THE INTERACTION OF EXPLOSIVELY DRIVEN DENSE PLASMA WITH A LOW INTENSITY LASER RADIATION

Yu. Zaporozhets[1], V. Mintsev[1], V. Gryaznov[1], H. Reinholz[3,4], G. Röpke[3], V.Fortov[1,2]

[1] *Institute of Problems of Chemical Physics of RAS, 142432, Chernogolovka, Russia.*
[2] *Institute for High Energy Densities of RAS, IHED-IVTAN, Izhorskaya 13/19, Moscow 127412, Russia*
[3] *Fachbereich Physik, Universität Rostock, 18051 Rostock, Germany*
[4] *School of Physics, University of Western Australia, Crawley WA 6009, Australia*

The investigation of explosively driven dense plasma using low intensity electromagnetic waves is an important diagnostic tool for studying transport properties of such medium. In particular, physical models describing the behaviour of matter under such conditions can be verified. However, to interpret correctly the results of reflectivity measurements it is necessary to know parameters of a transitive plasma slice. Angular dependence of s - and p-polarized reflectivities at several wavelengths can be used in the integration of corresponding Maxwell equations to construct the spatial profile of the density of charge carriers.

Here, the results of the first experiments on polarized reflectivities of explosively driven dense xenon plasma is presented. The study of polarized reflectivity properties of the plasma was accomplished within the range of plasma densities $\rho = 2 \div 3.2 g/cm^3$, pressures up to P ~ 18 GPa and temperatures up to $T \sim 3{\cdot}10^4$ K under conditions with strong Coulomb interaction (the nonideality parameter up to $\Gamma \sim 2.0$). We used a dynamic method to generate a strongly non-ideal plasma, based on compression and irreversible heating of the gas in front of a high-power ionizing wave. The variation of density and electron concentrations of the plasma was achieved by changing the initial gas pressure.

To measure the dense xenon plasma polarized reflectivity coefficient, the pulsed $Y_3Al_5O_{12}:Nd^{3+}$+KTP laser system with electro-optical shutter based on DKDP crystal and higher-order mode suppression of the laser radiation was used. For determination of the equilibrium properties of explosively driven plasma, appropriate gas dynamics calculations were carried out. The plasma composition was calculated within a chemical picture [1]. The thermodynamic model of the plasma takes into account Coulomb interaction in frames of Debye approximation in grand canonical ensemble and the short-range repulsion of heavy particles - within the soft spheres model.

The integration of Maxwell equations are based on an interpolation formula for dc conductivity, obtained from a systematic quantum statistical treatment of different limiting cases.

[1] Ebeling W, Förster A, Fortov V, Gryaznov V K and Polishchuk A 1991 *Thermophysical Properties of Hot Dense Plasmas* (Stuttgart: Teubner)