Plasma-surface interactions during tokamak disruptions and rapid shutdowns

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Abstract

Recent progress in understanding of disruptions and in developing methods to avoid disruption damage is presented. Nearly complete mitigation of conducted heat loads has been achieved with high-Z gas jet shutdown. The resulting local radiation heat flash melting in the main chamber might be a concern in ITER, especially with beryllium walls. During the current quench, significant vessel forces can occur due to halo currents I_{halo}; however, these are found to fall reliably below a boundary of (halo current fraction times halo current peaking factor) < 0.7 both experimentally and numerically. Numerical simulations indicate that runaway electrons (REs) could cause serious damage to hard-to reach components in ITER, making their suppression a high priority. During the current quench, less than 20% of the density required for collisional suppression of REs appears to have been achieved. Collisional suppression of REs may have been achieved, however, in full-current RE beams with gas injection.

PACS numbers: 52.55.Fa (tokamaks), 52.55.Rk (power exhaust)