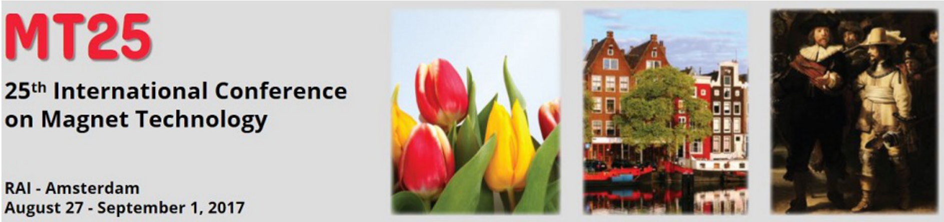

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Pulsed field stability and AC loss of ITER NbTi PF joints by detailed quantitative modeling

Wednesday, 30 August 2017 18:00 (15 minutes)

Abstract: The Poloidal Field (PF) magnet system of the International Thermonuclear Experimental Reactor (ITER) consists of six pulsed coils. Each coil comprises independent modules connected with "shaking hands" lap-type joints. The feasibility and stability of the plasma scenario requires the magnets to retain sufficient current and temperature margin. The joints essentially represent the weak and critical region as undertaking a combination of the steady state Joule heating in the resistance and the coupling losses due to the pulsed operations. A dedicated numerical model JackPot-ACDC is developed not only for a qualitative observation of the current and power distribution in 3D visualization, but also for quantitative calculation and analysis.
The current non-uniformity in the joint plays an important role in the power dissipation and consequent electrical and thermal stability. Previously, an updated design of the PF joint was proposed to reduce the largest induced current loops and coupling loss. Therefor a high resistive barrier called "mask"was introduced between strands and sole for the petals having double contact with the sole, subsequently a full-size joint was tested in the SULTAN facility to validate the idea. The mask and even more general non-homogeneous distribution of contact resistance between strands and sole are implemented in the quantitative model. This way the mechanism of the mask, the effect on the total resistance, current distribution, power distribution and stability is fully investigated. Furthermore, the results of the model suggest that the effect of increasing joint resistance with electromagnetic force (BxI) as observed in the Sultan experiment can be explained by a change in contact resistance beween strands and copper sole.

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