BL16B2
SUNBEAM BM

1. Introduction

BL16B2 is the SUNBEAM BM beamline. Together with its sister beamline BL16XU, it was designed to develop various industrial materials. It utilizes the high-brightness beam at the large-scale synchrotron radiation facility in SPring-8, and is operated by the SUNBEAM Consortium, a private organization comprised of 13 companies * (12 firms and 1 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 a multi-purpose experimental table for XAFS and imaging measurements. Figure 1 and Table 1 show a schematic and the characteristics of BL16B2, respectively.

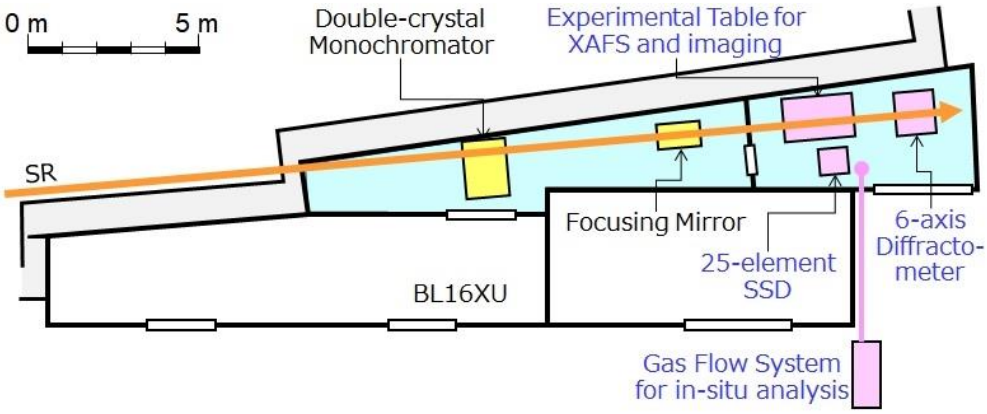

Fig. 1. Outline of BL16B2.

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)

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

2. Utilization

Figure 2 shows the utilization of BL16B2 in the past decade. The vertical axis shows the proportions for users, excluding the tune/study of the beamline itself. The upper graphic, which depicts the utilization by research field, demonstrates that BL16B2 is used in various industrial research fields.

The lower graphic shows utilization by equipment (technology). BL16B2 is mainly used for XAFS measurements, including two-dimensional (2D) XAFS and operand measurements where transmission XAFS is combined with energy-scanning X-ray diffraction. Diffraction and imaging experiments have increased significantly according to the facility investment in recent years.

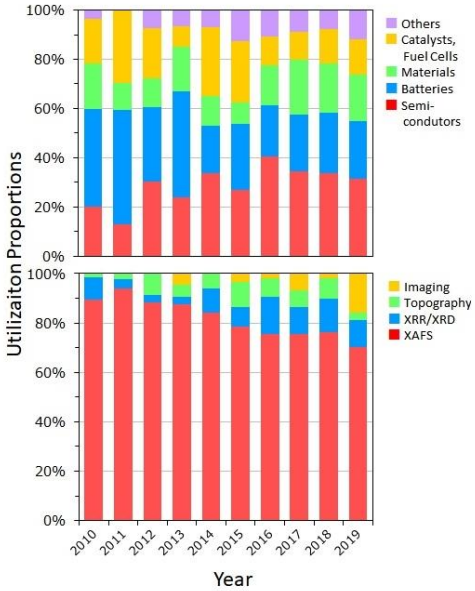

Fig. 2. Relative utilization times of BL16B2 in the past decade.

3. Topics in FY2019

Below research and upgrades conducted in FY2019 are described.

3-1. 2D XAFS

To understand the deterioration and reaction mechanisms of materials, XAFS can provide important information from both microscopic and macroscopic viewpoints. For battery electrode materials, an evaluation by a macro perspective is desired. In the case of multipoint measurements, it takes time to obtain high-definition 2D information. Hence, only sparse information can be obtained.

Our research endeavors at BL16B2 have independently developed software for performing a wide range (~10 cm) of 2D XAFS measurements (Fig. 3). Measurements using software developed by the LCF (linear combination fitting) method can obtain a wide range of high-definition information about materials in a short time (Fig. 4). Therefore, using this technology, a sample can be scanned in two dimensions for each specified energy, and the chemical state of the entire surface of the sample can be mapped in a short time. Visualization of the reaction distribution in materials on the surface such as catalysts and batteries will be performed in the future.

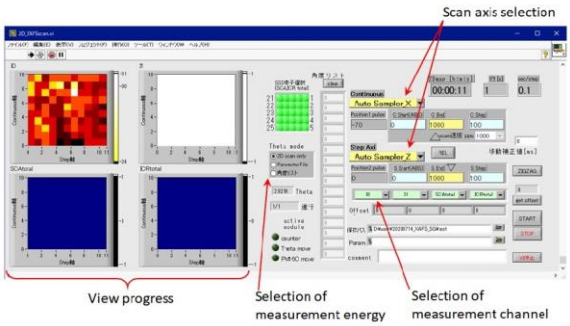

Fig. 3. Software for 2D XAFS measurements.

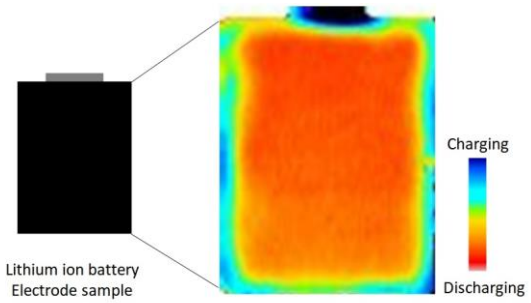

Fig. 4. Example of a measurement using 2D XAFS software.

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