

XP on the relation between surface conditions and the duration of lithium conditioning.

XP proposal for the NSTX LRTSG Research Forum Mar 15 – 18th, 2011

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Milestone 12-1 “Investigate the relationship between lithium-conditioned surface composition and plasma behavior.”

Brief description:

- The XP will examine the relationship between surface composition and the duration of the lithium plasma conditioning effect and is central to Milestone 12-1.
- The XP aims to use the MAPP probe to investigate the evolution of surface conditions with and without discharges and with and without successive LiTER intershot conditioning to look for correlations between the change in surface conditions and conditioning effect.

Background:

- In 2010 we often operated LiTER 10 mins between shots (typically @ 10 mg/min each LiTER) and saw a conditioning effect lasting for 2-3 discharges. MAPP surface analysis will allow the first measurements of the role of oxidation by residual gasses, Li intercalation and D diffusion in limiting the duration of the lithium conditioning effect.

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Experimental Plan :

1. MAPP graphite, and Mo samples will be exposed to plasmas with the outer strike point on the LLD and standard LiTER intershot operation 10 mg/min each for ten discharges. Repeated XPS and LEISS analysis will be performed afterwards (5:00 PM – 8:00 PM) to provide baseline spectra of the evolution of surface conditions.
2. A second set of samples will be pre-exposed to the plasma with the outer strike point on the LLD and standard LiTER intershot operation 10 mg/min each for five discharges to condition the surface.
For the next five discharges the samples will be withdrawn during LiTER evaporation but reinserted for plasma exposure. The evolution of the surface will be measured between the next successive five discharges and for 5:00 PM - 8:00 PM by XPS and LEISS (detailed timing will depend on MAPP experience).
3. Continue plasma operations the next day with same samples and use MAPP to measure how much LiTER operation is needed to restore original surface conditions (5 discharges)

Note:

Plan will be refined depending in initial MAPP operational experience and in group and team discussions.

XP may yield insights into potential improvements in LiTER operations.

Alternative LiTER scenarios can be tested in follow up XPs.

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Draft Experimental Plan:

Machine Time Requested:

- Total 25 discharges done over 2 days (to allow detailed analysis of the MAPP data for each case before proceeding to next.)

Minimum useful Machine time: (run days)

- Three sets of 2-3 hour periods.

Special requirements:

- MAPP probe

Operation / Development:

- Will use established discharges with outer strike point on LLD.
- Needs MAPP to be commissioned.

Analysis:

- Compare changes in plasma behavior e.g. confinement, ELMs, D pumping to changes in XPS and LEISS spectra.

Write up for DPP APS meeting and for PSI-2012 presentation.