

Comprehensive control of resistive wall modes in DIII-D advanced tokamak plasmas

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Abstract. The resistive wall mode (RWM) and neoclassical tearing mode (NTM) have been simultaneously suppressed in the DIII-D for durations of over 2 seconds at beta values 20% above the no-wall limit with modest electron cyclotron current drive (ECCD) and low plasma rotation. The achieved plasma rotation was significantly lower than reported previously. However, in this regime where stable operation is obtained, it is not unconditionally guaranteed. Various MHD activity, such as edge localized modes (ELMs) and fishbones, begins to couple to the RWM branch near the no-wall limit; feedback is useful to improve the discharge stability to such perturbations. Simultaneous operation of slow dynamic error field correction and fast feedback suppressed the ELM-induced RWM at high beta. This result implies that successful feedback operation

requires careful control of residual RWMs, which respond dynamically to a small-uncorrected error field near the no-wall beta limit. These findings are extremely useful in defining the challenge of control of RWM and NTM in the unexplored physics territory of burning plasmas in ITER.

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