BL05XU
R&D-ID I

1. Introduction

The BL05XU undulator beamline has two optical hutches, OH1 and OH2, and an experimental hutch (EH). In EH, small-angle scattering (SAXS) and wide-angle diffraction (WAXD) measurements have been performed with monochromatic X-rays from a double crystal monochromator (DCM).

In OH1, a double multilayer monochromator (DMM) designed to provide a 100 keV beam with a wide energy bandwidth of 1.0% has been installed and tested under high heat load conditions. In OH2, an atmospheric section called a high-energy test bench has been positioned upstream of DCM (Fig. 1). We obtained a 100 keV beam with a flux of 1.3×10^{13} photons/s at the high-energy test bench section. High-pressure and high-temperature experiments with the high-flux high-energy pink beam have been performed.

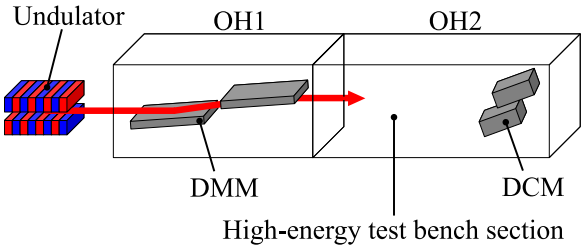

Fig. 1. Schematic of OH1 and OH2 at BL05XU.

2. Recent activities

Figure 2 shows a portable 5-axis stage with a load capacity of 2,000 kg. A large-volume press (LVP) with a maximum pressure of 10 GPa was mounted on the stage (Fig. 3). We installed the LVP at the high-energy test bench, as well as a GdTe area detector for diffraction and a CCD camera with a YAG scintillator for radiographic imaging. The pink beam allowed us to acquire two-dimensional diffraction patterns and radiographic images with an exposure time of 0.4 s. The diffraction patterns and images were alternately acquired by adjusting the sizes of the incident slit and detectors. Pressure and differential stress were determined from the *d*-spacing of a sample in a capsule. Strain was evaluated with platinum strain markers in the capsule. Temperature was monitored with a thermocouple placed on an anvil cell assembly.

With these instruments, we achieved high-pressure and high-temperature measurements with a time resolution of 1 s. Then, we performed small-strain deformation experiments on natural olivine, which is the major mineral in the upper mantle of the Earth. We successfully showed that time-dependent crustal deformation, which continues for decades after a great earthquake, is explained by the transient creep of olivine [1].

Fig. 2. Photograph of the portable 5-axis stage with a load capacity of 2,000 kg.

Fig. 3. Photograph of the large-volume press mounted on the 5-axis stage.

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Reference:

[1] Ohuchi, T. et al. (2024). *Geophys. Res. Lett.*, **51**, e2024GL108356.