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Development of an analytical hydrogen isotope exchange model in fusion relevant plasma facing components JOSEPH BARTON, University of California San Diego, YONGQUANG WANG, Los Alamos National Laboratory, RUSSELL DOERNER, GEORGE TYNAN, University of California San Diego —
A simple model for H isotope retention depth profiles in W is developed, which can easily be extended to other plasma facing components (PFCs). This retention model is subsequently used to model how the depth profile changes after H isotope exchange. We calculate how trapping defects in W trap D (or H) inventory as W is being exposed to plasma. The model characterizes each trapping site by a trapping rate and a release rate, where the only free parameters are the distribution of these trapping sites in the material. The filled trap concentrations for each trap type are modeled as a diffusion process because post-mortem D depth profiles indicate that traps are filled well beyond the ion implantation zone (3-4 nm with 100 eV ions). Using this retention model, an isotope exchange rate is formulated. The retention model and isotope exchange rate are compared to low temperature (100 °C) isotope exchange experiments in W with good agreement. Experimental retention profiles were measured using the D(^{3}He,p)α nuclear reaction after plasma treatment. We additionally discuss how a uniform damage profile up to 1 micron in W induced by Cu ions using incident energies of 0.5, 2, and 5 MeV affect retention in W and the retention model.

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