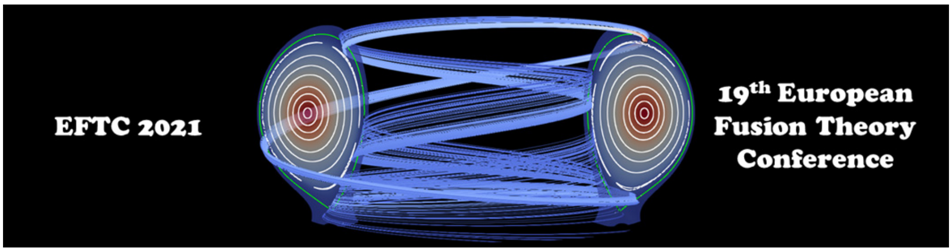

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3D non-linear MHD simulations of deuterium shattered pellet injection into H-mode JET plasma

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Shattered pellet injection (SPI) is the current concept for the ITER disruption mitigation system (DMS) to prevent disruption-related damage from thermal loads, electromagnetic forces or runaway electron (RE) beams. Compared with impurity or mixed deuterium-impurity pellets that contain large quantity of impurities like neon, pure deuterium (D2) SPI is expected to strongly dilute the plasma without immediately triggering a thermal quench and could be instrumental for RE avoidance in ITER. Detailed simulations of D2-SPI-induced disruptions, especially the (pre-)thermal quench phase in a JET discharge (#96874) with the JOREK code will be presented. In this discharge, a pure D2 pellet with a diameter of 12.5mm (barrel A) was shattered before entering the 3MA/2.9T H-mode plasma, exhibiting a much longer cooling time (~9ms between the arrival of the first shards at the plasma edge and the onset of thermal quench) than that with impurity pellets (typically 1~2ms). 3D non-linear MHD simulations show that the plasma is not fully cooled during the penetration and ablation of the D2 shards, allowing the current density (j) to evolve on a much slower time scale than the penetration of the shards and no evident global contraction of j has been observed. Detailed comparison between simulations and experimental measurements will be presented to validate the model as well as clarify the underlying physics. In particular, the role of background impurities, pointed out as a concern in the predictions for ITER, will be examined in detail. Possible effects of plasma rotation on (pre-)thermal quench dynamics will also be discussed.

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