Multi-periodic atmospheric pressure plasma jet for biomedical applications

Louis Saugé¹, Antoine Rousseau¹

¹Laboratoire de Physique Des Plasmas, École Polytechnique
mél: louis.sauge@lpp.polytechnique.fr

Atmospheric pressure plasma jets (APPJs) are studied for the biomedical field due to the transmission of Reactive Oxygen and Nitrogen Species (RONS) to biological targets combined with electric field and charged particles. RONS can activate cells, including the production of collagen, which is one of the main structural proteins and is omnipresent on skin.

In this study, we investigate an innovative methodology for generating APPJs, facilitating the transition from generating plasma pulses at each applied voltage period; to generating plasma pulses every n periods of applied voltage, where n denotes the multiplicity. The multi-periodicity is achieved by adding a ground electrode beneath the high voltage electrode. Previous studies [1][2][3] have examined this phenomenon, suggesting its potential application in the biomedical domain to enhance control over dosage and treatment duration.

The dual electrode configuration shows two types of modes:

- Random modes, the most common type, where the number of ionization fronts created for each period is random
- Multi-periodic modes, rare phenomenons, and create ionization fronts every n period, with n the multiplicity

![Figure 1: Different Multi-Periodic Modes. The 2P mode is achieved with an applied voltage of 5.77 kV and a frequency of 14.8 kHz, whereas the 3P mode is attained with U=6.48 kV and f=14.8 kHz.](image)

The emergence of multi-periodic modes is contingent upon a multitude of factors, primarily including applied voltage and frequency. Additionally, the presence or absence of plasma interaction with a target, electrode width [4][5], gas composition, and the characteristics of the target material also play pivotal roles in this phenomenon.

Références


Statut: 2nd Year PhD Student