Measurement of lithium and deuterium on carbon tiles from NSTX

P2-60

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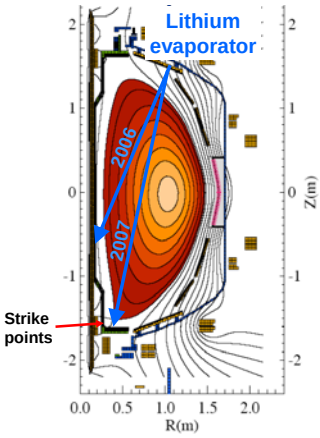
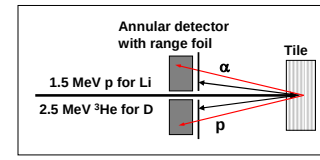
Introduction

- A thermal evaporator was used to coat the wall with lithium in NSTX during 2006 & 2007 run campaigns.
- Lithium improved density control and reduced impurities.
- Tiles were examined by nuclear reaction analysis to determine coverage & depth profiles of lithium and deuterium.





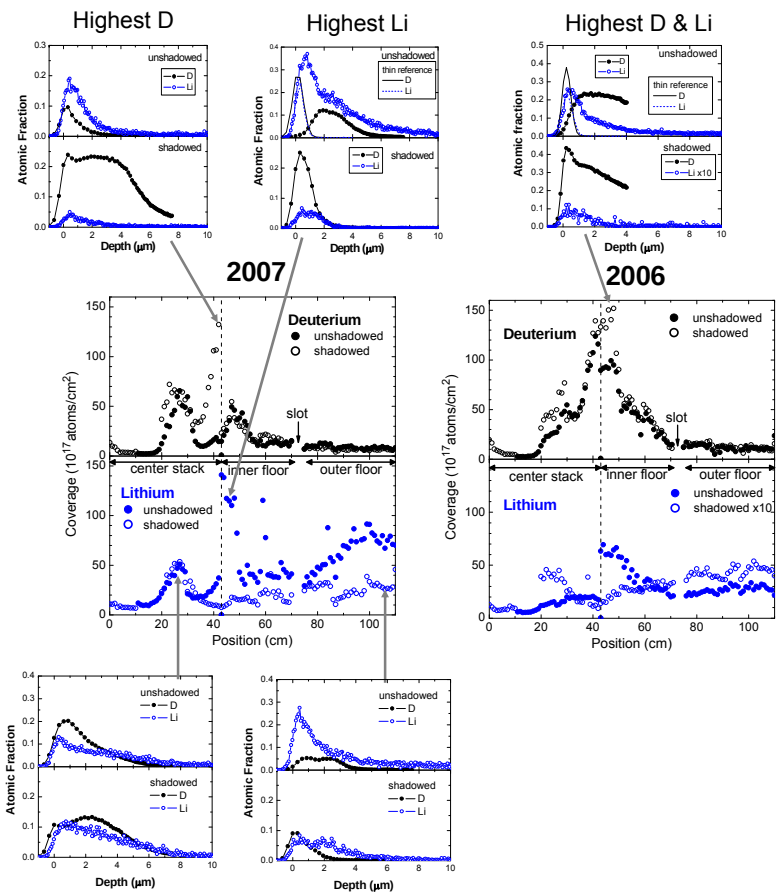
NSTX lithium evaporation campaigns

- Lithium was evaporated from a single source near the top of NSTX resulting in a region shadowed from Li by the center stack.
- **2006** - Li evaporation between discharges, no plasma during Li evaporation. 9 grams Li evaporated (0.4 μm if uniformly distributed).
- **2007** – Li evaporation continuous, ~60% into HeGDC. 93 grams Li evaporated.
- Plasmas during lithium campaigns were high triangularity, lower single null diverted, NBI heated, deuterium, H & L-mode, with strike points & PFZ near the base of the center stack.

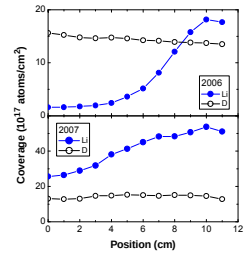
Tile Analysis

- Carbon tiles facing & shadowed from the Li evaporator were examined.
- Concentrations of lithium and deuterium were measured vs depth on 50 tiles by $^{7}Li(p,\alpha)\alpha$ and $D(^{3}He,p)\alpha$ nuclear reaction analysis.
- Particle energy spectra are measured using an annular detector.
- Particle energy varies with depth due to energy loss in the target.
- The energy scale is transformed to a depth scale using known stopping power.
- Yield is transformed to concentration using known NRA cross section. Absolute accuracy of concentration & coverage is ~20%.

Li & D coverage vs position and selected depth profiles



At the Li shadow boundary



Tile from the upper primary passive plate

2007 vs. 2006

- ~12x more Li in shadow
- ~3x more Li out of shadow
- D coverage similar & ~independent of Li

Conclusions

- The Li was within a few microns of the surface, typical of deposited layers, indicating little or no transport by diffusion through the carbon.
- Li coverage was higher on tiles facing the evaporator than on tiles shadowed from it.
- Li coverage was more uniform in 2007 than in 2006 indicating transport by the HeGDC.
- Accumulation of Li near the inner strike point suggests deposition by the plasma.
- D retention is highest near base of the center stack, i.e. near the strike points of the high triangularity plasmas. D retention here was lower in 2007 than in 2006.