EARTH & PLANETARY SCIENCE

The combination of synchrotron radiation and a large-volume multianvil apparatus (MA) at BL04B1 yields a powerful tool for investigating the deep interior of the Earth. Since the initial success of precise determination of the phase transition boundaries of mantle minerals at pressures up to about 25 GPa, diverse experimental studies have been conducted at this beamline. An example is precise determination of unit-cell volumes of high-pressure phases as a function of pressure and temperature, providing information on the density changes of these phases in the Earth's interior. Nishihara *et al.* successfully applied this technique to high-pressure phases in both mantle and subducted oceanic crust materials, and discussed the fate of the oceanic crust within the mantle by comparing the densities of these materials under compression.

Efforts have also been directed at expanding the pressure range to study deeper parts of the Earth's interior at BL04B1. Kubo *et al.* applied sintered diamond anvils as the second-stage anvils of MA, and examined the possible existence of "beta-phase" iron advocated by some researchers based on diamond anvil cell (DAC) experiments. They clearly demonstrated that there is no beta-phase at pressures up to 44 GPa, in contrast to the earlier studies by DAC, demonstrating the advantages of MA over DAC in unequivocal identification of high-pressure phases in such a high pressure regime.

To date, static pressures beyond 50 GPa have been produced only by using DAC. Hirose *et al.* tried to define the B1(NaCl)-B8(NiAs) transition in FeO, which is supposed to be abundant in the Earth's core, at BL10XU where a DAC with a laser heating system has been set up. They first succeeded in determining this boundary near 70 GPa, suggesting the presence of the B8-type FeO at the base of the Earth's mantle. Thus *in situ* X-ray observations under very high pressure using MA and DAC at SPring-8 have been successfully made to determine structural constraints and dynamic processes deep in the Earth's interior.

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