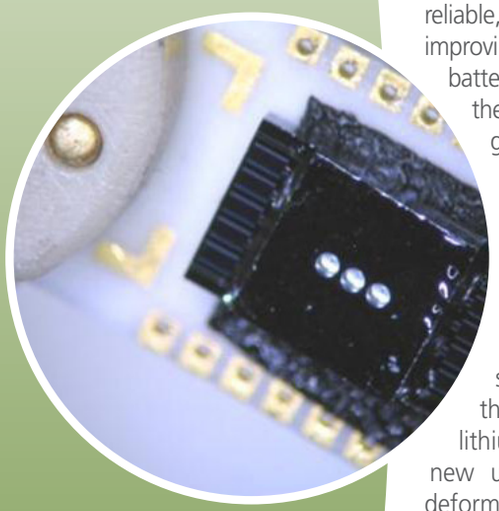
Sandia National Laboratories

Energy, Climate & Infrastructure Security

Electrify the Vehicle Fleet

The Science of Batteries

The Center for Integrated Nano Technologies (CINT) provides fundamental scientific understanding of batteries that reduces risk and accelerates the product development cycle.



Sandia has developed a unique suite of in-situ techniques to study and link the fundamental atomistic and chemical processes active during Li-ion battery cycling to the larger scale electrical response of the system.

Modeling Batteries for Safety, Reliability, and Failure Analysis

Transitioning from fossil-fueled to electrified vehicles depends on developing batteries that are increasingly economical, reliable, and safe. Substantially improving transportation battery performance in these areas requires greatly improving our fundamental understanding of the complex materials processes active in batteries.

By directly studying the atomistic processes of Li-ion batteries, Sandia has been able to elucidate structural and chemical changes that battery materials undergo during lithium insertion. This work has led to a new understanding of the charging and deformation process not possible with ex-situ techniques.

We have also developed techniques to allow for the direct in-situ observation of the chemical processes active at battery electrodes. By combining these capabilities with multi-scale battery models, we obtain a complete picture of the process active during battery use that can directly impact new battery material maturation cycle.

Sandia is also developing a physics-based numerical simulation capability for tracking thermal history and predicting the onset of thermal runaway in transportation-based, secondary Li-ion batteries. This simulation capability will enable exploration and characterization of a variety of operational conditions and their associated thermal histories so that potential safety and stability issues of new battery designs can be identified and mitigated prior to fabrication.

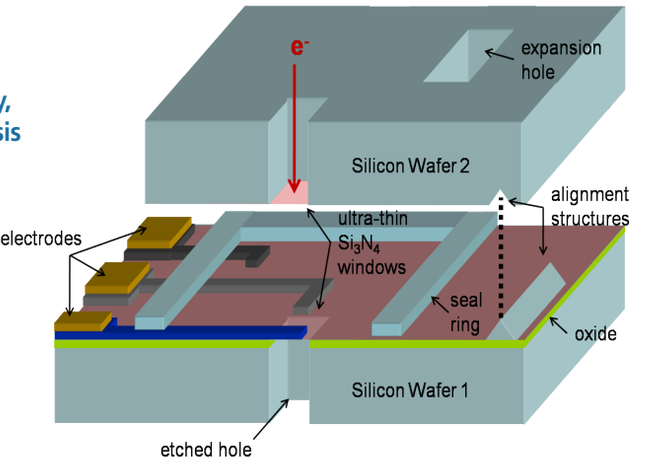


Image and schematic of in-situ battery TEM cell. (John Sullivan)

Fundamental Science at the Center for Integrated Nanotechnologies (CINT)

Many of these capabilities are available through the Center for Integrated Nano Technologies (CINT), which is one of the Department of Energy's five user facilities focusing on nano-technology. These facilities can provide direct access to researchers through a competitive proposal process, with CINT emphasis being the exploration of the path from scientific discovery to the integration of nanostructures into the micro and macro worlds.

CINT is available as a user facility for external researchers, government sponsors and commercial partners to enhance understanding and reduce risk during product development. Researchers can synthesize and characterize nanostructured materials, theoretically model and simulate their performance, and integrate nanoscale materials into larger-scale systems.

There are many avenues for external researchers to use the CINT facility, please refer to the CINT website at http://cint.lanl.gov for more information.

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U.S. DEPARTMENT OF ENERGY

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