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Investigation of Atmospheric Pressure Plasma Jet in Double Coaxial Dielectric Barrier Tubes Conjugated with Microsecond Voltage Pulse

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Atmospheric pressure plasma jet (APPJ) is gaining growing interest in a number of bio-applications. Among various APPJ sources, a dielectric barrier discharge (DBD) reactor has been considered as the most straightforward plasma system to generate APPJ, because one or more dielectric layers isolating metal electrodes can avoid abnormal increase of current during plasma generation. Several DBD configurations have been successful in generating APPJ, e.g., one-ring electrode, one-ring electrode conjugated with a centered pin electrode, and two-coaxial-ring electrodes. In this study, the plasma jet was generated by a particular DBD reactor configuration that comprised two coaxial dielectric tubes with different diameters and two-ring electrodes covering the outside of the larger tube. In order to avoid sparks between the electrodes, the electrodes were immersed in electrical insulating oil. With the two coaxial dielectric tubes, laminar flows of plasma jet (He/Ar) and shielding gas (N2/Air) can be created. The primary plasma discharge occurred with plasma gas inside the discharge zone, whereas there was no or weak plasma discharge of shielding gas due to high-voltage breakdown. The effects of shielding gas on the plasma jet parameters (plume length, temperature), optical emission spectrum, and gas emission will be examined under various applied voltages (microsecond voltage pulse).

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