Resistive wall mode stability in high beta plasmas in DIII-D and JET

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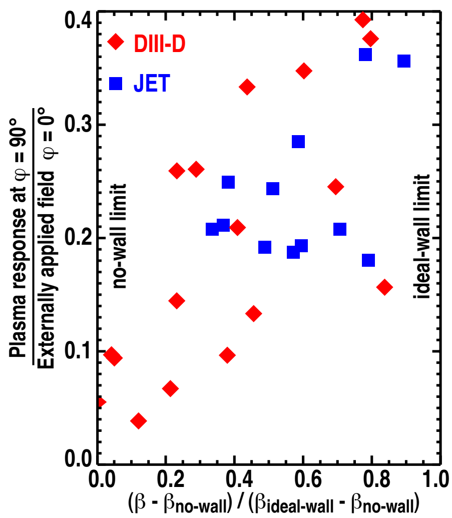
A quantitative comparison of resistive wall mode (RWM) stability in rotating high-β plasmas has been carried out in both the DIII-D and the JET tokamaks. The JET configuration with similar safety factor and pressure profiles has been developed in DIII-D, providing plasmas with the same ideal MHD stability properties but different wall properties, notably a different plasma-wall distance and a different characteristic decay time for wall eddy currents [H. Reimerdes, et al., Bull. Am. Phys. Soc. **49**, 142 (2004)]. The stability is studied passively by measuring the critical rotation required for RWM stability, Ω_{crit}, and actively by probing the plasma with externally applied resonant, $n = 1$ magnetic fields. In both devices the value of Ω_{crit} at the $q = 2$ surface is found to be of the order of a percent of the local inverse Alfvén time. Likewise, the resonant field amplification (RFA) of the externally applied field in both devices increases significantly once β is close to or above the no-wall kink limit. Evaluating the RFA at the plasma boundary in plasmas with the same normalized plasma rotation and at the same normalized distance between the no-wall limit, $\beta_{\mathrm{no-wall}}$, and ideal-wall limit, $\beta_{\mathrm{ideal-wall}}$, results in quantitative agreement (see Figure). The apparent independence of the RWM stability from the wall properties shows that the stabilization of the RWM is provided by the fast bulk plasma rotation relative to the quasi-static magnetic perturbation of the mode, whereas the position of the wall sets the ultimate, ideal-wall β-limit and the conductivity of the wall only prevents the mode from rotating with the bulk plasma.



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