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Extraordinary properties of dielectric barrier discharge in argon gas flow triggered by molecular impurities KEIICHIRO URABE, Kyoto University, KEITARO YAMADA, YU HIRAOKA, OSAMU SAKAI — Atmospheric-pressure dielectric barrier discharge (DBD) in argon (Ar) gas flow with molecular impurities showed distinctive dependence on the impurity's fraction far from linear relationship. We found this phenomenon in experimental investigation of discharge-mode transition from filamentary to glow-like modes in a jet-type DBD using an Ar/organic mixed flow. Emission spectra measured in each discharge mode were different especially in C_2 and CH molecular emission intensities detected due to organic molecule's decomposition, and the measurement results suggest that reactions of excited species and/or chemical radicals in the jet-type DBD are led to nonlinear evolution in both time and space because of much shorter characteristics length for reactions and diffusion than the given reaction space in such a high pressure. Following the discharge-mode transition, fine structures of deposited material on a metal-plate electrode were changed drastically: polymer film, powder, web-like structure composed of gathered particles, etc. We discuss the discharge mechanisms from view points of this nonlinear characteristic and the potential applications of the Ar DBD with the impurities of organic or inorganic molecules.

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