

Absolute Partial Pressures of Charged Species in the Saturated Vapor of Inorganic Salts - S. Abramov, N. Chilingarov, A. Kepman, M. Leskiv, and L. Sidorov (Moscow State University)

The absolute partial pressures of the  $\text{Na}^+$ ,  $\text{Na}_2\text{F}^+$ ,  $\text{K}^+$ ,  $\text{KNaF}^+$ , and  $\text{AlF}_4^-$  ions mainly presented in the saturated vapor of the  $\text{NaF-Na}_3\text{AlF}_6$  system in the 917–1063 K range were measured using the Knudsen mass spectrometry method. It was established that in the mass spectrum, the  $\text{K}^+$  is the dominant ion even when the sample containing a microscopic amount of  $\text{KF}$  was evaporated. The partial ion pressures were found to be 6–8 orders of magnitude lower than the total pressure in the system, which is determined by the molecular components. A ratio of the total pressure of negative ions to the total pressure of positive ions increases and tends to 1 with increased temperature. The estimated electron work functions of the salt surface decrease with increasing temperature; they are equal to 5.0–4.8 eV that is close to the electron work function of the effusion cell material (nickel). Thus, the electron pressure in the vapor is insignificant as compared with the pressure of major negative ion  $\text{AlF}_4^-$ , and relatively high concentrations of charged species are due to heterolytic dissociation of complex salt. At low temperatures, the vapor inside a cell is not electrically neutral. The Debye shielding radius decreases with a rise in temperature and is equal to 4.7–0.3 mm, i.e. it is close to the geometrical parameters of a cell. At 1063 K, the pressures of negative and positive species in the vapor become nearly equal; at the same time, the Debye shielding radius is 0.3 mm. Thus, within the whole temperature range studied, the ionized gas inside a cell is in the state, which does not strictly meet the condition of electrical neutrality in the plasma ( $r_D \ll 1$ ).

The study was carried out on a MI-1201 mass spectrometer with a combined ion

source that makes it possible to analyze both neutral and charged particles in the scope of one experiment. In the experiments, the equal sensitivity of an instrument on positive and negative ions was provided. Moreover, an instrument and the experimental procedure were somewhat modified to provide equilibrium in the system. An instrument was calibrated using the registered currents of the  $\text{Na}_2\text{F}^+$  and  $\text{AlF}_4^-$  complex ions and the constant of heterolytic equilibrium, in which these ions are involved. For all the ions, the curves of the signal intensity vs drawing out voltage were obtained.

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