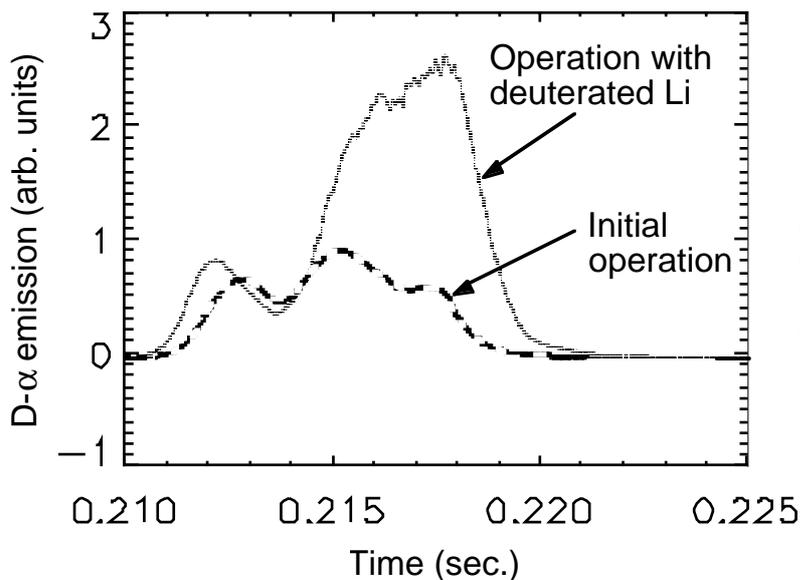


## Initial Experiments with the UCSD Liquid Lithium Limiter In CDX-U

A primary objective of the Advanced Liquid Plasma-facing Surface (ALPS) program is to develop liquid plasma facing systems for devices that operate in advanced, high power density physics regimes. Significant physics and engineering problems need to be addressed before liquid metals can be considered practical for this purpose. As a step toward this goal, the first experiments involving the use of solid and liquid lithium as a plasma limiter in CDX-U have recently begun, utilizing a lithium covered rail 5 cm in diameter, 20 cm long which was developed at UCSD.

The results of the first operation of CDX-U with a solid lithium limiter are shown in the figure below. Here we compare the D- $\alpha$  emission at the limiter surface with a lithium coating which has not been previously exposed to plasma, to the emission from a lithium coating which has been deuterated by exposure to plasma and gas puffing. Note that although recycling is markedly reduced for the case of initial operation with a solid lithium limiter, it is not eliminated. We have not yet observed any condition, for liquid or solid lithium over the  $\sim 20 - 300^\circ \text{C}$  temperature range, for which recycling is completely eliminated. At this point it is unclear whether surface impurities or contact with other plasma facing surfaces may be responsible for the residual recycling.



*Recycling comparison for a "fresh" lithium limiter coating (exposed to a base pressure of  $3 \times 10^{-7}$  T but not deuterated) and a deuterated surface. Discharge line density was identical to 5%; traces are normalized to the plasma current.*

Surface cleanliness has been a significant issue. Glow discharge cleaning (GDC) in an argon glow with the lithium rail limiter serving as the cathode has been found to be reasonably effective at removing visible surface coatings. Deuterium pumping by the limiter is significantly enhanced following an argon glow.

A fully toroidal belt limiter, consisting of a 10 cm wide trough filled with liquid lithium, is being installed in CDX-U. This will increase the lithium surface area to  $1600 \text{ cm}^2$  and the in-vessel volume to approximately 0.5 liter. The purpose of this next step is to investigate how a large lithium surface will affect CDX-U discharges, and study the effects these plasmas will have on the magneto hydrodynamics of the liquid lithium.

Visit <http://w3.pppl.gov/~cdx/> for more information about the CDX-U project. This work was supported by US Department of Energy contract DE-AC02-76-CH0-3073.