

## **Strength Measurement of Materials at Extreme Pressures and Strain Rates**

**Suraj Ravindran**

California Institute of Technology, 1200 E. California Blvd., Pasadena, CA 91125.

---

Measurement of strength at high pressures is critical to the understanding of the behavior of materials subjected to extreme loading conditions. Recently, the pressure shear plate experiments (PSPI) were extended to a high-pressure regime, approaching 50 GPa. This provides a unique opportunity to directly extract the complete stress-strain behavior of the material at relatively high pressures. The modified set up includes a new fiber-optic heterodyne transverse velocity interferometer system and new analysis methods to account for the inelastic response of the anvil plates. In this study, PSPI experiments are conducted on oxygen-free high conductivity copper (OFHC) at pressures ranging from 10-50 GPa and at strain rates of  $\sim 10^5$  /s. The hybrid methodology to measure the strength from these experiments include the use of numerical simulations, which allows one to extract the complete stress-strain behavior of the material. In order to check the robustness of the method, experiments were conducted at similar pressures and strain rates using two types of anvils that undergo different levels of plastic strains: tool steel and tungsten carbide. The behavior of copper at these high pressures are compared with previous data in the literature. The effect of pressure and strain rates on the strength behavior of copper are also discussed. In addition, the strength models to predict the response of copper at these extreme conditions are examined and validated.