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P3.078 Strain distribution in the Nb3Sn Rectangular Wind & React Conductor of the European DEMO project determined by inductive measurements

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Cable-in-Conduit Conductors (CICCs) are complex systems whose behaviour is not directly predictable studying their single components, and the explanation of their observed properties is not straightforward. The knowledge of the strain (Eps_th) distribution of Nb3Sn filaments in a CICC cross-section is a key parameter in understanding the performance and its evolution when the cable undergoes electromagnetic cyclic loading. This work focuses on the Wind and React (WR1) rectangular CICC sample designed by ENEA for the European DEMO project, that has exhibited a current sharing temperature (Tcs) above 6.9 K at 13 T and 81.7 kA, during its qualification tests in the EDIPO facility at the Swiss Plasma Centre. Compared to the critical current tests on the constituting wires, the observed CICC performance corresponded to an effective strain value of -0.55%. This work aims to interpret this result on the basis of the analysis of the strain distribution inside the cable itself. Susceptibility versus temperature, Chi(T), of WR1 constituting free standing strands has been measured before and after etching of the stabilizing copper, and it has been compared with the susceptibility measured on the cable during the test campaign in EDIPO. A well-known and already assessed method has been used, starting from susceptibility measurements, to compute the Tc distribution in the cable cross-section and, subsequently, to infer from that the thermal strain distribution. The obtained results give an indication that the Eps_th distribution in WR1 cable is narrow, compared to the strain distribution calculated with the same method for most ITER cables.

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