ABSTRACT

The range in density and collisionality for which resonant magnetic perturbations (RMPs) are effective in suppressing edge-localized modes (ELMs) in the presence of a radiating divertor was found to be modest for representative H-mode plasmas in DIII-D. When deuterium and argon gas injection rates were increased during RMP, both the electron collisionality in the pedestal (ν_e^*) and the maximum electron pressure gradient ($\nabla P_{\rm e,MAX}$) in the pedestal also increased. As $\nabla P_{\rm e,MAX}$ approached values consistent with the peeling-ballooning stability limit, as determined by edge stability analysis, ELMing activity re-emerged. For cases with the same injected neutral beam power, differences in argon accumulation in the main plasma between RMP and similar non-RMP ELMing H-mode plasmas were relatively small, with the RMP cases somewhat higher (~20–25%). Similar reductions in the core concentration of injected argon with an increasing rate of deuterium injection were observed in both RMP and non-RMP cases, suggesting that important features found in detailed UEDGE divertor and scrape-off layer analysis reported previously for *non*-RMP radiating divertor plasmas could also carry over to RMP plasmas. Although complete ELM-suppression in RMP radiating divertor plasmas in DIII-D was only accessible over a limited range in pedestal density and collisionality, significant ELM mitigation with heat flux reduction was possible over a wider range. Comparing RMP radiating divertor discharges after the re-appearance of ELMing activity during gas puffing with a standard ELMing plasma for cases with the same pedestal density reveals that the RMP discharges have (1) lower average electron temperature at the midplane separatrix, implying lower average electron temperature at the divertor target, (2) lower *time-averaged* peak heat flux, and (3) lower *transient* peak heat flux from ELMs even at the same pedestal collisionality.