Reduction Method Of DBTT Shift Due To Irradiation For Reduced-Activation Ferritic/Martensitic Steels

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Resistance of irradiation embrittlement of reduced-activation ferritic/martensitic steels is a high priority theme of R&D for the structural materials of DEMO reactor and IFMIF target. Large shifts of DBTT due to irradiation have been reported in several martensitic steels, which had different concentrations in some elements and were also tempered at different temperatures. However, the mechanisms for the relation between the shift of DBTT due to irradiation and the changes of yield strength in these martensitic steels are not clear, and it is necessary to reveal the effects of heat treatment and impurities on them. The improvement of resistances to irradiation embrittlement and hardening will be required. The purpose of this study is to examine the mechanism of irradiation embrittlement and hardening.

In this study, two approaches for the resistance of irradiation embrittlement of reduced-activation ferritic/martensitic steels have been applied for it. One is the method of modification of heat treatments which are changed with tempered conditions, and another is the mixed method of addition for very small amount of elements and heat treatment. Heat treatments for F82H-std were firstly performed at 750°C after normalizing at 1040°C. Second normalizing for F82H-std was carried out at 1040°C, and the time of subsequent tempering at 750°C was varied from 0.5 to 10 h. The second tempering was performed at 780°C for 0.5 h. The F82H steel doped with B and N was prepared. 1/3CVN and t/2-1/3CVN specimens were irradiated at 250°C to about 2 dpa in the JMTR, and the DBTT shifts were measured. The DBTT shift due to irradiation was reduced from about 145°C to 80°C by the method of modification of heat treatment, and the value was furthermore reduced to only 25°C by the mixed method.

Number of words in abstract: 286
Keywords:
Technical area: 22. Radiation effects Mechanical and physical property degradation
Special session: Not specified
Presentation: No preference
Special equipment: No special equipment