Abstract Submitted
for the GEC20 Meeting of
The American Physical Society

Particle-in-Cell/Monte Carlo Simulation of RF Hollow Cathode Discharge KALLOL BERA, SHAHID RAUF, Applied Materials, Inc. — Radio-frequency (RF) hollow cathode discharges (HCD) are used as plasma source for material processing in the semiconductor industry. Hollow cathode systems typically consist of an array of small hollow cylindrical holes on the cathode. Under certain conditions, the plasma in the hollow cavities can become more intense due to hollow cathode effect (HCE). In this study, we investigate RF hollow cathode discharge using Particle-in-Cell/Monte Carlo simulation. In this model, using charge density of particles, Poisson equation is solved for electric potential that yields electric field. Using this electric field, all charged particles' velocities are updated and the particles are moved. The leap-frog scheme is used for integrating the equations of motion. Based on probability arrays, particle collisions with each other and with neutrals are considered. Thereafter, particle density, hence charge density is determined. Statistics of these collisions are used to determine how electron energy is dissipated in the plasma. We have explored the effect of gas pressure and RF voltage on plasma density in the RF HCD using this model. At higher pressure, plasma penetrates inside the hole, leading to HCE enhancement. We compare the simulation results with experimental data in RF HCD.

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Date submitted: 07 Jun 2020 Electronic form version 1.4