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Analysis of AC losses in the tests of the ITER CS Module #2

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The ITER Central Solenoid (CS) will be realized by assembling a stack of six modules. Each module is a solenoid consisting of 40 pancakes wound with a Nb3Sn Cable in Conduit Conductor (CICC). The tests of the second module (CSM#2) are ongoing at the General Atomics (GA) facility in San Diego (US). During the test campaign, the CS Module is submitted to dumps of the transport current from different initial values (10, 15, 20, 25, 30, 35, 40 kA) to 0 kA, which allow measuring the AC losses in the coil.
In this paper we present the results on AC losses in the dumps as computed through two different methods. The first method is based on the observation that the dumps determine a very fast pressure rise of the supercritical helium embedded in the module, which undergoes an isochoric transformation. The method is therefore based on the computation of the variation of internal energy of the helium during the pressure rise itself. The second method is based instead on a calorimetric procedure aimed at estimating the enthalpy variation of the supercritical helium due to the thermal power deposited during the current dumps. A validated thermohydraulic model is also applied to a thorough analysis of the experimental results.
The results of AC loss tests performed with different decay time constants of the dumps are also presented. Since the transport current dumps are performed both in virgin conditions and after cyclic loading of the CS Module, the evolution of losses during the test campaign is finally discussed.

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