DETAILED PHOTOEMISSION MODELING USING THE 3D FINITE-ELEMENT PIC CODE MICHELLE

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Abstract

Low emittance, high current density sources are required to achieve the small beam size needed for high frequency vacuum electronic devices and for high power free electron lasers (FELs). Emission models are of particular importance in the emittance-dominated regime, where emission non-uniformity and surface structure of the cathode can have an impact on beam characteristics. We have been developing comprehensive time-dependent photoemission models for the simulation codes that account for laser and cathode material and surface characteristics. MICHELLE* is NRL's finite-element self-consistent electrostatic time-domain code: it has the ability to import an RF field, and has unique capabilities for modeling the emission and the self fields, near the cathode. In particular, some instances of surface irregularities and emission non-uniformity (due to work function variation) leading to such effects as beam emittance and high frequency oscillations are possible to model due to the code's conformal meshing capabilities. We will present results of the implementation of the 'next generation' photoemission models in the MICHELLE code for modeling surface roughness and non-uniformity.

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