BL12B2
NSRRC BM

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.

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. 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 20-400 K. High pressure x-ray diffraction can be carried out using CCD camera at protein crystallography table. Protein crystallography (PX) endstation which is equipped with CCD and SPring-8 standard auto sample changer system has been installed since 2009. The user interface software of PX is SPring-8 standard BSS. Remote access capability of this PX system has been tested and operated from 2011. The CCD detector has been upgraded from Quantum 210r 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. In 2016 we prepared electrode(AUTOLAB PGSTAT204(Metrohm)) for in-situ electrochemical experiment which is planning to carry out on 2017.

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 environmental science, nano science, geophysical science, etc. In 2016, BL12B2 users have published twelve papers in SCI journals. The material science and protein crystallography users have published ten and two papers, respectively. Figure 2 and 3 show the selected result from material science users. Figure 2 shows XANES spectrum of $Ti_{09}Mo_{0.1}O_y$ and $Ti_{0.8}Mo_{0.2}O_y$ sample from Prof. B.-J. Hwang(NTUST). They have studied molybdenum doped anatase TiO_2 as a Pt catalyst support which is important for polymer electrolyte membrane fuel cell(PEMFCs)[P1]. Figure 3 shows high pressure x-ray diffraction spectrum of iron based superconductors. They found new insight for possible superconducting origin of $K_xFe_{2-y}Se_2$ system[P10].

Until 2015 the beamtime had been shared between material science and protein crystallography users as equal amount. Due to completion of 3 GeV Taiwan Photon Source(TPS) at NSRRC, we reconsidered our beamtime distribution from 2016. The most of the beamtime is allocated for material science users. The major users of the B2 beamline in 2016 were from Taiwan. There were also international users from Japan and other places of the world. Users support had been provided by three local beamline scientists and one engineer.

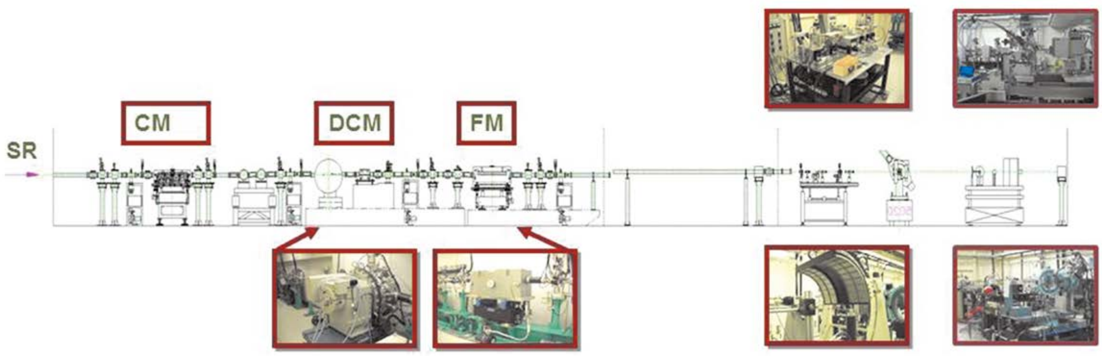

Fig.1 Schematic layout of BL12B2

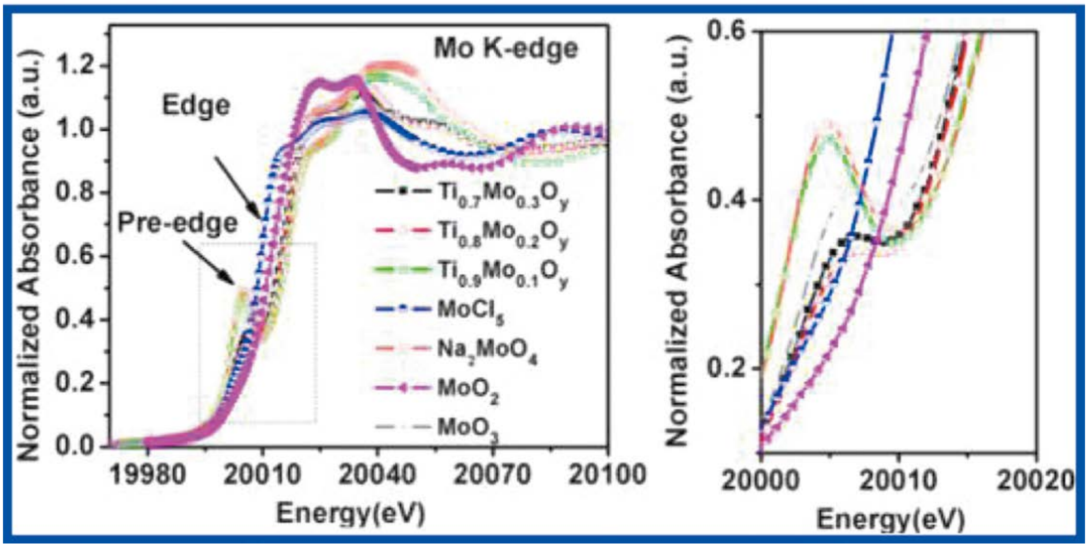

Fig.2 XANES measurements of $Ti_{09}Mo_{0.1}O_y$ and $Ti_{0.8}Mo_{0.2}O_y$ sample with Na_2MoO_4, MoO_2, MoO_3 and $MoCl_3$ references.[P1]

