STUDY OF PROPERTIES OF TUNGSTEN IRRADIATED IN HYDROGEN ATMOSPHERE

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The research goal is irradiation of tungsten samples in hydrogen and post irradiation studies of the samples for microstructure change after irradiation and comparison with non-irradiated samples. The tungsten samples of DF-grade, double forged pure, were manufactured in Julich, Germany.

Irradiation of tungsten samples was carried out at the WWR-K reactor of Institute of Nuclear Physics, Almaty, Kazakhstan; irradiation time was 3255 hours. Average temperature was 720^{o}C. Tungsten samples were studied to obtain data on the extent of the changes in structure and physics-mechanical properties of the material as a result of reactor irradiation. Gamma spectrometric measurements were carried out to determine the isotopic composition and activity of the radioactive emitters in the tungsten samples. Microstructural studies of tungsten samples irradiated in hydrogen and helium were carried out using the optical microscopes and scanning electron microscope. The experiments to study the parameters of hydrogen interaction with tungsten were carried out by thermo-desorption spectroscopy under linear heating with mass-spectrometer registration of the gases released during heating.

During the experiments we obtained the comparative characteristics of the microstructure and microhardness of tungsten samples, which were exposed to reactor irradiation in an atmosphere of hydrogen and helium; we determined hydrogen diffusion parameters in double forged pure tungsten, and W sorption characteristics towards hydrogen during reactor irradiation. The mechanism was proposed to describe the hydrogen interaction with tungsten during irradiation. Simulation experiments to study the effects of reactor irradiation on the characteristics of the hydrogen isotopes interaction with structural materials of fusion facilities will allow to establish correlation and synergistic effects between influence of fission and fusion reactors on the structural materials of fusion reactors.

This research has been performed in the framework of research project “Investigation of Changes in Structure and Properties of Tungsten Irradiated by Neutrons, Alpha-Particles and Heavy Ions within the Temperature Range up to 600'-to Predict its Behavior in Thermonuclear Fusion Reactors.”, CRP No. 17398, IAEA.