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Hydrogenic Fuel Retention in Refractory Metals D.G. WHYTE, B. LIPSCHULTZ, J. IRBY, PSFC-MIT, G.M. WRIGHT, FOM-Rijnhuizen — High-Z refractory metals such as tungsten and molybdenum (Mo) are favored as plasma-facing components in burning plasma experiment to minimize hydrogenic (H) fuel retention, mainly due to their low H solubility ($\sim$1 appm). Fuel retention in Mo has been measured and modeled in the Mo-tile Alcator C-Mod tokamak, and DION-ISOS a new facility that features simultaneous plasma bombardment and real-time retention diagnosis in the first 10 microns of the material. We find that high ion fluxes and the requirement for surface recombination into D2 in order to release the deuterium, leads to a type of "pressure-induced" trap formation $> 1\%$ concentration in the metals; i.e. much larger than the solubility. Exposure in tokamaks leads to temperature transients through plasma heating and neutron bombardment that also increase retention. High temperature drives D traps permeation into the Mo, but the sudden cooling of the material with removal of the plasma flux "freezes" the D deep in the Mo which can only be released by temperatures significantly higher than obtained during plasma exposure. Nuclear displacements by high-energy particles (neutrons, $\sim$MeV ions) also lead to damage sites that greatly enhance retention. These retention mechanisms occur in the bulk of the material, and are fundamentally different than co-deposition of D with surface films. Implications for burning plasma experiments will be discussed.

D.G. Whyte

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