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Multi-scale simulations of shock-induced plasticity M. SHEHADEH, Washington State University, E. BRINGA, Lawrence Livermore National Laboratory, H. ZBIB, Washington State University, B. REMINGTON, J. MCNANEY, Lawrence Livermore National Laboratory — A multi-scale model of plasticity that couples discrete dislocation dynamics and finite element continuum analyses is used to investigate shock-induced dislocation nucleation in copper single crystals. We include a model for homogeneous nucleation of dislocations based on large-scale atomistic simulations of shock loading. The resulting huge rate of dislocation production takes the uniaxialy compressed material to a hydrostatically compressed state (1D to 3D) after a few tens of ps, as observed experimentally. The density of dislocations produced in a sample with pre-existing dislocation sources decreases with shock wave rise time, implying relatively lower densities for isentropic loading conditions, as suggested by recent experiments. The work at LLNL was performed under the auspices of the U.S. Department of Energy and Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.

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