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P2.216 Effect of Hydrogen on Corrosion Properties of Reduced Activation Ferritic/Martensitic Steel F82H

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Reduced activation ferritic/martensitic (RAFM) steel, e.g., F82H, is the leading candidate structural material for fusion blanket. Of many blanket concepts, the water-cooled ceramic breeder blanket is an attractive concept because of its compactness and its compatibility with the technologies in conventional light water reactor. For tritium breeding, it is necessary to manage the corrosion of F82H by controlling not chemicals but hydrogen and oxygen in the cooling water. Understanding the effects of oxygen and hydrogen on corrosion property was therefore required for the blanket design. This work aims to investigate the corrosion behavior of F82H in high-temperature water with hydrogen added.
The material used in this study was Japanese RAFM, F82H. The flow-accelerated corrosion (FAC) test was performed using a rotating disk specimen (O.D. = 275 mm, I.D. = 130 mm, thickness = 3 mm). The circumferential velocity on the specimen edge was 5 m/s. The FAC tests were conducted at 543 K under the pressure of 6.3 MPa. The corrosion fatigue test was also performed under 0.6 % of the total strain range and 0.0004 %/sec of the strain rate with a triangle waveform at 573 K under the pressure of 13 MPa. The dissolved oxygen (DO) and dissolved hydrogen (DH) concentrations in the water were <5 ppb and 3.5 ppm, respectively, for both experiments.
The weight of rotating disk specimen in the high-temperature hydrogen-added water was decreased with increasing time as previously reported in [1] (573K, DO 20ppb). It is specurated that no considerable change of FAC was expected by hydrogen addition. In contrast, it was found that the number of cycles to fracture was decreased in the high-temperature water compared with the fatigue test at room temperature in air.

[1] M. Nakajima,et. al. Journal of Plasma and Fusion Research SERIES, 11 (2015) 69-72.

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