Poster and Abstract Title:

"Simulation of Helium in Fusion Reactor Materials"

Abstract:

The formation of "fuzz," a network of tendril-like nanostructures, on helium-irradiated tungsten surfaces is of keen interest to the nuclear fusion community due to concern that it will impact reactor operation. However, the mechanism by which fuzz forms is not well-understood. To build this understanding, molecular dynamics (MD) simulations have been performed to analyze the processes by which helium diffuses and forms bubbles under tungsten surfaces. The objective is to use the information generated to inform larger-scale models that can simulate helium dynamics at length and time scales relevant to fusion reactors. This study simulates high-flux helium irradiation of a relatively large (approx. 400 nm^2 plasma-facing surface) tungsten slab for over 285 ns (fluence 1.4×10^{21} m^{-2}). In these simulations, bubbles are observed whose sizes are comparable with those of bubbles seen in experiments. These large simulated bubbles form by repeated burst/refill cycles. We also observe that the bursting of one bubble can directly cause the bursting of another nearby bubble. The tungsten membrane that separates these "double-burst" bubbles is found to be of approximately the same thickness as that which separates the large bubbles from the plasma.