VISUALIZATION OF THE TEMPERATURE DISTRIBUTION IN A DBD-DRIVEN HELIUM ATMOSPHERIC PRESSURE PLASMA JET*

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A helium plasma jet is often used in modern studies on plasma-bio interactions as a source of cold atmospheric plasmas [1]. Thermal control is a crucial factor for a plasma jet application, especially for the treatment of living tissues [2].

Here, a gas temperature field visualization of the DBD-driven helium plasma jet directed along upward vertical axis is presented. The plasma jet was generated by a dielectric-barrier discharge in a quartz tube with the inner diameter of 4.6 mm and the thickness of the wall of 1 mm. An electrode system consists from an inner electrode, a copper wire of 1.5 mm in diameter, located along the tube central line at the distance of 7.5 mm from the edge of the tube and an outer electrode, a copper foil strip of 5 mm wide, wrapped around the tube at the distance of 5 mm from its edge. A high-voltage tailoring signal was applied to the inner electrode with the peak-to-peak value of 4.6 kV and a duty cycle of ≈90%. The applied voltage waveform and additional details about the experimental set-up can be found in [3].

Helium flow rates were set 2, 4, 6 and 8 l/min as in the paper [4]. A transition from one-pass propagation to stepwise propagation of a guided streamer along the plasma jet was observed at varying the gas flow rate . So, here we specified the temperature conditions associated with the transition from one-pass mode to stepwise propagation of the guided streamer.

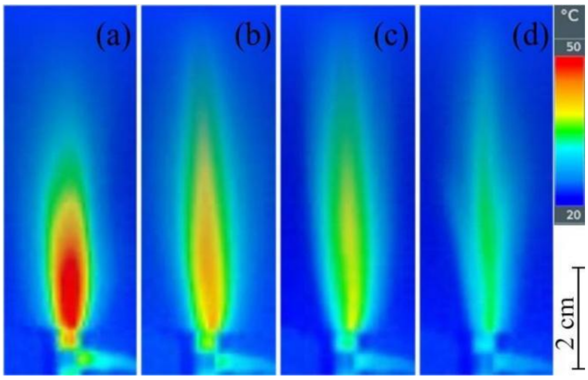

Fig.1. Temperature distribution in helium plasma jet at the gas flow rate of 2 **(a)**, 4 **(b)**, 6 **(c)** and 8 **(d)** l/min

The temperature field was visualized on a thin glazed paper sheet, placed along the axis of the jet, and measured with a thermal imager looked perpendicular at the sheet's surface. It was assumed that the temperature field qualitatively reflects the temperature distribution in the plasma jet. It has been experimentally determined that the temperature regime is set within two minutes. The temperature distribution patterns for different gas flow rates after 2.5 min are shown in Fig. 1. The temperature distribution obtained using the shadow method and temperatures obtained using thermocouples [5] coincides with those obtained using this technique.

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