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Gas flow phenomena in atmospheric-pressure plasma jets impinging on solid and liquid substrates investigated using numerical modelling and Schlieren imaging ADAM OBRUSNIK, Department of Physical Electronics, Faculty of Science, Masaryk University, Brno, Czech Republic, MARCO BOSELLI, EMANUELE SIMONCELLI, AUGUSTO STANCAMPIANO, MATTEO GHERARDI, Department of Industrial Engineering, Alma Mater Studiorum-Universit di Bologna, Italy, LENKA ZAJICKOVA, Department of Physical Electronics at Faculty of Science / Plasma Technologies at CEITEC, Masaryk University, Brno, Czech Republic, VITTORIO COLOMBO, Department of Industrial Engineering, Alma Mater Studiorum-Universit di Bologna, Italy — Neutral gas dynamics, i.e. the gas flow, gas mixing and heat transfer, play an important role in medical and other applications of helium atmospheric-pressure plasma jets (APPJs), as they determine the transport of plasma-generated active species to the substrate that is being treated. To capture the full complexity of this problem numerically, the buoyant Navier-Stokes equations (either laminar or with an appropriate turbulence model) must be solved together with multicomponent diffusion equations and the heat equation. In this contribution, we present the results of a combined experimental-numerical approach. The gas flow in three different plasma sources impinging on a flat surface, solid or liquid, is captured using high-speed Schlieren imaging. Special attention was dedicated to the onset of turbulence and the changes in the flow behaviour when a liquid substrate is used. By combining the experiments with numerical simulations of the flow (laminar and large-eddy simulation turbulent model), we analyze the role of three different types of plasmas on the gas flow and identify the phenomena that are likely responsible for the changes observed.

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