

Application of nano-polycrystalline diamond to novel ultrahigh-pressure technology

*Tetsuo Irifune¹

1. Geodynamics Research Center, Ehime University

Nano-polycrystalline diamond (NPD) developed at GRC, Ehime Univ., is known to be harder than conventional sintered polycrystalline diamond (SD) and single crystal diamond, and is potentially important as anvil material for various types of high-pressure apparatus. Some successful applications of NPD to both diamond anvil cell (DAC) and Kawai-type multianvil apparatus (KMA) have been achieved, including higher pressure generation in these apparatus and some mineral physics applications in deep Earth sciences. For DAC, the following progress has been made in the last couple of years; generation of pressures exceeding 500 GPa in a double-stage DAC (Sakai, Yagi, et al.), invention of rotational DAC for rheological studies in Mbar regime (Nomura, Azuma et al.), and successful applications to large DAC for high-pressure neutron (Komatsu et al.), X-ray absorption (Ishimatsu et al.; Pascarelli et al.) and X-ray Raman (Fukui et al.) studies. Some attempts have also been made using NPD anvils for Mbar generation (Kunimoto & Irifune) in KMA, demonstrating its potential importance as the third-generation anvil material, after tungsten carbide and sintered polycrystalline diamond. The current status of applications of NPD in these techniques will be reviewed with some future perspectives.

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