Abstract Submitted
for the SHOCK13 Meeting of
The American Physical Society

Thermodynamics of Dynamically Compressed Gases at Megabar Pressures VICTOR GRYAZNOV, Institute of Problems of Chemical Physics RAS, IGOR IOSILEVSKIY, Joint Institute for High Temperatures RAS, EUGENE YAKUB, Cybernetics Department., Odessa National Economic University, VLADIMIR FORTOV, Joint Institute for High Temperatures RAS — Thermodynamic model based on "chemical picture" is applied to calculation of equation of state of warm dense hydrogen, deuterium and helium at submegabar and megabar pressure range. Strongly compressed fluid is considered as a multi-component strongly interacted mixture of atoms, molecules, ions and electrons. Nonidealty effects of Coulomb interaction of charged particles and short-range repulsion of atoms and molecules are included in thermodynamic functions as well as in effective shifts of ionization and dissociation equilibrium. Effects of free electrons degeneracy are taken into account in charge screening. The results of calculation of principal Hugoniots of hydrogen and deuterium at submegabar pressures are compared with experimental data and calculations by means of ab initio DFT-MD approach and calculations on the basis of non-empirical atom-atomic approximation. New calculations of Hugoniots of high density precompressed deuterium at megabar pressures and extended density range are presented. The results of calculations of thermodynamic functions for isentropic compression of helium at multi-megabar pressures are presented and compared with experimental data and DFT-MD data. Contribution of various plasma effects, such as dissociation of molecular phase, ionization, interparticle interaction, degeneracy effects of free electrons whole range of pressures covered by the experiments are analyzed and discussed.

Victor Gryaznov
Institute of Problems of Chemical Physics RAS

Date submitted: 21 Feb 2013 Electronic form version 1.4