Theoretical Calculation of the Transport Properties of Monatomic Silver Vapor

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Calculations of transport property collision integrals are used to obtain the high temperature transport properties of silver atoms as a function of temperature. The collision integrals depend on the two-body interaction potentials between silver atoms in various electronic states. Contributions are included from the ground $X^{1}\Sigma^{ }_{g}$ and $^{3}\Sigma^{ }_{u}$ molecular electronic states of the silver dimer that dissociate to two ground state silver atoms and from the $A^{1}\Sigma^{ }_{u}$ molecular state that dissociates to a ground state and an excited state silver atoms. Spectroscopic constants are available for these three electronic states and these spectroscopic constants have been used to determine the Hulburt-Hirschfelder (HH) potentials for the three states. The HH potential is the best general-purpose potential for representing atom-atom interactions. This potential depends only on the spectroscopic constants. It is used to calculate the viscosity and diffusion collision integrals for the three electronic states. These collision integrals are then averaged over the three states. The results are used to calculate the thermal conductivity, viscosity, and self-diffusion coefficient of silver atoms over a wide temperature range from the boiling point of silver to temperatures at which ionization becomes important. Some aspects of the excitation exchange cross section between silver atoms in the ground and excited electronic states, important for diffusion, are also considered.