Cell Fabrication Analysis and Breakdown Laboratory

The Cell Fabrication, Analysis, and Breakdown Laboratory (CFAB) at the National Renewable Energy Laboratory (NREL) stands at the forefront of NREL's research effort into vehicle electrification. With collaborators from around the globe, CFAB serves as a proving ground for next-generation battery technologies.

Materials Synthesis

CFAB hosts projects with pioneering researchers worldwide, developing lighter, more energy-dense, lower-cost energy storage materials. The lab rapidly acquired a reputation for its analytical capabilities and has become a cornerstone of vehicle electrification efforts. Sponsored by industry and government agencies alike, the materials research portfolio includes:

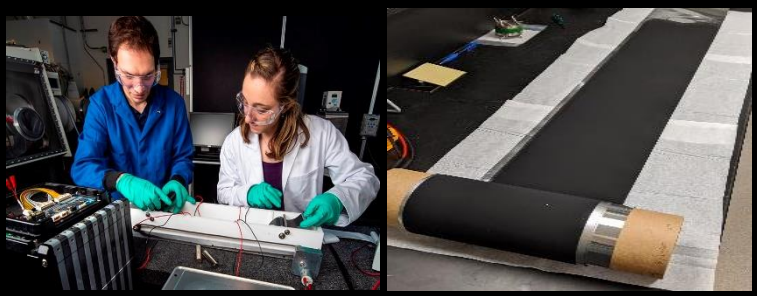
- Turnkey materials synthesis using solid state and sol-gel methods, vapor deposition and combinatorial sputtering with a variety of target materials
- Novel chemistries for solid-electrolyte cells
- Diagnostics and lifecycle analysis
- Characterization of high-capacity silicon anodes

Cell-Scale Evaluation

NREL has extensive device-scale diagnostic tools studying cells ranging from a µAh to entire battery packs.

Cell-Scale evaluation capabilities at CFAB include:

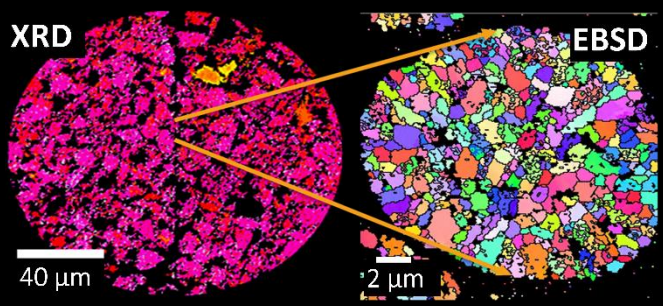
- Roll-to-Roll coating facility
- Pouch cell fabrication capabilities up to 1 Ah
- Characterization of high-capacity silicon anodes
- Thermal characterization at the material, electrode, and cell-scale during charge/discharge
- Cell tear-down and end-of-life thermal, chemical, and electrochemical characterization of cell components



Roll-to-Roll Capabilities at NREL enable evaluation of next-generation materials synthesized at lab scale (less than 50g) in pouch cells up to 1 Ah.

Materials Characterization

Some analytical capabilities relevant to battery recycling research include Electron Back Scatter Diffraction (EBSD) that uses the electron beam of a scanning electron microscope to study the crystallographic properties of materials with spatial resolutions up to nanometers. We use EBSD in combination with electron dispersion X-ray spectroscopy (EDS) to provide information on chemical composition of battery materials.



EBSD measurements provide grain size, chemical composition crystal orientation maps, lattice strain distributions at the primary particle scale.

Other analytical capabilities include a focused ion beam (FIB) equipped with an air-free specimen transfer capability to protect sensitive materials from exposure to oxygen and water to prepare specimens for structural (SEM, TEM, EBSD) and chemical (EDS) analysis in a variety of geometries. A heated (20°C–200°C) stage with a stainless-steel specimen clamp electrically connected to an external source meter allows *for in operando* observation of the evolution of structural and chemical characteristics.

Commercialization Path

CFAB's research partners cover a broad range of entities in the electrochemical research field. The lab's capabilities facilitated the R&D efforts of major automotive OEMs and small startup companies alike, in addition to those of partners in academia, and government agencies such as the U.S. Navy and NASA.

For more details visit: https://www.nrel.gov/transportation/energy-storage.html

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.