PECULIARITIES OF HELIUM PLASMA JET INTERACTING WITH UNEVEN AND PLANE SURFACES ORIENTED NORMALLY AND AT GRAZING ANGLES TO THE JET AXIS

Babaeva N. Yu., [*] ***Naidis G. V., Tereshonok D. V., Panov V. A.***

JIHT RAS, Moscow, Russia

**nybabaeva@gmail.com*

Motivations for studying atmospheric pressure plasma jets are primarily based on their applications for modification of various surfaces including biological tissue. A conventional plasma jet consists of a dielectric tube or arrays of tubes with different electrode configurations outside or inside the tube [1]. The jet plasma is usually composed of a sequence of ionization waves (IWs) which are identical to conventional atmospheric pressure streamers.

In this work, we discuss the results of the 2-dimentional computational investigation of the effect of a helium plasma jet interaction with dielectric surfaces. The surfaces are represented by either the dielectric plates positioned at different angles relative to the axis of the jet tube or by cups or grooves. The dielectric properties of such surfaces were varied. We show that the area of reactive oxygen and nitrogen species (RONS) spreading over the surface changes drastically when the treatment is performed at grazing angles. The splitting of the IW occurs near the edge of the plate. Then, separate surface ionization waves (SIWs) propagate along the upper and lower parts of the plate. We demonstrate the importance of two factor: the capacitance of the surface which slows the surface ionization wave and its conductivity which removes the charges from the surface and governs the SIW decay. The also discuss the evolution of the IWs which penetrate into dielectric grooves having different conductivities and dielectric constants.

The present studies are conducted using the nonPDPSIM code which is a 2-dimensional simulator which solves transport equations for charged and neutral species, Poisson's equation for the electric potential, the electron energy conservation equation and Navier-Stokes equations for the neutral gas flow. The results can be of interest for the researchers working in the area of plasma medicine.

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1. Babaeva N. Yu., Naidis G. V., Panov V. A., et. al. // Plasma Sources Sci. Technol. 2019. V. 28. P. 095006.