SHOCK07-2007-000524

Abstract for an Invited Paper for the SHOCK07 Meeting of the American Physical Society

## Strength of materials in the diamond anvil cell to 1 Mbar THOMAS DUFFY, Princeton University

The yield strength of materials at high pressure has diverse applications to interpretation of static and dynamic experiments, understanding mechanical performance, and constraining the rheology of planetary interiors. In recent years, diamond anvil cell techniques have been developed to measure lattice strain under non-hydrostatic loading using synchrotron x-rays. These studies constrain yield strength and provide insights into elastic moduli, equation of state, and texture development. Here we report results using this method to characterize the strength of a suite of metals (e.g., W, Re) and ceramics (e.g.  $B_6O$ ,  $MgSiO_3$ ) to pressures up to 1 Mbar. In general, strength increases with compression at a rate greater than the shear modulus, implying significant strain hardening under diamond cell loading. For W, the strength under static loading is comparable to that observed under dynamic quasi-isentropic loading. At pressures of 20-80 GPa, metals typically exhibit strengths of 1-3% of the shear modulus, G. Strong covalent oxides possess yield strengths that range from 4-8% of G. The consistency of strength trends across material classes suggests that reasonable empirical predictions of strength in the multimegabar pressure regime can now be made. Future advances can be expected to improve the capabilities of the diamond cell as a deformation device with the goal toward eventual direct determination of rheological properties at very high P-T conditions.