Mixed hydrogen-deuterium plasmas on JET ILW

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Abstract:

A study of mixed hydrogen-deuterium H-mode plasmas has been carried out in JET-ILW to strengthen the physics basis for extrapolations to JET D-T operation and to support the development of strategies for isotope ratio control in future experiments. Variations of input power, gas fuelling and isotopic mixture were performed in H-mode plasmas of the same magnetic field, plasma current and divertor configuration. The analysis ofthe energy confinement as a function of isotope mixture reveals that the biggest change is seen in plasmas with small fractions of H or D, in particular when including pure isotope plasmas. To interpret the results correctly, the dependence of the power threshold for access to type-IELMing H-modes on the isotope mixture must be taken into account. For plasmas with effective mass between 1.2 and 1.8 the plasma thermal stored energy (W_{th}) scales as$m_{0.1eff}$, which is weaker than that in the ITER physics basis, IPB98 scaling. At fixed stored energy, deuterium-rich plasmas feature higher density pedestals, while the temperature at the pedestal top is lower, showing that at the same gas fuelling rate and power level, the pedestal pressure remains constant with an exchange of density and temperature as the sotope ratio is varied. Isotope control was successfully tested in JET-ILW by changing the isotope ratio throughout a discharge, switching from D to H gas puffing. Several energy confinement times (300 ms) are needed to fully change the isotope ratio during a discharge