S5-O-018902

THE INFLUENCE OF THE TYPE OF THE ELECTRON DISTRIBUTION FUNCTION ON THE PROPERTIES OF A NANOSECOND DISCHARGE IN EXTENDED SHIELDED TUBES WITH CYLINDRICAL HOLLOW ELECTRODES *

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The paper presents the results of experimental research on the properties of plasma of a nanosecond discharge in neon in an extended shielded discharge tube with cylindrical hollow electrodes.

The block representation of the experimental setup used in this work is given in [1, 2]. To generate a nanosecond gas discharge, a voltage pulse generator was used. It generated high-voltage pulses with adjustable amplitude up to 40 kV, with a voltage pulse rise time of 50–80 ns and a pulse repetition rate of up to 100 Hz [3].

The results of experimental studies of the dynamics of the formation of optical radiation from the discharge, the dynamics of the population of metastable states of neon atoms, the structures of ionization wave fronts, their propagation velocities, and the damping coefficients of ionization waves in the neon pressure range of 1-60 Torr are presented. Experimental studies of the structure of longitudinal and transverse plasma inhomogeneities in a discharge tube as a function of amplitudes of voltage pulses and gas pressure have been carried out.

Numerical modeling of the kinetics of ionization processes for the type of discharge under consideration has been performed. The results of numerical simulations of the plasma of a nanosecond discharge in neon are presented, taking into account the electron distribution function from the solution of the Boltzmann kinetic equation in the two-term approximation. To analyze the influence of the form of the electron distribution function on the dynamics of the formation of the spatial distribution of plasma parameters in the discharge configuration under study, numerical simulation was performed taking into account the processes of direct and stepwise ionization from $2p^6$, $2p^5 3s$, and $2p^5 3p$ electronic configurations of the neon atom. To solve this problem, a two-dimensional axisymmetric model whose geometry corresponded to the experimental setup was used. The kinetic and transport properties of the plasma were determined using the electron distribution function calculated from the solution of the Boltzmann kinetic equation in the classical two-term approximation.

The results of the experimental research and numerical simulation are compared.

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* This work was partially supported by a grant from the Russian Foundation for Basic Research No. 20-32-90150 and the project of the Ministry of Education and Science of Russia FZNZ-2020-0002.