

High-pressure and high-temperature experiments using Kawai type apparatus with SD anvils

Yoshinori Tange[1]; Shigeaki Ono[2]; Eiichi Takahashi[3]

[1] Dept. of Earth & Planetary Sciences, Tokyo Institute of Technology; [2] IFREE, JAMSTEC; [3] Earth and Planetary Sci., Tokyo Inst. of Tech.

Kawai type (multi-anvil) apparatus and DAC (diamond anvil cell) is the most important experimental device to investigate the earth's deep mantle. Before using the SD (sintered diamond) anvils, experimental pressure performed by the multi-anvil apparatus has been limited to about 27 GPa by the strength of WC (tungsten carbide) anvils. In that time, DAC has been the only device to produce the deep mantle condition statically. However, DAC experiments have many problems especially in the heating and reproductivity, so it is important to confirm the results from the DAC experiments using the other experimental system.

Therefore we have tried to establish the way to do experiments using the multi-anvil apparatus with the SD anvils. Modifying the pressure medium and gasket size, we have designed the cell assembly for the 14 mm cubic SD anvils and 2 mm truncated edge length. In our assembly, baked pyrophyllite was used as the gasket material combined with pyrophyllite to generate higher pressure safely. Using that newly designed cell assembly, we performed the room temperature experiment investigating the phase transition of zirconium by SPEED Mk.II installed in BL04B1, SPring-8. The phase transition was observed from the electrical resistance change measured by the 4-wire method and diffraction pattern was also observed. Experimental pressure was calculated using the EOS of gold (Anderson et al., 1989). In our experiment, the transition pressure of zirconium (b-w) was decided as ~34 GPa at room temperature and we were able to generate high pressure above 40 GPa.

Recently, in addition to the room temperature compression, we can perform the high temperature experiment above 40 GPa. LaCrO₃ was used as the heating element and a WRe3%-WRe25% thermocouple was used for temperature measurement. In our last beam time in the SPring-8, we performed high P-T experiment at 27, 35 and 43 GPa in 1723K using SPEED Mk.II. Experimental run products of these experiments were now analyzed. In the poster, we will show the details of our high-pressure experimental method and the results of high P-T experiments.