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Modeling of Fuzz Formation on Helium-Ion-Irradiated Tungsten Surfaces DWAIPAYAN DASGUPTA, University of Tennessee, Knoxville, DIMITRIOS MAROUDAS, University of Massachusetts, Amherst, BRIAN WIRTH, University of Tennessee, Knoxville — Experiments have shown that helium (He) from plasma devices is responsible for the formation of a nanostructure with a fuzz-like morphology on the plasma-facing tungsten (W) surface after a few hours of plasma exposure, which can potentially impact fusion reactor performance. We report an atomistically-informed, continuous-domain model capable of describing the surface morphological evolution of He-ion-irradiated W and predicting the initial stage of fuzz formation on W surfaces. Based on this model, a systematic protocol of self-consistent dynamical simulations of the irradiated tungsten surface morphological evolution is conducted to compare the simulation results with experimental studies in the literature. Upon model validation, the simulations are used to identify the critical range of conditions for nanotendril formation on the surface, a precursor to fuzz-like surface growth. We examine a broad range of surface temperature, He ion energy, and He flux values relevant to experimental conditions and present the results of a sensitivity analysis of the key model parameters, such as He concentration and He nanobubble size. Further development of the model, driven by comparisons of its predictions with experimental observations also will be discussed.

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