



Overview of Battery R&D Activities

John Farrell

Laboratory Program Manager, Vehicle Technologies

National Renewable Energy Laboratory
Golden, Colorado



Pasadena, CA
February 11-13, 2020

NREL at a Glance

2,375

Employees, plus

214 Postdoctoral Researchers
68 Graduate Students
72 Undergraduate Students



World-class

facilities, renowned
technology experts

about
900

Partnerships

with industry,
academia, and
government



Campus

operates as a
living laboratory



Battery R&D Program

NREL's energy storage program develops & enhances battery technologies

Working on transportation and stationary applications:

- Materials Science for new Chemistries
- Microstructure Modeling
- Advanced Characterization
- Engineering and System Integration
- Circular Economy



Materials Research

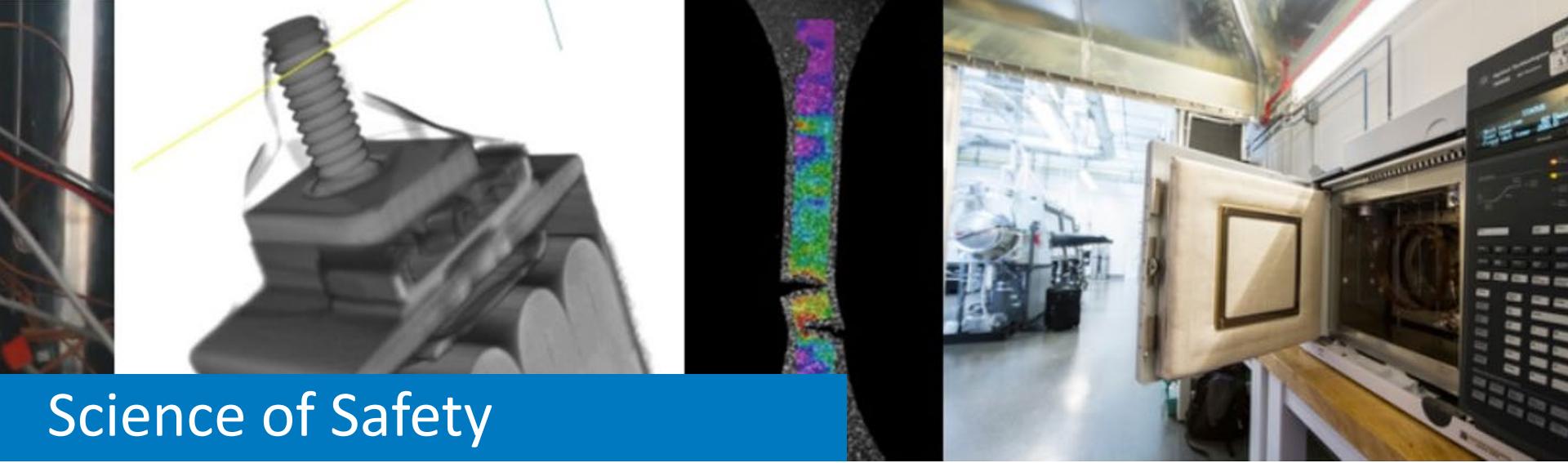
- Silicon Anode Consortium: NREL is working with other national laboratories to eliminate barriers to implementing silicon-based anodes in lithium-ion cells
- Atomic layer deposition for improving life and safety of electrodes
- Development and evaluation of high-nickel, low-cobalt cathodes
- The Cell Fabrication, Analysis and Breakdown (CFAB) laboratory to work on new materials, custom cell design, troubleshooting commercial cell performance, model validation, etc.



