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Shock Compression of Beryllium Single Crystals: Time-Dependent, Anisotropic Elastic-Plastic Response J.M. WINEY, Y.M. GUPTA, Washington State University — To gain insight into inelastic deformation mechanisms in shocked Be single crystals, wave propagation simulations were performed for crystals shocked along the c-axis, a-axis, and other crystal directions to peak stresses reaching 7 GPa. The simulations utilized a time-dependent, anisotropic material model that incorporated dislocation dynamics and deformation twinning based descriptions of inelastic deformation. The simulation results showed good qualitative agreement with the measured wave profiles [Pope and Johnson, J. Appl. Phys. 46, 720 (1975)], including features arising from wave mode coupling due to the highly anisotropic inelastic response of Be. The measured wave profiles can be understood in terms of dislocation slip along basal, prismatic, and pyramidal planes, together with deformation twinning. Our results provide insight into the complex nature of inelastic deformation in shocked Be, and are also expected to be valuable for understanding the anisotropic inelastic response of analogous hcp metals subjected to shock compression. Work supported by ARL and DOE/NNSA.

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