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Experimental and numerical study on the dynamics of a μs helium plasma gun discharge with various amounts of N_2 admixture[1]

ANNE BOURDON, LPP, Ecole Polytechnique, France, THIBAULT DARNY, ERIC ROBERT, GREMI, Orleans, France, FRANCOIS PECHEREAU, CERFACS, Toulouse, France, PEDRO VIEGAS, LPP, Ecole Polytechnique, France, JEAN-MICHEL POUVESLE, GREMI, Orleans, France — These last years, atmospheric pressure plasma jets formed by pulsed helium discharges ignited in thin dielectric tubes have been extensively studied due to their potential for biomedical applications. So far, most experiments have been dedicated to the study of the plasma plume. For endoscopic treatments, it is also important to better understand and optimize the propagation of discharges in long dielectric tubes as catheters. First we present an experimental and numerical study on the dynamics of a μs helium plasma discharge with N_2 admixture in a long dielectric tube. We compare the velocity of the discharge front for various amounts of N_2 and different applied voltages and show a good agreement between experiments and simulations. Second, we compare time-resolved measurements and simulations of longitudinal and radial electric fields associated with plasma propagation in the dielectric tube and in the plasma plume. It is interesting to note that measurements obtained with a probe located outside the dielectric tube are in excellent agreement with simulations. This allows to infer from simulations the time evolution of the electric field on the discharge axis which is a key parameter for applications.

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