第37回フロンティア材料研究所講演会

Special lecture on

"High-pressure and temperature plastic deformation of polycrystalline diamonds, with prospects of studying other superhard materials"

Prof. Yanbin Wang

GSECARS, The University of Chicago, USA

Date: May 29th, Monday, 2017

Time: 14:00 – 15:30

Room: 1F meeting room, Building R3

Abstract:

A series of deformation experiments was conducted on several selected sintered polycrystalline diamonds (PCD) using the deformation DIA (D-DIA) apparatus at Sector 13 (GSECARS) of the Advanced Photon Source (APS). The samples were well-sintered bulk PCDs sintered with either Co (from Sumitomo and Sandvik Hyperion) or Si (from Sandvik Hyperion) as binding material. Samples were deformed at ~7 GPa and 1273 K, under an essentially identical strain rate of 1.5x10^(-5) s^(-1). Under such conditions, PCDs are expected to deform by dislocation creep. The ability to plastically deform the hardest known material to strains up to ~20% is primarily due to the development of nano-polycrystalline diamond (NPD), which has mechanical properties superior to PCDs with micron-sized grains. NPD deformation pistons allowed proper transmission of differential stress from the D-DIA to the samples.

We also deformed NPD samples to compare their mechanical properties with PCD. NPD is brittle at 7 GPa and 1273 K. It cracks and does not deform plastically. At 9 GPa and 1473 K, however, NPD does deform plastically and exhibits a remarkably high strength, more than twice that of Co-based PCD. NPD deformation mechanism appears very different from that in PCD. Prospects of studying other superhard materials in the D-DIA will be discussed.

Contact: Nori Nishiyama (Wakai-Nishiyama Lab.)

email, nishiyama.n.ae@m.titech.ac.jp; tel, 045-924-5337