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Impact of impurity seeding on pedestal structure in ASDEX Upgrade and Alcator C-Mod

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Pedestal data from ASDEX Upgrade (AUG) and Alcator C-Mod are presented. Scans of impurity content have been performed in both machines, reaching states where the outer divertor is partially or fully detached. The impact of impurity seeding on pedestal structure is compared. In the analysed scenarios, nitrogen seeding increases the achievable pedestal top pressure in AUG, while excessive seeding leads to a decrease of the pedestal pressure in C-Mod as the outer divertor progresses to a fully detached state. Both of these effects are associated with a shift of the peak edge density gradient location; an inward shift (AUG) allows a higher pedestal pressure, while an outward shift (C-Mod) decreases the stability limit.

The origins of these shifts are analysed in both machines, paying particular attention to the role of the SOL and the radiation associated with impurity seeding. Data from AUG highlight the importance of high density structures in the high-field side SOL in influencing the peak density gradient location, while the degradation in the C-Mod scans is independent of such a structure. This implies that mitigating these high density structures does not guarantee optimal pedestal and global confinement. Additional scans from AUG altering the heating power, seeded impurity and magnetic geometry (lower single null and quasi-double null) are also presented, demonstrating the dominating effects that the SOL can have on the pedestal. Pedestal modelling using the SOL boundary conditions from experiments is also presented, helping to form an understanding of the leading processes affecting pedestal stability.

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