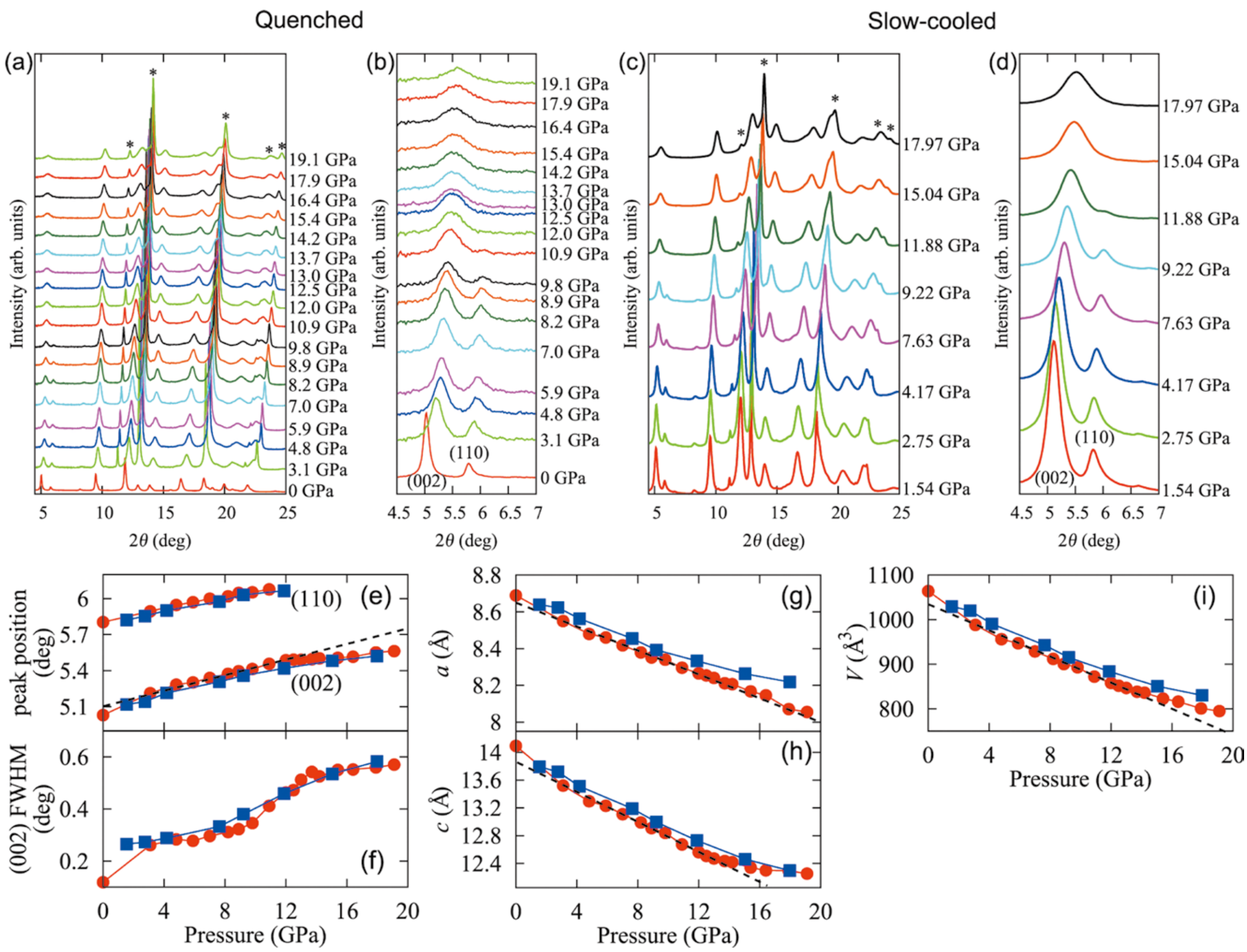

Fig.3 XRD pattern of $K_xFe_{2-y}Se_2$ single crystals (a) the quenched sample and (c) the slow-cooled sample. (b,d) Enlarged views of (a,c), respectively. Asterisk mark means reflection of NaCl used as the pressure medium of the diamond anvil cell. In the both quenched and slow-cooled samples, the (110) superstructure reflection disappear around 12 GPa. (e–i) Pressure evolution of the peak properties and the structure parameters of the quenched (red circle) and slow-cooled (blue square) samples. (e) Peak position of (002) and (110). (f) Full width at half maximum of the (002) peak. (g) Lattice constant along the a-axis. (h) Lattice constant along the c-axis. (i) Volume. Linear dashed-lines are guides for the eye.[P10]

Publications

Material Science

[P 1] M.-C. Tsai, T.-T. Nguyen, N. G. Akalework, C.-J. Pan, J. Rick, Y.-F. Liao, W.-N. Su, and B.-J. Hwang *"Interplay between Molybdenum Dopant and Oxygen Vacancies in a TiO_2 Support Enhances the Oxygen Reduction Reaction"* ACS Catalysis **6** , (2016) 6551.

