A wide-range multiphase equation of state for platinum

Elkin V M, Mikhaylov V N[@], Ovechkin A A and Smirnov N A

Federal State Unitary Enterprise "Russian Federal Nuclear Center—Academician Zababakhin All-Russian Research Institute of Technical Physics", Vasilieva 13, Snezhinsk, Chelyabinsk Region 456770, Russia

[@] v.n.mikhaylov@vniitf.ru

The paper presents a semi-empirical wide-range equation of state (EOS) for platinum with account for melting, evaporation, and ionization. The equation is based on a wide spectrum of experimental and calculation data. Parameters for the EOS were adjusted using a genetic algorithm which proved to perform well for optimizations in big data processing. In the regions where no experimental data were available, we used results of first-principles and average-atom model calculations. The EOS was used to calculate the melting curve of platinum to pressures above 1 TPa, sound velocities along the Hugoniot curve, parameters of melting under shock compression, and parameters of the critical point. An improved model is proposed for the shear modulus in (V, T) coordinates and its variation along the shock adiabat is calculated.