The thermophysical properties of low-temperature germanium plasma

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Various fundamental and applied tasks of physics require the information about thermophysical properties of a substance (the thermodynamical ones and electronic transport coefficients). So these properties have been investigated for more than a century and presently the necessary data is already obtained for many substances at different temperatures T and densities ρ even in the plasma region [1]. Nevertheless, for Ge the appropriate data are still absent in the low-temperature plasma (LTP) region, which is located at $T \leq 5$ - 10 kK and $\rho < \rho_0$ ($\rho_0 = 5.23$ g/cm^3 - is the density at ambient conditions). Germanium at ambient conditions is semiconductor. It plays important role in electronics. So there are many investigations of its properties in crystal and liquid phases, which together with relatively low melting temperature T_m=1211 K allow to construct reliable equations of states at $\rho \sim \rho_0$ [2]. However the data at lower ρ in LTP are still absent in literature, although they are presented for close element - Si [3, 4]. Previously, to solve this problem for other substances, we have developed a model of calculations of the investigated properties, which are based on the chemical approach and relaxation time approximation, see [4–6] and references therein. In present study we have modified this model and applied it to Ge LTP at $10^{-5} g/cm^3 \leq \rho \leq \rho_0$ and 8 kK $\leq T \leq$ 100 kK.

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