

Factors Affecting the Modeling of Trichel Pulses in Needle-Plane Configuration

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Abstract— A 2-D axisymmetric simulation of Trichel pulses in negative corona discharge with needle-plane configuration is reported in the paper. In order to investigate the properties of Trichel pulses in oxygen for a 1 cm air gap and atmospheric pressure, a series of simulations using the commercial software COMSOL have been carried out. In the present report, particular attention is given to the effect of parameters which cause numerical difficulties in terms of both divergence of the solution and accuracy of the final results. It is shown that the diffusion coefficient of the involved species and the domain mesh density are the most important factors. The simulations consider three species: electrons, positive and negative O₂ oxygen ions. The reactions considered are: ionization of neutral oxygen molecules, attachment of electrons to neutral oxygen molecules, recombination of electrons with positive ions and recombination of negative and positive oxygen ions. The number density distributions of all species, as well as the corona current waveform for different parameters are presented. The effects of these different parameters on the characteristics of Trichel pulses as well as the distributions of the species have been studied.