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Atomistic dynamics and the evolution of the Richtmyer-Meshkov instability VASILII ZHAKHOVSKII, Institute for Laser Engineering, Osaka University, Japan, SERGEY ZYBIN, CALTECH, SNEZHANA I. ABARZHI, Center for Turbulence Research, Stanford, KATSUNOBU NISHIHARA, Institute for Laser Engineering, Osaka University, Japan — For the first time the molecular dynamics (MD) approach is applied to study the evolution of the shock-driven Richtmyer-Meshkov instability(RMI), which develops at the corrugated interface separating two Lennard-Jones (LJ) liquids or two solids with different densities. Compared to traditional hydrodynamic simulations, MD has a number of fundamental advantages. It accounts for strong gradients of the pressure and temperature, and captures accurately the heat transfer and the viscous or plastic flow at early (shock passage) as well as late (turbulent mixing) stages of the instability evolution. MD has no limitations for the spatial resolution and does not require the assumption of thermodynamic equilibrium. We analyze the influence of the critical parameters, energy and mass transfer, and the governing stresses on the growth of the interface perturbations, and compare the cases of LJ liquids and solids. In liquids, RMI is driven by the non-uniform velocity shear and vorticity production. In solids, the development of visco-plastic flow, shear stresses, and elastic anisotropy influences significantly the evolution of initial perturbations.

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