Abstract Submitted
for the SHOCK19 Meeting of
The American Physical Society

Shock Compression/Release of Magnesium Single Crystals: Anisotropy and Time-Dependent Inelastic Response[1] PRITHA RENGANATHAN, J. M. WINEY, Y. M. GUPTA, Washington State University — To gain insight into the inelastic deformation mechanisms for shocked and released hexagonal close-packed (hcp) metals, magnesium single crystals were subjected to shock compression and release along c-axis, a-axis and a low-symmetry (LS) axis to two different impact stresses. The wave profiles, measured using laser interferometry, obtained along these orientations show significant differences (qualitatively and quantitatively) in both compressive and release wave profiles demonstrating that Mg exhibits strong anisotropy under both shock compression and release. In addition to the observed anisotropy, the wave profiles also demonstrated time-dependent inelastic deformation. Numerical simulations of the measured wave profiles using a time-dependent anisotropic modelling framework, that incorporated both dislocation slip and deformation twinning, showed that the inelastic deformation mechanisms governing the shock response of Mg single crystals can be understood in terms of dislocation slip on basal, prismatic, pyramidal I and pyramidal II planes, and deformation twinning along $(10\bar{1}2)$ twinning planes. These inelastic deformation mechanisms have been observed previously for Mg single crystals under quasi-static loading/unloading.

[1]Work supported by ARL and DOE/NNSA

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Date submitted: 26 Feb 2019 Electronic form version 1.4