Thermal Equation of State of Shock Compressed Hydrogen

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Experimental results presented more then 10 years ago for deuterium compressed by laser-generated shock waves has attracted attention of researchers to thermodynamics of hydrogen of megabar pressures. Recent experiments provided with Z-mashine in Sandia, new laser results of LLNL and those on shock and isentropic explosively driven compression in Sarov give new important information for development of thermodynamic theory for dense partially ionized hydrogen. Improved model for equation of state (EOS) of warm dense hydrogen is developed in frames of chemical picture. Hydrogen is considered as multi-component strongly interacted mixture of atoms, molecules, ions and electrons. Effects of Coulomb interaction of charged particles, strong repulsion at short distances and degeneracy of free electrons are taken into account. Behavior of the model is examined by comparison with whole collection of experimental data on compression of pre-compressed gaseous, liquid and solid deuterium. For liquid deuterium this comparison is painted in secondary shock. Additionally, results of calculations are compared with first principle computed data for Hugoniots and double shock. Asymptotics of presented model is studied for very high pressures along Hugoniots of deuterium. This is demonstrated by comparison with first principle calculations and results obtained with asymptotically exact models.