LONG-TERM PROPERTIES OF REDUCED ACTIVATION FERRITIC/MARTENSITIC STEELS FOR FUSION REACTOR BLANKET SYSTEM

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Reduced activation ferritic/martensitic steels (RAFMs) are recognized as the primary candidate structural materials for fusion blanket systems, as they have been developed based on massive industrial experience of ferritic/martensitic steel replacing Mo and Nb of high chromium heat resistant martensitic steels (such as modified 9Cr-1Mo) with W and Ta, respectively. Japanese RAFM steel, F82H (8Cr–2W–0.2V–0.04Ta–0.1C) is planned to be used for Japanese ITER test blanket module and DEMO reactor, and the R&D of the technical issues to utilize this material for the fusion reactor blanket system, such as the fabrication technology, design procedure for irradiated material, and material properties prediction during the irradiation environment are in progress under the International Fusion Energy Research Centre (IFERC) project in the Broader Approach (BA) activities between EU and Japan.

One of the R&D issues is the development of the material database for the DEMO design criteria and licensing. Long-term properties, such as creep properties and thermal aging properties are important properties to ensure the stability during the operation. Thermal aging and creep tests were conducted to characterize the materials stability and the tests exceeding 100,000 hours have been completed on the F82H IEA heat material. Thermal aging tests were conducted at temperatures 500, 550, 600, and 650°C for 1000, 3000, 10000, 30000, and 100000 hours. Hardness, Tensile, and Charpy impact tests were performed with microstructural analysis. Creep rupture tests were conducted at temperatures 500, 550, 600, and 650°C and applied stress were ranging from 26.5 to 274 MPa.

This paper presents the detailed results of the long-term properties, such as thermal aging properties and creep properties of RAFM steel, F82H.