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Gas Flow Effects on Discharge Characteristics in a Dielectric Barrier Discharge Reactor of Spray Type WOO SEOK KANG, HYUN-SU KIM, SANG HEE HONG, Seoul National University — The flow characteristic of discharge gas is an essential parameter in spray-type reactors of dielectric barrier discharge (DBD) to control the inside plasma density as well as the radical effluence density outside the reactors toward the work-piece surface in etching or surface treatment processing. To understand the effects of gas flow on reactor operation and plasma property, an experimental and numerical study has been carried out for a parallel-plate narrow-gap DBD reactor of spray-type, which is operated by 10 to 20 kHz sinusoidal voltages to produce argon or helium plasma with an oxygen additive. Varying gas flow rates from 0 to 100 liter/min, the discharge characteristics, such as current-voltage, breakdown voltage, and discharge power, are measured by electrical methods. Distributions of plasma temperature and some radicals ejected along the gas flow direction are estimated by OES diagnostics in both the inside discharge region and the outside radical effluence region. For detailed understanding of radical transport in the effluence area, a simple numerical modeling is developed on the basis of computational fluid dynamics including heat and mass transfer with plasma chemistry, and the calculated results are compared with experimental ones. Finally, the effects of metal surface treatment using the spray- type DBD with different gas flow rates are predicted and compared.

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