

Inelastic processes in collision of closed electron shell particles: K^+ - He case.

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Absolute cross sections for charge exchange, ionization, stripping and excitation in K^+ - He collisions were measured in the ion energy range 0.7 – 10 keV. The experimental data and the schematic correlation diagram of the $(KHe)^+$ system have been employed to discuss the mechanisms for inelastic processes realized in this collision.

Using a refined experimental setup that includes a transfer electric field methods (a condenser plate method), energy-loss, and angle-and energy –dependent collision of product ions we have measured the absolute total and differential cross sections for the charge exchange, ionization, stripping and excitation processes.

Based on analysis of the correlation diagram of $(KHe)^+$ system and experimental data we conclude: charge exchange in K^+ - He collisions mostly occur through the channel $K^+ (3p^6) + He (1s^2) \rightarrow K (4s) + He^+ (1s)$ resulting from the capture of the electron to the ground state of the atom; the primary ionization mechanism in K^+ - He collisions is the filling, of quasimolecular autoionization terms and their decay in the region of the transition into the continuum (in the stage in which a quasimolecule exists); stripping in K^+ - He collisions occur via a mechanism involving a transition of adiabatic term into the continuum.

The usage of the collision spectroscopy method has permitted us to observe exceptionally highly excited states of helium atom in the energy loss spectrum. The increase of the excitation probability of inelastic channels with the angle of scattering is revealed. An exceptionally highly excited state of He is observed and a peculiarity for the excitation function of resonance line is explained. The similarity of the population of the 4p state of the potassium ion and atoms as well as the anomalously small values of the excitation cross sections are explained.