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Effect of Ar admixture on production of Ar $1s_5$ metastable in a streamer-like He/Ar atmospheric pressure plasma jet BRIAN SANDS, ROBERT LEIWEKE, UES, Inc./AFRL, BISWA GANGULY, Air Force Research Laboratory — Dielectric-capillary atmospheric pressure plasma jet devices, initiated by a streamer-like ionization front, have typically been studied with He or Ar as the carrier gas. Our configuration uses He with a small admixture of Ar. With apparent exception to the pure gas cases, we have found that in the He/Ar plasma jet, production is renewed behind the leading ionization front in the residual streamer channel. Production of the metastable Ar $1s_5$ (Ar^m) state is dominated by this residual production near the capillary tip. The density can remain $>10^{11}$ cm^{-2} for up to 10 μs after discharge ignition, significantly extending the timescale for afterglow plasma chemistry. We extend this work by varying the Ar composition from 0-30% and use a combination of optical and laser spectroscopic methods and inductive loop current measurements to characterize the discharge in a 2 mm ID glass capillary with a 20 ns risetime unipolar voltage pulse. The Ar^m production rate in the residual streamer channel rises steeply up to 2% Ar; for larger concentrations, the level of overvolting is more significant in determining the optimum Ar percentage. The effect of Ar admixture on other discharge parameters and possible mechanisms for the residual channel production will be discussed.

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