calculations of thermophysical properties of low-temperature molybdenum plasmas

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Investigations of the thermophysical properties of various substances is very important practical and fundamental task. So their studies have continued for more than a century and allows us to have the reliable results in the solid state and liquid regions under relatively low temperatures. There are less number of analogous results in the temperature region more than approximately 5 kK (where the low-temperature plasma exists) due to the difficulties in the measurements under these conditions. Nevertheless, in particular for molybdenum at present moment there are the measurements of thermodynamics (pressure and density) in shock experiments performed in Sarov [1], Besides, there are the electrical conductivity measurements (in dependence on the density under constant energy input) in the wire explosion process by high currents [2]. We should note that the temperature was not measured directly in both experiments. However the available measurement data allows us to check the existing theoretical and numerical models by comparison of other parameters.

Previously we have developed corresponding model to calculate the plasma thermophysical properties, which were applied to various elements (see [3,4] and references therein). The plasma thermodynamics (composition, pressure, internal energy etc.) was considered within so-calleв the chemical approach, which is based on the acting mass law (see., for instance, [5]). The electron transport coefficients (the electrical conductivity, the thermal conductivity and the thermal power) were calculated within the relaxation time approximation. In present study we have applied our model for the case of molybdenum plasmas. The area of applicability of our model is limited by density from above just like for earlier considered substances. So we have used only the data up to 2 g/cm3 during the comparison with the measurements [1, 2] (the normal Mo density is 10.28 g/cm3). The range of considered temperatures was 10 -100 kK. We have also compared our results with the data of *ab initio* calculations of electrical conductivity [6]. The comparisons have shown that our model are in good agreement with the data of available measurements and calculations.

References

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