ARRAYS OF INDEPENDENTLY CONTROLLED RF EXCITED MICRO-DIELECTRIC BARRIER DISCHARGES

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Arrays of radio-frequency excited micro dielectric barrier discharges (mDBD's) are attractive as planar sources of radicals and charged species. The devices of interest have apertures tens of microns in diameter with spacing of tens to hundreds of microns. Displays using independent addressing of mDBDs are optimized for producing of UV photons and for isolation between discharges. When using the mDBDs to produce plumes of excited states and charged species, there are potential interactions between the mDBD devices. This is particularly the case when auxiliary electrodes are used to extract the charged species.

In this presentation, we will discuss the properties of small arrays of mDBD's sustained in atmospheric pressure N_2 and air using results from a two-dimensional simulation. The micro-DBD's are designed to produce plumes of radicals and charged species, and consist of sandwich structures using layers of dc and rf biased electrodes to help shape the plume. The model, *nonPDPSIM*, solves Poisson's equation and transport equations for charge and neutral species and the electron energy conservation equation for electron temperature. A Monte Carlo simulation is used for tracking sheath accelerated electrons. Rate coefficients and transport coefficients for bulk electrons are obtained from local solutions of Boltzmann's equation for the electron energy distribution. Radiation transport is addressed using a Green's function approach.

We find that the adjacency of the mDBDs and the dielectric properties of the materials being treated are important in determining how independently the mDBDs operate. For example, the electron plumes and electric potentials are shown in Fig. 1 for repetitive pulsing (25 MHz) of mDBDs in nitrogen at 1 atm. The plumes are incident onto a dielectric sheet. The charging of the sheet with successive pulsing is sufficient to produce divergent electric fields which warp plumes from successive pulses and reduce collected current. These properties can be controlled to some degree with choice of repetition rate, pulse shape and materials.

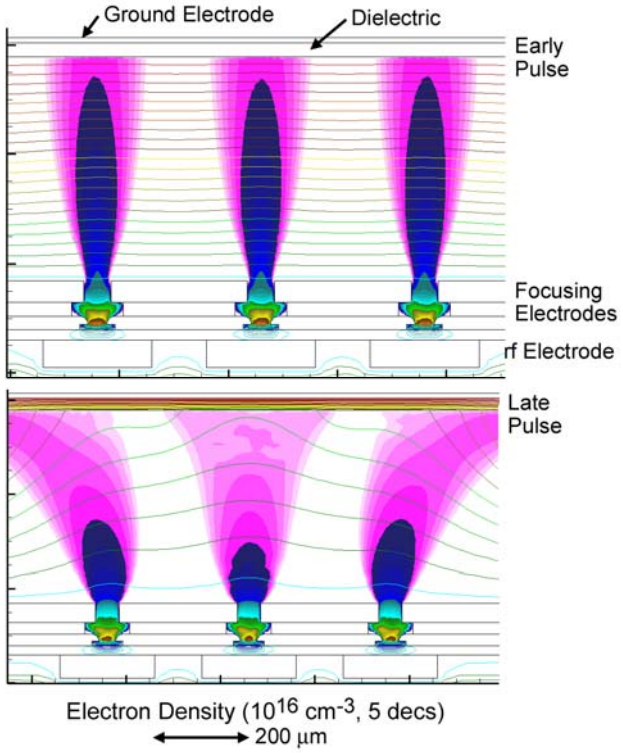

Figure 1 – Electron density (flood) and electric potential (contour lines) for multiple rf excited mDBDs incident onto a polymer sheet. The plumes of the early pulses are unperturbed. The plumes of the latter pulses are warped.