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PULSE PLASMA-BEAM DISCHARGES WITH EXTENDED SLOT CATHODE AND THEIR TECHNOLOGICAL APPLICATIONS*

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The results of studies of the kinetic processes of development of nanosecond discharges with an extended slot cathode in inert gases (He, Ne, and Ar) are presented. The block representation of the experimental setups is given in [1-4]. It is shown that, depending on the values of the parameters of the reduced electric field *E/N* and electron density, there are three different forms of functioning of a nanosecond discharge (a stratified discharge, a homogeneous volume discharge with a beam of electrons, and a high-current dense discharge with areas of cumulation of the electric field and charged particles). The main parameters of striations and boundaries of their formation in discharges with inert gases are determined. It is shown that in the presence of growing values of applied voltage in the gap, there appear high-energy electrons that destroy the spatial periodic structure of the discharge. The formation conditions, general regularities, and energy characteristics of high-energy electrons in transverse nanosecond discharges are established. It is shown that an unlimited discharge with a cathode with a rectangular cavity, where the beam current on the anode surface reaches up to 20% of the discharge current value, is optimal for generating electron beams.

It has been found that at high values of the applied external field, an area of uncompensated positive charge is formed along the center of the cavity in the cathode and at the exit from the cathode cavity, which leads to a change in the spatial structure of the discharge and the dynamics of ionization processes.

For the configuration of the discharge with an extended hollow cathode under consideration, the results of numerical simulation of the structure of ionization fronts during nanosecond gas breakdown are presented. The results of calculating the relaxation of the electron distribution function both inside the cathode cavity and between the electrodes are given. The possibility of using the two-term approximation in the calculation of the electron distribution function is analyzed.

The possibilities of using this type of discharge to create plasma reactors for precision plasma technologies for atomic layer etching of micro- and nanoelectronics materials are considered.

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