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Phase Transitions in Simulation of Hypervelocity Impact Experiments MIKHAIL POVARNITSYN, JIHT RAS, ALEXEY ZAKHARENKOV, KONSTANTIN KHISHCHENKO, PAVEL LEVASHOV — Hypervelocity impact experiments can give us additional information about thermodynamical properties of matter in extreme state. In this work we simulate shock–induced melting, fragmentation and vaporization in aluminum and zinc targets. A tantalum impactor strikes zinc and aluminum targets at a velocity of 10 km/s and causes melting of these materials in a shock wave. Then under intensive rarefaction the thermodynamic path crosses the liquid–vapor coexistence boundary and enters into a metastable liquid state. Liquid in a metastable state undergoes either liquid–vapor phase separation or mechanical spallation. The theory of homogeneous nucleation as well as mechanical fragmentation criterion are used to control the kinetics of these processes in our model. The first effect dominates in the vicinity of the critical point, the second one at lower temperatures and negative pressure. Phase transitions and kinetics of phase separations are taken into account using a thermodynamically complete equation of state in tabular form with stable and metastable states for all materials under consideration. It is shown that liquid–vapor properties are very important for adequate description of experiment.

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