BL12B2
NSRRC

BL12B2 is one of the two contact beamlines based on the collaborative Memorandum of Understanding between National Synchrotron Radiation Research Center (NSRRC, Taiwan), Japan Synchrotron Radiation Research Institute (JASRI), and RIKEN SPring-8 Center (RSC) since 1998. The user support and end station maintenance of the beamlines have been provided by NSRRC. BL12B2 has been maintained to serve for material science and protein crystallography users since 2000. Due to completion of 3GeV Taiwan Photon Source (TPS) at NSRRC, the beamtime distribution between these research fields have been changed. In 2017, the most of the beamtime has been assigned to material science users. About 75% of the users are from Taiwan. The rest of the beamtime is shared between international users from Japan and other places of the world.

The current schematic layout of the beamline is presented in Figure 1. The beamline is equipped with collimating mirror (CM), double crystal monochromator (DCM), and focusing mirror (FM). The measured spot size and total flux of the beam is about 250μm square and about $1.5x10^{11}$ photons respectively at the protein end station at incident photon energy of 12keV. Four end stations, EXAFS, X-ray diffraction, X-ray scattering, and protein crystallography (PX) end stations, are equipped tandemly inside the experimental hutch of BL12B2.

The EXAFS experiment is measured using two ion chambers at EXAFS table located at most upper stream of the BL12B2 experiment hutch. The users can carry out experiment by placing their sample in between these two ion chambers. Temperature dependent powder x-ray diffraction is measured using image plate at XRD table located next to the EXAFS table. X-ray scattering experiment can be carried out using HUBER six circle diffractometer. The sample environment of these two experiments can be changed from 20-400K. High pressure x-ray diffraction is carried out using CCD camera at protein crystallography table. Protein crystallography (PX) end station which is equipped with CCD and SPring-8 standard auto sample changer system has been installed since 2009. The user interface software for XRD experiment is SPring-8 standard BSS. The CCD detector has been upgraded to Raynox MX225-HE in 2014. The fast read out and wide detection area of the new detector will help user to collect high quality data. Electrode (AUTOLAB PGSTAT204 (Metrohm)) is prepared for in-situ electrochemical experiment.

EXAFS, x-ray diffraction, x-ray scattering end stations are serving for material science users. The material science experiments are covering wide area of topics, such as new material research, energy science, nano science, geophysical science, etc. In 2017, BL12B2 users have published twelve papers in SCI journals. Figure 2 and 3 show the selected result from material

