High temperature transport and thermodynamic properties of equilibrium Mars atmosphere

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Thermodynamic and transport properties of high temperature Mars atmosphere have been calculated in the pressure range (0.01-100) bar and in the temperature range (100-50000) K. Planetary explorations require an accurate analysis of entry or re-entry conditions for vehicles. For this reason reliable and consistent data sets of thermodynamic and transport properties are needed for numerical simulations [1].
Results have been obtained by using a self-consistent approach for the thermodynamic properties and higher order approximation of the Chapman-Enskog method for the transport coefficients. Debye-Hückel corrections have been considered in the thermodynamic properties while collision integrals of charge-charge interactions have been obtained by using a screened Coulomb potential. The atmosphere is a mixture of 53 components and electronic energies as well as spectroscopic data of the most important diatomic molecules used for calculations can be found in [2, 3], while for atomic species, the cutoff selected is the largest between the Fermi and Griem values [4, 5]. It must be pointed out that the Griem cutoff depends on the plasma composition making necessary a self-consistent solution of the problem. Plasma compositions have been performed by using a hierarchical method [6, 7]. In order to calculate transport properties, elastic collision integrals for neutral-neutral and neutral-ion interactions are calculated by means of a phenomenological approach and inelastic collision integrals, due to resonant charge exchange channels, have been considered [8].
Mars compositions, specific enthalpies and entropies, mean molar mass, specific heat, isentropic coefficient, total thermal and electric conductivities and viscosity are presented as function of temperature for different pressures.

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