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Snowflake Divertor Configuration Effects on Pedestal Stability and Edge Localized Modes in NSTX and DIII-D

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Analyses of snowflake (SF) divertor experiments in NSTX and DIII-D show that the SF divertor can increase edge magnetic shear and modify pressure profiles of the H-mode pedestal enabling pedestal stability control while maintaining good H-mode confinement (H_98y2˜1). The scrape-off layer (SOL) geometry modifications lead to reduced peak temperature of plasma-facing components (PFC) via significant additional dissipation and partitioning of ELM heat fluxes between additional strike points. In NSTX, where pedestal stability operating condition was close to the kink/peeling boundary with the standard divertor and lithium conditioning, the SF divertor formation led to destabilization of large ELMs and a concomitant reduction of carbon concentration by 30-50% in the pedestal. In DIII-D, kinetic profiles were weakly affected by the SF configuration; a reduction in energy lost per ELM was observed and the ELM frequency was slightly increased. Planned linear MHD stability calculations will help understand the SF effects that appeared to depend on pedestal stability operating point. A reduction of ELM-induced divertor peak temperature Tsurf (and heat flux) in the SF divertor (cf. standard divertor) was observed in both NSTX and DIII-D experiments. The divertor ELM energy density in the SF configuration (cf. standard divertor) is reduced due to a combination of increased ELM ion transit time, power splitting between additional SF strike points, and additional dissipative losses, which are especially large in the high-density radiative SF divertor. The observed pedestal and SOL modifications are generally beneficial, and can be further developed into ELM control scenarios and ELM mitigation techniques.
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