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Three-Dimensional Dynamic Loading Simulations of Stress-Strain Response of Shape Memory Materials RAJEEV AHLUWALIA, TURAB LOOKMAN, AVADH SAXENA, Los Alamos National Lab — We present 3-D simulations of the microstructure and mechanical response of shape memory materials. The simulations are based on a nonlinear elastic free energy for a cubic to tetragonal transition in terms of the appropriate strain fields. The dynamics is simulated by force balance equations for the displacement fields with a damping term derived from a dissipational function. This approach ensures that the elastic compatibility relations, which play a crucial role in determining the microstructure of shape memory alloys, are naturally satisfied. Stress-strain properties in the pseudoelastic as well as the shape memory regime are investigated using three dimensional strain loading simulations that take into account the microstructural evolution during deformation. The role played by the microstructural evolution on the strain-rate dependence of the stress-strain properties is also demonstrated.

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