BL12B2
NSRRC BM

BL12B2 is one of the two contract beamlines operated by National Synchrotron Radiation Research Center (NSRRC, Taiwan) under collaborative research with the Japan Synchrotron Radiation Research Institute (JASRI) and RIKEN. Although this beamline was originally designed for materials science and protein crystallography, because of the completion of the 3-GeV Taiwan Photon Source (TPS) at NSRRC, the beamtime distribution between these research fields has changed. For the last several years, most of the beamtime has been assigned to materials science users, about 75% of whom are from Taiwan. The rest of the beamtime is shared between international users from Japan and around the world. Since the start of the COVID-19 pandemic in 2020, overseas travels had been severely restricted. Most of the beamtime was cancelled and shifted to mail-in operation. From the middle of this year, this situation has gradually become relaxed.

Figure 1 schematically depicts the beamline layout. The beamline is equipped with a collimating mirror (CM), a double-crystal monochromator (DCM), and a focusing mirror (FM). The measured spot size and total flux of the beam are about 250 μm^2 and 1.5×10^{11} photons at the protein end-station at an incident photon energy of 12 keV, respectively. Five end-stations—EXAFS, projection X-ray microscopy (PXM), X-ray diffraction, X-ray scattering, and powder X-ray diffraction (powder XRD)—are equipped tandemly inside the experimental hutch of BL12B2.

EXAFS experiments are performed at the EXAFS table. The EXAFS spectrum can be measured using both transmission and reflection modes. X-ray scattering experiments can be performed using the HUBER six-circle diffractometer. The sample temperature in the X-ray scattering experiment can be changed from 20 to 400 K. In 2018, the PXM end-station was

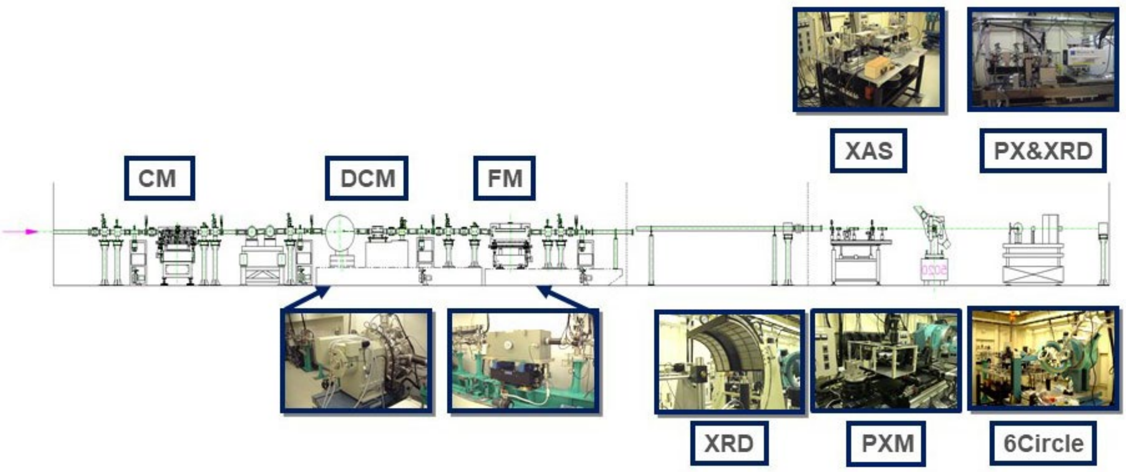

Fig. 1. Schematic layout of BL12B2.

installed at the XRD table. High-pressure X-ray diffraction is performed using a CCD camera at the protein crystallography table.

The powder XRD end-station, which is equipped with a CCD and a SPring-8 standard auto–sample-changer system, was installed in FY2009 and used for protein diffraction experiments until FY2017. However, beamtime for protein crystallography users has diminished since FY2017. Currently, the powder XRD end-station is mainly used by material scientists. The user interface software for powder XRD experiments is the SPring-8 standard BSS software. The CCD detector was upgraded to Raynox MX225-HE in FY2014. A nitrogen gas flow cryostat and heat gun enable the sample temperature to be changed from 60 to 500 K. Also, a closed-cycle He cryostat can be used for low-temperature experiments. Electrodes [AUTOLAB PGSTAT204 (Metrohm)] were prepared for *in situ* electrochemical experiments. High-pressure experiments can be performed using a plate-type diamond anvil cell (DAC).

