Simulation of Richtmyer–Meshkov instability in solids via smoothed particle hydrodynamics

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The shock loading of solid samples which have perturbations on the free surface may lead to the development of Richtmyer–Meshkov instability [1,2]. It was demonstrated recently [3–5] that the analysis of such flow allows to define shear and yield properties of material at extremes. According to the experimental studies we perform simulations using the smoothed particle hydrodynamics method. The two regimes are analyzed: the light shock load, when only limited growth of perturbations is observed, and the heavy load leading to an unstable growth of jets from the free surface. In the first regime we noticed that shear waves can propagate along a corrugated surface causing the low-amplitude harmonic oscillations of the surface. A good agreement of the oscillation period with the theoretical dependence [3] is demonstrated. The possibility of using simulations to assess the strength of tantalum according to [5] is also analyzed. In the second regime the jet velocities obtained in simulations of copper samples loading are in a good agreement with the experiments [4].

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