Design and Development of Xenon DBD Excimer Source

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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, a xenon-filled coaxial dielectric barrier discharge (DBD) has been studied to understand the high-pressure nonequilibrium nonthermal plasma discharge. A quartz coaxial DBD tube (ID: 6 mm, OD: 12 mm) at 400-mbar xenon-filled pressure has been used in the experiment. High frequency sinusoidal and unipolar pulse like voltages have been 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. 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.

References:

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