Contribution ID : **84** Type : **not specified**

12.9 Design and Performance Tests of the In-vessel Components of ITER Microfission Chamber

Wednesday, 18 April 2018 20:30 (120)

The in-vessel neutron flux monitor equipped with Microfission Chambers (MFCs) are exposed to the extreme ITER environment, such as high radiation and high electromagnetic (EM) forces. Therefore, the in-vessel components need to withstand such ITER environment. In this study, various analyses and tests have been carried out for the in-vessel components to show that they can be applied for ITER. Soundness verification tests such as high-temperature and noise immunity tests showed that the MFCs can be operated under high temperature up to 550C and have the noise resistance in the ITER condition. Neutronic and EM analysis also showed the in-vessel components can withstand high radiation and EM forces due to disruption events. An electrical feedthrough is one of the most important components of the MFC because it forms vacuum and tritium boundaries of ITER tokamak. Structural analyses for expected accidents suggested that the fire accident is the most severe accident. However, it was shown that thermal stress on the feedthrough due to the fire accident can be lower than its allowable stress by designing the feedthrough appropriately. Above results indicate that the in-vessel components of the MFC can be used in the extreme ITER environments without any replacements.

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Session Classification : Session #12, Wednesday Night Poster Session