Abstract Submitted
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Influence of ion effects on a space charge limited field emission flow: from non-relativistic to ultra-relativistic regimes[1] M.C. LIN, P.C. CHANG, P.S. LU, NSSL, Fu Jen Catholic University, J.P. VERBONCOEUR, PTSG, UC Berkeley — Influence of ion effects on a space charge limited field emission flow has been studied systematically, by employing both analytical and numerical approaches. In our model, the field emission of electrons is described by the Fowler-Nordheim equation. The cathode plasma and surface properties are considered within the framework of an effective work function approximation. Ionization effects at the anode as well as electron space-charge effects are described by Poisson's equation coupled with the energy conservation equation including the relativistic effects. The calculations are carried out self-consistently to yield the steady states of the bipolar flow. The electric field on the cathode surface is found to be saturated due to space charge effects and is determined by the effective work function approximately. In addition, the upstream ion current bas been treated as a tuning parameter. It is found that the field emission currents in the presence of saturated ion currents can be enhanced to be nearly 1.8, 1.5, and 1.4 times of the cases with no upstream ion current in non-relativistic, intermediate, and ultra-relativistic regimes, respectively. The solutions have also been verified using 1D PIC simulations, as implemented in the OOPD1 code developed by PTSG of UC Berkeley.

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