

Experimental study of cyclic action of plasma on tungsten

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Abstract

We report on experimental results on multiple action of hydrogen, deuterium, and helium plasmas produced by a plasma gun and the Globus-M tokamak on tungsten. The surface temperature in the course of irradiation is measured with a bichromatic pyrometer with a time resolution of $\sim 1 \mu\text{s}$. The morphology of the surface layer is investigated and X-ray structure analysis of tungsten exposed to multiple radiations by the plasma under various conditions is carried out. A slight decrease in the lattice parameter in the sample subjected to the maximal number of irradiation cycles is detected. It is shown that the morphology of the tungsten surface irradiated by the hydrogen plasma from the gun and by the deuterium plasma from the Globus-M tokamak changes (the structure becomes smoother). The characteristic depth of the layer in which impurities have been accumulated exceeds $0.5 \mu\text{m}$. This depth was the largest for the sample exposed to 1000 shots from the gun and 2370 shots from the tokamak. It is shown that the helium jet from the plasma gun makes it possible to simulate the action of helium ions on the International Thermonuclear Experimental Reactor (ITER) diverter, producing a layer of submicrometer particles (bubbles).