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Testing Fowler-Nordheim-type equations

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Fowler-Nordheim (FN) theory uses “smooth-surface” conceptual emitter models. It is not accurate theory because it disregards the existence of atoms, and takes the emitter surface charge as confined to an infinitesimally thin classical layer. Developing fully self-consistent field emission theory will be intensively difficult, and has received limited attention. It could take 50-100 years. However, it seems long overdue that we seriously consider how to test FN-type equations, to get a better idea of where physical weaknesses lie.
Deciding how to do this testing is itself a very complex problem, because many assumptions go into derivations, and up to seven parameters may appear in a FN-type equation. It seems best to start with the exponential. The inverse dependence on field has been well tested, and probably the dependence on w[illegible] adequately tested. The largest poorly tested assumption is that the tunnelling barrier is better modelled as a Schottky-Nordheim (”planar image rounded”) barrier rather than an exactly triangular barrier. Eight putative methods are identified in the Poster, but very few are actually decisive. A summary will be given of current conclusions. Briefly, the SN barrier looks the more plausible model, but the evidence to date is not completely decisive.

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