

Elastic diffuse scattering of neutrons in Fe₃Pt Invar alloys

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Very recently, we have found elastic diffuse scattering of neutrons around various Bragg peak positions for the typical Invar alloys Fe_{1-X}Ni_X ($0.35 < X < 0.60$) alloys. The scattering intensities depend on temperature and Ni concentration and increase with decreasing temperature and decrease with increasing Ni concentration. Since the ranges of temperature and Ni concentration, for which diffuse scattering is observed, coincide with those for which the Invar anomalies are observable, the diffuse scattering seems to have strong correlations with the Invar effect. The experimental data were well reproduced as diffuse scattering due to the formation of clusters with the local lattice deformation wave propagating along the $\langle 1\ 1\ 0 \rangle$ direction and the $\langle 1\ -1\ 0 \rangle$ polarization vector. Since an Fe₆₅Ni₃₅ Invar alloy is located close to the phase boundary of fcc-bcc martensitic transformation, the origin of the diffuse scattering would be explained as a pre-martensitic phenomenon of an fcc-bcc phase transition of the alloy.

Another archetypical Invar alloys, ordered and disordered Fe₃Pt alloys are also located close to the phase boundary of an fcc-bcc martensitic transformation. Thus, we can expect similar diffuse scattering for these Invar alloys. We report observation of similar elastic diffuse scattering of neutrons for ordered and disordered Fe₃Pt Invar alloys as those for the FeNi alloys. The experimental data were analyzed using the Huang diffuse scattering. In Fig 1, diffuse scattering observed around (200) for ordered Fe₇₂Pt₂₈ alloy and calculated one using the expression of Huang diffuse scattering are given. This pattern is very similar to that observed for the Fe₆₅Ni₃₅ alloy. Since the similar diffuse scattering is observed for the disordered Fe₇₂Pt₂₈ al-

loy, appearance of elastic diffuse scattering is a common feature of typical Invar alloys, ordered and disordered Fe₃Pt and Fe_{1-x}Ni_x ($0.35 < x < 0.5$). Various anomalous magnetic behaviors have been reported by previous authors as common properties for the Invar alloys. The local lattice deformation observed here would give a strong effect to the magnetism of the Invar alloys. Spin modulations coupled with the local lattice deformation would be the future problem.

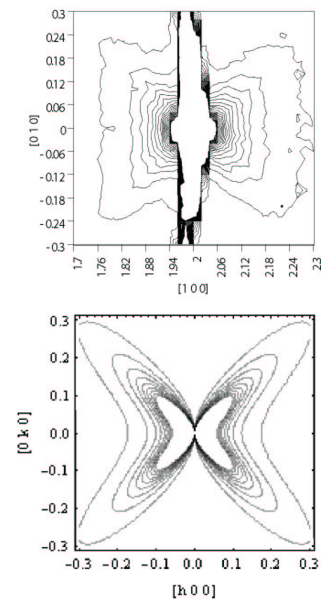


Fig. 1. Fig.-1 Observed and calculated diffuse scattering around (2 0 0)