LANGMUIR-TYPE OF INVESTIGATIONS OF ATMOSPHERIC PRESSURE PLASMA JETS

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The new generation of microplasma sources, generating plasma jets of few millimeter size at atmospheric pressure, requires specific methods of characterization.

Besides optical emission or absorption spectroscopy methods, the electric probe method is very attractive due to its simplicity to be implemented.

However, contrary to optical data, the interpretation of the obtained I-V curves requires a quite complex theoretical analysis that, in the case of atmospheric pressure plasmas is still in development.

The present work[1] deals with the experimental characterization of a microplasma source, driven by a microwave oscillator at 2.45 GHz. We investigate the behavior of helium, argon, nitrogen, and air plasma and find distinct I-V curves. The measurements are performed in the current-source mode of a Keithley 2410 unit in a wide range of currents and voltages until the electrode become an active part in generating plasma. We study the gas flow, input microwave power, and the influence of the distance between electrode and source on the I-V curves, in order to develop a model of plasma – electrode interaction.

The current voltage-characteristics are further analyzed in the frame of this theoretical model. The model is an extension of the theory presented in ref. [2] for the case of a flowing gas. We interpret the ionic saturation current as a result of an ambipolar diffusion process superimposed by a convection charge flow. The steep region of the I-V curve is predominantly given by electrons decelerated in the electrode potential. The detailed energy distribution function cannot be determined, however, with the assumption of a Boltzmann distribution one can obtain the electron temperature.

Fitting the experimental data with the formulas presented in this work we can determine the main plasma parameters, electron density and temperature. The data are in good agreement with other experimental work[3,4]. The method is a simple and useful tool for quick characterization of microplasma sources.

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