Pedestal performance of JET Ne-seeded D and D-T discharges

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Abstract: ITER baseline scenario for burning plasma conditions (Q_{DT} = 10) requires the introduction of low-Z impurity seeding, such as neon [1]. Recent research on JET focused on Ne seeding showed that increasing Ne concentration at favourable conditions leads to a performance improvement at stationary conditions without significant ELM activity using deuterium as fuel [2]. The aim of presented work consists in the assessment of the impact of Ne seeding on pedestal behaviour and its structure of JET high-power and high performance (I_p=2.5-3.0 MA, P_{in} up to 35 MW) discharges mostly from DTE3 campaign with comparison to DTE2 campaign results [3].

Characterization of pedestal properties of DTE3 discharges both in D and D-T with respect to increasing Ne concentration consistently shows an increase of pedestal temperatures ($T_{e,i}$) while electron density n_e decreases for different fueling rate and various D and D-T fuel mixtures. The total pedestal pressure is rising, however, significant widening of both $T_{e,i}$ and n_e pedestals is observed, which leads to lower pedestal pressure gradient. Due to these effects the plasma operation point is stabilized against Peeling-ballooning (PB) modes with introduction of Ne seeding. However, marginal destabilization of ballooning modes resulting in PB boundary shift towards lower values of normalized pressure gradient is observed. By improving discharge performance partial recovery of the operation point approaching PB boundary was observed. This was supported by results obtained from DTE2 in both D and D-T discharge datasets. Agreement with the scaling of the width of pressure pedestal Δ_{pe} with $\sqrt{\beta_{ped}^{pol}}$ was observed for the unseeded cases. The effect of increasing pedestal width with Ne seeding, endorsed by EuroPED calculations presented here, suggests to increase the scaling coefficient to match the experiment [3].

References

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