Comparison of L-mode regimes with enhanced confinement by impurity seeding in JET and DIII-D

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Abstract. Impurity seeding in both the Joint European Torus (JET) and DIII-D tokamaks has produced L-mode discharges with confinement enhancements comparable to H-mode and a near doubling of the core ion temperature when compared to similar unseeded discharges. Although Z_{eff} increases with the neon injection, the total neutron rate is as high, or higher, than reference discharges and the calculated thermal neutron rate

increases dramatically in both devices. Modeling with the gyrokinetic simulation (GKS) code shows a reduction in low k turbulence growth rates with neon injection decreasing to less than the $\mathbf{E}\times\mathbf{B}$ shearing rate, consistent with stabilization of ion temperature gradient (ITG) modes in both JET and DIII-D. Reductions in ion thermal diffusivity are also observed with impurity seeding. Neoclassical m/n=3/2 tearing modes limit the duration of best performance in DIII-D with neon injection, while n=1 and n=2 magnetohydrodynamic (MHD) modes limit the performance in JET.