Industrial Consortium ID (BL16XU)

1. Introduction

The Industrial Consortium ID Beamline for Materials Research (BL16XU), together with its sister beamline BL16B2, is designed by an industrial consortium of 13 companies, in cooperation with JASRI.

X-ray fluorescence analysis, X-ray diffraction, and X-ray microbeam systems were constructed and preliminary experiments were completed in the summer run of 1999. The beamline has been open to user experiments since the autumn run of 1999. An overview of BL16XU and BL16B2 is shown in Fig.1.

2. Light Source and Optics

The light source is an in-vacuum type undulator with a magnetic period length of 40 mm, which is longer than that of the standard type, to extend the photon energy down to 4.5 keV.

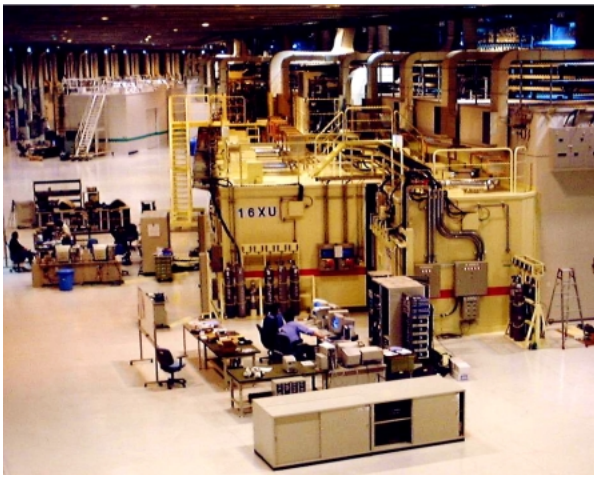

Fig. 1. BL16XU and BL12B2 in the experimental hall.

Optics of this beamline consists of the standard crystal (Si (111)) monochromator developed at SPring-8, a bent cylindrical mirror for focusing, and a pinhole.

The bent cylindrical mirror is set downstream of the monochromator with an incidence angle of 5 mrad. The reflecting surface is a thin film of Rh on silicon substrate. This mirror suppresses the higher harmonics in the photon energy from 4.5 keV to 14 keV, and focuses the beam on the pinhole.

The pinhole in the experimental hutch acts as a virtual source point of the X-ray microbeam system.

3. Experimental Station

Apparatus for X-ray fluorescence analysis, X-ray diffraction, and microbeam experiments is set up at the experimental hutch in tandem. The X-ray fluorescence analysis system has both a wave and an energy dispersive detector. A grazing incidence experiment is possible in a vacuum chamber. Sensitivity of 10^9 atoms/cm^2 is obtained for a contaminated Si wafer using the energy dispersive detector. The X-ray diffractometer is designed to analyze thin films, multi layers, and powder. The X-ray microbeam system consists of two elliptic mirrors arranged in KB-mirror geometry. The beam size depends on the pinhole size. We obtain the beam size of ~1μm at 10 keV.

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Light Source	
Type	In-vacuum X-ray undulator
Undulator period, λ_u	40 mm
Number of periods, N_{period}	112
Brilliance	~1×10^{19}photons/s/mrad^2/mm^2/0.1%b.w. (100mA, 20 keV)

X-rays at Sample	
Energy range	4.5 - 40 keV
Energy resolution	$\Delta E/E$ ~10^{-4} (4.5-20keV)
Photon flux (~ mm beam)	<10^{14} ph/s
(~ μm beam)	~ 10^{11}ph/s

Facilities in Experimental Station

(1) X-ray fluorescence analysis system
* Analyzer crystals and detectors (SC, FPC) for wave-dispersive spectrometry
* Solid-state detector for energy-dispersive spectrometry

(2) X-ray diffractometer
* ω-2θ goniometer (ω: 0.045”/step, 2θ: 0.36”/step)
* 6-axes sample stage
* Analyzer crystal and detectors (SC, IC)

(3) X-ray microbeam system
* Two elliptic mirrors for KB configuration
* XZ-scanning stage (10nm/step, stroke 20mm)
* Detectors (IC, SC, SSD)

Motor control and data acquisition system using a PC