Disruption mitigation experiments carried out using the new shattered pellet injection on DIII-D*

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New rapid shutdown strategies have been recently tested in the DIII-D tokamak to mitigate the runaway electrons (RE). Disruptions in ITER are predicted to generate multi-MeV REs that could damage the machine. Thus the mitigation of REs is critical for the reliability of ITER. Among the new techniques developed to mitigate the RE, one of the most promising is the shattered pellet injection (SPI). The RE generation process in ITER is expected to be mainly an avalanche process which can be mitigated by collisional losses at high electron density levels, n_{crit}. The SPI injects enough particles into the plasma to reach electron densities close to n_{crit} in the form of a large cryogenic pellet (15 mm x 20 mm). Before entering the plasma, the pellet is shattered into small fragments by impacting on two metal plates in order to increase surface area for a more efficient ablation and to protect the plasma facing components that could be damaged by the pellet if it was intact. It has been tested by injecting deuterium and neon pellets in DIII-D H mode plasmas. Fast visible camera data and visible bolometer tomography show that the SPI allowed a deep penetration of the particles into the core during the thermal quench (TQ). These experiments achieved record levels of local electron density (up to 9×10^{21} m^{-3}) during the TQ with the density perturbation appearing to scale with the size of the pellet and the plasma energy content. The SPI usually triggered very fast current quenches: about 5 ms compared to ~15 ms for a "typical" disruption in DIII-D thus reducing the vessel displacement and the poloidal halo currents in the vessel by a factor of ~2.

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