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Strategy of disruption mitigation using multiple injection of shattered pellets in KSTAR

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ITER adopts massive particle injection using shattered pellet injection (SPI) as a basic mitigation method to mitigate three major risk factors that can occur in the process of plasma disruption: heat load, electro-magnetic load, and runaway electrons. The injected particles composed of a combination of hydrogen and neon increase the density of plasma through the assimilation process to prevent runaway electrons and emit stored energy in the form of radiant energy. A safe and effective disruption mitigation strategy in the ITER disruption mitigation system capable of injecting a total of 27 pellets depends on which combination of pellets are injected at what time. Among these strategies, the most basic issue is whether to sequentially or simultaneously inject hydrogen, which increases density, and neon, which emits energy. On the other hand, plasma dilution-cooled by hydrogen becomes plasma with completely different characteristics from typical tokamak plasma due to its high density and low temperature. The pellet assimilation in the dilution-cooled plasma and the radiation of stored energy may be different from those of typical tokamak plasma. However, experiments on dilution-cooled plasma have not been sufficiently conducted. KSTAR with two SPIs that form a symmetry in the toroidal direction can independently inject three different pellets for each SPI. KSTAR has conducted experiments to test the disruption mitigation strategy of ITER using multiple SPIs and diagnostics capable of diagnosing the plasma disruption process.

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