Characterization of Discharge Parameters in VD Configuration of DBDs

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Abstract: Non-thermal, Non-equilibrium and high pressure dielectric barrier discharges are increasingly being used in various novel applications. In this paper, xenon and argon filled coaxial dielectric barrier discharge (DBD) cell have been studied to understand the high-pressure nonequilibrium nonthermal plasma discharge. Two quartz coaxial DBD tubes filled with xenon and argon at different pressures have been used in the experiment. High frequency sinusoidal and unipolar pulse like voltages are applied to the discharge electrodes for the generation of microdischarges. In case sinusoidal excitation single discharge is observed in per half cycle of the voltage waveform while in case of pulse excitation single as well as double discharge are observed per applied voltage pulse. Visual images of the discharges and electrical waveforms confirm more diffused-type discharge in pulse excitation. The knowledge obtained by dynamic processes of DBDs in the discharge gap explains quantitatively the mechanism that is obtained in the ignition, development and extinction of DBDs. An equivalent electrical Simulink model representing the DBD phenomenon has been developed which validates the characteristics of the discharge parameters. A series of simulations has been carried out in order to obtain the internal discharge parameters including discharge impedance which are not measurable during the experimental process. A good correlation of discharge parameters between simulated and experimental results has been established. The behavior of different discharge parameters has also been analyzed. From the experimental results and equivalent electrical circuit, the dynamic nature of equivalent capacitance has been reported. The relative intensity analysis of the Xe peak in the optical emission spectra (172 nm) has also been carried out for different applied conditions. It has been observed around three times increase in radiation power in pulse excitation than that of sinusoidal excitation.

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