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CALCULATION OF THERMOPHYSICAL PROPERTIES OF LOW-TEMPERATURE INDIUM PLASMA *)

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Thermophysical properties of various substances such as the thermodynamical ones (pressure, internal energy) and electronic transport coefficients (electrical conductivity, thermal conductivity, thermal power) play important role in different fundamental and applied problems of different physics areas. including the plasma physics as well [1]. That is why their studies within numerous experimental and theoretical techniques continue for more than a century and presently there are necessary data for many substances in very different regions pf the phase diagrams [2]. However, there are some substances for which such data are absent. In particular, indium belongs to them and namely in the region of the low temperature plasma.

Indium has a relatively low melting temperature 422.55 K. So the considered properties for it are well known from the measurements in the liquid region approximately up to the boiling temperature 2345 K. There are also the reliable data of calculations, which allows one to construct an accurate analytical equation of state for practical applications [3]. But under temperature rising the number of corresponding data is notably lower, in particular, there are the results of the shock-wave measurements for the states with the densities near the solid state values. i.e., 7.31 g/cm^3 [4], there are the data of the spectroscopic measurements [5]. But, for instance, the position of the phase boundary lines is unknown. For the critical point coordinates there are only separate estimates in the range 4–7 кK and 0.33–2 g/cm^3 [6] for the temperature and density respectively. After all in the temperature region 10–100 кK and the densities lower than the critical one any published data have been absent both for the measurements and the theory. But namely these parameters correspond to the position of the low-temperature plasma for the most of metals.

Previously, we have developed a model to describe the considered thermophysical properties in this region, which was successfully applied to a number of metals and semiconductors. In the present study, we have modified the parameters of our model to apply it to indium plasma. The detailed description of our model is presented in [7]. Here we mention that it is based on the chemical approach to describe the thermodynamics and on the relaxation time approximation to calculate the transport coefficients. As far as there are no the other data for comparison in this region, we have additionally calculated the pressure along several isochores by means of the semi-empirical equation of state, offered in [8], and have found a good agreement between two models.

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