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Reloading and Unloading Response of Shocked Aluminum Single Crystals: Time-Dependent Anisotropic Material Description J.M. WINEY, J.N. JOHNSON, Y.M. GUPTA, Wash. State Univ. — To gain insight into the inelastic deformation mechanisms governing reloading and unloading of shocked Al, wave propagation simulations were performed for Al single crystals shocked to 13 GPa along [100], [110], and [111] directions. The simulations utilized a time-dependent anisotropic material model based on a dislocation dynamics description of shock- induced elastic-plastic deformation. The simulation results provide good qualitative agreement with the measured wave profile data [Huang and Asay, J. Appl. Phys. 101, 063550 (2007)], including reloading and unloading features previously identified with quasi-elastic response. Deviations from the ideal elastic-plastic response in shocked Al single crystals can be understood in terms of time-dependent material response. Therefore, a complete understanding of the reloading and unloading response of shocked polycrystalline solids may require consideration of both time-dependent response and material inhomogeneity (resulting in a distribution of shear stresses in the shocked state). Work supported by DOE/NNSA.

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