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EX/P7-20: L-H Power Threshold, Pedestal Stability and Confinement in JET with a Metallic Wall

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After the change-over from the Carbon-Fibre Composite (CFC) wall to an ITER-like metallic wall (ILW) the baseline type I ELMy H-mode scenario has been re-established in JET with the new plasma-facing materials Be and W. A key finding for ITER is that the power required to enter H-mode has reduced with respect to that in JET with the CFC wall. In JET with the ILW the power threshold to enter H-mode (PL-H) is below the international L-H power threshold scaling P_Martin-08. The minimum threshold is P_L-H=1.8MW compared to P_Martin-08=4MW with a pedestal density of nped=2x10^19m^-3 in plasmas with I_p=2.0 MA, B_t=2.4T. However the threshold depends strongly on density; using slow ion cyclotron heating (ICRH) power ramps P_L-H varies from 1.8 to 4.5MW in a range of lower and upper plasma triangularity (delta_L=0.32-0.4, delta_U =0.19-0.38).
Stationary Type I ELMy H-mode operation has been re-established at both low and high triangularity with I_p≤ 2.5MA, q_95=2.8-3.6 and H_98≤1. The achieved plasma collisionality is relatively high, in the range of 1< nu_eff<4 due to the required strong gas dosing. Stability analysis with the linear MHD stability code ELITE show that the pedestal is marginally unstable with respect to the Peeling Ballooning boundary. Due to the stabilising effect of the global pressure Beta_N on the pedestal stability, a strong coupling between core and edge confinement is expected. Indeed in an H-mode profile database comparison with 119 CFC- (0.1< nu_eff<1) and 40 ILW-H-modes a strong coupling of the core versus edge confinement is found, independent of wall material. In addition, the pedestal predictions using the EPED predictive pedestal code coincide with the measured pedestal height over a wide range of normalised pressure 1.5< Beta_N<3.5.
Due to the strong core-edge coupling, beneficial effects of core profile peaking on confinement are weak in the database comparison. However, differences in the individual temperature and density profile peaking occur across the database. When collisionality is increased from nu_eff=0.1 to 4, the density peaking decreases from R/L_ne=4 to 0.5 but is compensated by an increase in temperature peaking from R/L_Te = 5-8, offering a challenge for micro turbulence-transport models.

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