EV Extreme Fast Charging

NREL is developing 3D microstructure models to increase rate of charging in support of DOE's Extreme Fast Charge Program

- Simulate tortuosity morphology and particle alignments
- Simulate lithium plating
- Modify electrode design and electrolyte for faster Li transport
- Validate with experiments and advanced diagnostics
- Investigate novel solutions



Science of Safety

- The newly commissioned Science of Safety facility aims to provide a comprehensive look at battery safety across multiple length and timescales.
- Integrating a cell abuse test chamber with custom Gas Chromatography, Mass Spectrometry, Flame Ionization, FTIR and Raman units enables in operando characterization of electrolyte composition, gaseous effluents, and interfacial evolution while the battery is subjected to mechanical or thermal loading.
- This helps us directly relate changes in chemistry and design to abuse behavior of batteries.
- Used to validate multiple NREL safety modeling tools

Strategic Partnerships





Battery Recycling

Performing research as part DOE's ReCell program

- Refurbishing and rejuvenating electrodes
- Design for recycling
- Materials and powder modeling
- Supply chain analysis

Administering the U.S. DOE's Lithium-Ion Battery Recycling Prize

- Increase collection, sorting, storing, and transporting of all Li-ion batteries

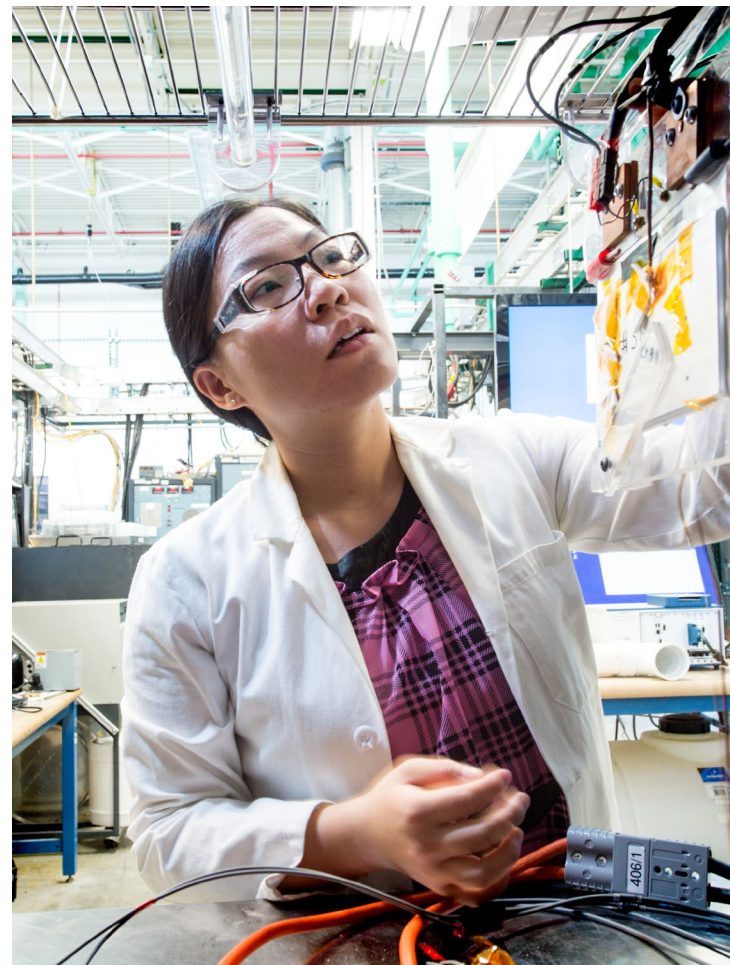


U.S. DEPARTMENT OF ENERGY

U.S. DOE Lithium-Ion Battery Recycling Prize

- Phase II teams are in the process of developing end-to-end solutions that demonstrate a viable business model that can be scaled.
 - Includes partnering with battery industry to help iterate, solidify design, or demonstrate the validity of their proposed strategies
- Join us **Thursday, Feb. 13 at 1:45 p.m.** to hear from U.S. DOE and from the Phase II teams seeking industry partners

Also, learn about an opportunity for industry to apply to become a Voucher Service Provider Network member for up to 10 winners selected to advance to Phase III – Pilot Validation.



Thank You

www.nrel.gov

www.nrel.gov/transportation/energy-storage.html

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided predominantly by the DOE Office of Energy Efficiency and Renewable Energy's Vehicle Technology Office and Fuel Cell Technologies Office. The views expressed in this presentation do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

