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Modeling a Lithium Vapor Box Divertor and Resulting Ion Flows on NSTX-U using SOLPS

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Divertor detachment with medium-Z impurities seeded through gas puffing can entail radiating regions within the last closed flux surface. The lithium vapor box divertor seeks to detach via near-target low-Z lithium evaporation with the result that such a radiating region does not form. We show SOLPS-ITER predictions for the effect of a lithium vapor box divertor on NSTX-U. Past work has shown the lithium vapor box is capable of reducing 65 MW/m^2 of perpendicular heat flux to below 5 MW/m^2 for upstream lithium densities equal to a few percent of the electron density. Those results are tested for their sensitivity to choices of transport coefficients, recycling coefficients and puffing location. Even when transport coefficients are reduced to provide less particle flow from the core and higher heat flux at the target, sub-10 MW/m2 solutions are available to the lithium vapor box, as compared with an unmitigated perpendicular heat flux of 92 MW/m^2. Private Flux Region (PFR) fuel puffing is seen to be more effective at reducing upstream lithium content while Common Flux Region (CFR) fuel puffing is seen to be more effective at heat flux reduction. The efficacy of both puffing locations is increased by increases to the divertor recycling coefficient. Increased recycling at walls upstream of the baffles improves the effect of the puffs, leading to cases with lower upstream lithium content for less heat flux.

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