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Secondary electrons in dual-frequency capacitive radio frequency discharges[1] JULIAN SCHULZE, EDMUND SCHUENGEL, UWE CZARNETZKI, Ruhr-University Bochum, ZOLTAN DONKO, Hungarian Academy of Sciences
— Two fundamentally different types of dual-frequency capacitive RF discharges can be used to realize separate control of the ion mean energy, $<E_i>$, and the ion flux, Γ_i, at the electrodes: (i) Classical discharges operated at substantially different frequencies, where the low and high frequency voltage amplitudes, $\phi_{lf}$and ϕ_{hf}, are used to control $<E_i>$ and Γ_i, respectively. (ii) Electrically asymmetric (EA) discharges operated at a fundamental frequency and its second harmonic with adjustable phase shift, θ, between the driving frequencies, which is used to control $<E_i>$. We study the effect of secondary electrons on the quality of this separate control in both discharge types in argon at different gas pressures by PIC/MCC simulations with focus on the effect of the control parameter for $<E_i>$ on Γ_i for different secondary yields, γ. A dramatic effect of tuning ϕ_{lf} in classical discharges and a significantly less pronounced effect of tuning θ in EA discharges is observed. This is caused by a transition from α- to γ-mode induced by changing ϕ_{lf} and not induced by changing θ.

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