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P2.108 Fracture mechanics analyses of divertor vertical target under thermal loading conditions

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In-vessel plasma facing components such as first-wall, blanket and divertor modules should withstand harsh design conditions. In particular, since the divertor module undergoes extreme thermal loads, several tests for mono- and multi-block mock-ups as well as lots of stress analyses for the mock-ups and module themselves have been carried out. However, there were a little fracture mechanics studies limited on cracked simple geometries subjected to sudden severe thermal loads during micro-seconds period due to edge-localized mode(ELM). In this study, parametric linear elastic fracture mechanics assessment was conducted to determine critical crack lengths(CCLs) of ITER divertor vertical target. Typical heat fluxes under normal steady-state and ELM conditions were applied to the target with a postulated semi-elliptical surface crack on the tungsten blocks. Systematic finite element analyses were performed by changing crack locations, orientations and depths with a constant aspect ratio of 3. Stress intensity factors(SIFs) were computed and compared with the corresponding plane strain fracture toughness in ITER SDC-IC. Effects of crack features and heat fluxes on CCLs of the divertor vertical target were fully discussed.

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