In-Operando Thermal Diagnostics of Electrochemical Cells

U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

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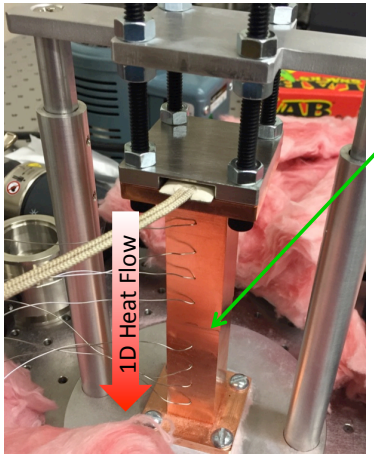
Objective: Develop and apply a metrology to measure *in-operando* temperatures and thermal transport property depth profiles within an electrochemical cell under various operating conditions.

Impact:

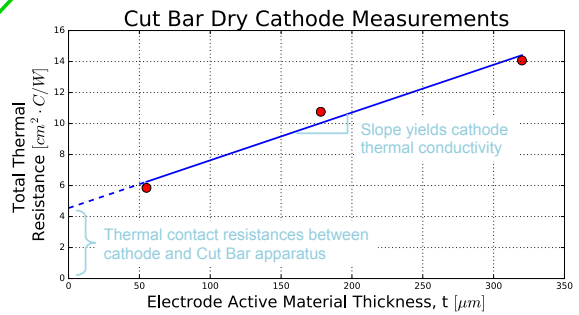
- Provide crucial insights on thermal transport within batteries in different operating conditions.
- Enable these diagnostic capabilities for industry and other research labs. Additionally, such insights could:
  - Enable faster charge/discharge of battery
  - Improve safety vs. thermal runaway phenomena
  - Improve battery lifetime reliability
  - Reduce required external battery cooling power

High Accuracy Ex-Situ Component Measurements to Support In-Operando Data Analysis

Cut Bar Apparatus



Sample placed between Cu bars
Temperature drop measured



Accomplishments:

- First *in-operando* measurement of cathode-separator thermal boundary resistance in fully-functional Li-ion battery pouch cell.
- Development of new metrology and data analysis to enable such measurements.
- Numerical optimization of sample design for measurement accuracy and sensitivity.
- Construction of Cut Bar apparatus for high accuracy *ex-situ* component complimentary measurements.

FY19 Milestones:

- High accuracy ex-situ measurements of individual battery components to support 3-omega data analysis (Q1)
- Robust thermal model development (Q2)
- *In-Situ* battery 3-omega measurements from both anode and cathode side (Q3)
- Detailed *in-operando* thermal measurements performed and analyzed (Q4)

FY19 Deliverables: Final high-accuracy *in-operando* 3-omega measurements of full battery from both sides.

Funding: FY19: $100k, FY18: $145k