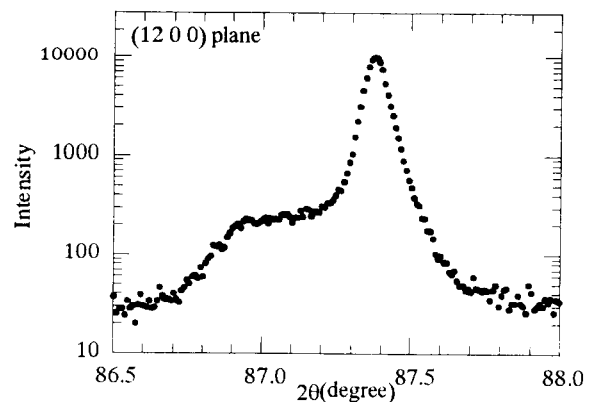


Fig.3 Peak profile of (12 0 0) fundamental diffraction