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Integrated model predictions of the impact of He pre-exposures on ITER burning-plasma conditions ANE LASA, SOPHIE BLONDEL, University of Tennessee - Knoxville, JON DROBNY, DAVIDE CURRELI, University of Illinois Urbana Champaign, JEREMY LORE, JOHN M. CANIK, Oak Ridge National Laboratory, BRIAN D. WIRTH, University of Tennessee - Knoxville —
The interplay between the most abundant gases (hydrogen isotopes and helium, He) present in fusion plasmas is known to alter fuel retention, especially in tungsten, the leading material candidate for the divertor. However, this interplay is yet to be sufficiently understood or characterized in order to confidently project fuel retention levels to future fusion devices. Here, we present a series of integrated simulations that include surface erosion, ion implantation, and sub-surface gas dynamics and recycling; and apply them to modeling the exposure of a tungsten target pre-damaged by He plasma to 100 MW burning plasma conditions in ITER. We have selected multiple scenarios for the He pre-exposure; including predictions of sub-surface damage resulting from early ITER He-operation as well as calculations of higher-fluence He plasma exposures in linear devices. Initial results, focused on the outcome of gas implantation, dynamics and recycling, indicate that under fluxes sufficient for He bubbles to nucleate in the near-surface, these clusters will locally increase the hydrogenic retention, but decrease the hydrogen species permeation. Our results also predict longer term ITER behavior.

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