

Structural Fluctuation in Ternary Alloys

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Most of the materials include some disorder or/and fluctuation in their crystalline structures, which more or less affects the physical and chemical properties. The structural disorders are ideally investigated through the X-ray diffuse scattering measurements. Diffuse scatterings are, in general, widely broaden in reciprocal space, but some of them are concentrated as relatively sharp maxima. The former is generally very weak and the latter must be measured with a considerably high resolution.

We have performed the two following experiments with the use of seven-circle diffractometer at the beamline BL02B1 of Spring-8 as our trial. First experiment is to determine the angular dependence of the full width at half maximum (FWHM) affecting from the phason distortion in single quasicrystal Al-Ni-Co ternary alloy. We have performed the perpendicular scanning Q_{\perp} of

Bragg reflections against the diffraction vector with the use of highly resolved X-ray beam. The linear relation between the value of FWHM and Q_{\perp} is obtained. From this experimental result, we have confirmed an appearance of linear phason in quasicrystal Al-Ni-Co ternary alloy. The second experiment is to observe diffuse scattering intensity due to the static displacement of atoms in Ni single crystal after irradiation by first electron (2MeV , $3 \times 10^{18} \text{e}^{-}/\text{cm}^2$). The diffuse scatterings are expected to appear near the Bragg reflections. We have, therefore, observed the difference of such scattering (i.e. Huang scattering) intensity profiles between before and after irradiation. In this experiment, the diffuse intensity itself was so weak that we could not take the quantitative informations. However, an quantitative analysis of the Huang scattering will be performed after the full injection is starting.