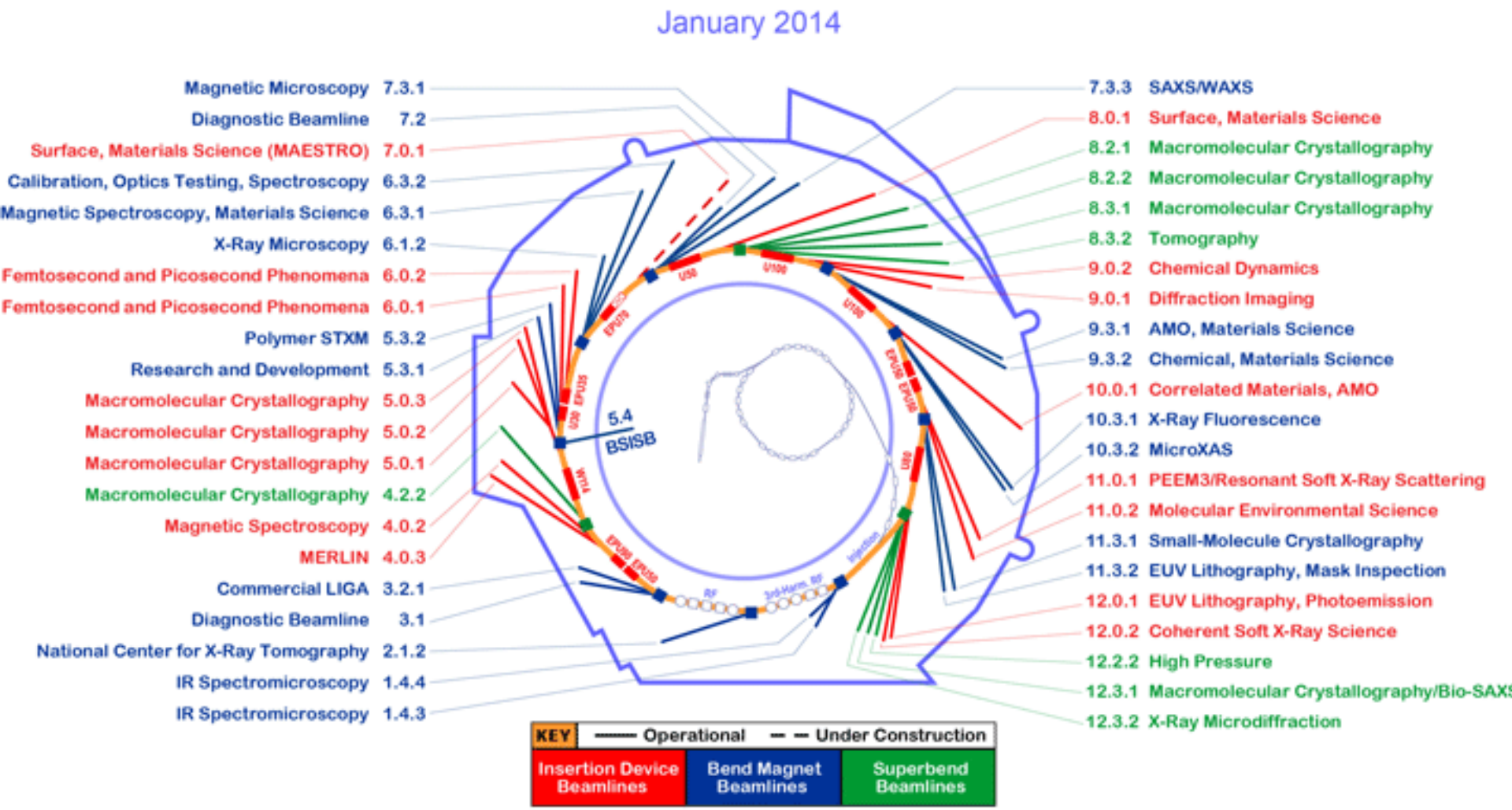
Dula Parkinson

X-RAY IMAGING AT THE ADVANCED LIGHT SOURCE

The ALS has a lot of “beamlines”



YOUR COMPANY
can do experiments at the ALS!

