Hydrogen and helium retention in liquid lithium

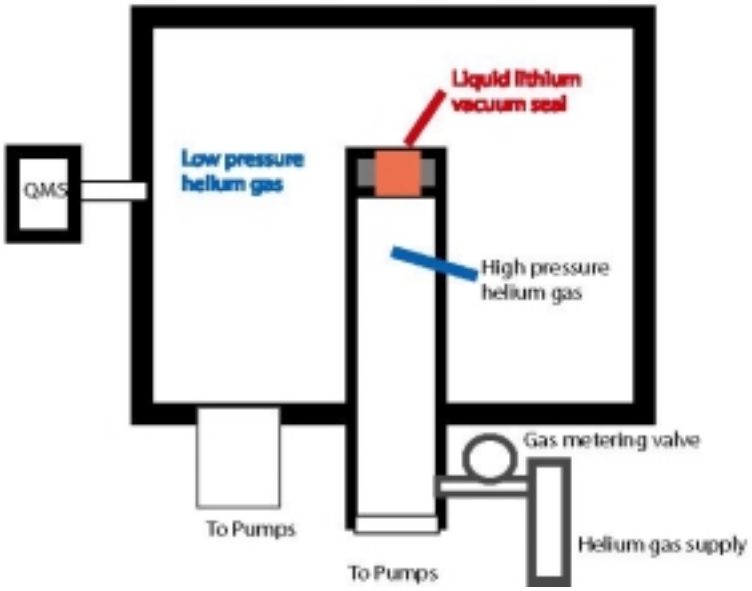
S.C. Luckhardt, M. Baldwin, R. Doerner, and the
UCSD PISCES Group

ALPS/APEX Meeting

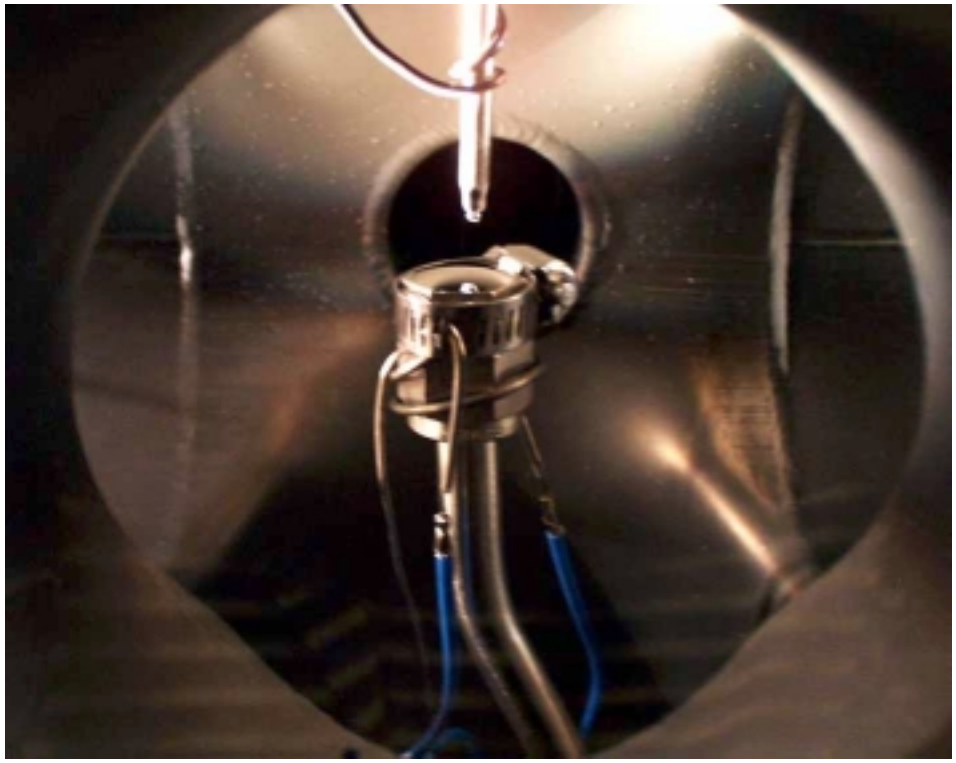
Albuquerque, 11/2000

Liquid lithium vacuum sealing and diffusion experiment
UCSD PISCES Laboratory

1- Liquid lithium metal vacuum sealing test
2- Measurement of helium retention time constant.

