Development of High Resolution X-ray Imaging by the Refraction Contrast Method

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Refraction contrast X-ray imaging has been recently studied actively. Using this method, the radiation dose can be small, as compared with the absorption contrast imaging. Another advantage of this method is that the high contrast images may be obtained for the sample consisted of light elements in hard X-ray region. However, this method needs a micro-focused X-ray source or a well-collimated X-ray beam (order of a few micro-radians).

The third generation synchrotron sources, like SPring-8, ESRF and APS, are candidates to make the micro-focused X-ray sources. For instance, by focussing X-rays from synchrotron radiation on a metal target, fluorescent X-rays from the metal target can be the micro-focused X-ray sources. Multilayer supermirrors are promising for such focussing optics in high energy X-ray regions.

Several types of supermirrors were fabricated by a magnetron DC sputtering method. The design parameters of the supermirrors were described in Yamashita et al. (1999) in detail.

The reflectivity measurements were carried out at BL24XU. X-rays with the energy of 32 keV were monochromatized by the beamline monochromator. The X-ray beam was collimated to 50×50 μm^2 in size by a slit placed at about 70 m apart from the source. The beam divergence was about 0.4 arcsec. The sample and scintillation counter were mounted on a $\theta - 2\theta$ table. The measured reflectivity is shown in Fig. 1. The solid line represents the measured result and the dotted line is derived from the calculation with the designed parameters involving the micro-roughness of 3.8A. The 2nd and 3rd order Bragg reflections are easily recognized. The higher order reflection is useful to investigate the structure of supermirrors more in detail.

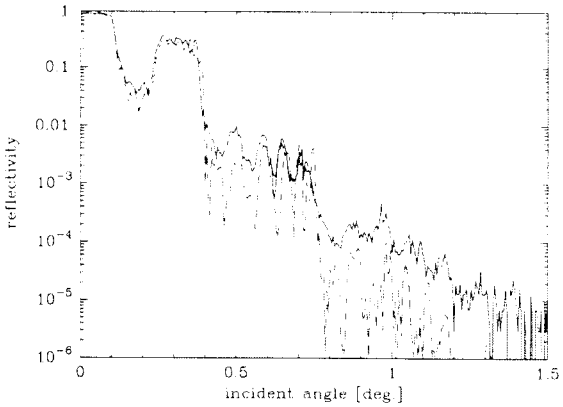

Fig. 1. Supermirror reflectivity at 32 keV.

References

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