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Deuterium retention behavior in tungsten irradiated with neutron under divertor operation temperature

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In the fusion reactor, tungsten will be exposed to high heat flux, neutrons, ash and fuel plasma of fusion reaction including tritium. The irradiation defects generated by neutrons will dynamically migrate, which results in the accumulation and annealing of irradiation defects. The irradiation defects in tungsten will act as potential trapping sites for hydrogen isotopes and, therefore, increase the hydrogen isotope retention.
Tungsten samples were irradiated by neutrons in HFIR (High Flux Isotope Reactor) in ORNL (Oak Ridge National Laboratory) up to 0.5dpa at temperatures of 1073 and 1373 K (named as AW-51 and AW-53 according to the sample ID in ORNL, respectively), which are equivalent to the divertor operation temperature in DEMO. Then, the samples were exposed to deuterium plasma at 673 K, and deuterium retention was evaluated by TDS (Thermal Desorption Spectroscopy) conducted in INL (Idaho National Laboratory).
The deuterium desorption spectrum for AW-51 showed deuterium desorption peak at around 850 K. That of AW-53 was also at the same temperature. This indicates the species of irradiation defects should be the same between these tungsten samples. Besides, deuterium retention in AW-53 was almost half compared to that of AW-51. It was suggested that the irradiation defects induced in tungsten annealed during neutron irradiation under high temperature. Consequently, deuterium retention was reduced for AW-53 due to the lower concentration of irradiation defects.

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