C1-O-003002

CHARACTERISTIC OF PLASMA JETS FORMED AT THE BASIS OF GLOW DISCHARGE IN THE FLOWS OF ARGON AND AIR *

V.O. NEKHOROSHEV, N.V. LANDL, Y.D. KOROLEV

Institute of High Current Electronics SB RAS, Tomsk, Russia

Currently, plasma jets formed at the basis of the atmospheric-pressure discharges are attracting increasable attention [1, 2, 4]. Typical examples of gas discharge systems used for obtaining discharge in a gas flow and plasma jet are so-called plasmatron and "Gliding arc" [1–3]. The electrodes of plasmatron are configured to allowing the carrier gas to flow through the discharge region [2, 3]. Thus, the flow of heated and weakly ionized gas, so-called "plasma jet", forms in the plasmatron outlet [1–5].

The paper deals with the investigation of atmospheric-pressure gliding glow discharges and characterizing the properties of plasma jets, formed at the basis of that discharges. One of the features in proposed experimental setup is using an additional electrode for plasma jet electrical diagnostics (fig. 1).

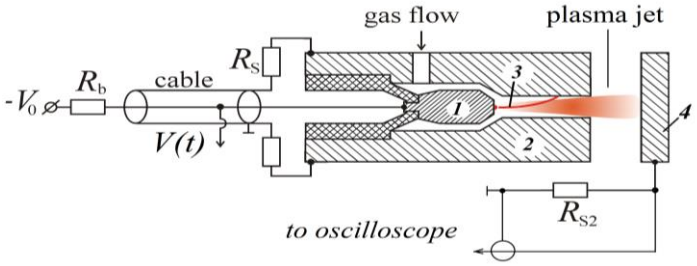

Fig.1. Simplified circuit of experimental plasma jet setup, based on non-steady state plasmatron. 1 – cathode, 2 – anode, 3 – gas discharge channel, 4 – additional electrode for plasma jet diagnostics, $V(t)$ – discharge burning voltage, V_0 – power supply voltage, R_b – ballast resistor, R_S, R_{S2} – shunt resistors for current measurement.

The discharges in argon flow and in airflow for coaxial plasmatron and gliding arc-type electrodes have been investigated using oscillography methods and CCD camera photography. Waveforms of discharge current and current through the plasma jet at the coaxial plasmatron outlet using the system of diagnostic electrodes are obtained. The gas temperature in the plasma jets are measured using thermocouple. The analysis compares the results on the discharge behavior and their effect on the jet parameters in argon and in the airflow.

The obtained data allow to concluding that the electrical current flowing through the jet volume forms due to electrons that can drifted from the discharge plasma region. Based on experimental data, the estimated value of the electron density in the jet is (10^7–10^9) cm^{-3} for air and up to 10^{12} cm^{-3} for argon. At such value of electron density, the electric field in plasma jet volume is weakly distort by the space charge of electrons and this can lead to the current self-limitation effect. It shown that the jet current magnitude determined by the flow rate and type of carrier gas, the discharge channel position and strongly depends from the parameters of the gas discharge in the plasmatron.

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* The work was supported by Russian Science Foundation, project № 22-29-00703.