FABRICATION OF HIGH-PRECISION CURVED CRYSTAL SUBSTRATE FOR JOHANSSON-TYPE DOUBLY CURVED CRYSTAL BY NUMERICALLY CONTROLLED LOCAL WET ETCHING

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It is essential to focus the excitation beam to realize high-sensitive μ-XRF analysis. The doubly-curved-crystal (DCC) with Johansson-type geometry is one of the devices which realizes both monochromatization and focusing of X-ray at once. The crystal plane of this device has a meridian radius of $2R$ (R: the radius of Rowland circle) and a sagital radius of $2R\sin^2\theta$ (θ: Bragg angle). Furthermore, the curvature radius of the surface should be figured to R in meridian direction. In conventional machining techniques, the crystallographical subsurface damage layers are inevitably generated because a plastic deformation or a brittle fracture is utilized as a removal mechanism. The damage layers of DCC which utilize Bragg diffraction cause degradation of FWHM and decreasing of reflectivity of the X-ray.

We have developed numerically controlled local wet etching (NC-LWE) technique to fabricate the ultraprecision optical devices and to finish the functional materials [1,2]. In this technique, removal of the material is carried out by a chemical reaction between the etchant and the surface of the workpiece, so that there is no degradation of the physical properties of the workpiece material. In this study, we report the measuring results of rocking curve and figure accuracy of the Si (111) substrate fabricated in cylindrically shape by NC-LWE.

[1] Kazuya Yamamura, Annals of the CIRP **56** (2007) 541.
[2] Kazuya Yamamura, Takuro Mitani, Surf. Interface. Anal. **40** (2008) 1011.