BL16B2
(SUNBEAM BM)

1. Introduction

BL16B2, which is a SUNBEAM BM beamline, together with its sister beamline BL16XU, was built to develop various industrial materials by utilizing the high-brightness beam at the large-scale synchrotron radiation facility in SPring-8. It is utilized and operated by the SUNBEAM Consortium, a private organization comprised of 13 companies* (12 firms and one electric power group). BL16B2 began operations in September 1999, and the beamline use contract was renewed in April 2018.

X-rays emitted from a bending magnet are monochromatized, shaped, and converged in an optics hutch. The experimental hutch contains a diffractometer and multi-purpose experimental table for XAFS and imaging measurements. Figure 1 and Table 1 show a schematic and the characteristics of BL16B2, respectively.

2. Utilization

Figure 2 shows the utilization of BL16B2 in the past decade. The vertical axis shows the proportions for users, excluding tuning and studying the beamline itself. The upper graphic, which depicts the utilization by field, confirms that BL16B2 is used in various industrial fields.

The lower graphic shows utilization by equipment (technology). BL16B2 is mainly used for XAFS measurements, but diffraction and imaging experiments are increasing significantly, according to the facility investment.

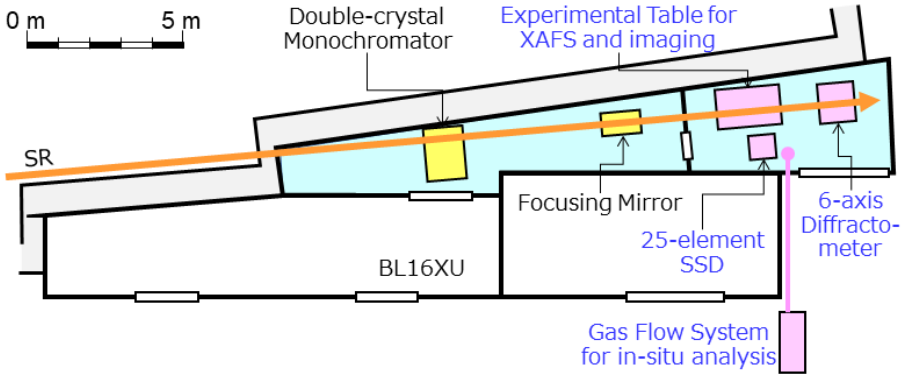

Fig. 1. Outline of BL16B2.

* Kawasaki Heavy Industry, Ltd., Kobe Steel, Ltd., Sumitomo Electric Industries, Ltd., Sony Corp., Electric power group (Kansai Electric Power Co., Inc., Central Research Institute of Electric Power Industry), Toshiba Corp., Toyota Central R&D Labs., Inc., Nichia Corp., Nissan Motor Co., Ltd., Panasonic Corp., Hitachi, Ltd., Fujitsu Laboratories Ltd., Mitsubishi Electric Corp.

Table 1. Characteristics of BL16B2

Light Source	Bending magnet
Energy range	4.5 - 113 keV
Energy resolution (ΔE/E)	~ 10^{-4}
Photon intensity, beam size	~ 10^{10} photons/s < 60 mm(H) × 5 mm(V) without focusing mirror < 0.1 mm(H) × 0.1 mm(V) with focusing mirror
Experimental facilities	XAFS, Topography, Imaging, XRD, Gas flow system (corrosive or toxic gas are possible)

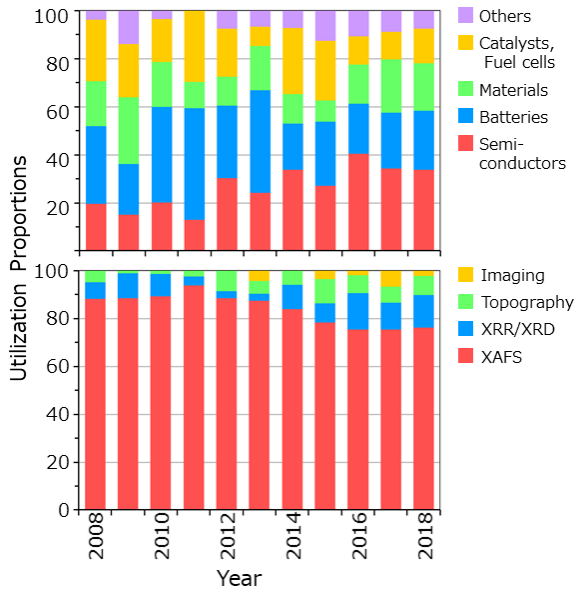

Fig. 2. Relative utilization times of BL16B2 in the past decade.

3. Topics in 2018

Below research and upgrades conducted in 2018 are described.

3-1. 25 element SSD

Because BL16B2 is mainly used for XAFS measurements, its efficiency is continually improved. In 2018, to improve the sensitivity and energy resolution, the 19-element detector was replaced with a 25-element SSD detector. The signal processing system is digital. Trace constituents such as dopants in semiconductor devices can be measured with a high precision due to the high energy resolution, high counting rate, simultaneous multi-edge measurements, and separation of near peaks.

3-2. Imaging system

In the experimental hutch, a beam expander using an asymmetric reflection of the Si single crystal was installed to enhance the beam size in the vertical direction more than five times. Additionally, a wide-field camera was installed. Hence, the topography of semiconductors such as SiC and GaN, tomography of large samples such as food products and polymers, laminography of devices and materials can now be observed.

Furthermore, a He gas flow system was installed into the monochromator to avoid contamination for high-quality imaging.

3-3. Measurements without exposure to air

A glove box was installed in the BL16B2 sample preparation room (Fig. 3) to measure anaerobiotic

and corrodible materials such as Li ion batteries without damage. Users of SUNBEAM (BL16XU/B2) can use the glove box to ensure that measurements without exposure to air can be carried out for all equipment (technology) in SUNBEAM, including XAFS, HAXPES, and XRD.

Fig. 3. Glove box in the BL16B2 sample preparation room.

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