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Propagation dynamics of a streamer-like discharge in a He/Ar atmospheric pressure plasma jet BRIAN SANDS, UES, Inc./AFRL, SHIH KANG HUANG, JARED SPELTZ, MATTHEW NIEKAMP, Wright State University, BISWA GANGULY, Air Force Research Laboratory — Using a 20 ns risetime positive unipolar voltage pulse, a streamer-like discharge is generated in a He gas jet with a small Ar admixture that is effused into ambient air from a 2 mm ID glass capillary. The anode is electrically isolated by the glass dielectric barrier resulting in a very stable discharge, which allowed us to acquire spatiotemporally resolved emission from He $3^3S \rightarrow 2^3P$ and $3^3D \rightarrow 2^3P$ to track the propagation of the ionization front up to 50 mm from the tip. The He emission lines appear in time before the emission from both Ar and air molecules and due to their higher excitation threshold energies, they provide a more precise marking of the streamer head. The streamer speed is first accelerated over a few mm distance near the capillary tip, then reaches a quasi-steady propagation speed before decelerating in the outer region of the jet. Addition of Ar to the He flow increases streamer speed by $\sim$20%, peaking at 1-2% Ar admixture, corresponding to the minimum in the discharge initiation delay. The dependence of the plasma jet propagation dynamics on both applied voltage and anode location has been measured, and a discussion of the underlying mechanism will be presented.

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