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**Computer models of ion-material and electron-material interactions with application to ion accelerators**[1]

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Researchers in heavy-ion-driven high-energy density physics, tokamak physics, high-power microwave physics and accelerator physics are actively studying the interaction between plasmas and walls and between beams and metal surfaces. These interactions result in secondary electron emission, neutral gas desorption, and electron and ion production through impact ionization. A main tool for studying the physics of beam or plasma interaction with surfaces is computer modeling, but many of the main codes in the plasma and beam simulation field do not have sophisticated models of particle-surface interactions. To help fill this need for numerical models of particle-surface interactions, researchers at Tech-X Corporation, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory and the University of California at Berkeley have developed a set of modules for simulating these interactions. Researchers have benchmarked these modules and used them to help understand results of the High Current Experiment (HCX). We will show the agreement of the numerical routines and experimentally measured results from the HCX that 1.0 MeV potassium ions incident on stainless steel induces the release of roughly six electrons per ion at normal incidence. We also show how self-consistent particle-in-cell simulations using these modules to include effects of secondary electrons produce results that agree more closely with measured currents in the HCX clearing electrodes than simulations without secondary electrons. Researchers have also applied these modules to simulations of high-gradient waveguide breakdown and gas-filled diodes, and we will show results from each.

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