Precise Profile Measurements on AuCd Alloy Prior to the Martensitic Transformation

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Introduction

The martensitic transformation is known to be a displacive phase transformation and to be a typical first-order transformation. The macroscopic characteristics of the martensitic transformation are described well by the phenomenological theory. However, the mechanism of the transformation from microscopic point of view has not been completed yet. AuCd alloy is typical alloy, which shows a martensitic transformation. Close to equi-atomic composition, there is martensitic phase called ζ_2', which transforms from the B2 (CsCl) parent phase. Studies of precursor phenomena associated with the martensitic transformation of AuCd have also been reported for understanding microscopic mechanism of the transformation. Noda et al.[1] reported incommensurate reflections appearing prior to the transformation and Ohba[2] proposed transitional (intermediate) state prior to the transformation. Another approach for understanding the mechanism of the martensitic transformation was made in this report.

Experimental

AuCd single crystals were cut approximately 5mm x 5mm and polished. Martensite start temperature (Ms) is 301K. Diffraction profiles were measured precisely above the *M*s by four-circle diffractometer at BL-10A. Two different wavelengths were utilized for the measurements, which changes penetration depth of X-ray.

Results and Discussion

The log-log plot of 011 diffraction profiles measured at wavelength, λ=0.55, were shown in Fig. 1. Least-squares fitting with $\log I = n \log q$ were made and n were determined. They are shown in Fig. 2. Close to the *M*s, n becomes smaller than 2. The value n relates to defect in a crystal. Therefore it may suggest that defect in a crystal plays a role for the transformation and thus the change of n represents a precursor phenomenon viewing from precise profile measurements. Authors are analyzing results performed at another wavelength and preparing interpretation.

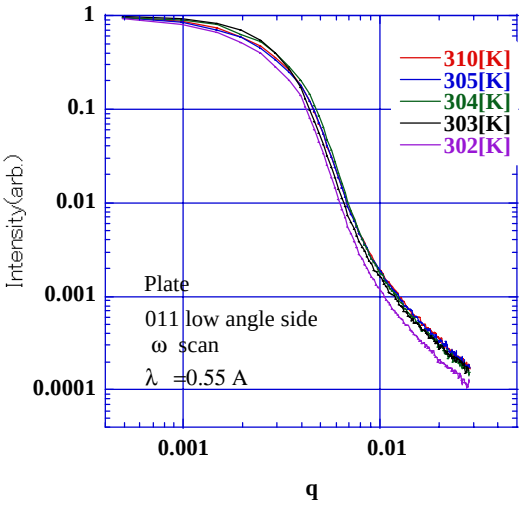

Fig. 1. Diffraction profile measured at various temperatures.

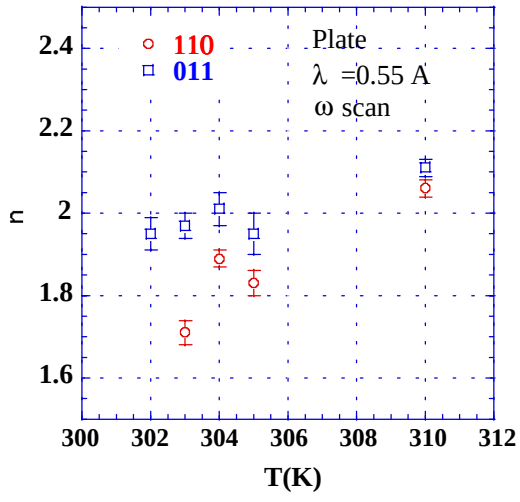

Fig. 2. n determined by least-squares fitting against temperature.

References

[1] Y. Noda et al., Metall. Trans., **A19**(1988) 265.
[2] T. Ohba, Proceedings of International Conference on Solid-Solid Phase Transformations '99, (1999) 815.

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