Connecting recent JET isotope L-H transition studies to ITER H-mode access in new baseline scenarios

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To achieve H-mode access, the power coupled to the plasma (P_{loss}) must exceed a given threshold (P_{L-H}). In current devices and prior to the α-heating ramp-up in reactor-like devices, P_{loss} relies only on auxiliary heating systems. ITER new experimental strategy, designed to accelerate and secure the path to the nuclear phase, envisage diverse isotope plasmas and mixtures with varying levels of T and incremental increases in auxiliary power, featuring a full W wall from the beginning. Successful ITER's operation does require H-mode access. Over the past decade, JET has undertaken several experimental campaigns dedicated to studying ITER-relevant dependencies of P_{L-H}, including a comprehensive isotope plasma scan. P_{L-H} and the density at which it is minimum ($n_{e,min}$) are shown to decrease in JET with the plasma effective mass. P_{L-H} and $n_{e,min}$ also decrease with plasma current, with a correlation observed between $n_{e,min}$ and the Greenwald density fraction. This suggests that, in the pre-DT phases of ITER operation, H-mode access may only be achieved at densities closer to $n_{e,min}$, lower magnetic fields and plasma currents. Possibly, density reduction in ITER will face limitations in Neutral Beam Injection (NBI) power due to shine-through risk mitigation. To address this physics challenge, wide-range parameter scans have been performed using IMAS numerical simulations to investigate the operability of NBI in ITER plasmas. In JET NBI-heated DD and DT plasmas with dominant ion heating at moderate NBI energies of ~ 0.1 MeV, the role of ion heat flux in determining the existence of $n_{e,min}$ is not evident. With larger beam injection energies and strong wave-heating, ITER will be characterized by electron-heated plasmas, though with NBI input torque comparable to that of JET. This contribution presents recent findings from JET concerning L-H transitions and $n_{e,min}$ existence in diverse isotope plasmas and mixtures. The presentation discusses then the correlation of these findings with ongoing numerical modelling efforts aimed at characterizing ITER operational space, with a specific focus on evaluating NBI power availability in low-density plasmas.