Abstract Submitted
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**Particle-in-Cell Simulations of Atmospheric Pressure He/2%H2O Discharges**[1] E. KAWAMURA, M.A. LIEBERMAN, A.J. LICHTENBERG, D.B. GRAVES, R. GOPALAKRISHNAN, Univ of California - Berkeley — Atmospheric pressure micro-discharges in contact with liquid surfaces are of increasing interest, especially in the bio-medical field. We conduct 1D3v particle-in-cell (PIC) simulations of a voltage-driven 1 mm width atmospheric pressure He/2% H2O plasma discharge in series with an 0.5 mm width liquid H2O layer and a 1mm width quartz dielectric layer. A previously developed two-temperature hybrid global model of atmospheric pressure He/H2O discharges [Ke Ding, M.A. Lieberman and A.J. Lichtenberg, J. Phys. D: Appl. Phys. 47, 305203 (2014)] was used to determine the most important species and collisional reactions to use in the PIC simulations. We found that H13O6+, H5O3-, and electrons were the most prominent charged species, while most of the metastable helium He* was quenched via Penning ionization. The ion-induced secondary emission coefficient $\gamma_i$ was assumed to be 0.15 at all surfaces. A series of simulations were conducted at 27.12 MHz with $J_{\rm rf} \approx$ 800–2200 A/m$^2$. The H2O rotational and vibrational excitation losses were so high that electrons reached the walls at thermal temperatures. We also simulated a much lower frequency case of 50 kHz with $V_{\rm rf} = 10$ kV. In this case, the discharge ran in a pure time-varying $\gamma$-mode.

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