Diagnostics of cold non-equilibrium atmospheric plasma jets

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Recently a great attention is attracted to the creation of the small size nonequilibrium atmospheric plasma jets and their interaction with living tissue. This facilitates the development of appropriate tools for their diagnostics. Traditional tools include photographing with fast ICCD cameras and optical emission spectroscopy. In this work we present our recent advances in development the diagnostic tools for cold non-equilibrium atmospheric plasmas.

A new method for temporally resolved measurements of absolute values of plasma density in the plasma column of small-size non-equilibrium atmospheric plasma jet utilizing Rayleigh microwave scattering was developed [1], [2]. The system utilizes irradiation of the plasma jet with the microwaves and following detection of the scattered signal using homodyne receiver. The system was calibrated using the dielectric scatterers with known physical properties. Calibrated system is able to measure absolute values of average plasma conductivity (density) and may be potentially applied for many types of atmospheric microplasmas such as for laser induced ionization of air, atmospheric inductively coupled plasma torches, rf microdischarges, and dielectric barrier discharges.

A simple method for the measurement of the electric potential of streamer associated with cold non-equilibrium atmospheric plasma jets was proposed [3]. The method utilizes external scatterer with certain DC potential applied to it, which is used in order to stop the streamer propagation. The proposed method allows to determine number of key streamer properties such as streamer head charge, electric field and conductivity/plasma density of the streamer column. Application of Rogowski coil for the measurements of the currents flowing in the streamer channel was also considered [1].

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