Materials science experiments cover a wide area of topics such as new materials research, energy science, nanoscience, and geophysical science. In FY2022, BL12B2 users published 18 papers in SCI journals [1–18].

BL12B2 is used for *in situ* or *in operando* X-ray experiments for research on electrocatalysis [1–5], such as batteries [1,2] and oxygen reduction [3]. Other studies have been focused on samples under extreme conditions to investigate new physical phenomena [6–15]. Research on a new type of superconductivity is a hot topic in the field of solid-state physics. Prof. Kubozono's (Okayama Univ.) group has studied the crystal structure and superconducting properties of a new type of titanium−pnictide superconductor, $BaTi_2(Sb_{1-y}Bi_y)_2O$ [9]. The behavior of superconducting temperature T_C changes under pressure in accordance with y substitution (Fig. 2). User support is provided by two local beamline scientists and one engineer.

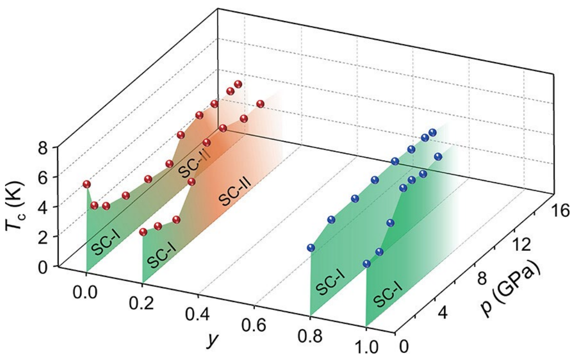

Fig. 2. Tc–p phase diagram of BaTi2(Sb1–yBiy)2O at y = 0–1.0. Note that the sample at y = 0 refers to Ba0.77Na0.23Ti2Sb2O, and the samples at y = 0.2, 0.8, and 1.0 refer to the corresponding BaTi2(Sb1–yBiy)2O [9].

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References:

[1] Wu J. et al. (2022). *Nano Energy* **102**, 017715.

[2] Chen S. W. et al. (2022). *Appl. Mater. Today* **26**, 101333.

[3] Pan Y. et al. (2022). *Adv. Mater.* **34**, 2203621.

[4] Sun H. et al. (2022). *J. Am. Chem. Soc.* **144**, 1174.

[5] Zhang J. et al. (2022). *J. Am. Chem. Soc.* **144**, 2255.

[6] Lin, C. M., et al. (2022). *J. Phys. Chem. Solids* **161**, 110487

[7] Vriankić M. et al. (2022). *J. Alloys Compd.* **894**, 162444.

[8] Li H. et al. (2022). *Phys. Chem. Chem. Phys.* **24**, 7185

[9] Ikeda M. et al. (2022). *Inorg. Chem.* **61**, 20538.

[10] Suzuki A. et al. (2022). *J. Phys. Chem. C* **126**, 21405.

[11] Suzuki A. et al. (2022). *J. Phys. Chem. C* **126**, 9948

[12] Yamaoka H. et al. (2022). *J. Phys.: Condens. Matter* **34**, 255501.

[13] Yamaoka H. et al. (2022). *J. Phys. Soc. Jpn.* **91**, 024704.

[14] Yamaoka H. et al. (2022). *J. Phys. Soc. Jpn.* **91**, 124701.

[15] Yamaoka H. et al. (2022). *Phys. Rev. B* **106**, 205122.

[16] Morgan H. W. T. et al. (2022). *Inorg. Chem.* **61**, 7043.

[17] Koike T. et al. (2022). *J. Ceram. Soc. Jpn.* **130**, 691.

[18] Masuda I. et al. (2022). *Phys. Status Solidi B* **259**, 2100571.