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Accelerated Molecular Dynamics studies of He Bubble Growth in Tungsten BLAS UBERUAGA, LUIS SANDOVAL, DANNY PEREZ, ARTHUR VOTER, Los Alamos National Laboratory — Understanding how materials respond to extreme environments is critical for predicting and improving performance. In materials such as tungsten exposed to plasmas for nuclear fusion applications, novel nanoscale fuzzes, comprised of tendrils of tungsten, form as a consequence of the implantation of He into the near surface. However, the detailed mechanisms that link He bubble formation to the ultimate development of fuzz are unclear. Molecular dynamics simulations provide insight into the He implantation process, but are necessarily performed at implantation rates that are orders of magnitudes faster than experiment. Here, using accelerated molecular dynamics methods, we examine the role of He implantation rates on the physical evolution of He bubbles in tungsten. We find that, as the He rate is reduced, new types of events involving the response of the tungsten matrix to the pressure in the bubble become competitive and change the overall evolution of the bubble as well as the subsequent morphology of the tungsten surface. We have also examined how bubble growth differs at various microstructural features. These results highlight the importance of performing simulations at experimentally relevant conditions in order to correctly capture the contributions of the various significant kinetic processes and predict the overall response of the material.

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