MODELLING OF ATMOSPHERIC PLASMA JETS

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Atmospheric pressure plasma jet sources provide plasmas that are not spatially bound to any electrode and overcome the need for vacuum systems. Typically plasma is generated internally and then convected to an ambient environment via a gas flow. Applications for non-thermal atmospheric pressure plasma jets range from material processing to recent applications in medical physics. The finite element numerical approach allows for simulation of the non-uniform geometries often used in atmospheric plasma systems. In this work we discuss models for mass transport of plasma species for nonthermal atmospheric pressure plasma jet sources employing dielectric barrier on the electrode. Fluid models using a drift diffusion approximation for the species flux are solved for the electron and heavy gas species along with the electron energy. This is coupled with a mixing gas model of a low density gas jet in the quiescent environment employing the Navier Stokes equations and a mass balance equation for gas mixing. Two dimensional axi-symmetric models of Argon and Helium-Nitrogen jets for a cross-section of cylindrical dielectric barrier geometries with AC and pulsed DC power sources will be discussed. The commercial finite element partial differential equation solver Comsol Multiphysics is used for simulation in this work.

1. National Centre for Plasma Science and Technology, Dublin City University: http://www.ncpst.ie