Comparison of Electron and Chemistry Properties between 0-D Global Model and 1-D Fluid Model for Parallel Plate Dielectric Barrier Discharges in Humid Air of Atmospheric Pressure

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The 0-D global model of Sakiyama et. al. [1] assumes spatially homogeneous Gaussian-like pulsed electric field to calculate the volume averaged transient behavior of microdischarges and chemical species. This assumption is adequate for surface microdischarges because the discharges generally cover most of the electrode surfaces, and the characteristics of the discharges are mainly dependent on the electric fields at the dielectric surfaces. However, for the volume microdischarges such as parallel plate dielectric barrier discharge (DBD), the characteristics of discharges depend on the electrode geometry, e.g. gap distance, as well as electric field in the discharge volume. In addition, the microdischarges in air generally do not appear on entire volume between the electrodes. Thus the spatially homogeneous Gaussian-like pulsed electric field may need modifications or tunings to properly simulate the parallel plate DBDs of various gap distances. In this paper, the transient properties of electrons and chemical species of parallel plate DBDs in humid air of atmospheric pressure were numerically investigated by using 0-D global model and 1-D fluid model. The validity of spatially homogeneous Gaussian-like pulsed electric field for parallel plate DBDs was examined by comparing the transient behavior of electrons and chemical species of the 0-D and 1-D calculations, and the proper modifications on the properties of electric field were presented if necessary.

REFERENCES:

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