# Spatial Emission Peculiarities Of Argon And Helium Atmospheric-Pressure Plasma Jets

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During the last decade physical processes in atmospheric pressure plasma jet generated mainly in the capillary barrier discharge sources are being intensively studied. The objects of study in these jets usually are their optical properties, electrical and dynamic parameters. Atmospheric pressure plasma jets also have a wide range of applications in various fields such as surface engineering, aerodynamics, biomedicine, surgery, etc. [1].

In this work under laboratory conditions it was obtained plasma jets of noble gases helium and argon in atmosphere. To generate the jets a DBD-device was used containing a quartz capillary having 5 cm length, an inner diameter of 3 mm, and an outer diameter of 6 mm. A needle electrode with a diameter of 2.3 mm and length of 4.5 cm contains inside the capillary. Through the capillary argon or helium are flowing. Gas flow typically was equal about 2–5 l/min, and the velocity of the atoms and ions of rare gas at the outlet of the capillary can be estimated of about 5 m/s. Dielectric barrier discharge through the quartz capillary was carried out by thyratron supply source of unipolar voltage pulses with a repetition rate of about 1 kHz. When the discharge is applied, at the outlet of the capillary it is formed needle-shaped torch that lights.

The emission spectrum of helium jet is relatively simple. It contains a number of spectral lines of helium and oxygen in the range of 580-800 nm, bands of molecular nitrogen (neutral and ionized) in the range of 330-450 nm, and band of A→X electronic transition (306-320 nm) of radical OH.

In the emission spectrum of argon one can see the same emissions as in helium jet, that is molecular nitrogen and hydroxyl. Long-wavelength portion of the spectrum contains only neutral argon spectral transitions (700-950 nm). It was shown that obtained spectra contains the spectral lines of neutral argon and helium, having the upper levels adjacent to the ionization potential values within 1.5 – 2 eV.

The spatial-spectral intensity distribution of plasma jets radiation was also studied in detail. It is registered that radiation spectra of plasma jets at the outlet of the capillary cutoff are characterized mainly by electronic-vibrational transitions of the first negative system of ionized nitrogen molecule $N_2^+\left(B\,^2\Sigma_u^+ \to X\,^2\Sigma_g^+\right)$ and second positive system of neutral nitrogen molecule $N_2\left(C\,^3\Pi_u \to B\,^3\Pi_g\right)$. Within the capillary volume it is prevailed a radiation of used rare gases.

[1] D. Pappas, *J. Vac. Sci. Technol. A* **29,** 020801 (2011).