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Shock Compression and Release of c-axis Magnesium Single Crystals: Time-Dependent Elastic-Inelastic Response PRITHACHAKARAN RENGANATHAN, J.M. WINEY, Y.M. GUPTA, Washington State Univ — To gain insight into the inelastic deformation mechanisms for shocked hcp metals, 0.5 - 4.0 mm thick c-axis magnesium (Mg) single crystals were shocked to peak stresses of 2.6 and 4.2 GPa followed by release. Measured wave profiles, obtained using laser interferometry, show a two-wave elastic-inelastic response. Rapid decay of the elastic precursor and the stress relaxation behind the elastic wave indicate a strongly time-dependent elastic-inelastic response. Several interesting experimental observations are: the distinct peaked structure observed in the release wave; the significant scatter observed in the measured elastic wave amplitude for 0.5 mm thick samples; and the larger elastic wave amplitudes in the lower peak stress (2.6 GPa) experiments compared to the elastic wave amplitudes in the higher peak stress (4.2 GPa) experiments. Numerical simulations, carried out using a time-dependent anisotropic modeling framework, show that wave profiles calculated using a combination of dislocation slip and twinning provide a good match to the measured profiles for c-axis Mg. Efforts to resolve and understand the scatter in the thin sample experiments and the relationship between the elastic wave amplitude and peak stresses are underway. Work supported by ARL and DOE/NNSA.

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