

Influence of helium seeding into deuterium plasma on the deuterium retention in W and Eurofer under stationary plasma and transient events

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The impact of the He seeding into the D plasma and temperature gradient on the deuterium diffusion and retention in W-based and Fe-based materials has been studied by irradiation in quasi-stationary plasma accelerator QSPA-T using pure D, pure He and mixed D/He plasma (at heat flux below and above the melting point). We show that in the steady state plasma exposure, the He seeding into the D plasma decreases the D retention in W and Eurofer and this reduction increases with increasing the fluence. In the transient regime, the He seeding into the D plasma does not noticeably affect the D retention up to 10 pulses but leads to a decrease in the D retention after 30 pulses. In both cases of pure D and 10%He-seeded D plasma gun exposures, the D retention at high number of pulses can be higher compared to the steady state plasma exposure at a sample temperature above 600 K for both W and Eurofer indicating the dominant influence of ELM-like events on the D retention compared to normal operation regime.

Moreover, the modification of W fuzz in the case of exposure of W by plasma gun as a function of number of pulses has been studied. It was shown that W fuzz does not disappear from W surface after 10 ELM-like pulses, but the fibers are enlarged and surface structure is modified. And although the “fuzz” disappears after 30 pulses, there are still many bubbles on the W_f surface with maximum size of one micron. In both cases of pure D and D+10%He plasma gun exposures, cracks of different sizes were formed in all samples after plasma gun irradiation.

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