The 470th Geodynamics Seminar

Equations of state at multi-megabar pressure III

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Abstract

The double stage diamond anvil cell (dsDAC) is claimed as an advance technique to generate a TPa static pressure. We have been trying to develop the dsDAC as a well-controlled experiment device using the focused ion beam (FIB) system because it is needed to prepare a desired anvil shape; i.e., the culet and bevel size and so on, in order to control the pressure distribution at the tip of the 2nd anvils. Here we report the results of the dsDAC experiments using the newly synthesized nanopolycrystalline diamond (NPD) with a single-nano order grain size as a micro-anvil material. The X-ray diffraction patterns from the rhenium sample showed very broad peaks due to the large pressure gradient at the tip of the micro-anvils as contrasted with the sharp peaks observed in previous works. The deconvolution of the peak results that the rhenium was compressed to be V/V0 = 0.633 which corresponds to about 420 GPa according to the equation of state of the rhenium reported by Anzellini et al. (2014), but 620 GPa by Dubrovinsky et al. (2012). Anzellini et al. (2014) discussed that the large discrepancy between these EoSs might be explained by the effect of deviatoric stress. On the other hand, our recent compression experiment for rhenium and platinum done by dsDAC shows that the compression curve of rhenium agrees with the result of Anzellini et al. (2014) nevertheless our experiment was a direct cold compression. It might show that the discrepancy between previous studies cannot be explained only by the effect of the deviatoric stress.

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