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Evolution of Plasma-Exposed Tungsten Surfaces Due to Helium Diffusion and Bubble Growth KARL HAMMOND, University of Tennessee, Knoxville, LIN HU, DIMITRIOS MAROUDAS, University of Massachusetts Amherst, BRIAN WIRTH, University of Tennessee, Knoxville, PSI-SCIDAC TEAM — Helium from linear plasma devices and tokamak plasmas causes the formation of microscopic features, termed "fuzz" or "coral," on the surface of plasma-exposed materials after only a few hours of plasma exposure. The details of such surface modifications are only beginning to be understood. This study examines the initial and intermediate stages of fuzz formation by large-length-scale molecular dynamics (MD) simulations of helium-implanted tungsten over time scales of up to microseconds using single-crystalline and polycrystalline supercell models of tungsten. The large-scale MD simulations employ state-of-the-art many-body interatomic potentials and implantation depth distributions for the insertion of helium atoms into the tungsten matrix constructed based on MD simulations of helium-atom impingement onto tungsten surfaces under prescribed thermal and implantation conditions. The large-scale MD simulations reveal surface features formed via the sequence of helium implantation, diffusion of helium atoms and their aggregation to form bubbles, growth of bubbles and consequent production of tungsten self-interstitial atoms, organization of those atoms into prismatic loops, glide of those loops to the surface, and bubble rupture.

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