INVESTIGATIONs OF THE COLD PLASMA JET generator based on the ATHMOSPHERIC MICROVAWE DISCHARGE

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In recent years, there has been a significant scientific and practical interest in the development and research of new generators of low-temperature non-equilibrium atmospheric pressure plasma, connected with the opening of new possibilities for using such plasma in a number of innovative applications based on the modification of the functional surface properties of a wide variety of materials (metals, ceramics, glasses, polymers, organics, etc.) [1].

In 2018, the experimental set-up with the new multi-purpose microwave plasmatrone was created in the JIHT RAS laboratory to study non-equilibrium non-thermal plasma in plasma jets at atmospheric pressure. The microwave plasmatrone was designed and produced in collaboration with RIRAE and SPE LLC "AgroEcoTekh" (Obninsk, Russia) on the basis of typical microwave generator for laboratory studies [2]. The microwave plasmatron developed has a wide range of possibilities for creating a microwave discharge in dielectric discharge tubes of different diameters placed in a rectangular metal resonator (waveguide), and in a remote electrode burner (torch), electromagnetic energy to which is supplied through a coaxial cable. In this work, we used a scheme with the torch designed to generate microwave plasma of "soft" action at a temperature close to room temperature ("cold" plasma). In this case, gas flow is supplied directly into the torch, and discharge channels arise between the cylindrical body (common chamber) and rod electrodes inside it. The microwave power to the torch is taken from the waveguide via a coaxial cable connected to the central section of the sectional waveguide (the splitter section). The plasma torch also has a sectional design with the ability to quickly replace the nozzle after switching off the supplied power to the torch. This extends the range of parameters of the plasma jet formed behind the nozzle. Argon was used as a plasma-forming gas. The gas flow was of the order of slm.

Using the chromatographic gas complex "Chromos GH-1000" the analysis of the chemical composition of the plasma jet formed behind the outlet of the torch as a result of interaction with atmospheric air was carried. The electrophysical properties of the generated cold plasma are studied by means of electrical probe technique and the spatial distribution of the electrical field intensity in the plasma torch behind the burner outlet is obtained. The periodicity of the generation process, oscillations and noises in the cold plasma are studied.

References

1. Didenko A.N. Microwave Energetics: Theory and Practice (Nauka, Moscow, 2003) (in Russian)
2. Tikhonov V.N., Aleshin S.N. et al. Journal of Physics.: Conf. Ser. 927, 012067 (2017).