Addressing Heterogeneity in Electrode Fabrication Processes

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

PI/Co-PI: Dean R. Wheeler (BYU)/ Brian A. Mazzeo (BYU)

Objective:

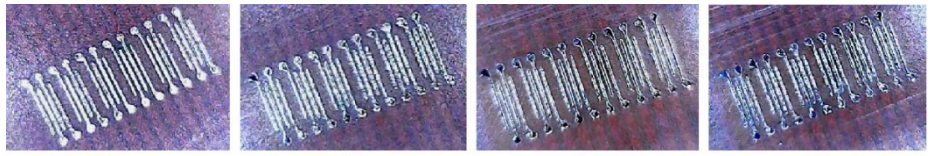
Better understand connections between fabrication conditions and undesired heterogeneity of thin-film electrodes by means of new non-destructive inspection techniques and a computer model.

Impact:

- Real-time measurement of heterogeneity will enable manufacturer quality control improvements
- Measurement tools will enable researchers to compare different electrodes and improve formulations

Use of Flex Probe to Test Commercial Electrodes

Enhancements were made to the apparatus, fixture, and algorithms associated with our flexible conductivity probe. The probe was used to create conductivity maps of multiple cathodes and anodes from various commercial manufacturers. This figure demonstrates the outstanding wear characteristics of the micron-scale probe surface during use–at the start of sampling (a) and after 3,000 (b), 7,000 (c), and 10,000 (d) sampling points. The probe continued to function well after all these measurements.



Accomplishments:

- Integrated flex probe with off-the-shelf CNC positioning system to enable interrogation of large-format electrode films
- Integrated flex probe with prototype rolling apparatus to enable interrogation of continuous-roll electrode films
- Demonstrated that adapting conductivity probe to localized ionic measurements works adequately for continued development
- Quantified the durability of flex probes to validate suitability for industrial use

FY 19 Milestones:

- Quantify microstructure heterogeneity effects on overall cell performance (Q1)
- Create localized ionic electrode conductivity maps (Q2)
- Create design package for commercialization of the conductivity probe including controls and hardware (Q3)
- Investigate the physics of the drying process with the smoothed particle hydrodynamics drying model (Q4)

FY19 Deliverables:

Reports, scientific publications, apparatuses, and a model to evaluate new measurement approaches

Funding:

— FY19: $350,000; FY18: $350,000; FY17: $350,000