C1-O-008401

APPLICATION OF AN ELECTRON BEAM GENERATED BY A FORE-VACUUM PLASMA SOURCE TO INITIATE A NON-SELF-SUSTAINED GLOW DISCHARGE IN LONG NARROW METAL TUBES*

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Ion-plasma processing methods have found wide application for the tasks of surface cleaning, coating deposition and modification of the near-surface layer of dielectric and metallic materials for various purposes [1].

Ion-plasma treatment of the internal surfaces of narrow extended cavities with a transverse size of several millimeters requires a joint solution of the problems of plasma penetration into the cavity and ensuring its uniformity along the entire length of the cavity. Many works [2-4] have been devoted to solving the problem of ion-plasma treatment of the inner surface of tubular products.

One way to facilitate the generation of plasma in narrow extended cavities is the injection of electrons into the cavity to initiate non-self-sustained glow discharge [4]. However, the use of a focused electron beam generated at elevated pressures of the working gas [5] as an ionization source inside the cavity will provide great opportunities for controlling the processes of initiation and burning of a non-self-sustained discharge in a narrow extended cavity.

The paper presents the results of a study of the propagation processes and geometric dimensions of a focused electron beam generated at elevated pressures in the fore vacuum range. The processes of propagation of a focused electron beam during its passage through a narrow extended metal tube were studied. The conditions for the initiation of a non-self-sustained glow discharge in a narrow extended metal tube, initiated by injection of a focused electron beam into the tube, are studied. The results of studying the influence of the parameters of a focused electron beam and working gas on the filling of a narrow extended tube with non-self-sustained discharge plasma are presented. Presented in fig. 1 photographs show the dynamics of ignition and the distribution of the discharge in the tube.

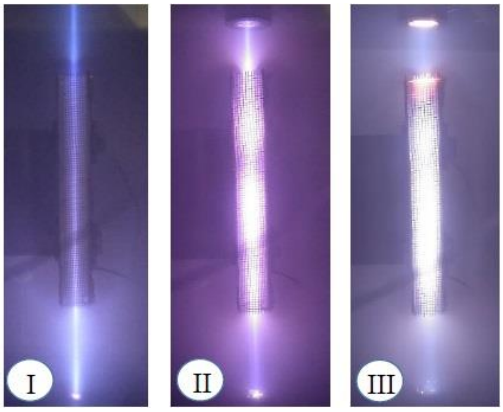

Fig.1. Photographs of the glow of the electron beam and the discharge in the tube for various beam currents Ib: I - 7 mA; II - 18 mA; III - 24 mA. Length of the tube - 15 cm, internal diameter – 12 mm.

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* The work was supported by the Russian Science Foundation in the framework of Project No. 21-79-10217, https://rscf.ru/project/21-79-10217/.