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High Strain Rate Effects in Quasi-Isentropic Compression of Solids[1] R. RAVELO, University of Texas-El Paso, B.L. HOLIAN, T.C. GERMANN, Los Alamos National Laboratory — We have performed large-scale molecular dynamics (MD) simulations of shock loading and quasi-isentropic compression in copper crystals, modeling the inter-atomic interactions with an embedded-atom method potential. We find that under high shear-stress conditions, disordering and amorphization competes with traditional (dislocation) plastic deformation mechanisms. Characteristic parameters for amorphization (stress relaxation and strain rate) are used in a modification of Eyring's theory for Couette shear flow in fluids, which can be compared with MD results for quasi-isentropic compressions in initially damaged, isotropic crystals. Above the yield stress (non-zero for a solid), the theory exhibits a linear normal-stress difference vs strain rate, which then bends over at high rates in a manner reminiscent of shear-thinning in fluids; the MD data shows remarkably similar behavior.

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