Abstract Submitted
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Particle-in-Cell Simulations of the Alpha and Gamma Modes in Collisional Nitrogen Capacitive Discharges[1] EMI KAWAMURA, MICHAEL LIEBERMAN, ALLAN LICHTENBERG, University of California, Berkeley, PASCAL CHABERT, Ecole Polytechnique, France — We perform 1D particle-in-cell (PIC) simulations to study the α and γ modes in an intermediate pressure (0.6 and 6 Torr), 2.5 cm gap capacitive nitrogen discharge driven at 13.56 MHz with current density amplitudes J_0=10 to 75 A/m^2. As in a previous study of a comparable argon discharge,[Kawamura et al, JVST A **38**, 023003 (2020)], the nitrogen discharge can be described by a "passive bulk" model in which the ionization is negligible in the central bulk region and is due solely to electron sheath heating. However, unlike the argon discharge, the nitrogen discharge undergoes an α-γ transition in the applied J_0 range due to secondary electron emission, characterized by an increase in density and a decrease in sheath widths. We introduce a theoretical J_0-V_1 transition curve, where V_1 is the sheath voltage amplitude at 13.56 MHz, giving the α-γ transition. We compare the PIC results in the α-mode to the passive bulk model, and, in the γ-mode with the expected J_0-V_1 curve. We find reasonable agreement with the simulations in both the α and γ regimes, and the α-γ transition is reasonably well predicted by the model.

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