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Startup of Beamline BL-18B for Thin Film Analysis

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Introduction

According to the upgrade of the PF ring, we moved the activity of old beamline BL-17A ,C to the BL-18B at end of 2005. Due to the different geometry of the beamline components, we replaced the toroidal mirror to the newly designed mirror during the summer shutdown in 2006. After the tuning of the mirror, we obtained the focused x-ray with a high flux enough to analyze the thin film materials.

Specification of the beamline 18B

Beamline

In the upstream of the beamline, the total reflection double mirror is equipped and the following Si(111) double crystal monochrometer provides the monochromatic x-ray at the same height in the experimental hutch for the wide range of x-ray energy as shown in Figure 1. When the monochrometer crystal escaped from the beam path, the beamline can provide the mirror reflected white x-ray, that can be used for the fluorescence analysis of the trace elements.

Figure 1 Experimental hutch at the beamline BL18B.

Mirror system

The parameters of the mirror system are as follows. The distance between mirror and x-ray source, p = 15.75m, and the distance between mirror and focus point in the hutch, q = 17.75m. Upstream mirror is a flat type Rh coated Si with a size of L=500mm, W=130mm and T=40mm. Second mirror is a toroidal shape Rh coated Si with a same size whose transverse radius of curvature, R1 = $2pq\sin\theta/(p+q)$ = 75.1 mm, and a longitudinal radius of curvature, R2 = $R1/(\sin\theta)^2$ = 3709 m, where the glancing angle θ is 4.5 mrad. Surface roughness of the mirror before Rh coating was less than 0.5nm. With the bent mechanism, longitudinal radius can be changed.

Figure 2 A beam shape at the entrance of the experimental hutch. on the beamline BL18B.

Performances

Figure 2 shows a beam shape at the entrance of the experimental hutch. By tuning the mirror parameters, we obtained the beam size below 1mm in FWHM at focusing point placed at the center of the hutch. We confirmed the beam intensity is high enough to do the diffraction, scattering and fluorescence study on the thin film materials.

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