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Pedestal Confinement and Stability in JET-ILW ELMy H-Mode Scenarios

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The pedestal confinement of JET-ILW H-modes is presented and their stability investigated in the framework of P-B stability and the predictive code EPED. The changes in wall composition from C to Be/W point to the possible role of neutral recycling, low-Z impurities and scrape-off-layer physics in pedestal stability, highlighting the need for refinement of models predicting the pedestal height. Local linear gyro-kinetic analysis of JET pedestals finds them stable against KBMs due to the large bootstrap current. pPED increases rapidly with power and the pressure gradient is in agreement with limits set by finite-n P-B instabilities both at high and low beta. In low delta, low beta H-modes the energy confinement is reduced due to higher deuterium fuelling than in JET-C, to avoid high W influxes into the core plasma. Changes in deuterium recycling from JET-C to JET-ILW may also play a role in cooling the pedestal. When the effective recycling is reduced good confinement can be recovered and the operation point is at the P-B stability boundary. In high delta, low beta H-modes a further degradation in energy confinement is observed compared to JET-C, due to reduced pPED. The pedestal structure at the end of the ELM cycle varies from narrow and steep at low fuelling to wide and shallow at high fuelling, challenging the EPED model, which does not predict a variation in pedestal width at fixed pPED. At low beta plasma shaping does not affect pedestal confinement. This is consistent with the P-B model, predicting little or no improvement in pPED with delta at high collisionality, due to reduction in edge bootstrap current. In high beta hybrid H-modes pPED is 30% higher than at low delta, increasing more rapidly with power. The reduction in energy confinement of low beta, high delta H-modes can be compensated by nitrogen seeding. The P-B stability at the end of the ELM cycle is resumed, with the increase in pPED being due to broadening of the pedestal pressure width at constant gradient. The mechanism underlying this improvement in pedestal stability with nitrogen seeding is not yet understood and challenges current predictive pedestal models.

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