PLASMA-LIQUID SYSTEM WITH ROTATIONAL GLIDING ARC AND LIQUID ELECTRODE

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Atmospheric pressure plasmas can be created by various types of discharges: transverse arc; discharge in gas channel with liquid wall and others. But most of them aren't sufficiently stable. Stabilization of discharge in the high pressure powerful plasmatron is attained by vortex flow of gas. In the low-powered high pressure discharges the reverse vortex flow "tornado" type can be used for the space stabilization. Previous investigations were performed only for discharges with solid-state electrodes. And we have not much information about discharges with liquid electrodes, which were stabilized by reverse vortex gas flow.

Plasma-dynamic system with rotational gliding arc with liquid electrode was investigated in this paper. This system can be used as a source of active particles that are injected into the reaction chamber. Since arc is glide on metal electrode under the influence of the gas flow, such system should be longer lived than at the absence of gliding and rotation. Therefore, this discharge is of special interest for plasma assisted reforming of liquid hydrocarbons into syn-gas.

Current-voltage characteristics of rotational gliding arc with liquid electrode at the different gas flow rate and operating mode were investigated. The voltage between the electrodes was supplied by a DC power supply. The power supply provides voltages up to 7 kV. The working fluid was distilled water. Emission spectroscopy was used for diagnostics of plasma. Emission spectra were registered using a spectral device that consists of an optical fiber and spectrometer S-150-2-3648 USB. Bands of hydroxyl (OH), lines of hydrogen (H), and multiplets of oxygen (O) are present on emission spectrum of plasma between liquid and solid electrodes. Bands of hydroxyl (OH) and lines of copper (Cu) are present on emission spectrum of plasma torch. Temperature population of excited electronic T_e^*, vibrational T_v^* and rotational T_r^* levels were determined. Also it was studied distribution of these temperatures along the plasma torch depending on gas flow and current. Behavior of rotational gliding arc by using high-speed cameras was studied. Calculated relative concentration of plasma components observed on the emission spectra. Also it was investigated dependence of their concentration from the gas flow rate and power, which inputted into the discharge.