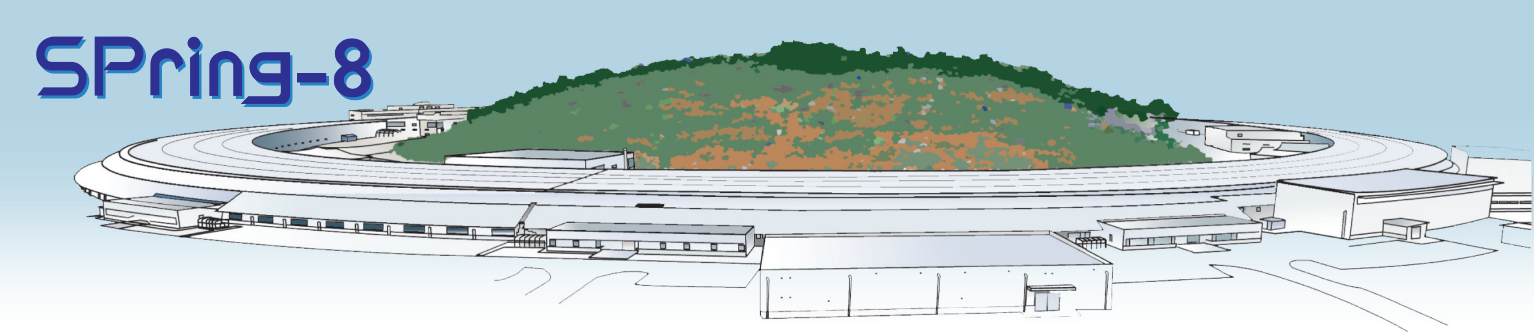

JAEA Materials Science Beamline, BL14B1

This beamline is designed for various types of experiments on diffraction and XAFS-type spectroscopy in the energy range of 5 - 90 keV for monochromatized beams and 5 - 150 keV for white beams. The main optics comprises the standard SPring-8 bending magnet system with two mirrors and a fixed-exit double-crystal monochromator. These optical elements can be removed completely for experiments using white beams. This beamline has two experimental hutches: one is dedicated to high-pressure experiments, while the other is dedicated to the structural analysis of the surface and interface of materials including glass, ferroelectrics, catalysts and metals.

Synchrotron radiation X-ray investigation on the formation and decomposition of AlH_3 at high pressure and high temperature

AlH_3 is a promising hydrogen storage material because of its large gravimetric and volumetric hydrogen content (10.1 wt.% and 148 kg/m^3, respectively). AlH_3 is thermodynamically unstable under ambient conditions and has only been synthesized by a solution reaction method so far. The thermodynamic and kinetic properties of the aluminum-hydrogen system, particularly upon the hydrogenation of aluminum, have not been well established. The JAEA research group has performed *in situ* X-ray diffraction experiments on the aluminum metal and hydrogen system at high pressure and high temperature using synchrotron radiation X-rays at SPring-8 (Fig. 1). The hydrogenation of pristine aluminum and its dehydrogenation-hydrogenation cycles were recorded during temperature increases and decreases at a fixed pressure using an SSD detector (Fig. 2). The pressure-temperature diagram of the binary system was determined. Single crystals, which had dimensions of several tens of microns, were grown and successfully recovered under ambient conditions. These single crystals will be useful for characterizing the thermodynamic and kinetic properties of pure α-AlH_3 as well as for studying its bonding nature, which is expected to promote the development and improvement of hydrogen storage materials consisting of aluminum hydride components such as alanates.

Reference: Applied Physics Letters **93**, 151918 (2008)

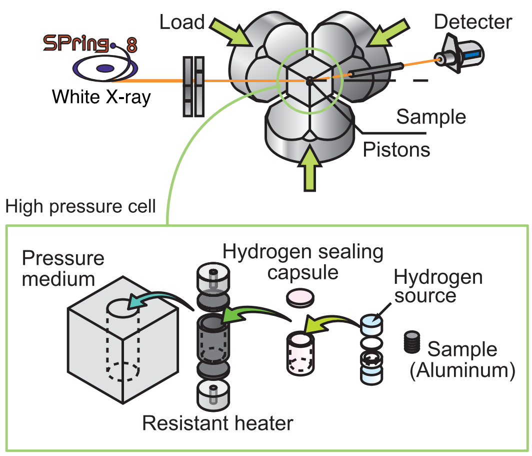

Fig. 1

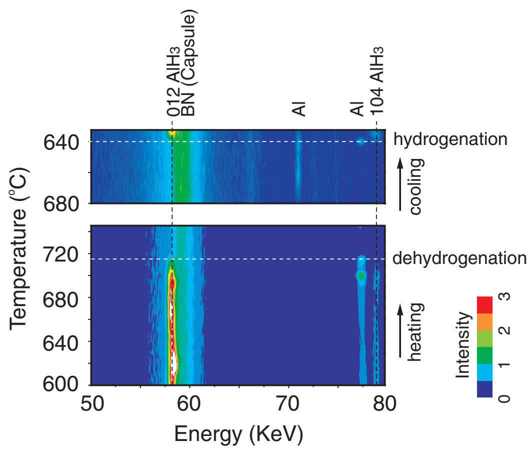

Fig. 2

Fig. 1
Schematic of *in situ* X-ray diffraction measurement system.

Fig. 2
Temperature variation of X-ray diffraction profile taken at 8.9 GPa. The sample was heated and cooled at a rate of 10 °C/min. Diffraction profiles were taken every 30 s.