Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Multi-physics modeling of plasma-material interactions[1] ANE LASA, DAVID GREEN, JOHN CANIK, Oak Ridge National Laboratory, TIMOTHY YOUNKIN, SOPHIE BLONDEL, BRIAN WIRTH, University of Tennessee, JON DROBNY, DAVIDE CURRELI, University of Illinois at Urbana-Champaign — Plasma-material interactions (PMI) can degrade both plasma and material properties. Often, PMI modeling focuses on either the plasma or surface. Here, we present an integrated model with high-fidelity codes coupled within the IPS framework that self-consistently addresses PMI. The model includes, calculation of spatially resolved influx of plasma and impurities to the surface and their implantation; surface erosion and roughening; evolution of implanted species and sub-surface composition; and transport of eroded particles across the plasma and their re-deposition. The model is applied and successfully compared to dedicated PISCES linear device experiments, where a tungsten (W) target was exposed to helium (He) plasma. The present contribution will focus on the analysis of W erosion, He retention and sub-surface gas bubble and surface composition evolution, under the different He plasma conditions across the surface that are calculated by impurity transport modeling. Impact of code coupling, reflected as interplay between surface erosion, fuel / impurity implantation and retention, and evolution of target composition, as well as sensitivity of these processes to plasma exposure conditions is also analyzed in detail.

[1]This work is supported by the US DOE under contract DE-AC05-00OR22725

Mark Cianciosa
Oak Ridge National Lab

Date submitted: 14 Jul 2017 Electronic form version 1.4