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p2.124 Maximizing JET divertor mechanical performance for the upcoming Deuterium-Tritium experiments

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The next Deuterium-Tritium campaign will push JET ITER-like wall to high divertor power and energy levels. During the 2016 campaign, the Strike Point (SP) sweeping technique enabled us to run relevant H-mode scenarios without exceeding the temperature limits imposed by JET Operation Instructions (JOIs). In the subsequent shutdown, six outer divertor tungsten-coated 2D carbon fibre composite (CFC) tiles were found to have radial cracks between the fibre planes.
In this paper we describe the results of a 3D thermo-mechanical analysis aimed at understanding the origin of the cracks. A sensitivity assessment has been carried out for modelling the temperature time-evolution on a realistic tile 3D model during high power shots, both with fixed and sweeping SPs. Time and space-varying heat flux density loads on the divertor surface have been calculated using different techniques for reconstructing the power engineering footprint. The results have been benchmarked against the temperature measurements by high resolution infrared (IR) diagnostic systems.
The study has confirmed the source of the cracks and their localization in the upper part of the tile, giving CFC ply normal direction stress values higher than the Ultimate Tensile Stress allowable for this composite material.
Other parameters have been found playing an important role on the stress values arising in the tile. An intrinsic structural criterion has been found that relates, at the same time, the input power, the radial location of the SP and the amplitude of the sweeping tile surface. Using this criterion as threshold, the optimal combination of these parameters has been calculated which maximises the performance of divertor tiles without exceeding the limits on input energy and maximum surface temperature imposed by the JOIs.

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