Batteries and Beyond

Energy storage technologies are critical to enhancing the nation's power grid capabilities, advancing the electrification of vehicles, and guaranteeing a secure, reliable electrified future for a prosperous economy. Oak Ridge National Laboratory translates scientific discoveries into early-stage technologies and works closely with industry to develop energy storage solutions that boost energy efficiency, increase energy security, and create economic opportunity. Capabilities span from world-leading high-performance computing to materials discovery, scaling, prototyping, manufacturing, multiscale evaluation, battery recycling, and integration of energy storage systems.

DOE Battery Manufacturing Facility at ORNL

PROTOTYPING new technologies

INTEGRATING energy storage systems

IMPROVING battery safety and performance

DEVELOPING storage solutions for vehicles and grid

EVALUATING materials from nanoscale to pilot scale

Energy Storage Solutions

Megawatt-scale storage for the grid—Creating systems that can store large amounts of electricity to stabilize the power grid

Fast-charging for electric vehicles—Developing new battery technologies and wireless charging that can power a vehicle as quickly as fueling up at the pump

Roll-to-roll manufacturing—Boosting America's competitiveness through new production processes and technologies

Cobalt-free cathodes—Demonstrating the effectiveness of new materials to enable high-performance lithium-ion batteries without cobalt

Solid state batteries—Advancing the development of new solid electrolytes for a system with high energy density and safety

ReCell Center—Supporting DOE's first lithium-ion battery recycling center by designing cells to optimize recyclability

Beyond batteries—Developing novel approaches ranging from transactive control of building energy loads to geothermal energy storage to technology that stores electricity in pressure vessels

"We're looking at the next generation of energy storage. It only takes one new material to catalyze a whole new family of battery technologies."

Nancy Dudney, ***Physical Chemistry Scientist***

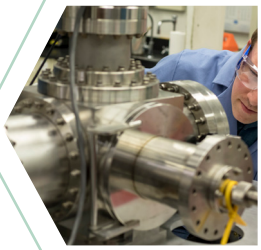
OAK RIDGE National Laboratory

U.S. DEPARTMENT OF ENERGY

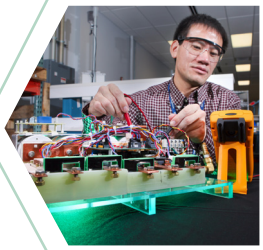
Comprehensive Capabilities

Rapid prototyping—The DOE Battery Manufacturing Facility at ORNL, the nation's most comprehensive roll-to-roll research facility, capable of prototyping new materials and processes with scalable results

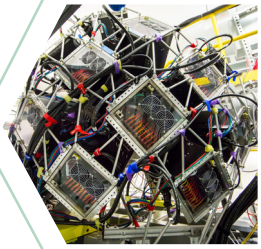
High-performance computing—The nation's fastest supercomputer for open science, using artificial intelligence to accelerate research and development



Materials synthesis and characterization—Deep expertise in the synthesis and evaluation of new materials, including polymers, electrolytes, and the study of material interfaces



Power electronics and controls—Development of new controls, devices, and systems, including transactive controls and wireless charging technologies



Neutron science—Two of the world's most powerful sources of neutrons for research, providing a nondestructive view inside energy storage devices

Grid monitoring and analysis—Dynamic modeling of interconnections, cyber-aware advanced sensors, and secure communications and controls

Recent Impacts

- SPARKZ Inc. licenses five ORNL technologies to eliminate cobalt in lithium-ion batteries
- Exploring the structure and performance of novel composite electrolytes to advance solid state batteries
- New method creates electrolytes that solidify on impact, preventing batteries from catching fire
- Open-access Virtual Integrated Battery Environment platform simulates battery performance from cells to packs
- Fast formation protocol shortens battery production step by six times and improves capacity retention
- Novel components advance low-cost, redox flow battery for megawatt-scale energy storage
- Electron beam instantly adheres cathode coatings to lithium-ion batteries without solvents
- New system, GLIDES (Ground-Level Integrated Diverse Energy Storage), provides a low-cost, efficient, flexible way to store electricity mechanically in pressurized vessels

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