-general user time

-proprietary time

USER GUIDE

How Do I...?

1. Register with the ALS

Register with the ALS by creating an account on ALSHub—the ALS user portal— that provides access to important user tools.

2. Apply for Beam Time

Log in to ALSHub to submit a new proposal or a Beam Time Request (BTR) using an existing active proposal.

3. Establish a User Agreement

Your institute must have a signed agreement with Berkeley Lab before you may do work at the ALS.

4. Get Access to Work Onsite

- New users need to register, and returning users need to update their ALSHub profile at least TWO WEEKS before arriving at the ALS.
- Users arriving out of regular office hours must either have a valid Berkeley Lab ID badge, or have completed registration to be granted access to the ALS.
- Users from T4 countries (Cuba, Iran, Sudan, and Syria) need DOE permission, which can take 4–6 months to obtain, and should register as soon as possible to start the approval process.

5. Complete Experiment Safety Documentation and Review Safety for Users

Log in to ALSHub to create or update safety documentation TWO WEEKS before your planned beam time. Experiments involving any biological material or radioactive material require more review steps so please allow several weeks for these.

6. Complete Online Safety Training

All users are required to register with the ALS and complete their online training before they will be granted unescorted

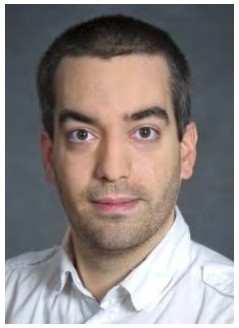
HARD X-RAY TOMOGRAPHY (MICRON-SCALE 3D IMAGING)

