

# Physics & Astronomy Colloquium

Presents



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Tuesday, March 10, 2020  
4:10 pm, Webster Room 17

### “Dynamic Deformation of Polycrystalline Metals at Temperatures Approaching their Melt”

Plastic deformation of metals at large strains and high strain rates, studied extensively for nearly fifty years, has recently attracted renewed interest because of the discovery of strong effects at very high strain rates and elevated temperatures, and because of the importance of these effects for dynamic damage mechanisms. At high loading rates, the mobility of dislocations can shift from thermal activation to the viscous-drag regime. Furthermore, in crystalline hexagonal closed packed (hcp) solids, inelastic deformation can be accommodated through both dislocation slip and deformation twinning. Understanding the contributions of these mechanisms to the deformation of polycrystalline pure metals in the ultra-high strain rate and elevated temperature regimes is limited by the lack of reliable experimental data.

To address the above issues, experimental developments were undertaken to examine thin metal foil specimens heated to temperatures in excess of 1000oC prior to impact, thereby extending the capability of combined compression-and-shear plate-impact experiments to elevated temperatures. Using these new capabilities, including heterodyne interferometric methods for particle velocity measurements, compression and combined compression-and-shear plate-impact experiments were conducted on polycrystalline Al and Mg samples to investigate their dynamic shearing resistance at strain-rates  $>105 \text{ s}^{-1}$ , temperatures in excess of 600°C, and shear strains approaching 100%. The characterization of the plastic deformation of Al and Mg ( $T_m = 660\text{oC}$  for Al, and  $T_m = 650\text{oC}$  for Mg) at elevated temperatures and very high strains rates is particularly valuable because of its usefulness in understanding the shearing resistance of fcc and hcp metals at high plastic strains as they approach their melt.

*Please meet our guest speaker and share in refreshments 3:45-4:10 p.m. in the foyer on floor G above the lecture hall*

Host: Dr. Brian Saam



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