SAND2012-2712P

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Sandia National Laboratories

Sandia Energy Storage Program Overview

Given by Glenn Kubiak

U.S. DEPARTMENT OF ENERGY

NNSA Nuclear National Security Administration

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Sandia's Energy Storage Program

Sandia strives to enhance the nation's energy security by delivering robust cost-effect energy storage solutions. We leverage our S&T base and our capabilities developed for the nuclear weapons program to:

- *Improve battery performance, economics, and safety enabling the electrification of the transportation fleet.*
- *Provide cost-effective large-format energy storage to enable grid integration of variable renewable energy sources.*

The Center for Integrated Technology (CINT), a BES national user facility houses state of the art diagnostic tools for in-situ characterization.

Sandia's super computing facilities are used in developing mechanistic models to improve battery reliability and safety.

The power source technology group at Sandia has wide ranging battery R&D capabilities, including 6,700 sq.ft. of dry room space for prototyping and production.

The new 1 MW Energy Storage Test Bed integrated with renewable energy generation at Sandia's Distributed Energy Technology Laboratory.

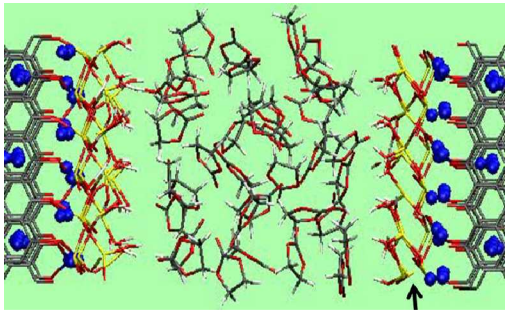
Vehicle Technologies

Lead laboratory for safety analysis and testing of vehicle batteries

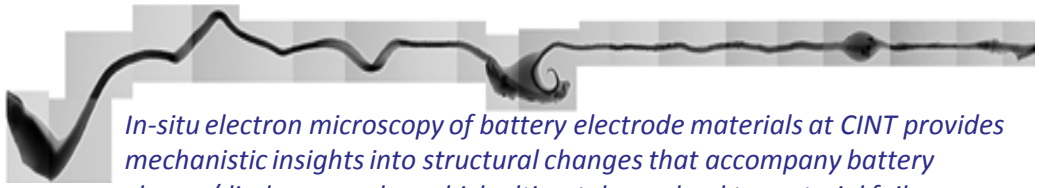
- Sandia's Battery Abuse Testing Laboratory understands failure mechanisms, evaluates next generation materials, and develops advanced materials and electrolytes.
- DOE Office of Vehicle Technologies (OVT) FY12 support: $2.2 M FY12, $4.2 M FY10-12 (ARRA)
- Our capabilities are extensively utilized by battery and other industries through work-for-others programs

The SNL Accelerating Rate Calorimeter (ARC) is used to analyze thermal runaway in a variety of battery materials.

The SNL cell prototyping facility is the largest DOE dedicated R&D facility equipped to manufacture small lots of Li-ion cells in various sizes.



Computer simulations provide mechanistic understanding of electrolyte/electrode reactions.

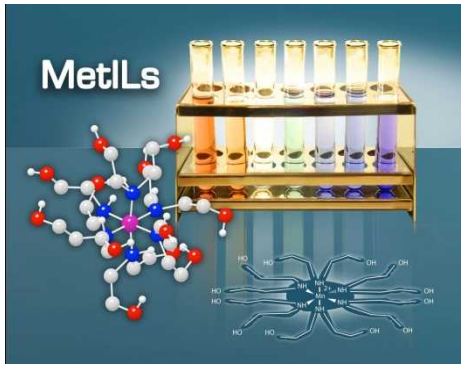


In-situ electron microscopy of battery electrode materials at CINT provides mechanistic insights into structural changes that accompany battery charge/discharge cycles, which ultimately can lead to material failure.

Storage for the Grid

Sandia is the OE Stationary Energy Storage Program lead lab with PNNL as a significant partner

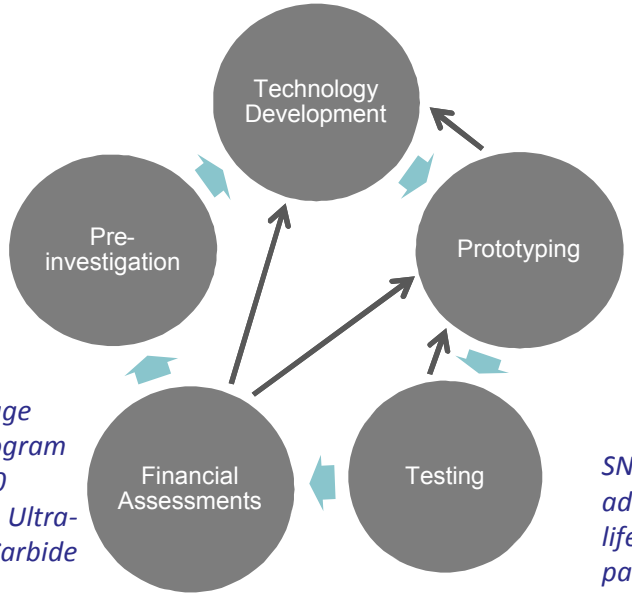
- FY12 DOE OE Funding to SNL, PNNL, and other labs: $18M
- The Stationary Energy Storage Program addresses 3 key barriers to storage integration into the grid:
  - Reducing the cost of storage technologies
  - Demonstrating effectiveness of storage technology in grid service
  - Developing analytics and policy basis to properly value storage
- Sandia deploys a fully integrated approach from technology development through grid demonstration coupled with performance value and policy analysis.

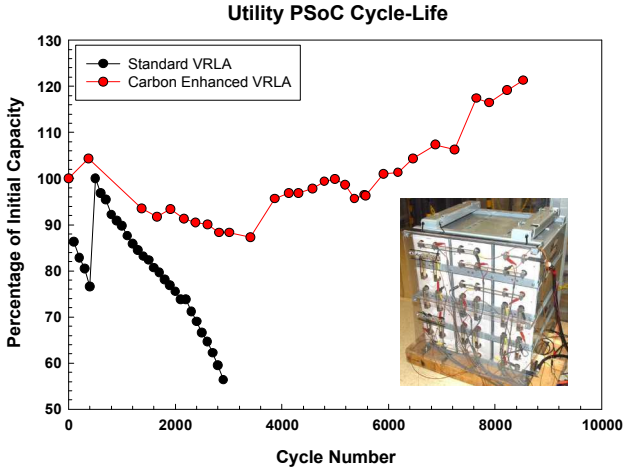


SNL is researching a novel approach to low battery technologies using metal-based ionic liquids (MetILs).

OE demonstration project led by SNL proved effectiveness of NaS in peak shaving/capital deferment project.

Sandia's energy storage power electronics program has won four R&D100 awards, including the Ultra-high-voltage Silicon Carbide Thyristor shown left.





SNL CRADA with led carbon manufacturer: Carbon additions (PbC) have a dramatic improvement on the life cycle of led acid batteries. Sandia and industry partners are developing and understanding this effect.