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Modeling RF-induced Plasma-Surface Interactions with VSim<sup>1</sup> THOMAS G. JENKINS, DAVID N. SMITHE, ALEXEI Y. PANKIN, CHRISTINE M. ROARK, PETER H. STOLTZ, SEAN C.-D. ZHOU, SCOTT E. KRUGER, Tech-X Corporation — An overview of ongoing enhancements to the Plasma Discharge (PD) module of Tech-X's VSim software tool is presented. A sub-grid kinetic sheath model, developed for the accurate computation of sheath potentials near metal and dielectric-coated walls, enables the physical effects of DC and RF sheath dynamics to be included in macroscopic-scale plasma simulations that need not explicitly resolve sheath scale lengths. Sheath potential evolution, together with particle behavior near the sheath (e.g. sputtering), can thus be simulated in complex, experimentally relevant geometries. Simulations of RF sheath-enhanced impurity production near surfaces of the C-Mod field-aligned ICRF antenna are presented to illustrate the model; impurity mitigation techniques are also explored. Model extensions to capture the physics of secondary electron emission and of multispecies plasmas are summarized, together with a discussion of improved tools for plasma chemistry and IEDF/EEDF visualization and modeling. The latter tools are also highly relevant for commercial plasma processing applications. Ultimately, we aim to establish VSimPD as a robust, efficient computational tool for modeling fusion and industrial plasma processes.

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