Isotope mass dependence and physics of internal transport barrier trigger and sustainment in JET with Be/W wall

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In view of ITER and future fusion reactors, where internal transport barriers (ITBs) may form spontaneously, there is a need to fully understand the physics of ITB trigger and sustainment in order to avoid ITBs or control their strength. For the first time on JET with metallic wall, we reveal the importance of the main ion isotope mass (A_{eff}) on ITB triggering and strength by comparing a unique dataset of discharges performed in D, T and D-T. First-principle calculations of the reduction of anomalous transport with different isotopes are provided to shed light on the underlying physics. The JET-ILW D-T ITB scenario (3.4 T / 2.7 MA, q_{95} ~ 3.8, $n_e \leq 4$ x10^{19} m^{-3}, $T_{i,core} \geq 10$ keV, q_0 >1) had auxiliary heating from NBI only. The optimised q-profile in the phase prior to full NBI likely facilitates the transition to improved core thermal ion and electron confinement, as indicated by a semi-empirical ITB transport model, which combines magnetic and *ExB* rotation shear effects. The ITB appears to be triggered at the location of the plasma q = 2 surface, as observed in JET with C wall. After ITB onset, the density profile becomes very peaked, primarily due to a reduction in pedestal density ($n_{e,PED}$). A clear ITB is observed at mid-radius in both ion and electron channels. A significant impact of A_{eff} on ITB access and strength is observed: the ITB is more easily triggered (namely, at lower NBI power) and, once fully developed, has its foot at a larger radius in T than in D. With fully developed ITB, the core ion heat diffusivity χ_i is lower for T than D and over a wider plasma volume, reaching neo-classical values. GENE and CGYRO simulations of the core plasma are ongoing to understand the impact of A_{eff} on ITB trigger and strength, as well as the roles of magnetic and toroidal rotation shear, fast ion and thermal ion density and their interplay with respect to ITB formation. The discharge phase with ITB is correlated with a transition to a pedestal with 'small/high frequency ELMs' and strong decrease in $n_{e,PED}$. The pedestal density of plasmas with ITB decreases with A_{eff} from D to T, opposite to what observed in type I ELMy H-modes. GENE simulations of the ITB plasmas low-density pedestal are on-going to identify the dominant micro-instabilities at play and assess the isotope dependence of pedestal heat and particle transport. A key question is whether low $n_{e,PED}$ and absence of type I ELMs are necessary to trigger the ITB or if the formation of an ITB leads to degradation of the pedestal pressure gradient. Intrinsic impurities are Be, W and Ni. Core W and Ni impurity transport is explained with NEO predictions. The complex interplay of high Mach number (M_ϕ ~ 0.6) enhancing impurity screening at low plasma collisionality, but enhancing inward convection with increasing Z_{eff}, regulates the high and mid-Z impurity dynamics. Sensitivity scans on the gradients of the driving parameters,∇T_i and∇n_e, within experimental uncertainties, are carried out to enhance confidence in the model predictions.