Abstract Submitted
for the SHOCK15 Meeting of
The American Physical Society

Shock-Induced Elastic-Plastic Deformation of Molybdenum Single Crystals A. MANDAL, Y.M. GUPTA, Washington State Univ — To gain insight into the shock-induced deformation response of Molybdenum (Mo), high purity single crystal samples were shocked along <100>, <110>, and <111> orientations to a peak stress of 12.5 GPa. Elastic-plastic wave profiles, measured at different propagation distances ranging between 0.3 and 3 mm using laser interferometry, suggest a highly anisotropic time-dependent material response. Initially, the elastic wave amplitude exhibited a large and rapid decay before reaching a threshold stress beyond which no significant decay occurred. The decay rates were larger along <100> and <110> orientations. The resolved shear stresses on the quasi-static slip systems at the threshold stress are comparable to the reported Peierls stress of screw dislocations in Mo. Numerical simulations, performed using a dislocation-based plasticity model, suggested that quasi-static slip systems are likely operative under shock loading. A good fit to the measured profiles was obtained when a term, representative of dislocation nucleation [Winey and Gupta, J. Appl. Phys. **99**, 023510 (2006)], was included in the model in addition to regenerative multiplication. A physical justification for the nucleation term will be discussed. Work supported by DOE/NNSA.

Michael Winey
Washington State Univ

Date submitted: 28 Jan 2015 Electronic form version 1.4