X-ray Camera View
Penetrating Power
Multiple Angles

3D Micron-scale imaging

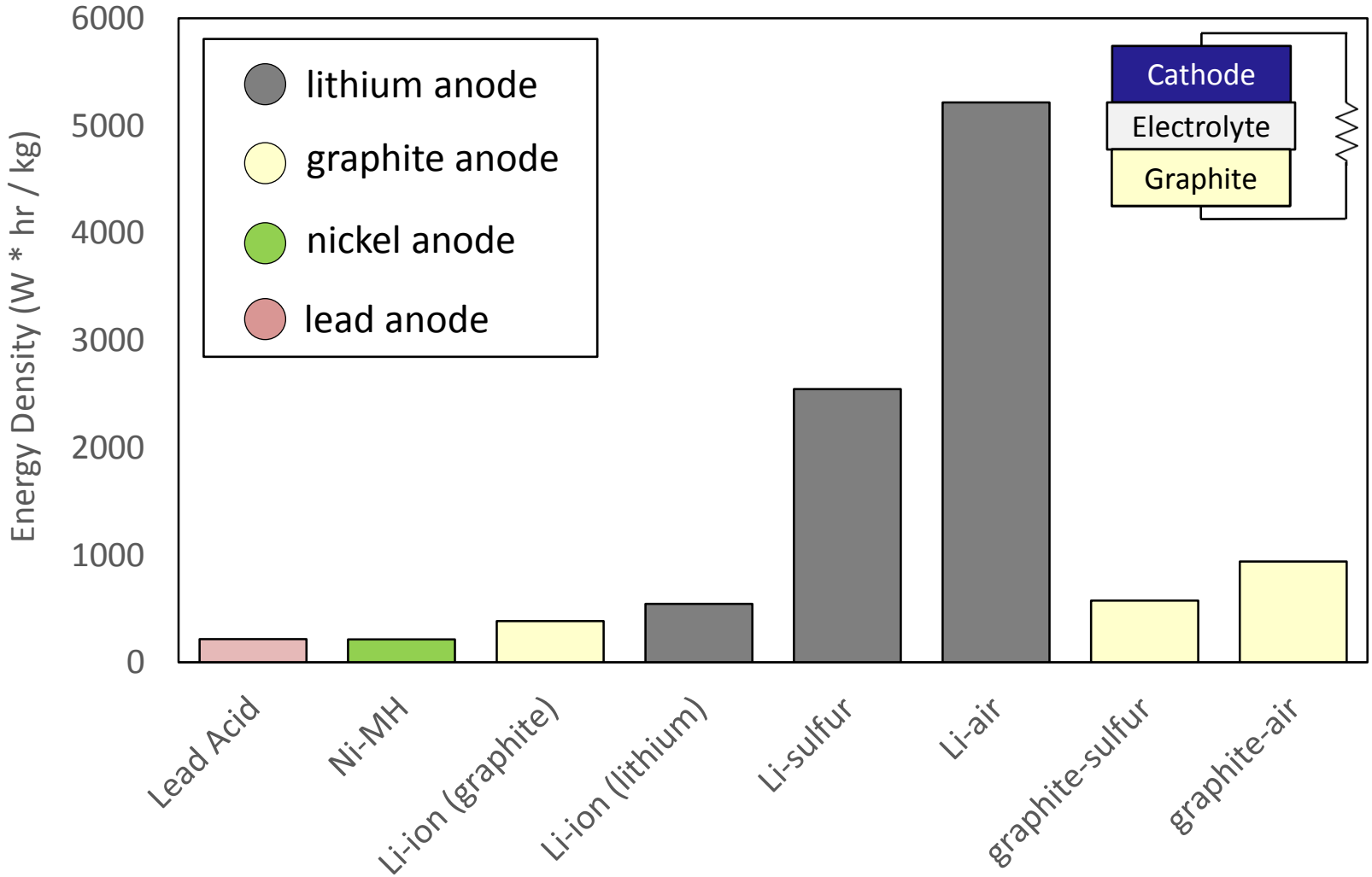
SOLID POLYMER ELECTROLYTE MEMBRANES

Acknowledgements



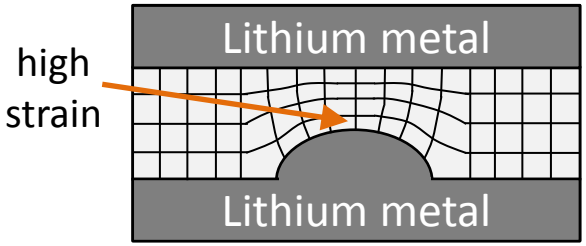
Katherine J. Harry,
Nicole S. Schauser,
Didier Devaux, and
Nitash P. Balsara

Energy density of rechargeable batteries

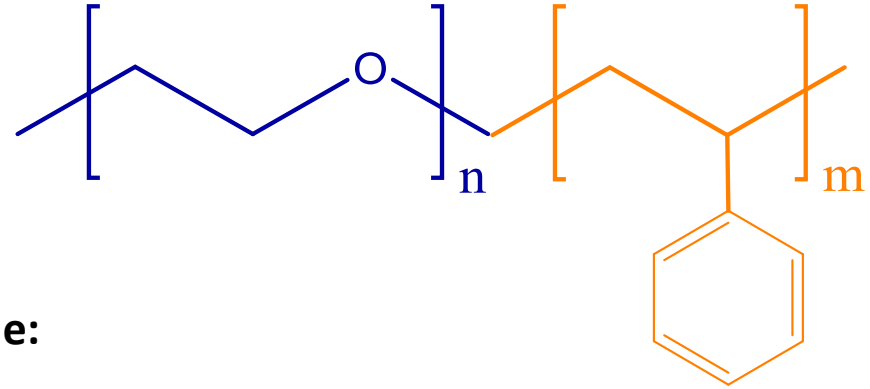


1. N. P. Balsara, and J. Newman, 'Comparing the Energy Content of Batteries, Fuels, and Materials', *Journal of Chemical Education,* 90 (2013), 446-52.