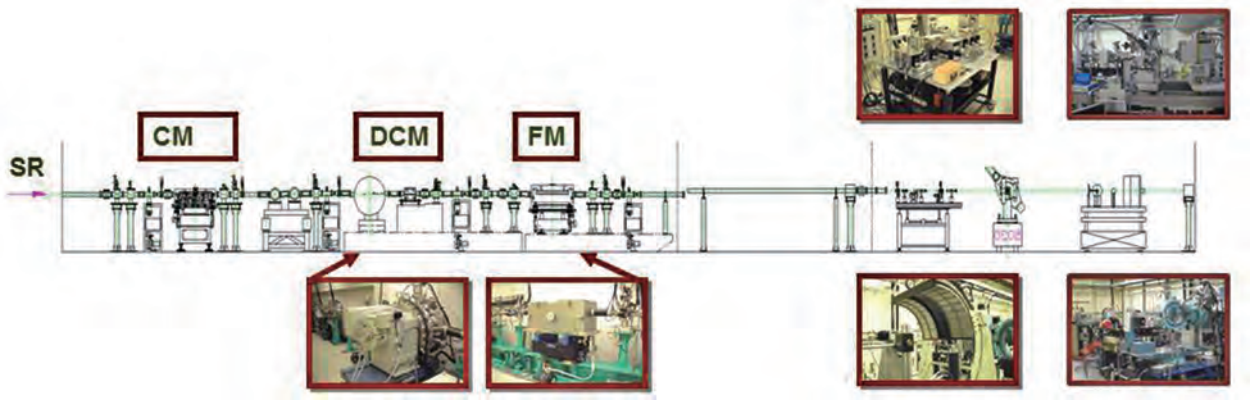

Fig.1 Schematic layout of BL12B2

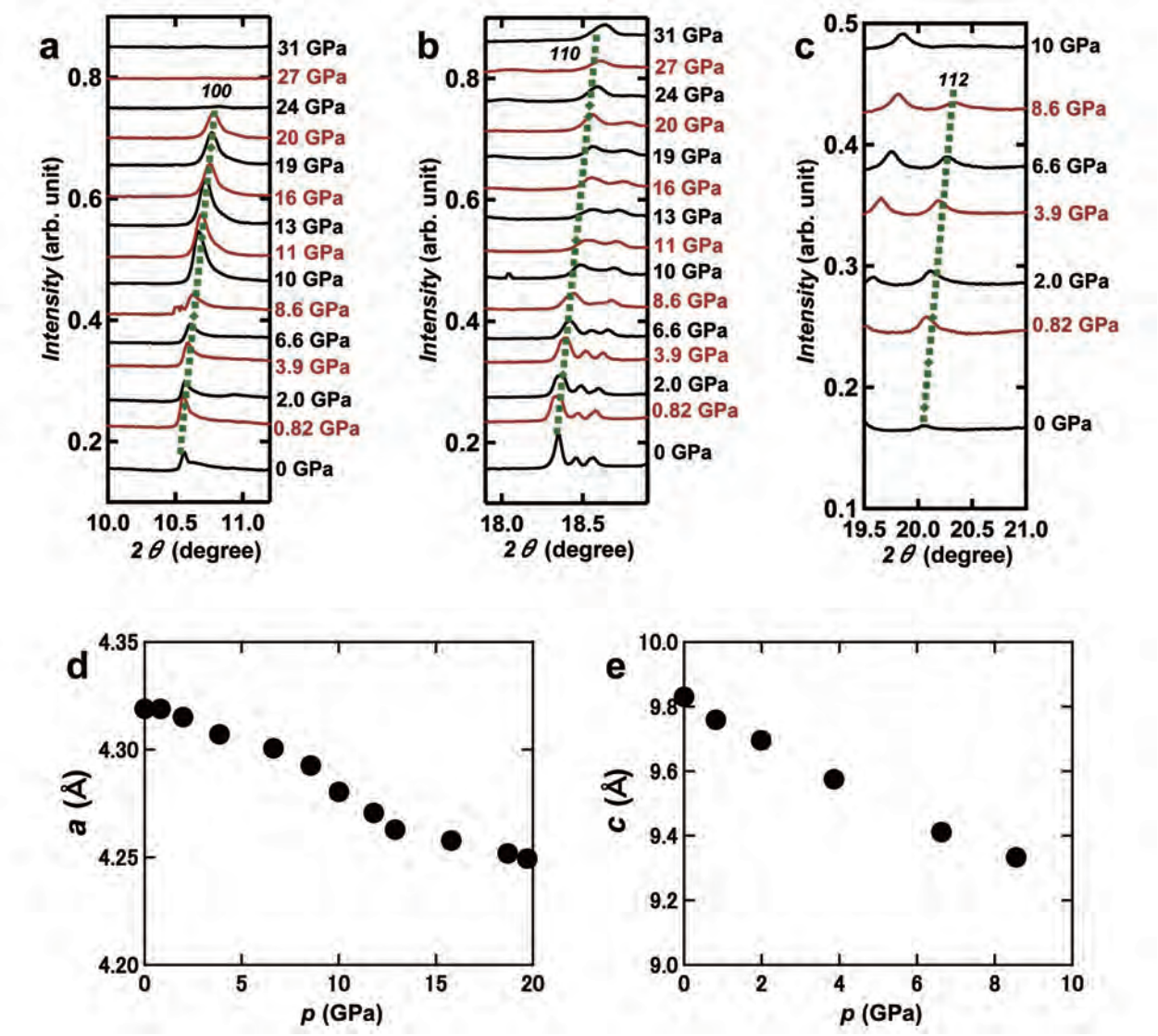

Fig.2 Pressure dependent XRD of $Ca_{0.5(2)}Sr_{0.5(2)}C_6$. Peaks ascribable to (a) 100, (b) 110 and (c) 112 respectively. (d) Pressure dependence of lattice constants, (d) a and (e) c axis. [P3]

science user. Figure 2 shows pressure dependent XRD spectrum of new graphite superconductor $Ca_{0.5}Sr_{0.5}C_6$ sample from Prof. Y.Kubozono (Okayama Univ.). They have produced a super conducting binary-elements intercalated graphite, $Ca_XSr_{1-X}C_y$. The compound is made by intercalated Sr and Ca into high-oriented pyrolytic graphite. [P3] These compounds become superconductor at around 3K. They have studied its superconducting property along with crystal structure change under pressure. Figure 3 shows the *in operando* XRD results of bismuth particulated anode under electrochemical sodiation-desodiation process from Prof. N-L. Wu (NTU) .[P12] The understanding of microstructural stability during charge-discharge cycle of active -material particles is crucial for maintaining the integrity of battery electrodes.

