Abstract Submitted
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A Self-consistent General Thermal Field Emission Model[1] M.C. LIN, Tech-X Corporation — Emission of electrons from cold or hot cathode surfaces has attracted a lot of attention in the past century due to its wide applications in vacuum nano-electronics as well as understanding the fundamental surface physics and basics of vacuum breakdown and electrical discharge phenomena. Electron emission is strongly dependent upon not only the work function but the local surface electric field of cathode. A general electron emission equation, namely general thermal field (GTF) equation, was developed to account for both tunneling and thermal emission for general potentials, particularly when both processes are non-negligible. However, the GTF equation was derived without considering the space charge effects on the emission surfaces. Although in most cases, space charge effects are not important, a formula cannot be said to be complete without including the space charges of the emission electrons. In this work, a self-consistent GTF emission model is formulated and the space charge effect on the original GTF equation is studied analytically. We have also implemented the GTF algorithm in VORPAL, a conformal finite-difference time-domain (CFDTD) particle-in-cell (PIC) code. This analytic model could serve as a benchmark standard for the GTF CFDTD PIC simulations.

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