Influence of exposure conditions on helium transport and bubble growth in tungsten

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In fusion devices, extreme fluxes of helium (He) and hydrogen (H) are expected. These fluxes will be mostly located on the divertor which will also exhaust the plasma He ashes. A promising candidate for divertors is tungsten (W).

It is expected for implanted He to cluster and form bubbles in W. These He bubbles can then act as traps for H in the plasma facing components and therefore affect the H inventory in tokamaks. To this end, it is crucial to understand the mechanisms at stake and to be able to predict He transport and bubble growth in W.

He diffusion, clustering and bubble nucleation and growth are modelled using the finite element method. A parametric study is performed to investigate the influence of exposure conditions on He inventory, bubbles density and size. Temperature is varied from 120 K to 1200 K and the implanted flux of 100 eV He is varied from 1E17 m-2.s-1 to 5E21 m-2.s-1.

Comparison with experimental measurements in W is also performed and the bubble density simulated by the model is in quantitative agreement with experiments.