The isotope effect on the detachment density in JET-ILW
Ohmically confined plasmas

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Studies in JET with the ITER-like wall (JET-ILW) Ohmic plasmas show that the density range, in which the partial detachment at both divertor targets is accessible, is affected by the hydrogen isotope species as well as by the divertor geometry. These studies are consistent with previous research showing that the detachment onset density for different hydrogen species in JET with the carbon wall (JET-C) scales inversely with the ion mass for vertical target (VT) configuration L-mode discharges [1]. The isotope effect on the detachment density was reassessed for hydrogen and deuterium plasmas in the vertical and horizontal target (HT) configurations. The density of the detachment onset in the HT configuration for the deuterium discharges is 10\% lower than for the hydrogen at the outer target (OT), while in the VT configuration the isotope effect is stronger (30\%) and affects detachment onset density at both targets. Simulations with the EDGE2D-EIRENE code [2,3] showed that the deuterium HT cases have 50\% higher neutral densities. The pumping plenum conductance depends on the thermal velocity of the molecules and causes the difference in neutral densities. Due to the louvre and JET subdivertor geometry, the probability of recycled particles from the inner target (IT) to reach the cryopump via IT subdivertor entrance is close to zero. The probability to reach the cryopump for the recycled particles from the OT is approximately 20\%. The poloidal drift affects the magnitude of the isotope effect by moving particles from the OT to the IT in case of the normal $B_T$ (weaker isotope effect) or towards the OT and the cryopump in the reversed $B_T$ (stronger isotope effect). Experiments with deuterium exposed 30\% higher radiation losses than with hydrogen. Simulations showed that $P_{\text{rad}}$ difference is caused both by higher neutral densities and by higher sputtering rates in the deuterium cases.

In the HT configuration, the molecules at the IT can not be pumped, whereas, in the VT configuration, the private flux region connects both targets with the OT subdivertor entrance. The strike-point position in the VT configuration affects the neutral densities in the divertor and the isotope effect magnitude due to the curvature of the target plates.