Enhanced H-mode pedestals with lithium injection in DIII-D

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Abstract. Periods of edge localized mode (ELM)-free H-mode with increased pedestal pressure and width were observed in the DIII-D tokamak when density fluctuations localized to the region near the separatrix were present. Injection of a powder of 45 μm diameter lithium particles increased the duration of the enhanced pedestal phases to up to 350 ms, and also increased the likelihood of a transition to the enhanced phase. Lithium injection at a level sufficient for triggering the extended enhanced phases resulted in significant lithium in the plasma core, but carbon and other higher Z impurities as well as radiated power levels were reduced. Recycling of the working deuterium gas appeared unaffected by this level of lithium injection. The ion scale, $k_\theta \rho_s \sim 0.1$–0.2, density fluctuations propagated in the electron drift direction with $f \sim 80$ kHz and occurred in bursts every ~1 ms. The fluctuation bursts correlated with plasma loss resulting in a flattening of the pressure profile in a region near the separatrix. This localized flattening

allowed higher overall pedestal pressure at the peeling-ballooning stability limit and higher pressure than expected under the EPED model due to reduction of the pressure gradient below the "ballooning critical profile". Reduction of the ion pressure by lithium dilution may contribute to the long ELM-free periods.