ENGINEERING APPROACHES TO DENDRITE FREE LITHIUM ANODES

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

PI/Co-PI: Prashanth N.Kumta (UPitt)/Moni K. Datta (UPitt)/Oleg I. Velikokhatnyi (UPitt)

Objective:

The project involves strategies to deliver high energy density Li anode based battery cells comprising high specific capacity novel Lithium ion conductor (LIC) coated structurally isomorphous alloy-porous foams (SIA-PFs) integrated electrodes (IE) coupling various cathodes (lithium-free and lithium-rich).

Impact:

1. Novel Li anode generation enabling Li metal-free cathodes.
2. Expedite developments in high energy battery systems such as lithium-sulfur and lithium-air batteries.
3. The proposed Lithium-anode battery technology will cost ~$125/kWh less than the current limit of $500/kWh offering 75% cost reduction to the end-user.

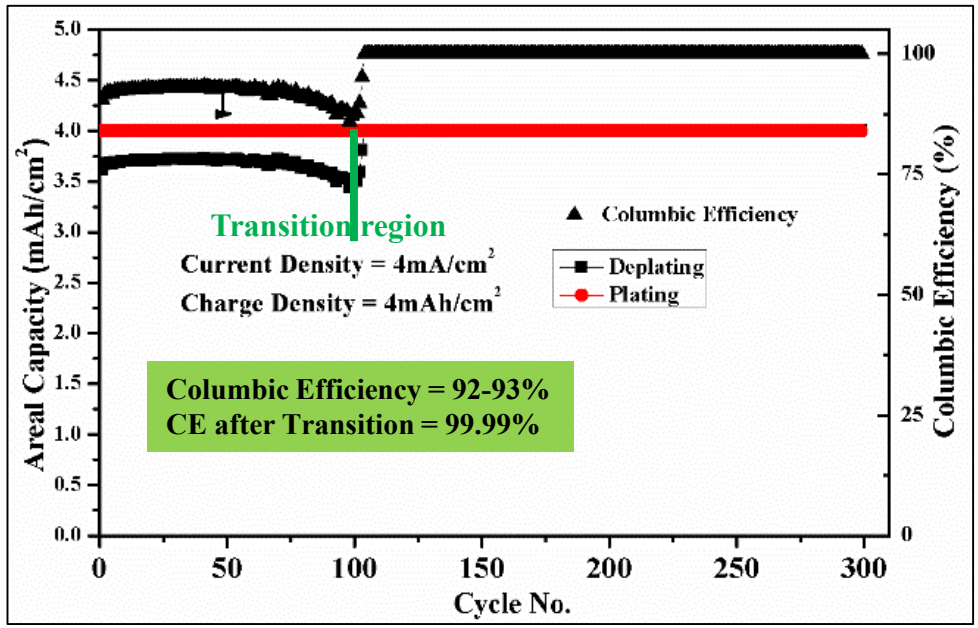

Fig.1 – Cycling performance of multilayer porous foam anode.

Accomplishments:(FY18)

- Synthesis and testing of structurally isomorphous alloy (SIA) electrodes.
- Design and engineering of high capacity composite multilayer anode (CMA).
- Optimization of porous foam electrodes to improve capacity and stability for large scale generation and testing.
- Development of novel high capacity and high columbic efficiency Effective Nucleating Host Alloys (EHNA) with low Li plating/stripping over potentials.

FY 19 Milestones:

- Generation of Integrated electrode (IE) by optimization to maximize lithium content without formation of dendrites over extended cycling.
- High capacity demonstration at high rates without dendrite formation.
- Fabrication of the desired 10 mAh full cells.
- Business Value Analysis.

FY19 Deliverables:

- High capacity ≥2000 mAh/g (≥10 mAh/cm^2), ~1000 cycles, LPC ≤0.01%, CE: ≥99.99% with superior rate capability.

Funding:

— FY19: $416,687, FY18: $416,687, FY17: $416,687