The 398th Geodynamics Seminar

Development of the double stage diamond anvil cell

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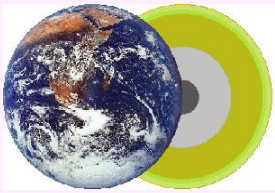

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Abstract

1 TPa region is still far frontier for the high pressure physics, especially for the static compression experiment. Historically, the expansion of the high pressure generation range leads directly to discover new phase (e.g. Murakami et al. 2004; Kuwayama et al. 2005). The maximum pressure generated by diamond anvil cell is about 400 GPa (Akahama and Kawamura, 2010). The generation over 400 GPa can be reached only by shock compression study, but there are some limitations, id est, very short duration (a few hundreds nanosecond order), and rapid temperature increase by the adiabatic compression. The realization of the generation over 400 GPa by the static compression experiment is important because it enables us to do several optical measurements such as X-ray analyses, Raman scattering, and infrared spectroscopy. Recently, Dubrovinsky et al. (2012) reported the generation of 640 GPa using double stage diamond anvil cell. This new technique makes 1 TPa region a realistic goal for static compression experiments. They used nanocrystalline diamond semi-balls by direct conversion of glassy carbon ball as a second-stage anvil. But there are some technical difficulties such as a second-stage anvil's shape controllability, gliding of anvil (slip) under pressure, and the difficulty of a sample filling. These problems depress the reproducibility of experiment.

In this study, second-stage "micro anvils" were made by focused ion beam (FIB) system from the nano-polycrystalline diamond (NPD) or single crystal (SC) diamond. Micro manufacturing using FIB system enables us to control anvil shape, process any materials (NPD, SC and also sample), and fill the sample between the second-stage anvil gap precisely. This method has a high reproducibility of the experiment. The high pressure over 300 GPa was achieved and confirmed by the combination of micro anvil and well-focused micro X-ray beam at SPring-8 BL10XU.

詳細は当センターホームページ：http://www.ehime-u.ac.jp/~grc/をご覧ください
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