**In-Operando** Thermal Diagnostics of Electrochemical Cells

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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

**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