Passage of the rarefaction wave through the region of metastable states.

Shutov A.V.[1,@]

[1] Federal Research Center of Problems of Chemical Physics and Medicinal Chemistry of the Russian Academy of Sciences, Akademika Semenova˜1, Chernogolovka, Moscow Region, 142432, Russia

[@] shutov@ficp.ac.ru

The process of propagation of a rarefaction wave in a heated and compressed substance with a change in the phase state is considered. Typical examples of this process include the expansion and evaporation of a substance after the passage of a powerful shock wave, or after high instantaneous heating. When a substance evaporates in a rarefaction wave from the liquid state, there is a kink in the equilibrium isentrope at the phase transition boundary (binodal) in the pressure–specific volume coordinates. The metastable branch of the isentrope intersects the binodal without a kink. A normal substance, when it enters the region of metastable states, behaves in an anomalous way. The formation of the rarefaction shock wave at the initial moments of time and the change over time are shown. Three solutions of the rarefaction wave propagation, which successively replace each other, have been marked: 1) the self-similar solution with the maximum and constant pressure difference in the rarefaction shock wave; 2) the transitional solution with the decrease of the pressure difference in the rarefaction shock wave; 3) the self-similar solution with the formation of the "binodal layer" - a layer with fixed hydrodynamic parameters (pressure, density, mass velocity, internal energy)