BL12B2
NSRRC BM

BL12B2 is one of the two contract beamlines operated by the 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 material 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. During the COVID-19 pandemic, overseas travel was severely restricted. Travel restrictions were eased at the end of 2022. The beamline has accepted foreign users throughout the year for the first time after the pandemic ended.

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 ×250 μm^2 and 1.5×10^{11} photons/s 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 of X-ray scattering experiments can be changed from 20 to 400 K. In 2018, the PXM end-station was installed at the XRD table. High-pressure X-ray diffraction is performed using a CCD camera at the protein crystallography table.

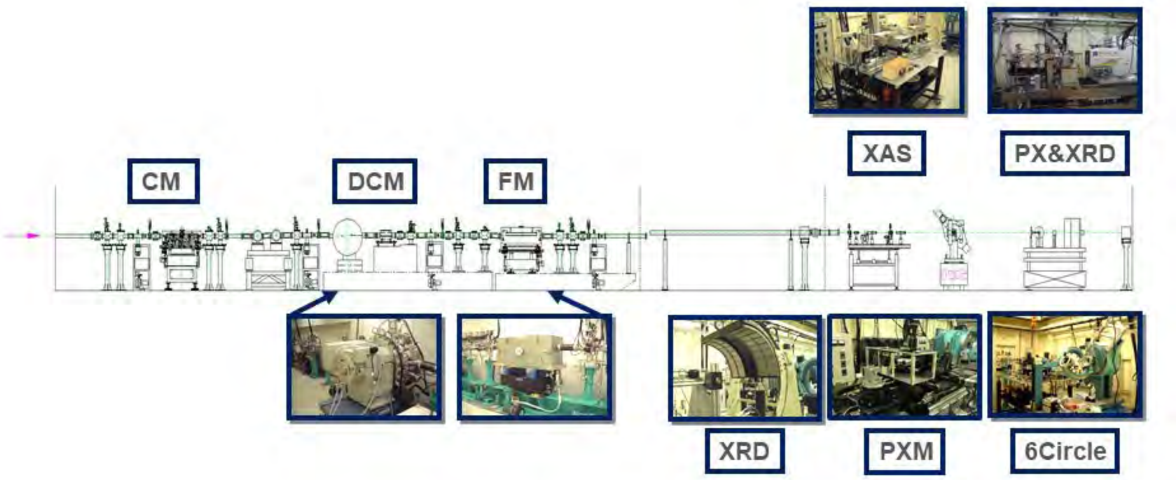

Fig. 1. Schematic layout of BL12B2.

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, the 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. The sample temperature can be changed from 60 to 500 K using the nitrogen gas flow cryostat and heat gun. The closed-cycle He cryostat can also 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 range of fields such as new materials research, energy science, nanoscience, and geophysical science. In FY2023, BL12B2 users published 27 papers in SCI journals [1–27].

The Taiwan beamlines upgrade project started at the beginning of this year. We replaced our CCD detector with a photon-counting-type area detector Dectris EIGER2 X CdTe 4M. The detector will be commissioned in early 2024.

BL12B2 is used for *in situ* / *operando* X-ray experiments for research on electrocatalysis, such as those related to batteries and oxygen reduction [1–20]. Other studies have been focused on samples under extreme conditions to investigate new physical phenomena [21–27]. Research on a new type of Fe-based superconductivity is a hot topic in the field of solid-state physics. Prof. Kubozono's (Okayama Univ.) group studied the crystal structure and superconducting properties of alkaline earth metal-doped FeSe, $(NH_3)_y AE_x FeSe$ (AE: Ca, Sr, and Ba) prepared by the liquid ammonia (NH_3) technique [26]. The FeSe layer distance and superconductive property have been studied using doped alkaline metal (Fig. 2). User support is provided by two local beamline scientists and one engineer.

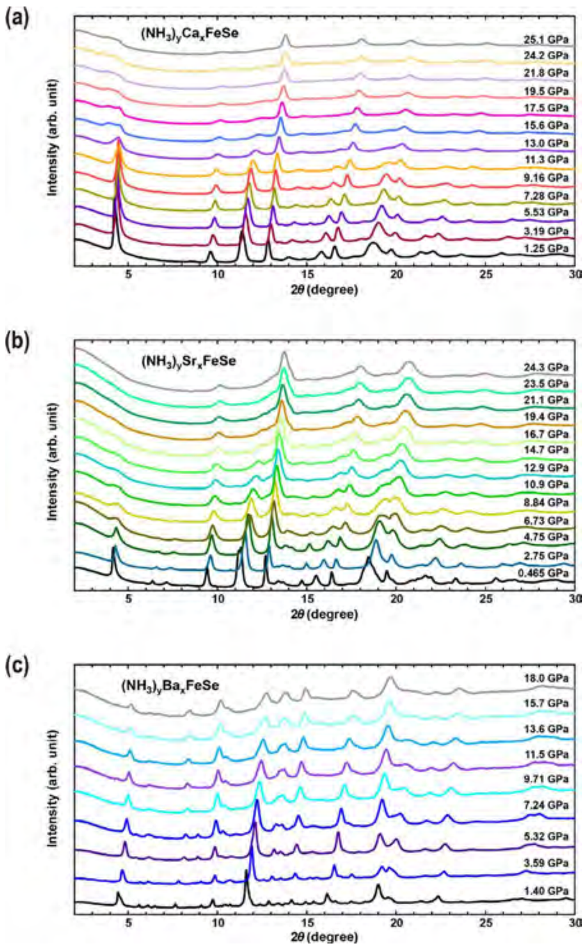

Fig. 2. Pressure-dependent XRD patterns for (a) $(NH_3)_yCa_xFeSe$, (b) $(NH_3)_ySr_xFeSe$, and (c) $(NH_3)_yBa_xFeSe$ [26].

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