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## EX/P5-27: The Effects of Increasing Lithium Deposition on the Power Exhaust Channel in NSTX

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Previous measurements on the National Spherical Torus Experiment (NSTX) demonstrated peak, perpendicular heat fluxes,  $q_{dep, pk} \leq 15$  MW/m<sup>2</sup> with an inter-ELM integral heat flux width,  $\lambda_{q, int} \sim 3\text{--}7$  mm during high performance, high power operation (plasma current,  $I_p = 1.2$  MA and injected neutral beam power, PNBI = 6 MW) when magnetically mapped to the outer midplane. Analysis indicates that  $\lambda_{q, int}$  scales approximately as  $I_p^{-1}$ [1]. The extrapolation of the divertor heat flux and  $\lambda_{q, int}$  for NSTX-U are predicted to be upwards of 24 MW/m<sup>2</sup> and 3 mm respectively assuming a high magnetic flux expansion,  $f_{exp} \sim 30$ , PNBI = 10 MW, balance double null operation and boronized wall conditioning.

While the divertor heat flux has been shown to be mitigated through increased magnetic flux expansion[1], impurity gas puffing[2], and innovative divertor configurations[3] on NSTX, the application of evaporative lithium coatings in NSTX has shown reduced peak heat flux from 5 to 2 MW/m<sup>2</sup> during similar operation with 150 and 300 mg of pre-discharge lithium evaporation respectively. Measurement of divertor surface temperatures in lithiated NSTX discharges is achieved with a unique dual-band IR thermography system[4,5] to mitigate the variable surface emissivity introduced by evaporative lithium coatings. This results in a relative increase divertor radiation as measured by the divertor bolometry system. SOLPS[6] modeling of heavy lithium evaporation discharges will be presented to elucidate divertor operation in this scenario. While the measure divertor heat flux is reduced with heavy lithium evaporation,  $\lambda_{q, int}$  contracts to 3–6 mm at low  $I_p$  but remains constant as  $I_p$  is increased to 1.2 MA yielding  $\lambda_{q, int}$ 's comparable to no lithium discharges at high  $I_p$ . Implications for NSTX-U operation with heavy lithium coatings in the divertor will be discussed.

- [1] T.K. Gray, et al., J. Nucl. Mater. 415 (2011) S360-S364
- [2] V.A. Soukhanovskii, et al., Phys. Plasmas 16 (2009) 022501
- [3] V.A. Soukhanovskii, et al., Nucl. Fusion 51 (2010) 012001
- [4] J-W. Ahn, et. al., Rev. Sci. Instrum. 81 (2010) 023501
- [5] A.G. McLean, et al., submitted to Rev. Sci. Instrum. (2011)
- [6] J.M. Canik, et al., Phys. Plasmas 18 (2011) 056118

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