IMPACT OF PULSED DEUTERIUM PLASMA IRRADIATION ON THE SURFACE OF DUAL-PHASE TUNGSTEN AND TUNGSTEN HEA

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One of the potential energy sources that we could use in the future is fusion energy. In fusion devices, namely in plasma chambers, are some parts that are exposed to extreme heat and particle loads, which may lead to failures of the plasma chamber. Theoretical calculations, as well as experimental studies, indicate that plasma and heat loads can lead to cracking, erosion, and detachment of pure tungsten or other materials, and this leads to less efficient fusion reactions.

In our work, the resistance to pulsed particles and heat loads, are investigated in two types of materials: dual-phase tungsten alloy and tungsten HEA. Two different dual-phase tungsten alloys were used, HPM1800 and HPM1850 consisting of 95% and 97% tungsten, and 5%, and 3% nickel-iron, respectively. Tungsten HEA was made up of 95% of tungsten and 5% of FeNiCrCuMn, using spark plasma sintering (SPS). The samples were irradiated with 25 and 100 deuterium plasma pulses in different regimes, which are comparable to transient events' heat flux factor of ITER, using plasma focus device PF-12. The surface and cross-sections of irradiated samples are analyzed by SEM. Resistance to the generation of the defects is compared with the results for pure tungsten and between samples. 2D and 3D profilometry are used for the characterization of the exposed surface, also. It has been found that dual-phase tungsten alloys have better resistance to crack formation than pure tungsten, and maybe having the second phase as HEA could lead to even better results.

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