DBD Cell Designs for Efficient UV/VUV Production suitable to Biomedical Treatment and Sterilization

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Dielectric barrier discharges (DBD) are the non-equilibrium glow discharge plasmas operated at/near atmospheric pressure [1-3]. The atmospheric pressure discharge is restricted to operate in the glow discharge regime by discharge current limitation through dielectric charging. The wide selection of electrode configurations, gases, materials and applied waveforms etc. make it a highly scalable and flexible discharge source. In many researches, DBD sources are found highly prominent for various Industrial applications [2]. These DBD sources are capable to efficiently produce UV/VUV radiations suitable to biomedical applications, air/water purification, discharge lamps and plasma displays etc. Hence it is always required to increase the discharge efficiency of DBD plasmas that provide UV/VUV radiation efficiently [4].

Our work includes the discharge efficiency improvement through DBD cell designs comprising co-planar electrode configuration. The discharge characteristics have been tested in a plasma display panel filled with Neon + Xenon (10%) gas mixture at 450 Torr pressure [4-6]. On discharge ignition, the xenon excimer formation results in the emission of VUV radiation of the wavelength 147 nm and 172 nm. The electrode designs are aimed to provide high intensity electric fields through optimization of discharge gap, cell capacitance etc. The electric field intensity has been obtained through 2-D computer simulation [5]. At discharge ignition, we have measured the light emission from discharge cells and simultaneously obtained the breakdown voltage and discharge delay time. The measured high luminous intensity, low breakdown voltage and low discharge delay time are direct signatures of high discharge efficiency and VUV production efficiency. A comparison of various electrode designs is presented. The optimized DBD cell designs with suitable gas mixtures can be successfully implemented portably as well as large scale DBD source formation for producing germicidal UV wavelength (240-280 nm) applicable to biomedical treatment and sterilization.

References

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