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. In August 2020, we received an interim evaluation and obtained a "continuation" evaluation result.

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

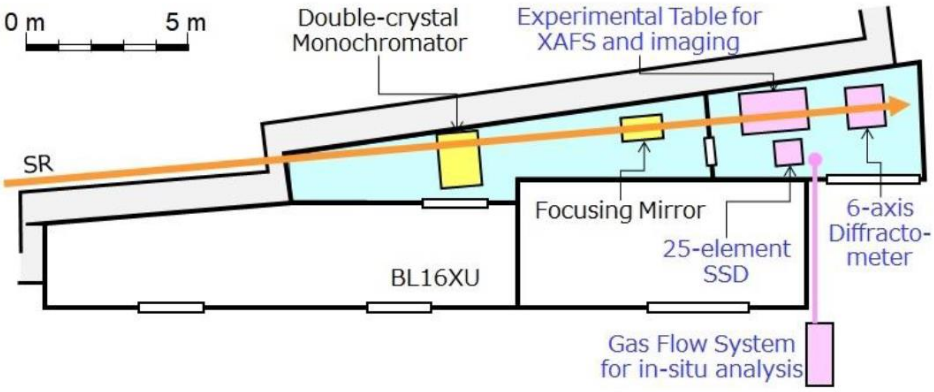

Fig. 1. Outline of BL16B2.

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) x 5 mm(V) without focusing mirror <0.1 mm(H) x 0.1 mm(V) with focusing mirror
Experimental facilities	XAFS, Topography, Imaging, XRD, Gas flow system (corrosive or toxic gas is possible)

* 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.

2. Utilization

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

BL16B2 is mainly used for XAFS and imaging measurements. In XAFS measurements, we have been improving usability by creating two-dimensional XAFS measurement software and 25SSD data analysis software. For imaging measurements, we launched a He introduction system to reduce the carbon contamination of spectroscopic crystals.

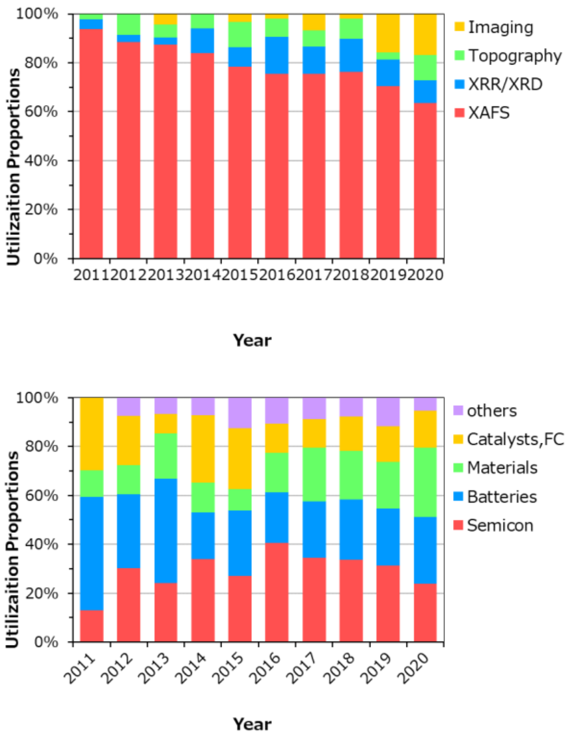

Fig. 2. Relative utilization times of BL16B2 in the past decade.

3. Topics in FY2020

Below, the research and upgrades conducted in 2020 are described.

3-1. He gas introduction system

"Noise-free X-ray imaging" at BL16B2 is listed as one of the research items in the 3rd phase research plan of the Sunbeam Community. This research theme is roughly divided into "the realization of a high-quality X-ray beam" and "the realization of a beam magnifying optical system using asymmetric Bragg reflection". Here, regarding "the realization of a high-quality X-ray beam", we report on the He gas introduction system for the reducing carbon contamination of spectral crystals.