Solid polymer electrolyte membrane



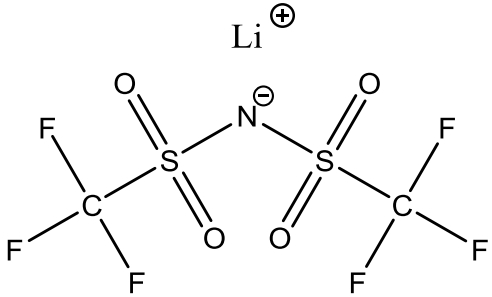
Polyethylene oxide (PEO) **Polystyrene (PS)**



Polymer electrolyte membrane:

- 240-260 kg/mol SEO
- $r = \frac{[Li^+]}{[EO]} = 0.085$
- $T_{operating} = 90\ °C$

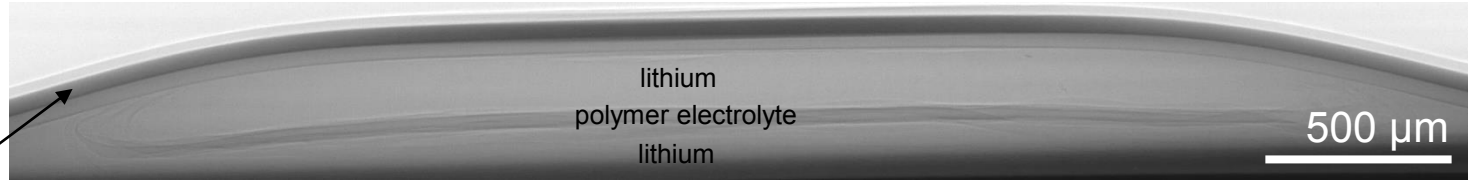
Salt (LiTFSI)



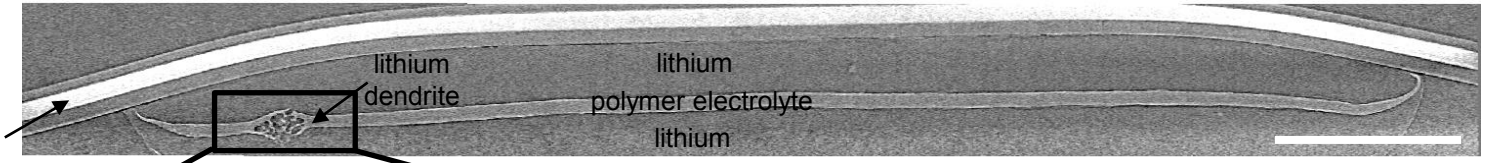
1. C. Monroe, and J. Newman, 'Dendrite Growth in Lithium/Polymer Systems', *Journal of The Electrochemical Society,* 150 (2003), A1377.
2. C. Monroe, and J. Newman, 'The Impact of Elastic Deformation on Deposition Kinetics at Lithium/Polymer Interfaces', *Journal of The Electrochemical Society,* 152 (2005), A396.

