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An Improved Self-consistent Fitting Model for Characterizing Field Emitters¹ M.C. LIN, NSSL, Department of Physics, Fu Jen Catholic University, J.P. VERBONCOEUR, Department of Nuclear Engineering, University of California, Berkeley — Field emission of electrons has attracted a lot of attention due to its wide applications in vacuum nano-electronics as well as understanding the fundamental surface physics. In recent experiments of field emission arrays (FEAs), the Fowler-Nordheim (FN) plots were found to become nonlinear and apart from the prediction of the conventional FN theory. A self-consistent model including the space charge and within the framework of an effective work function approximation demonstrated a good fit to the I-V characteristics of FEAs. Although the theory showed good agreement with the experiments and indicated that space charge effects cause the saturation, a constant effective work function is not enough to characterize all the emission surface properties as one can see a discrepancy in the transition region. A later study employing the effective enhancement factor model showed that geometric enhancement effects are strongly dependent on the applied fields. In this work, we employ both effective work function and effective enhancement factor approximations to improve the fitting model for better characterizing field emitters.

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M. C. Lin
NSSL, Department of Physics, Fu Jen Catholic University

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