PERFORMANCE OF V-4Cr-4Ti ALLOY EXPOSED TO THE JFT-2M TOKAMAK ENVIRONMENT*

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A long-term test has been conducted in the JFT-2M tokamak fusion device to determine the effects of environmental exposure on the mechanical and chemical behavior of a V-4Cr-4Ti alloy. Test specimens of the alloy were exposed in the outward lower divertor chamber of JFT-2M in a region away from direct contact with the plasma, and were held in a fixture which contained a heater to preheat the specimens to 300°C just prior and during plasma discharges. During their nine-month residence time in JFT-2M, the specimens experienced exposure to air, low-pressure hydrogen and deuterium (~10–1 Pa), titanium (during vessel interior conditioning via sputtering of titanium by Ar ions with magnetron-type rf discharges), and interaction with neutral high energy particles, including metallic species, during approximately 200 lower-single-null divertor shots for which high energy particle fluxes to the pre-heated test specimens were significant. The specimens were also exposed to approximately 2,010 upper-single-null divertor shots and non-divertor shots (including disruptions developed prior to establishing the divertor configuration), for which high energy particle fluxes to the test specimens were very low. During most of these shots the test specimens were at room temperature where particle retention is expected to be low. Data from post-exposure tests have indicated that the performance of the V-4Cr-4Ti alloy would not be significantly affected by environmental exposure to gaseous species at partial pressures typical for tokamak operation. Absorption of interstitials by the alloy appears to be limited to the very near surface, and neither the strength nor the Charpy impact properties of the alloy appear to be significantly changed from the exposure.

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