Contribution ID: **49** Type: **not specified**

Developing Field Emission Models Employing Nanoscale Surface Characterization

Wednesday, 21 April 2021 09:30 (30 minutes)

A popular approach for modeling field emission in particle-in-cell (PIC) simulations is to employ a calibrated Fowler-Nordheim emission model. In this approach, the calibrated geometric enhancement factor, β, is often tuned to extremely large values (10-1000) to reproduce experimentally observed
currents. It is an open question if such high-β features actually exist, and thus whether this approach has an actual scientific basis or if the artificially high β is compensating for incomplete physics. We are pursuing an approach that will model field emission with a distribution of β, as well as the work function φ, where these distributions are taken from direct material surface measurements. A step in this analysis is to simulate fields in a domain with directly measured nm-sized surfaces from microscopy to produce actual β field enhancement factors. PIC simulations of mm-sized electrodes cannot resolve atomic-scale (nm) surface features and therefore we generate micron-scale models using probability distributions for effective "local" β, φ, and emission areas. We compare simulated nm-scale Fowler-Nordheim field emission currents with the currents generated using the micron-scale model on a coarse mesh with a perfectly flat model surface.

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

Summary

Presenter: HOPKINS, Matthew (Sandia National Laboratories)

Session Classification: Session 6