It is considered that the main cause of the deterioration of the beam quality of the incident X-ray beam is the nonuniformity of the beam intensity as a result of the carbon contamination of the spectral crystals. Therefore, it was decided to try to reduce the amount of carbon adhered by introducing He gas into the beamline. However, it is necessary to introduce He gas carefully into the beamline, because the deterioration of vacuum may be caused by He gas introduction, and in making this system. We proceeded with the specification study and the preparation of the introduction system while repeating close discussions with the facility department.

Figure 3 shows a schematic diagram of the BL16B2 beamline after modification with the He gas introduction system. The spectroscope was equipped with two sets of full-range vacuum gages. It is designed to stop the introduction of He gas by closing the electromagnetic valves installed both upstream and downstream of the MFC when the

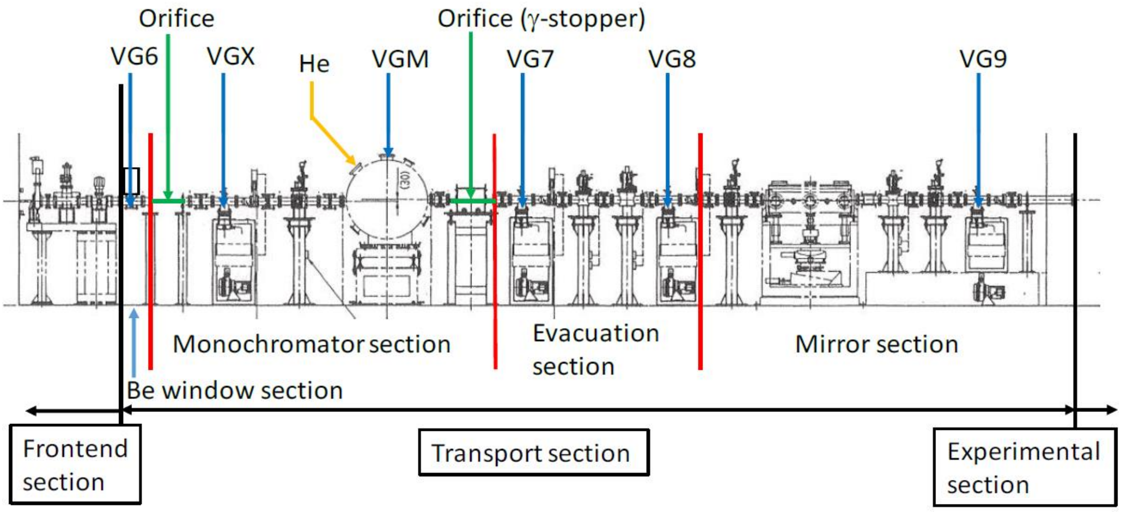

Fig. 3. Schematic of BL16B2 beamline after modification with the He introduction system.

degree of vacuum indicated by either vacuum gauge deteriorates to below a set value. Figure 4 shows the relationship between the amount of He gas introduced and the degree of vacuum in the beamline. The system attained a degree of vacuum close to that calculated. In the future, we will actually introduce He gas during the beam time and confirm the reduction of the amount of carbon adhered to the spectroscopic crystals.

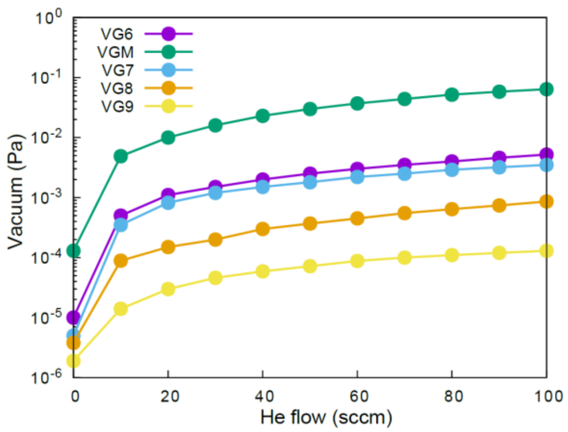

Fig. 4. Relationship between amount of He introduced and degree of vacuum.

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