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2D PIC simulations of realistic plasma-surface interactions in geometrically asymmetric capacitive radio frequency discharges[1]

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The effects of realistic surface coefficients on the charged particle dynamics in geometrically asymmetric capacitively coupled argon discharges operated at low pressure and high voltage are studied by 2D Particle-In-Cell/Monte Carlo collision simulations. By including plasma and SiO_2 surface interaction processes, the energy dependent ion (γ-electron) and electron induced (δ-electron) secondary electron emission are found to influence the electron dynamics a lot. Due to the high energy ion bombardment at the electrodes, a high number of γ-electrons is emitted. These γ-electrons are found not to contribute much to the ionization directly, as they are too energetic after being accelerated by the sheath electric field, but they can significantly enhance the δ-electron emission from boundary surfaces, especially in asymmetric discharges, where they constitute the main channel for the δ-electron emission. After the δ-electrons are emitted, they cause nearly 40 % of the total ionization. By switching on and off the surface coefficients, large changes of the electron dynamics and a reduced plasma density is found, which indicates that both the γ- and δ-electrons play important roles in the discharge.

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