New technique on thin foil preparation for TEM: An application to melting experiments on mantle materials by a diamond anvil cell

Shigehiko Tateno[1]; Kei Hirose[1]

[1] Dept. Earth & Planet. Sci., Tokyo Tech.

A combination of a laser-heated diamond anvil cell (LHDAC) experiment and transmission electron microscope (TEM) allows us to constrain the mineralogy and petrology in the deep lower mantle. We recently installed a newly produced Ion Slicer (JEOL EM-09100IS) for the thin foil preparation for TEM observation. The Ion Slicer can produce thin foil specimens faster and easier than conventional preparation tools. It is improved about geometry of irradiation of argon beam to a specimen relative to conventional ion milling method, such as a low-angle and broad argon ion beam irradiates the specimen, which can yields wider thin foil. We first applied this instrument to a recovered sample from LHDAC especially for melting experiments of mantle materials in the deep lower mantle condition.

We could obtain the thin foils covering over half the whole disk sample, $20*50$ micron, which was much wider than the sample processed by a focused ion beam technique. The sample thickness was about 20 micron after LHDAC experiments. Thus, we made it possible to analyze the overall sample along the axial direction in the heated area. Moreover, in the radial direction, half of the sample could be observed, which contains the laser-heated spot.

Preliminarily, the melting experiment on MORB was conducted up to 70 GPa using LHDAC. In the recovered sample from 70 GPa, we confirmed that three phases appeared along the axial direction of the disk sample. The silicate glass existed at the high-temperature end and accompanied the two solid phases with decreasing temperature along the thermal gradient. Similarly, such texture is obtained in multianvil experiments. These solid phases included Ca-rich perovskite and Mg-rich perovskite contrary to the previous study at 27 GPa (Hirose and Fei, 2002).