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EXPERIMENTAL STUDY OF THE PROPERTIES OF A MICROWAVE DISCHARGE WITH DIELECTRIC BARRIER CONFIGURATION*

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Broad prospects for the use of non-thermal atmospheric pressure plasma (NTAP) are associated with its huge potential for unique technological capabilities in the creation of new products and technologies [1-3]. This article presents the results of an experimental study of the parameters of the microwave NTAP source, which combines the characteristics of a dielectric barrier discharge and a non-thermal plasma jet [4, 5].

Studies of the formation processes, as well as the structure and dynamics of a microwave dielectric barrier discharge of atmospheric pressure excited in an argon flow have been carried out by the high-speed video filming. Thermocouple and thermal imaging measurements of the temperature profiles of the plasma jet formed in argon flow behind the discharge tube outlet have been made. Measurements and analysis of emission spectra of the discharge in the region of the argon plasma jet have been carried out. In the emission spectra of the plasma, molecular bands of N_2, OH, and atomic lines of Ar are observed (see Figure 1 on the left). Figure 1 on the right shows a thermogram of a heat spot on aluminum foil placed across the plasma flow at a distance of 30 mm from the discharge tube nozzle.

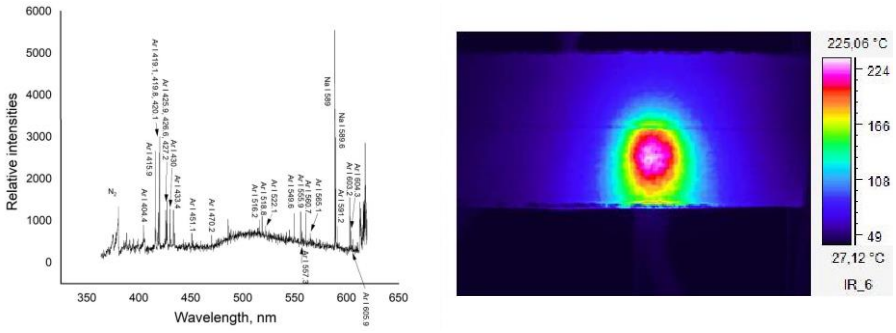

Fig.1. Emission spectrum of the microwave DBD argon plasma jet in the wavelength range 350-650 nm (left). Thermogram of a heat spot on aluminum foil placed across the plasma jet (right).

To measure the temperature by the contact method, we used an open fast-response chromel-copel thermocouple of the L type. The thermocouple was fixed with a special holder on a positioning table with a micrometer feed along the axis of the discharge tube. A quartz tube with an outer diameter of 8 mm and a wall thickness of 1 mm was used as the discharge chamber. The tube was located in such a way that the cut of its exit hole coincided with the plane of the outer surface of the narrow wall of the waveguide. The measurements were carried out at a microwave generator power of 600 W for two flow rates of the working gas (argon), 15 and 30 L/min. Under these conditions, at a distance of 12 mm from the nozzle, the measured jet temperature was 350 and 260 degrees Celsius, respectively. At an argon flow rate of 10 L/min, the length of the visible (luminous) part of the plasma jet was about 26 mm. Modification of heat-sensitive surfaces by treating with such DBD-discharge plasma jets opens new possibilities for development of novel materials.

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