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Ion flux on emissive surface with debye-scale erosion trenches[1]
IRINA SCHWEIGERT, MICHAEL KEIDAR, George Washington Univ — The surface of walls confining the low temperature plasma can erode with time due to plasma-wall interaction that leads to variations of electron and ion fluxes over the surface. In this work, the sheath structure modification near the emissive surface with a Debye length scale erosion trenches is analyzed with increasing the beam electron energy. In 2D3V Particle-in-cell Monte Carlo collision simulations, we study the effect of the secondary electron emission from the floating grooved plate on the plasma sheath at low gas pressure and compare our results with the known experimental data. The discharge operation and secondary electron emission from the hBN plate are controlled by an electron beam from heated cathode. The Boltzmann equations are solved to find the distribution functions for electrons and ions together with the Poisson equation for the electrical potential. Since the BN-plate is under the floating potential the total current on it equal zero. In simulations, the wall material sample has four identical trenches. It is shown that the potential distribution acts as a focusing lens on the ion current and on low energy electron current and redirect the ion current inside to the trenches and the electron current to the front surface. The ion flux to the front surface and bottom of grooves is analyzed in the terms of the ion energy distribution function. We consider also a segmented plane surface with the different secondary electron coefficients. It is shown that an non-uniformity of emissive surface properties affects the ion flux distribution, and consequently increases locally etching rate.

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Irina Schweigert
George Washington Univ

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