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(G*) Electrical and Optical Investigation of Atmospheric Pressure Streamer-Spark Discharge in Pin-to-Droplet-to-Pin Configuration: Impact of Electrical Conductivity

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In the realm of plasma physics, the intricate interplay between electrical discharges and dielectric materials remains a subject of fascination. This study delves into the propagation of an atmospheric pressure streamer-spark discharge directed towards a water droplet in a Pin-Droplet-Pin configuration, presenting a unique opportunity to explore the interfacial dynamics between electrical conductivity, discharge propagation, and optical emissions. Such discharges exhibit great interest in many applications such nanomaterial synthesis, water treatment, and medical treatments. To enhance the efficiency of water activation, reducing the surface-to-volume ratio (SVR) has proven effective in maximizing the solvation process. Understanding the propagation of the streamer discharge on the droplet's surface and the subsequent transition to a spark is essential for optimizing these processes.
In this communication, we investigate the propagation of nanosecond discharges across a millimetric droplet that has various electrical conductivity from 0.05 to 5 mS/cm. The discharges are characterized electrically as well as optically, using time-resolved (1-ns-integrated) ICCD images and optical emission spectroscopy. The results show great influence of the electrical conductivity on the occurrence of a primary and secondary streamers as well as their transition to a spark.

Keyword-1

Nanoseconde discharge

Keyword-2

Plasma-droplet interaction

Keyword-3

Rime-resolved imaging

Author: Mr SEBIH, Lyes (Université de Montréal)

Co-authors: Prof. HAMDAN, Ahmad; CARBONE, Emile (Institut National de la Recherche Scientifique)

Presenter: Mr SEBIH, Lyes (Université de Montréal)

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