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**Cluster dynamics simulations defining end of dilute limit for fusion relevant conditions** THIBAUT FANEY, University of California, Berkeley, SERGEI KRASHENINNIKOV, University of California, San Diego, BRIAN WIRTH, University of Tennessee, Knoxville — In fusion reactors, plasma facing components (PFC) and in particular the divertor will be irradiated with high ion fluxes of low energy (100 eV) helium and hydrogen. Tungsten is one of the leading candidate divertor materials for ITER and DEMO fusion reactors. However, the behavior of tungsten under high dose, coupled helium/hydrogen exposure remains to be fully understood. The aim of this study is to understand and predict primary defect production and defect diffusion, clustering and interaction of tungsten surface exposed to low energy helium irradiation at high fluences ( $10^{26}$  He/m<sup>2</sup>) and temperatures (1000 K). We report results from a spatially-dependent cluster dynamics model based on reaction-diffusion rate theory. The model was improved to be able to include very large helium vacancy clusters expected to form under these irradiation conditions. We also focus on defining the validity of the assumptions of the model (dilute limit assumption, surface morphology changes). We find good agreement between the model and analytical work. We also compare results with molecular dynamics simulations and existing experimental results. We identify the regime in which the dilute limit approximation breaks down and/or the surface morphology changes are dominant and discuss potential solution to overcome these difficulties.

Thibault Faney  
University of California, Berkeley

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