The 531st Geodynamics Seminar

High-pressure generation to 150 GPa using a 6-8-2 type multianvil system with nano-polycrystalline diamond anvils

Dr. Takehiro Kunimoto
(Postdoctoral fellow, GRC)

EHIME UNIVERSITY GRC GEODYNAMICS RESEARCH CENTER

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The pressures available in Kawai-type multianvil apparatus (KMA) that use tungsten carbide (WC) anvils or sintered diamond (SD) anvils are commonly limited to approximately 30 GPa and 60 GPa, respectively [e.g.1,2]. However, in the last few years, introduction of dedicated anvil material for high-pressure experiment and improvements in configuration for cell assembly significantly expanded the pressure limitation to 60 GPa for WC anvils and 120 GPa for SD anvils [3,4,5]. Then, Kunimoto and Irifune (2010) introduced a newly-designed cell assembly for 6-8-2 type cell with nano-polycrystalline diamond (NPD) third-stage anvils, and generated pressures of up to 125 GPa [6]. Nevertheless, it has been difficult to encompass the pressures of the entire D" region in the Earth. So, we have been trying to improve a cell assembly of the 6-8-2 type system to generate the pressures leading to the Earth's core-mantle boundary.

In situ X-ray experiments were conducted using KMA (SPEED-Mk.II) at SPring-8, BL04B1. We used preliminary synthesized $MgSiO_3$-perovskite (Pv) as a starting material. Generated pressures were determined from the calculated volume of Au and MgO on the basis of the equation of states [7,8]. In the compression process, judging from the shape of the X-ray diffraction peaks of $MgSiO_3$-Pv, it changed to an amorphous-like phase under room temperature and high pressure. Eventually, we were able to generate pressures of approximately 150 GPa at room temperature at a press load of 6.0 MN. The pressures achieved in this run completely cover the entire the D" region (approx. 125-135 GPa). Further optimization of a cell assembly for 6-8-2 type system with NPD would greatly contribute to the study of constitutive minerals of the entire the Earth's mantle.

[1] K. Litasov et al. (2013). [2] E. Ito, (2007). [3] T. Kunimoto et al. (2016). [4] D. Yamazaki et al. (2019). [5] T. Ishii et al. (2017). [6] T. Kunimoto, and T. Irifune (2010). [7] T. Tsuchiya (2003). [8] Y. Tange et al. (2009).

Contact : Masayuki Nishi, Ph.D. (e-mail: nishi@sci.ehime-u.ac.jp)