THERMOPHYSICAL PROPERTIES OF DENSE LEAD PLASMA

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Study of thermophysical properties of non-ideal plasmas is a rather complex experimental task. For such plasma the ionization degree should be of the order of unity and the potential energy of interactions between the ions is comparable with the kinetic energy of their thermal motion. To create such plasma, it is possible to compress a gas by means of a strong shock wave. On the other hand, the plasma can be created by heating of a metal sample by an electric current pulse so that it expands homogeneously to the plasma state [1]. Due to the remoteness of the plasma state from the initial state of the sample on the phase diagram, the problem of maintaining the homogeneity of the sample becomes particularly complex. In the present work the experimental technique [1] is used to study the thermophysical properties of dense plasma of lead. A lead sample in the form of a foil strip with the thickness of 10 - 30 micrometers was sandwiched between two sapphire plates (or silica glass plates). Thermodynamic functions and electrical resistivity of lead plasma have been measured in the density range from 0.36 to 0.04 of the normal solid density. For this plasma we have determined the dependencies of electrical resistivity, the Gruneisen coefficient, and the speed of sound on density and specific enthalpy. Thermal expansion of the sample was measured by the Michelson interferometer. This interferometer allowed us to reduce the multi-beam interference and thuse to improve the accuracy of the measurements of density compared to the results obtained by means of the interferometer [2].

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1. Kondratyev A. M., Korobenko V. N., and Rakhel A. D. // J. Phys.: Condens. Matter. 2016. V. 28. P. 265501.
2. Kondratyev A. M., Korobenko V. N., and Rakhel A. D. // Carbon. 2016. V. 100. P. 537.