

Multilayer Fresnel Zone Plate at AIST and SPring-8 ----- high diffraction efficiency, high-energy x-ray region -----

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A multilayer (sputtered-sliced) Fresnel zone plate (FZP) is one of promising focusing optics with high spatial resolution for high energy X-ray region, especially over 20 keV, because a large "aspect ratio" (the ratio of the FZP thickness to zone width) can easily be realized [1,2]. In addition, it is highly important that the kinoform type zone plate (the theoretical diffraction efficiency is 100 %) can be fabricated by the sputtered-sliced method (Fig.1).

A higher diffraction efficiency is indispensable as well as a higher spatial resolution. In order to realize higher focusing efficiency, a multilevel-type [3] (4-step: quasi-kinoform type) multilayer FZP with the diameter of 70 micron has been fabricated (Fig.2). Such a FZP was composed of concentric multilayer of alternating high-Z (Cu), low-Z (Al) and composite materials. The focusing test of the FZP was performed at the BL20XU undulator beamline of SPring-8. The measured diffraction efficiency has been more than 45 % around 50 keV, which exceed the theoretical limit of the phase FZP.

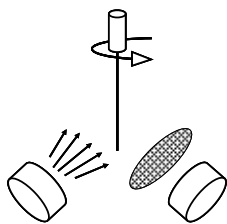
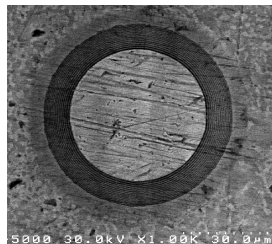
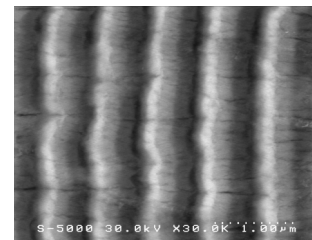


Fig.1 DC sputtering apparatus



(a)



(b)

Fig.2 Scanning electron micrographs of Cu/Al 4-step multilayer FZP : (a) Full view, (b) its close-up view.

[1] N.Kamijo, S.Tamura, M.Yasumoto et al: Review of Scientific Instruments, 74 (2003.12)5101.

[2] S.Tamura, M.Yasumoto et al.: Journal of Synchrotron Radiation, 9 (2002.5)154.

[3] E Di. Fabrizio et al.: Nature 401(1999)895.