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Hydrogenic Fuel Retention in Molybdenum 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 (~1 appm). Fuel retention in Mo is studied and modeled in the Mo-tile Alcator C-Mod tokamak, and DIONISOS a new facility that features simultaneous plasma bombardment and real-time retention diagnosis. We find that high ion fluxes leads to D trap sites in the Mo; energy wells in which the fuel can reside at concentrations ~ 1%, i.e. much larger than the solubility. The tokamak environment leads to other unique characteristics such as temperature transients through heating and neutron bombardment that further increase retention. High temperature drives D traps and retention deeper into the Mo, but the sudden cooling of the material with removal of the plasma flux "freezes" the D deep in the Mo. This physical model recreates the C-Mod retention result, i.e. that a large fraction (~30%) of the fuelled D can be retained reproducibly over many shots, despite the absence of low-Z film growth. This retention mechanism is fundamentally different than co-deposition of D with carbon, which is observed to dominate D retention in most current tokamaks. The implications for burning plasmas with high neutron loads will be discussed.

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