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Experimental study of plume induced by nanosecond repetitively pulsed spark microdischarges in air at atmospheric pressure. THOMAS ORRIERE, NICOLAS BENARD, ERIC MOREAU, DAVID PAI, Institut PPRIME (CNRS UPR 3346, Universit de Poitiers, ISAE-ENSMA) — Nanosecond repetitively pulsed (NRP) spark discharges have been widely studied due to their high chemical reactivity, low gas temperature, and high ionization efficiency. They are useful in many research areas: nanomaterials synthesis, combustion, and aerodynamic flow control. In all of these fields, particular attention has been devoted to chemical species transport and/or hydrodynamic and thermal effects for applications. The aim of this study is to generate an electro-thermal plume by combining an NRP spark microdischarge in a pin-to-pin configuration with a third DC-biased electrode placed a few centimeters away. First, electrical characterization and optical emission spectroscopy were performed to reveal important plasma processes. Second, particle image velocimetry was combined with schlieren photography to investigate the main characteristics of the generated flow. Heating processes are measured by using the $N_2(C \rightarrow B)$ (0,2) and (1,3) vibrational bands, and effects due to the confinement of the discharge are described. Moreover, the presence of atomic ions N^+ and O^+ is discussed. Finally, the electro-thermal plume structure is characterized by a flow velocity around 1.8 $m.s^{-1}$, and the thermal kernel has a spheroidal shape.

David Pai
Institut PPRIME (CNRS UPR 3346, Universit de Poitiers, ISAE-ENSMA)

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