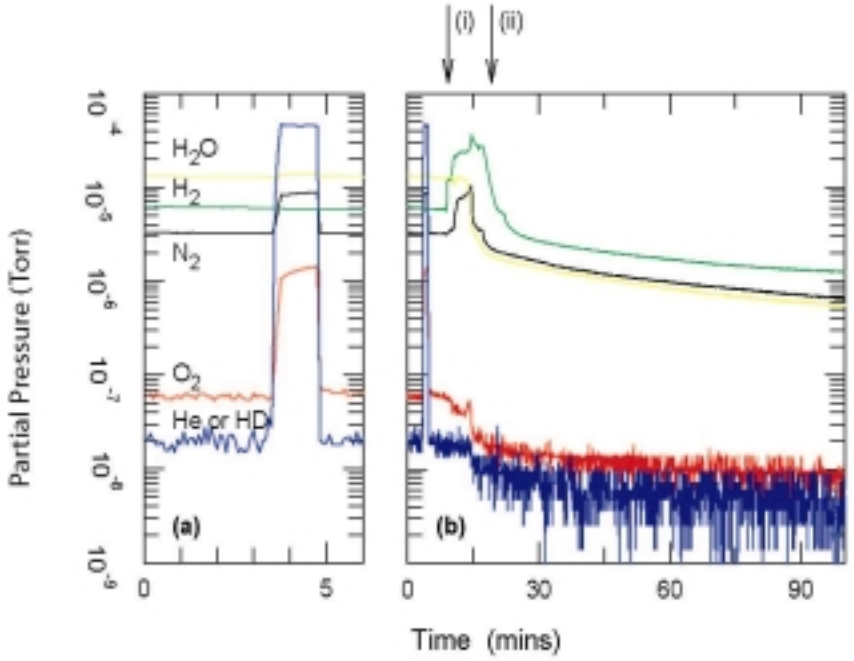


Liquid lithium vacuum seal formed at 500 C and allowed to cool to 300 C (120 C above m.p.). Temperature lowered to prevent vacuum windows from coating with evaporated Li.

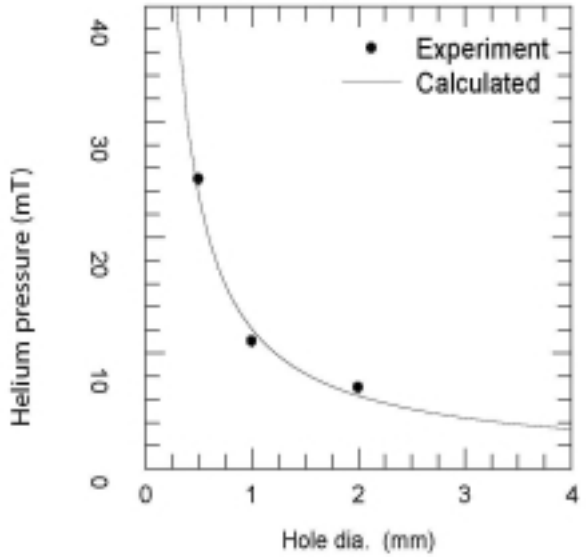


RGA response (a) and (b) time evolution of specific partial pressures with 0.1 Torr He applied to back of seal.

(i) forming seal, (ii) application of He.



Critical pressure for liquid lithium seal rupture agrees with surface tension model.



Solubilities and solution chemistry of liquid alkali metals review by

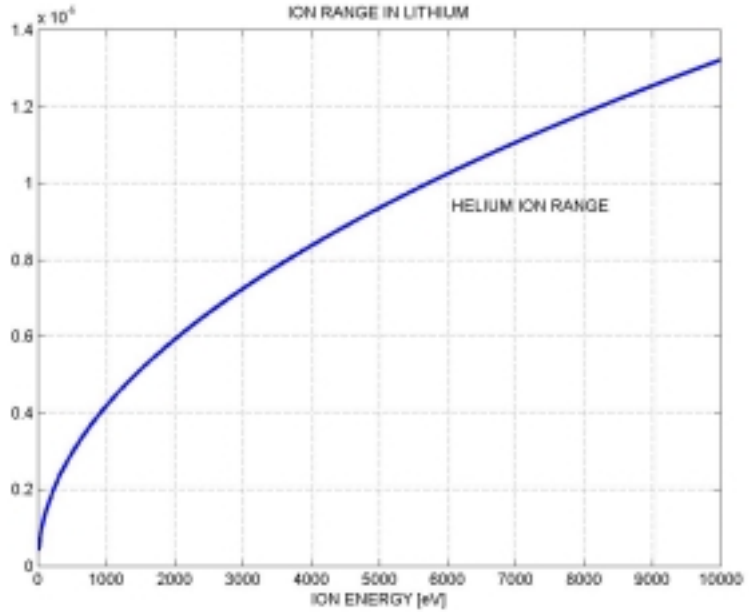
Borgstedt and Guminski, Monatshefte fur Chemie 131 917 (2000).

Liquid lithium solvent:

Helium atom residence time in liquid lithium is given by the diffusive time scale:

$$\tau_{res(E)} = d(E)^2/D_{He}$$

where d(E) is the ion range and D_{He} is the helium diffusivity.



Combining helium atom perimation rates measured on PISCES with Borgstedt, Guminski solubility indicates a diffusivity of approximatley

$D_{He} \sim 10^{-4}$ cm^2/sec.

and

TAU-res ~ 10^{-4} sec.