THERMOPHYSICAL PROPERTIES OF THE LOW-TEMPERATURE PLASMA OF METALS

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Various thermophysical properties of substances are studied for more than a century. Here we will consider the equations of stated and the electronic transport coefficients - electrical conductivity, thermal conductivity and thermal power. However, their investigations for different metals at high temperatures ($T \geq T_0$, $T_0 \approx 5$ kK) have evident hinders. At first, these high-temperature states are difficult to obtain in measurements. At second, the reliable theories exists whether at very low densities (almost ideal gas or ideal plasma at T increase), or at the liquid metal near the melting curves. In the other area the theories and calculations exist as well, but they are not so reliable and give rise to ambiguous results. However, during recent two dozen years new mesurements have appeared for the plasma of metals [1,2]. In this experiments the properties under study were obtained in wide range of parameters. These data allows one to check and to make more precise the existing techniques of calculations.

Previously we have developed a model for calculations of the considered properties in the region of low-temperature plasma of metals (see [3] and references therein). It is applicable to the region of the temperatures $T=$ 10-100 kK and the densities lower than the critical one. It is based on the chemical approach, which considers a substance as a mixture of electrons, positive ions, atoms etc. Within this approach it is possible to find not only the thernodynamical functions but the concentrations of the components as well, i. e. the chemical composition. Further the composition is used to calculate the electronic transport coefficients within the relaxation time approximation. Presently we present the results of calculations by means of the above model for a number of metals, for instance, Ni, Fe and Mo. Our results were compared with the data of calculations and measurements of other researchers. The comparison have shown good agreement.

1. DaSilva A.W., Vunni G.B. // Phys. Rev. 2011. V. 83. No. 3. 037402.
2. Clerouin J. et. al. // Phys. Plasmas 2012. V. 19. No. 8. 082702.
3. Apfelbaum E. M. // High Temp. 2017. V. 55. No. 1. P. 1.