Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

**High-pressure and high temperature deformation studies of polycrystalline diamond** XIAOHUI YU — With Vicker's hardness 120 GPa, shear modulus 535 GPa, diamond is the hardest material known to mankind. However, because diamond is difficult to deform, little is known with regard to its constitutive properties such as yield strength. In this work, we present results obtained at NSLS using deformation-DIA on polycrystalline diamond at different P-T conditions. As expected, even at total strains up to 20%, we did not observe the yield point of diamond at room temperature and a confining pressure of 4 GPa. However, for deformation at 1000 and 1200 °C, we observed an plastic flow of diamond at total strains of 10% and 5%, respectively, indicating that diamond weakens rapidly when temperature is over 1000 °C. We further derived the micro stress of diamond from peak width analysis, and found that the micro and macro stresses show similar variations with total strain at both room temperature and 1000 °C. However, at 1200 °C, the micro stress remains constant in entire deformation, indicating that stress is uniformly distributed within diamond particles at 1200 °C. We also carried out SEM studies on the recovered samples to investigate the miscrostructures, and find that the grain size of diamond decreases substantially during the deformation, from the initial microns to sub-microns for the room temperature deformation, however, almost doesn't change for the 1200 °C.

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Date submitted: 09 Nov 2010 Electronic form version 1.4