Self-assembling rechargeable Li batteries from alkali and alkaline-earth halides

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

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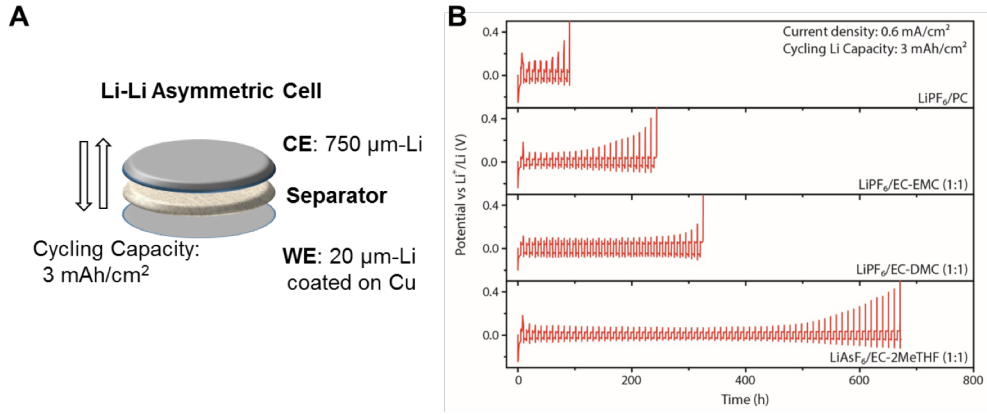
Objective: Investigate electrochemical formation of lithium halide based solid electrolytes, with the goal of enabling and demonstrating self-assembling/self-healing batteries using lithium metal negative electrodes.

Impact:

- The self-forming process is a ***simple and scalable***.
- Enables very high energy density (>350 Wh/kg) that could improve the driving range and reduce the cost for electric vehicles.

Asymmetric Li-Li cell cycling showing improved performance using Halide additives



Accomplishments:

- Completed initial computations and halide solubility studies and construct experimental matrix of halides and solvents.
- Demonstrated cell designs and electrochemical testing parameters that allow clear differentiation of dendritic and non-dendritic behavior of Li electrodes.
- Delivered characterization results for morphological evolution of Li metal surface showing that halide additives diminish Li dendrite formation.
- Demonstrated Li-Li cell using halide additives that outperforms additive-free cell

FY 18 Milestones:

- Deliver structural and chemical characterization results for baseline halide films on Li metal
- Deliver structural and chemical characterization results for self-healed halide films on Li metal
- Establish quantitative criteria for effectiveness and reproducibility in dendrite-suppression experiments
- ***FY18 Deliverables:***

Demonstrate Li-Li cells that show reproducible dendrite-suppression, while cycling ≥3 mAh/cm2 at C/5 rate over 30 cycles

Funding:

— FY18: $462,912, FY17: $456,742