Characterization of a streamer-initiated atmospheric pressure plasma jet for spatially guided pulsed plasma generation

BRIAN SANDS, UES, Inc., BISWA GANGULY, Air Force Research Laboratory — We examine the characteristics of a streamer-initiated atmospheric pressure plasma jet (APPJ) terminated by a cathode ground plane in air. The plasma jet is generated using a 12 kV submicrosecond voltage pulse exciting a single positively biased electrode wrapped around a 3 mm diameter glass capillary with a 2 slm, 5% Ar/He mixture, gas flow. This APPJ device is distinguished from flow-driven APPJs by its ability to generate excited species in situ over its length. The presence of the cathode downstream provides ionization gain that is not characteristic of flow-driven APPJs in similar configurations but rather is characteristic of a single dielectric barrier microdischarge filament that is confined to the capillary axis. With a conducting cathode, this discharge filament can carry several Amps of current in a ~30 ns pulse.

In this experiment, we study this atmospheric pressure plasma source with cathode materials of varying resistivity including conducting metals, semiconducting silicon, and insulating dielectrics at distances up to 3 cm from the capillary tip. We monitored spatiotemporally resolved emission intensities from the Ar/He/air discharge to track the relative gain of electron impact excitation across the gap. This will be correlated with current and voltage measurements to estimate energy deposition in the gap.

Brian Sands
UES, Inc.

Date submitted: 11 Jun 2008