Unified data set for transport and radiation properties of low-temperature plasma of noble gases

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Noble gases have a very wide use in industry and science, from lasers and light sources to different types of discharge plasma. Knowledge of transport and radiation properties of noble gases is necessary for predictive modelling of chemically and optically active plasma. This work presents the methodology and detailed set of data for transport and radiation properties of noble gases (He, Ne, Ar, Kr, Xe) and their mixtures in wide range of temperatures (T=100-50000 K) and pressures (P=0.1-300 bar). Transport coefficients were calculated in the assumption of the local thermal and chemical equilibrium (LTE) in the framework of Chapman-Enskog theory. All coefficients were calculated in the second approximation by the accurate formulas of Chapman-Enskog theory. Effective thermal conductivity was calculated as a sum of translational thermal conductivity and reactive one, which was obtained from the advanced version of Butler-Brokaw formula. Absorption coefficients of noble gases plasma were calculated based on data set of electronic energy levels, transition probabilities of atoms, potential energy curves and transition dipole moments of excimers. A numerical realization of described above was implemented in the Fluid Workbench program suit.