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Theoretical Modeling of Pulse Discharge Cycle in DBD Plasma Actuator SHINTARO SATO, NAOFUMI OHNISHI, Tohoku University — In order to reveal a detailed mechanism of discharge cycle in dielectric barrier discharge (DBD) plasma actuator, we have conducted two-dimensional simulations of the DBD plasma actuator with a drift-diffusion model and theoretical analysis based on them. There are two distinct phases in the discharge process when a positive ramp voltage is applied to the exposed electrode. In the first phase, an ion cloud is formed at the edge of the exposed electrode due to electron avalanche. A simple theoretical model is proposed that considers time evolution of electron number density at the edge of the exposed electrode using the first Townsend ionization coefficient and provides a good agreement with the result of the numerical simulation. In the second phase, the cloud expands along the dielectric surface, followed by the streamer propagation at a high velocity. The period of streamer discharge cycle becomes shorter as the voltage slope increases. The simulation result shows that the period of the first phase is inversely proportional to the voltage slope, while that of the second phase is inversely proportional to the square of the voltage slope.

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