[P 2] H. Li, Y. Liu, Y. Chen, S. Wang, M. Wang, T. Xie, and G. Wang *"Biochar Amendment Immobilizes Lead in Rice Paddy Soils and Reduces Its Phytoavailability"* Sci. Rep.-UK **6** , (2016) 31616.

[P 3] T.-Y. Chen, P.-C. Huang, Y.-F. Liao, Y.-T. Liu, T.-K. Yeh, and T.-L. Lin *"Shell Thickness Effects on Reconfiguration of NiO_{core}-Pt_{shell} Anodic Catalysts in a High Current Density Direct Methanol Fuel Cell"* RSC Adv. **6** , (2016) 72607.

[P 4] C.-M. Lin, H.-T. Liu, S.-Y. Zhong, C.-H. Hsu, Y.-T. Chiu, M.-F. Tai, J.-Y. Juang, Y.-C. Chuang, and Y.-F. Liao *"Structural Transitions in Nanosized $Zn_{0.97}Al_{0.03}O$ Powders under High Pressure Analyzed by in Situ Angle-dispersive X-ray Diffraction"* Materials **9** , (2016) 561.

[P 5] X. Miao, S. Nishiyama, L. Zheng, H. Goto, R. Eguchi, H. Ota, T. Kambe, K. Terashima, T. Yokoya, H. T. L. Nguyen, T. Kagayama, N. Hirao, Y. Ohishi, H. Ishii, Y.-F. Liao, and Y. Kubozono *"Emergence of Superconductivity in $(NH_3)_yM_xMoSe_2$ (M: Li, Na and K)"* Sci. Rep.-UK **6** , (2016) 29292.

[P 6] T.-Y. Chen, Y.-T. Liu, P.-C. Wu, C.-W. Hu, P.-W. Yang, L.-C. Hsu, C.-H. Lee, and C.-C. Chang *"Lithiation-induced Crystal Restructuring of Hydrothermally Prepared Sn/TiO_2 Nanocrystallite with Substantially Enhanced Capacity and Cycling Performance for Lithium-ion Battery* " RSC Adv. **6** , (2016) 48620.

[P 7] W.-C. Liu, Y.-Z. Zheng, Y.-C. Chih, Y.-C. Lai, Y.-W. Tsai, Y.-Z. Zheng, C.-H. Du, F.-C. Chou, Y.-L. Soo, and S.-L. Chang *"X-ray Multi-beam Resonant Diffraction Analysis of Crystal Symmetry for Layered Perovskite $YBaCuFeO_5$"* J. Appl. Crystallogr. **49** , (2016) 1721.

[P 8] K.-L. Lin, C.-M. Lin, Y.-S. Lin, S.-R. Jian, Y.-F. Liao, Y.-C. Chuang, C.-S. Wang, and J.-Y. Juang *"Structural Properties of Pressure-induced Structural Phase Transition of Si-doped GaAs by Angular-dispersive X-ray Diffraction"* Appl. Phys. A-Mater. **122** , (2016) 117.

[P 9] T.-Y. Chen, S.-T. Chang, C. W. Hu, Y.-F. Liao, Y. J. Sue, Y.-Y. Hsu, K.-W. Wang, and Y.-T. Liu *"Self-aligned Synthesis of a NiPt-$alloy_{core}$@Pt_{shell} Nanocrystal with Contrivable Heterojunction Structure and Oxygen Reduction Activity"* CrystEngComm **18** , (2016) 5860.

[P10] Yoshiya Yamamoto, Hitoshi Yamaoka, Masashi Tanaka, Hiroyuki Okazaki, Toshinori Ozaki, Yoshihiko Takano, Jung-Fu Lin, Hidenori Fujita, Tomoko Kagayama, Katsuya Shimizu, Nozomu Hiraoka, Hirofumi Ishii, Yen-Fa Liao, Ku-Ding Tsuei & Jun'ichiro Mizuki *"Origin of Pressure-induced Superconducting Phase in $K_xFe_{2-y}Se_2$ studied by Synchrotron X-ray Diffraction and Spectroscopy"* Scientific Reports **6**, (2016) 30946.

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