EMISSION SPECTRA OF ATMOSPHERIC-PRESSURE ARGON MICROWAVE DISCHARGE AND COLD PLASMA JET


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At present time, cold plasma jets based on an atmospheric-pressure microwave discharge are intensively investigated for purposes of plasma modification in practical medicine, microbiology, agriculture and food industry [1, 2]. In this work, the method of emission spectroscopy was applied to study both an electrode microwave discharge in a plasma torch and a cold plasma jet behind the torch outlet. The previously developed multipurpose atmospheric-pressure microwave plasmatron with the plasma torch of 2.5 cm in outlet diameter was used [3]. The plasmatron operates at a frequency of 2.45 GHz, has a microwave power in the waveguide of up to 2.5 kW and a power in the torch of up to 200 W. The plasma torch consists of cylindrical common chamber with 6 rod-like electrodes, which form a regular hexagon in a cross-section. Discharge channels arise between the ends of the electrodes and the inner wall of the discharge chamber. High purity argon (99.998%) was used with a flow rate range of 0–10 standard liters per minute. In order to conduct spectral measurements, Avaspec 2048 three-channel spectrometer with a wavelength range of 200–1100 nm and a spectral resolution of 0.15 nm was used. In spectra of the discharge channels, molecular lines of NO, OH, N\textsubscript{2}, NH and atomic lines of Ar were found. Based on the analysis of the spectra, it was shown that gas temperature in the discharge channels can reach 1500 K. In the cold plasma jet spectra, due to weak luminescence of the jet, only the molecular lines OH and N\textsubscript{2} were reliably observed. By means of thermocouple measurements it was obtained that temperature of the gas in the plasma jet is about 100°C at a distance of 2 cm from the plasma torch outlet.

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