Abstract Submitted
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Lithium Cooling in the Tokamak Scrape-off Layer ZHAONAN QU, Princeton University, ROBERT GOLDSTON, Princeton Plasma Physics Laboratory — We used collisional radiative model data from the ADAS atomic physics database to investigate the cooling rate of lithium in comparison with beryllium, carbon and nitrogen. The model data incorporate collisional ionization and recombination, collisional excitation, and both radiative and collisional de-excitation. The last is important for Li and Be at the high densities and low temperatures expected close to the divertor surface. The charge state distribution is determined as a function of n_e and T_e by assuming a steady source of neutrals balanced by losses due to an effective confinement time, τ, the same for all charge states. We then calculate L_z, the cooling rate, and the total cooling energy per particle injected. For τ in the range of $10^{-4} - 10^{-2}$ sec with $n_e \sim 6\ 10^{19}/\mathrm{m}^3$ and $T_e \sim 100$eV, we find the cooling energy per Li injected to be $\sim$ 500eV. Following Post [1] we have integrated the calculated cooling power along a field line, assuming pressure balance. We corrected the Z_{eff} dependence of κ_{0e} and included the local density dependence of the charge-state balance. We find that, at fixed fuel depletion, all four species are similar in reduction of $q_{||}$ at upstream temperatures $\sim$ 100 eV, but C and N give greater reductions than Li and Be at lower upstream temperatures. For $\tau \sim 1$ msec and fuel depletion of $\sim$ 30%, the reduction in $q_{||}$ at the divertor plate in cases corresponding to characteristic NSTX experimental conditions can easily equal the expected total $q_{||}$. This work supported by the Princeton Environmental Institute and DOE Contract # DE-AC02-09CH11466.

[1] D.E. Post, J. Nucl. Mater. 220-222 (1995) 143.

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