Self-forming thin interphases and electrodes enabling 3-D structured high energy density batteries

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

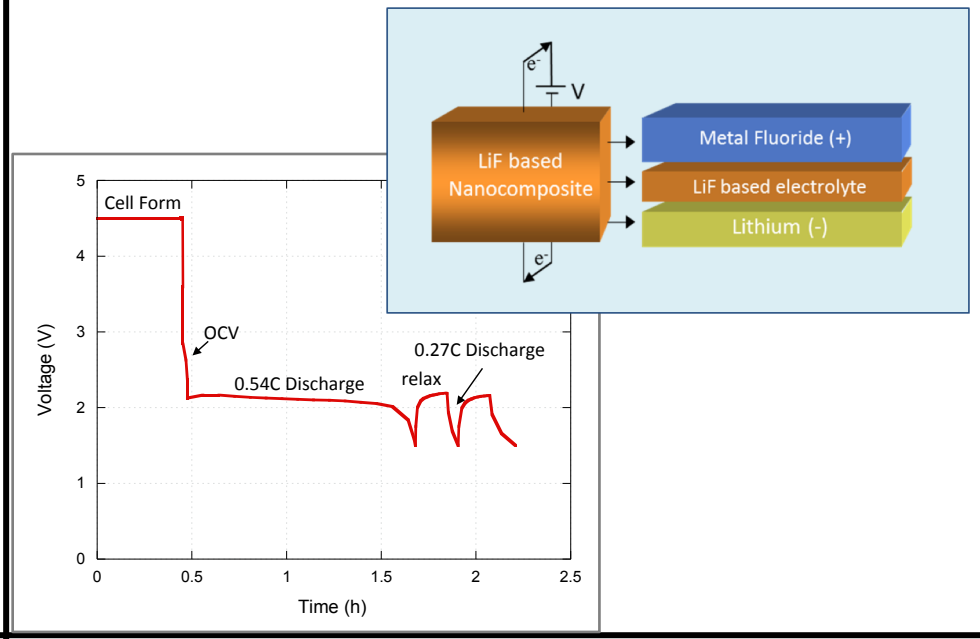
PI/Co-PI: Glenn G. Amatucci, PI (Rutgers University)
Nathalie Pereira, Co-PI (Rutgers University)

Objective: Develop and implement a novel in-situ formed lithium metal-based metal fluoride battery which will enable packaged 10mAh batteries of energy densities > 1000 Wh/L and >400 Wh/kg at 12V within one planar unit.

Impact:

- Enable Li metal electrodes via solid state electrolytes
- Eliminate Li metal in fabrication and handling of cells
- Highest practical energy density electrochemical system
- Unique pathway to high voltage systems

In-situ formed lithium-metal fluoride battery



Accomplishments:

- Achieved self-formed cell-stack with >500 Wh/L at a rate of C/10
- Implemented maskless scalable patterning technique for the fabrication of the self-forming cells
- Established positive reactive current collector compositions that achieved > 30% of the theoretical energy density
- Established a bi-ion solid-state conducting glass composition with ionic conductivity > $1x10^{-4}$ S/cm post formation

FY 18 Milestones:

- >10^{-4} S/cm solid state electrolyte *after* in-situ cell formation
- >75% utilization of positive electrode
- >90% utilization of Li at the negative
- Achieve 12V within one planar design

FY18 Deliverables: Achieve self formed cell stack with energy densities of at least 1000Wh/L and 300 Wh/kg, >80% capacity retention after 100 cycles

Funding: *including 15.3% cost share*

- FY17: $ 488,821 and FY18: $ 382,441