Equations of State and Phase Transitions of Metals at High Temperatures and Pressures

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Modeling of thermodynamic properties of matter in a broad region of the phase diagram is interesting for both basic research and applications. Simulations of hydrodynamic processes in condensed media under intense influences require equations of state for structural materials over a wide range of thermodynamic parameters from normal conditions to extremely high values of temperatures and pressures. Proper inclusion of phase transitions is important from the standpoint of interpretation of those processes. In the present work, a semiempirical equation-of-state model, which takes into account polymorphic transformation, melting, evaporation, and ionization effects, is proposed. Multiphase equations of state for some metals (tungsten, titanium, and iron) are constructed on the basis of developed model. Calculation results are compared with available experimental data for the metals at high temperatures and pressures. The most essential static-compression and shock-wave experiments are described.