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Particle-in-cell Simulation of Langmuir Probes FELIPE IZA, JAE KOO LEE, Pohang University of Science and Technology — Ion kinetics in the sheath and pre-sheath of planar and cylindrical probes has been studied by means of 1-dimensional (1d3v) particle-in-cell Monte Carlo collision simulations. Collisionless and collisional regimes are considered and simulation results (floating potentials and the ion saturation currents) are compared with available theories. As pressure increases, the ion velocity at the sheath edge decreases below the Bohm velocity (u_B). For planar probes, this velocity is $\sim u_B(1+5\lambda_{De}/\lambda_i)$ where λ_{De} is the Debye length at the sheath edge and λ_i the ion mean free path. Although ionization can be neglected in the sheath region, it plays a key role in determining the voltage across the presheath. For planar probes and Maxwellian electrons, this voltage increases rapidly for electron temperatures below $\sim$2eV. For cylindrical probes, however, the voltage across the presheath can be drastically reduced by the geometrical increase of current density as ions approach the probe. At low pressure, simulation results lie between the Laframboise and the ABR theories. As pressure increases, however, collisions and ionization in the presheath becomes critical in determining the ion flux to the probe at a given bias voltage.

Felipe Iza
Pohang University of Science and Technology

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