Users support had been provided by three local beamline scientists and one engineer.

Publications

Material Science

[P1]C. Hu, Q. Ma, S.-F. Hung, Z.-N. Chen, D. Ou, B. Ren, H. M. Chen*, G. Fu*, and N. Zhen*
"In Situ Electrochemical Production of Ultrathin Nickel Nanosheets for Hydrogen Evolution Electrocatalysis" Chem 3 , 122 (2017)

[P2]D. Mikhailova*, Z. Hu, C.-Y. Kuo, S. Oswald, K. M. Mogare, S. Agrestini, J.-F. Lee, C.-W. Pao, S.-A. Chen, J.-M. Lee, S.-C. Haw, J. M. Chen, Y.-F. Liao, H. Ishii, K.-D. Tsuei, A. Senyshyn, and H. Ehrenberg, *"Charge Transfer and Structural Anomaly in*

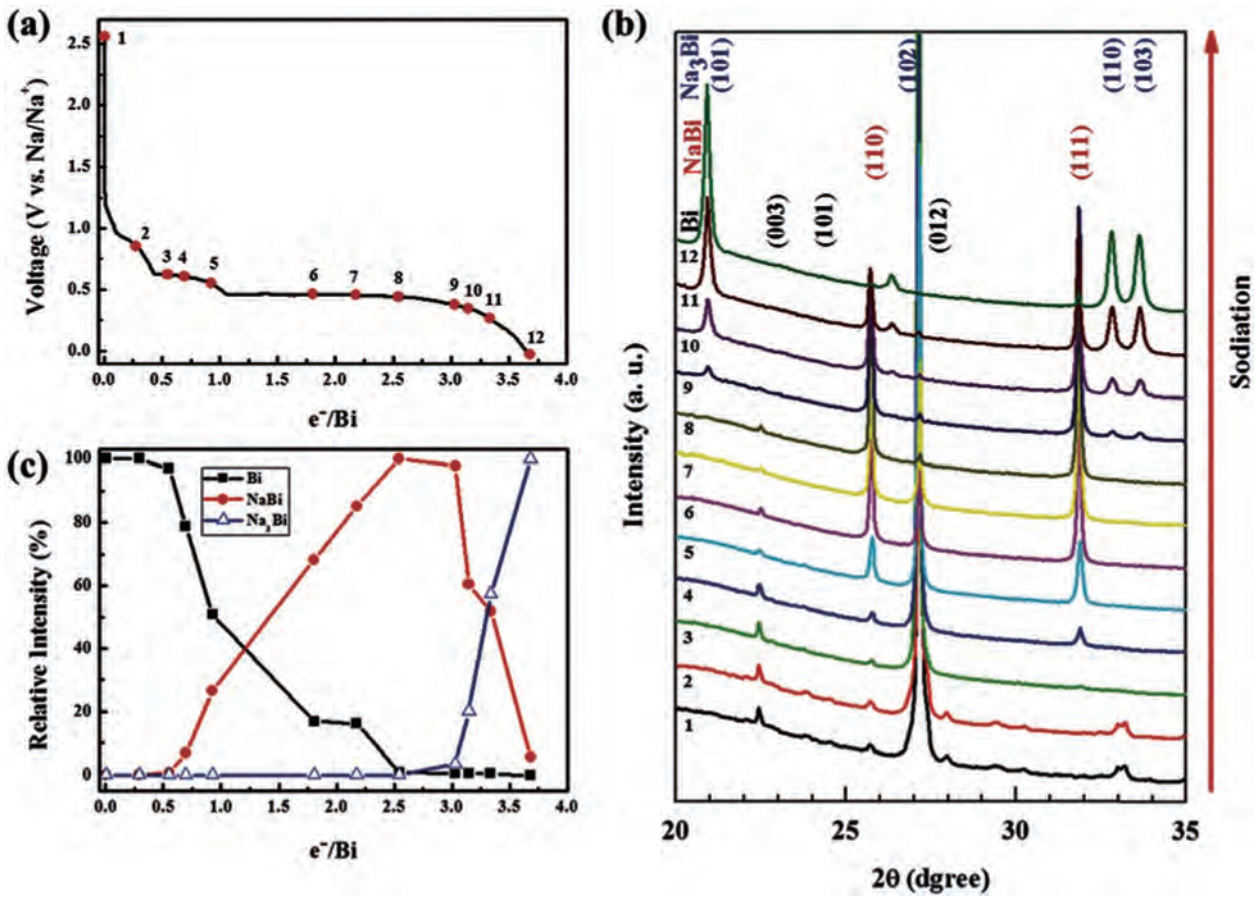

Fig.3 In operando XRD analysis of Bi anode desodiation. (a) voltage plot (b) XRD patterns (c) intensities of strongest reflections of different phases, including Bi, NaBi and Na_3Bi Number in (a) mark the moments when the XRD patterns (b) where acquired. [P12]

Stoichiometric Layered Perovskite $Sr_2Co_{0.5}Ir_{0.5}O_4$" Eur. J. Inorg. Chem. **2017**, 587 (2017)

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[P4] A. C. Gandhi and J. G. Lin, *"Exchange Bias in Finite Sized NiO Nanoparticles with Ni Clusters"* J. Magn. Magn. Mater. **424**, 221 (2017)

[P5] A. C. Gandhi, R. Das, F.-C. Chou, and J. G. Lin, *"Magnetocrystalline Two-fold Symmetry in $CaFe_2O_4$ Single Crystal"* J. Phys.-Condens. Mat. **29**, 175802 (2017)

[P6] A. C. Gandhi and J. G. Lin, *"Magnetic Resonance Study of Exchange-biased Ni/NiO Nanoparticles"* J. Phys.-Condens. Mat. **29**, 215802 (2017)

