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Retention modeling in ion damaged W and diffusivity calculation including trapping effects[1] JOSEPH BARTON, UC San Diego, YONGQIANG WANG, Los Alamos National Laboratory, RUSS DOERNER, MICHAEL SIMMONDS, GEORGE TYNAN, UC San Diego — A Cu ion beam is used to induce controlled levels of damage (10^{-3}, 10^{-2}, and 10^{-1} dpa) in room temperature W samples. A single 5 MeV beam energy yielding a peaked damage profile 0.8 μm into the material, or 3 beam energies (0.5, 2, and 5 MeV) producing a relatively uniform damage profile from the near surface up to 1 μm were used. The W samples were then exposed to a D plasma ion fluence of 10^{24} ions/m^2 at 383 K, and the resulting D retention was measured using the D(^{3}He,p)α reaction analysis. We observe that there is no significant difference in retention whether the damage profile is peaked or uniform, further justifying the use of heavy ions as neutron surrogates. A retention model [1] provides concentration profiles that can be directly compared to NRA data and total retention measurements. Taking the trapping energies from DFT calculations, the only free-parameter is the defect density. The model can fit our data within the experimental error of the measurements. A new diffusion coefficient is calculated with the model that is not only a function of temperature but also a function of the trapped concentration. This calculation resolves discrepancies of various diffusivity measurements and models in the literature.

[1] J.L. Barton et al., J. Nucl. Mater., 463 (2015) 1129-1133

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