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H-14

AMBIPOLAR TRANSPORT IN THE STRUCTURE OF GAS DISCHARGE PLASMA

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Although charged particles in plasma can move in different trajectories and in opposite directions, in attempting to leave the bulk, according to the Poisson equation, such "runaway" particles will be subject to the returning force caused by the influence of uncompensated space charge. By now, in addition to ambipolar diffusion, two other types of transport providing the motion of plasma as a whole are known: ambipolar drift known from the theory of electrolytes [1] and transport caused by the action of the energy of the plasma electric field. These three types of ambipolar transfer are sufficient for describing the structure of direct-current atmospheric glow discharge [2]. Ambipolar drift, which plays a special role in maintaining the discharge plasma at medium pressures, becomes, at atmospheric pressures, a key mechanism of transfer of charged particles from the near-electrode layers providing the existence of a discharge without ionization in the bulk.

The presence of near-electrode layers results in the fact that the field in the quasi-neutral part of the discharge is always smaller than between the electrodes, outside the plasma pinch. Therefore, the external surface of the plasma pinch in the radial direction will be subject to the action of a force, determined by the energy gradient of the electric field, compressing the pinch. On the other hand, the action of thermal energy leads to the diffusion expansion of plasma. Thus, ambipolar diffusion and ambipolar transport caused by the action of the electric field energy resist each other, determining the plasma pinch radius. A detailed analysis of the results of an experimental investigation of atmospheric pressure discharges in various gases and a comparison with estimates based on three kinds of ambipolar transport of plasma have shown that the coincidence of the plasma pinch radii is not more than 20%. Nevertheless, the role of ambipolar transport in the gas discharge has not been fully understood yet, since the concept of local balance of particles is widely used.

1. *Medvedev A.E.* Structure formation of atmospheric pressure discharge // EPJ D. 2016. V. 70. P. 37–47.

H-15

MODIFICATION OF ELECTROPHYSICAL PARAMETERS OF HgCdTe EPITAXIAL HETEROSTRUCTURES UNDER THE ACTION OF A PULSED NANOSECOND DISCHARGE IN GAS ENVIRONMENT AT ATMOSPHERIC-PRESSURE

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The search for new methods for the controlled changing of the parameters of the properties of semiconductor materials HgCdTe is still an urgent task. The first experimental results of the impact of a pulsed nanosecond discharge in atmospheric pressure air showed the promise of this type of action for modifying the properties of HgCdTe. The aim of this work was a comparative analysis of the results of the action of a low- and high-frequency impulse nanosecond discharge on the electrophysical characteristics of the HgCdTe epitaxial heterostructures.

For experiments the samples of epitaxial HgCdTe films of the p-type conductivity were prepared. Under the action of a low-frequency discharge, the RADAN-220 generator was used as the source of the pulse voltage, the pulse repetition rate was 1 Hz, the number of pulses was 100–1200 pulses. At high-frequency irradiation the NPG-18/3500N generator was used, the repetition rate was 1200 kHz, the irradiation time was 2, 5, 10 minutes. At high-frequency action, a laminar gas flow was fed into the discharge chamber, the pumping rate was 1.5 l/min. Measurements of the electro-physical parameters of the samples before and after irradiation were made at the temperature of liquid nitrogen using the Hall Electromotive Force (EMF) method in the Van-der-Pau configuration.

Experimental data have shown that the qualitative results of the action of low and high-frequency pulsed discharge in an atmosphere of air and nitrogen coincide. After the action, an increase in the conductivity of the epitaxial HgCdTe structures is observed. At the same time, there are differences. These differences are associated with different dynamics of the relaxation of the magnetic field dependences of the Hall coefficient after the action. These results allow us to make the assumption that the mechanisms of low- and high-frequency impact of volume nanosecond discharge on the electrical parameters of HgCdTe heterostuctures are different.

H-16

COMPARISON OF THE CROSS SIZES OF A VISUAL AREA AND THE MODIFIED SURFACE OF THE SUBSTRATE BEING PROCESSED BY A PLASMA JET

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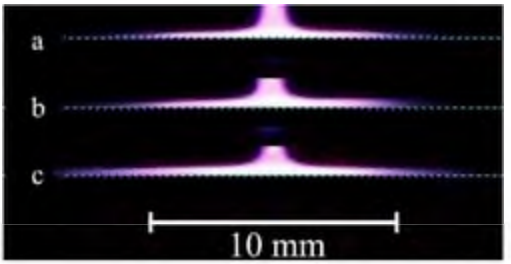
The report presents the results of experiments devoted to search on the interaction of plasma jet with the surface of the quartz. Plasma jet is generated by DBD in the flow of He and ejected into the ambient air. It is shown that the cross size of the modified dielectric surface treated by plasma jet exceeds by a factor of 2 the visual area formed by jet on this surface. The grounding of a metal surface on which the processed plate is placed practically doesn't influence the diameter of a visual spot formed by jet. As an example, a part of results is given in Figs. 1 and 2. A detailed set of the received results will be presented in the full version of the report.

a



b

Fig. 1. Photo of a plasma jet and visual spot on a quartz plate placed on the grounded metal surface. Exposure time is 10 ms. The amplitude of sin voltage $U = 2.7$ kV (*a*); The increased photo of a visual spot on a quartz plate: a – metal is not grounded, b – plate in air, c – metal is grounded (*b*). The amplitude of sin voltage $U = 3.5$ kV