Effects of rhenium doping on surface morphology and deuterium retention in tungsten

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The surface morphology and deuterium retention of tungsten (W) and tungsten- rhenium (Re) alloys exposed to 100 eV deuterium (D) plasma was investigated. During the experiment, the flux was fixed at ~1.8×10^{22} D/m^2/s, the exposure temperatures were 470 and 506 K, respectively. Before irradiation, the results of Nano-indentation and XRD show that Re doping leads to a decreases of the hardness and lattice parameters of tungsten. In the case of irradiation at 470 K, as the dose increased, the blisters size of pure W rised drastically while the that of W-Re alloys decreases obviously. Both the total deuterium (D) retention of pure W and W-Re alloys increase as the fluence increases, but the total D retention in W-Re is lower than that of pure W as the dose increased up to 2.6×10^{25} D/m^2. Further increasing the exposure fluence to 5.2×10^{25} D/m^2 at 506 K leads to significant blister size and D total retention increase in pure W, but the blister size and D total retention of W-5Re is strongly suppressed. In this case, the D retention in W-5Re is about 1 orders of magnitude lower than retention in pure W.