Abstract Submitted
for the GEC05 Meeting of
The American Physical Society

Simulation of ion deposition in nanofabrication of single-crystalline carbon nanotip electron field emitters IGOR LEVCHENKO, KEN OSTRIKOV, School of Physics, The University of Sydney, Australia — Three-dimensional topography of microscopic ion fluxes in the reactive hydrocarbon-based plasma-aided nanofabrication of ordered arrays of vertically aligned single crystalline carbon nanotip microemitter structures is simulated by using a Monte-Carlo technique. The ion trajectories are computed by integrating the equations of motion in the electric field of a biased substrate. It is shown that the ion flux focusing onto carbon nanotips is more efficient under conditions of low potential drop U across the plasma sheath. Under low-U conditions, the ion current density onto the surface of nanotips is higher for higher-aspect-ratio nanotips and can exceed the mean ion current density onto the nanopattern in up to 5 times. This effect becomes less pronounced with increasing the substrate bias, with the current enhancement not exceeding 1.7. This value is higher in denser plasmas and behaves differently with the electron temperature depending on the substrate bias. When the substrate bias is low, the ion current decreases with the electron temperature, with the opposite tendency under high-U conditions. The results are relevant to the PECVD of ordered large-area nanopatterns of vertically aligned carbon nanotips, nanofibers, and nanopyramidal microemitter structures for flat panel display applications.

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Date submitted: 17 May 2005 Electronic form version 1.4