THE EFFECT OF METAL VAPOR ON ON GAS DISCHARGE IN ARGON

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Typically in the gas discharge current is determined primarily by electrons because its mobility of 1 - 2 orders of magnitude higher than the mobility of the ions, due to their density are approximately equal. However, the transport of ions can determine many of the characteristics of the gas discharge, because the ion flux from the plasma determines necessary to maintain the discharge rate of ionization.

Metal ions in the discharge in noble gases may appear as a result of erosion of the cathode, boiling reactors structural elements, etc. Due to the lower ionization potentials metal atoms have a higher probability of ionization. It is therefore very likely is the situation when a small concentration of metal vapors can completely determine the ionic composition. Then the conditions of discharge will be determined by the drift of the metal ions in the buffer noble gas.

In this paper, for a mixture of Me - Ar ion drift characteristics are calculated in a gas at a constant and uniform electric field. As an example, the metals commonly used in industrial processes and structural elements: aluminum , titanium, vanadium, chromium, iron , nickel , copper and mercury.

Cloud of ions is considered, each of which starts from the starting point and permanently accelerated by a constant and uniform electric field. At some point in time, there is a collision of the ion with atom, the probability of such an event is played from the known collision cross sections of different types. We consider a collision with resonance charge transfer, polarization interaction and repulsion due to the interaction of the electron shells. Model ion-atom collisions, implemented the Monte Carlo method, allows to properly take into account the energy balance of ions when they drift [1]. This formulation allows to calculate all the kinetic transport coefficients necessary for modeling spatially inhomogeneous plasma and non-stationary processes in it: coefficient of ion mobility and diffusion along and across the field:

- distribution function of the velocity in the direction along and across the field,

- angular and energy distribution of ions bombarding the surface.

Earlier *iDrift* code used to simulate transport processes in dusty plasmas, where the ion - atom collisions can have a major influence on the characteristics of the subsystem in dusty plasmas [2, 3]. These calculations revealed a deep analogy between the cryogen discharge and discharge in a mixture of light and heavy gas, as well as make significant conclusions about the theory of limits of applicability of the widely used BGK approximation [4].The study was supported by The Ministry of education and science of Russia, project 8392.

References

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