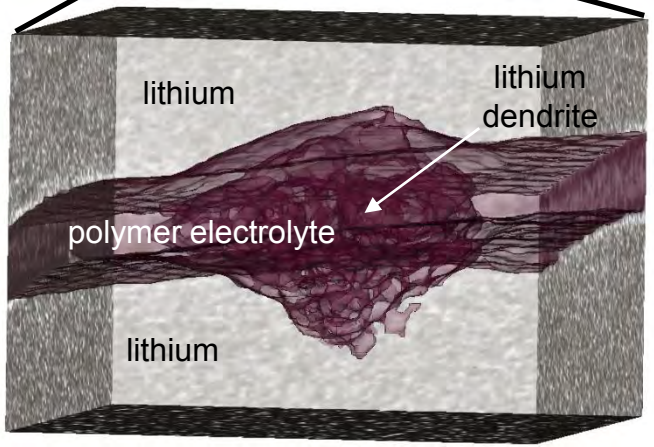
X-ray microtomography imaging

Radiograph image

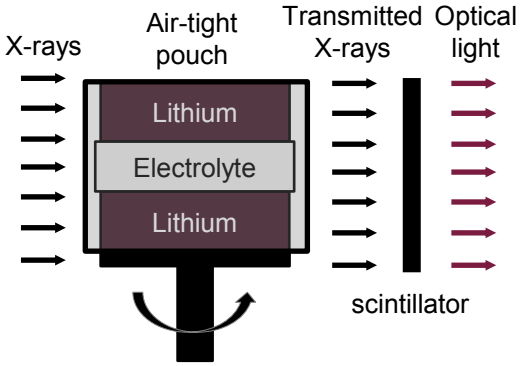


Cross-section from reconstructed image





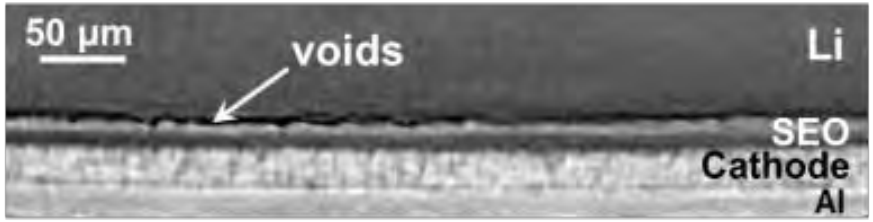
100 µm

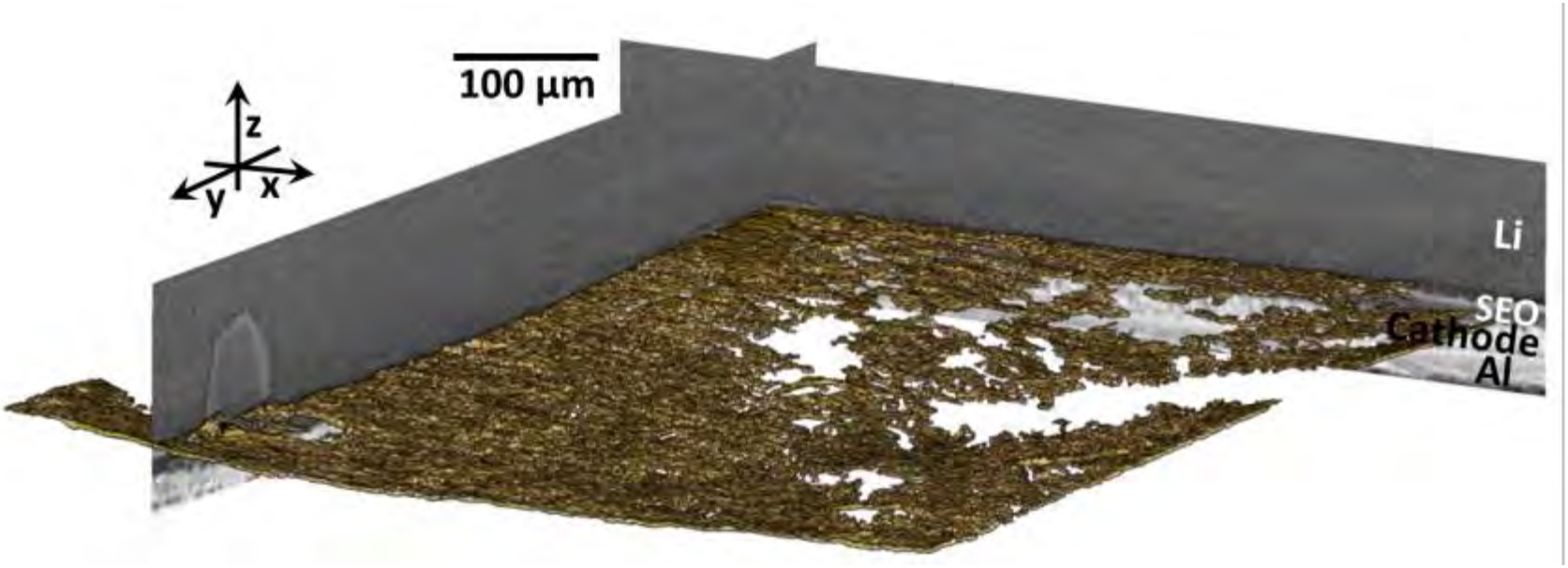


- ***Ex*-situ X-ray microtomography to image void formation**

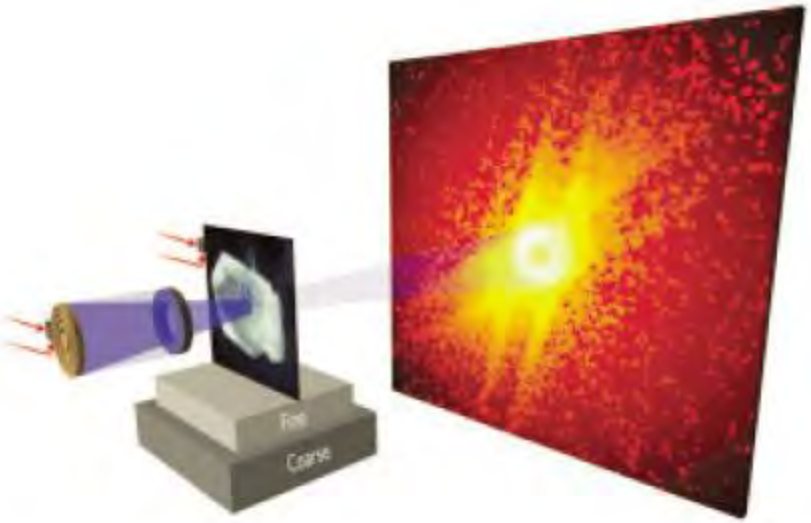
Before cycling

After cycling

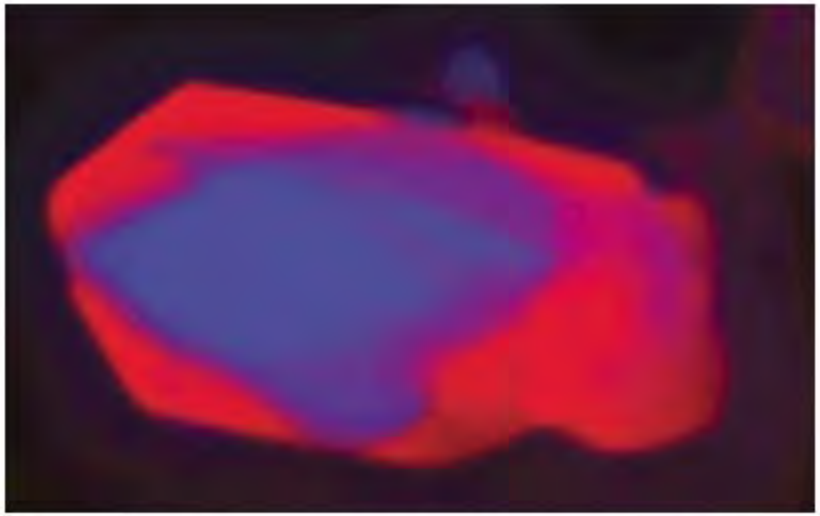




Ptychography (nm resolution imaging with chemical sensitivity)



In this soft x-ray ptychography set-up, a zone plate with a 60-nm-wide outer zone focuses a coherent soft x-ray beam onto the sample, which is scanned in 40-nm increments to ensure overlap of the probed areas.



Ptychographic image using soft x-rays of lithium iron phosphate nanocrystal after partial dilithiation. The delithiated region is shown in red.

THANKS!