

**CDX-U Press Release – APS/DPP Annual Meeting
October 2003**

October 30, Thursday, 2:00 p.m., Kiva Auditorium, Albuquerque Convention Center, Invited Paper RI1.004 – “Liquid lithium experiments in CDX-U” by Dick Majeski (Princeton Plasma Physics Laboratory)

Liquid Lithium Makes Solid Improvement in Fusion Plasmas

Creating a liquid lithium “wall” in fusion reactors could mean better fusion plasmas — and more resilient fusion devices.

For the first time, experiments to investigate the interaction of large surface areas of liquid lithium with plasmas were conducted on the Current Drive Experiment-Upgrade (CDX-U) at the DOE Princeton Plasma Physics Laboratory (PPPL). This device confines hot plasmas in a compact toroidal magnetic bottle, or “spherical torus.” A special tray was installed in the bottom of CDX-U and filled with liquid lithium.

The CDX-U device was then operated with the plasma in contact, or “limited,” with the liquid lithium. Spherical torus machines require a current to be driven in the plasma to produce the confining magnetic field, and to heat the plasma. With the liquid lithium limiter, there was a large increase in the efficiency of driving the current. In addition to the hydrogen fuel, magnetic confinement devices have impurity elements like carbon and

oxygen that can cool the plasma. In CDX-U, these impurities were immediately reduced to negligible levels, due to their absorption by the lithium.

Isotopes of hydrogen are the fuel planned for fusion reactors, and lithium has the attractive property of strongly binding this element. The predicted absorption of the hydrogen by the lithium was also shown in these experiments by the large increase in the rate that the hydrogen fuel had to be added to sustain the plasma. Thus, a lithium wall will completely absorb any hydrogen plasma that reaches it. This prevents the undesirable build-up, at the plasma boundary, of the cool gas that “recycles” back from this first wall.

Using liquid lithium for the interior surface of a fusion machine also offers hope of a better material for reactor walls. A liquid metal “first wall,” for example, cannot be damaged from intense radiation bombardment like a solid material would be. This is because the surface of a flowing liquid can be continuously renewed. Furthermore, liquid lithium has the ability to handle the high heat flux expected to impinge upon the first wall of a fusion reactor.

The significant improvements in plasma performance due to liquid lithium bode well for the use of liquid metals in future fusion reactors.



Contacts

Dick Majeski, PPPL, 609-243-3112, rmajeski@pppl.gov

Bob Kaita, PPPL, 609-243-3275, rkaita@pppl.gov

Further information

“CDX-U Operation with a Large Area Liquid Lithium Limiter” by R. Majeski *et al.*,

Journal of Nuclear Materials, Vol. 313-316, pp. 625-629 (2003)

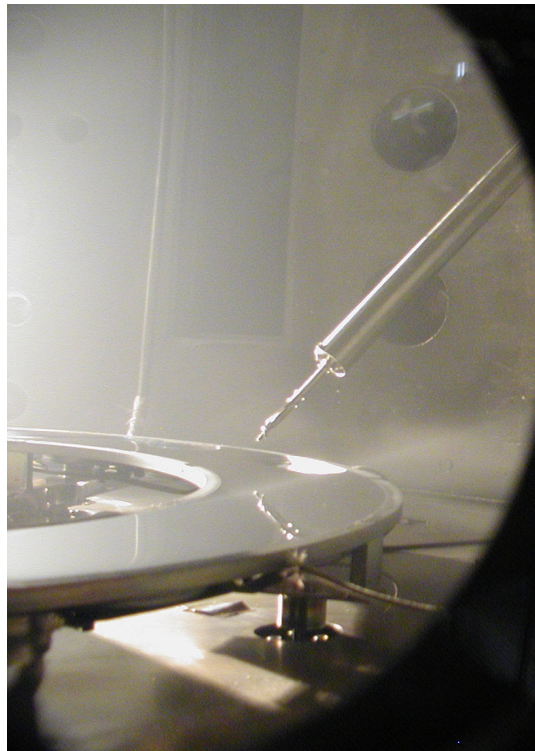


Figure Caption:

Pool of liquid lithium in the tray that encircles the bottom of the CDX-U device. The tip of the liquid-lithium injector, which is removed before plasma operations, is reflected on the shiny surface of the liquid lithium.

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