Abstract Submitted
for the GEC11 Meeting of
The American Physical Society

Modeling the generation and propagation of plasma jets J.P. BOEUF, L. YANG, M. FOLETTO, L.C. PITCHFORD, LAPLACE, Univ Toulouse, L. JOLY, ISAE, Toulouse, FR — A 2-D fluid model was used to study plasma jets initiated in a dielectric barrier discharge configuration consisting of a dielectric tube (3 mm inner radius) surrounded by a grounded electrode and propagating in air at atmospheric pressure. A voltage pulse of +5 kV with a rise time of 50 ns is applied to a annular electrode inside the tube. Helium is maintained at atmospheric pressure inside the tube by a gas flow with a velocity of some 10 m/s. Electron impact ionization of ground state atoms is the only ionization process considered, and the secondary electron emission coefficient due to ion impact is supposed to be constant. Dielectric boundary conditions are applied on the tube walls, and electrons and ions at the surface are assumed to recombine instantaneously when a charged particle of opposite sign arrives at the same surface element. The computational volume extends a finite distance past the exit plane of the dielectric tube and the computational boundaries are supposed to be at ground potential. The helium/air density profiles past the exit plane of the tube are assumed to follow scaling laws for laminar flow with parameters adjusted to fit available experimental results. Consistent with experiment, the model predicts the initiation of a streamer during the voltage rise which propagates preferentially in the easily-ionized helium potential core.

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Date submitted: 21 Jul 2011 Electronic form version 1.4