[P7] S.-C. Hou, Y.-F. Su, C.-C. Chang*, C.-W. Hu, T.-Y. Chen, S.-M. Yang, and J.-L. Huang, *"The Synergistic Effects of Combining the High Energy Mechanical Milling and Wet Milling on Si Negative Electrode Materials for Lithium Ion Battery"* J. Power Sources **349**, 111 (2017)

[P8] Y.-Y. Li, H.-L. Chen, G.-J. Chen, C.-L. Kuo, P.-H. Hsieh, and W.-S. Hwang, *"Investigation of the Defect Structure of Congruent and Fe-doped $LiNbO_3$ Powders Synthesized by the Combustion Method"* Materials **10**, 380 (2017)

[P9] Q. Ma, C. Hu, K. Liu, S.-F. Hung, D. Ou, H. M. Chen*, G. Fu*, and N. Zheng, *"Identifying the Electrocatalytic Sites of Nickel Disulfide in Alkaline Hydrogen Evolution Reaction"* Nano Energy **41**, 148 (2017)

[P10] H.-Y. T. Chen, J.-P. Chou, C.-Y. Lin, C.-W. Hu, Y.-T. Yang, and T.-Y. Chen, *"Heterogeneous Cu-Pd Binary Interface Boosts Stability and Mass Activity of Atomic Pt Clusters in the Oxygen Reduction Reaction"* Nanoscale **9**, 7207 (2017)

[P11] S. Hosokawa*, J. R. Stellhorn, T. Matsushita, N. Happo, K. Kimura, K. Hayashi, Y. Ebisu, T. Ozaki, H. Ikemoto, H. Setoyama, T. Okajima, Y. Yoda,

H. Ishii, Y.-F. Liao, M. Kitaura, and M. Sasaki, *"Impurity Position and Lattice Distortion in a Mn-doped Bi_2Te_3 Topological Insulator Investigated by X-ray Fluorescence Holography and X-ray Absorption Fine Structure"* Phys. Rev. B **96**, 214207 (2017)

[P12] C.-H. Lim, B. Selvaraj, Y.-F. Song, C.-C. Wang, J.-T. Jin, S.-S. Huang, C.-H. Chuang, H.-S. Sheu, Y.-F. Liao, and N.-L. Wu, *"Insight into Microstructural and Phase Transformations in Electrochemical Sodiation-desodiation of a Bismuth Particulate Anode"* J. Mater. Chem. A **5**, 21536 (2017)

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