Materials Science:

In situ structural investigation is one of the most attractive research areas in materials science, in which synchrotron radiation science can make significant contributions with highly specific light source characteristics. The first experiment regarding a nanosecond-scale time-resolved pump and probe X-ray diffraction in SPring-8 has been conducted for the phase change phenomena of digital versatile disc-random access memory (DVD-RAM) materials, as reported by Kimura *et al*. This experiment was carried out using the "X-ray pinpoint structural measurement" system developed at the BL40XU high-flux beamline. The system enable a picosecond time-resolved X-ray diffraction experiment using submicron scale beams and may expand of outcomes for the investigation of pinpointed information on chemical reactions. Nikulin *et al*. reported "Towards *in situ* X-ray diffraction imaging at the nanometer scale: Early detection of nanoparticle growth in light metal alloys," which is a nano-application of the 2D reciprocal space map (RSM) method developed by O. Sakata at BL13XU. Saitoh *et al*. performed an elaborated experiment, "*In situ* X-ray diffraction measurement of hydrogenation and dehydrogenation of Al at high pressure and temperature," at BL14B1. Tsutsui *et al.* explored the potential of "skutterudite" to become a novel thermoelectric material by high-resolution inelastic X-ray scattering (IXS) at BL35XU and reported "Direct observation of motion in atom cage."

In addition, the number of structural research studies on novel-functional nanosized materials has been increasing continuously. Zheng *et al*. reported their work, "Giant negative thermal expansion in magnetic nanocrystals," which is another structural research on nanomaterials conducted to create novel thermoelectric materials. Very recently, Kitagawa *et al*. successfully created a unique nanoparticle structure, that is, Pd(core)/Pt(shell), as a new type of hydrogen storage material and carried out *in situ* characterization at BL02B2 through hydrogen absorption/desorption. From the viewpoint of uniqueness, the results obtained in the study entitled "Rational design of iron oxides with square planar coordination" by Kageyama *et al*. is significant, indicating that the potentials of novel iron-oxide-related materials should be explored.

STRUCTURE

Finally, the work conducted by Tanaka *et al*. on "Helical X-ray probe crystal chirality," is the first successful attempt at investigating the crystal chirality of the quartz by a resonant X-ray diffraction experiment using polarized X-ray beams with the newly developed soft X-ray diffractometer at RIKEN beamline BL17XU. This new diffractometer is quite promising and widely applicable to research on liquid crystals, amino acids, and multiferroic materials as well as magnetic chirality. The newly developed instruments shall reinforce the new measurement technique critical for the emerging materials science.

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