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A new method to fitting the I-V characteristics of field emission arrays¹ MING-CHIEH LIN, NanoScience Simulation Laboratory, Department of Physics, Fu Jen University — In recent years, the wide applications of vacuum electronic devices call for a well development of field emission cathodes. Field emission arrays (FEAs) are a good candidate for the use as a field emitter. The emission property of an emitter is characterized by the I-V curves. The field emission could be described by the well-known Fowler-Nordheim (FN) equation. The FN plots are widely employed to fit the experimental data. With the advancement in the fabrication technology, the emission current density of a FEA achieves even higher and higher values than ever before. In recent experiments of FEAs, the FN plots show that the results are apart from the FN fits. In this work, we propose a new method to fitting the I-V characteristics of the FEAs that may be operated at high current density. The FN equation is modified with an effective work function. The effective work function characterizes the surface properties of the field emission array. A self-consistent FN equation including the space charge effects of the field emission electrons is demonstrated to be a good fit to the I-V characteristics of FEAs. The theoretical results show good agreement in comparisons with some experimental results.

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