New Electrode Design for Ultrahigh Energy Density

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

PI/Co-PI: Y.-M. Chiang (MIT) / A.P. Tomsia (LBNL)

Technical Approach:

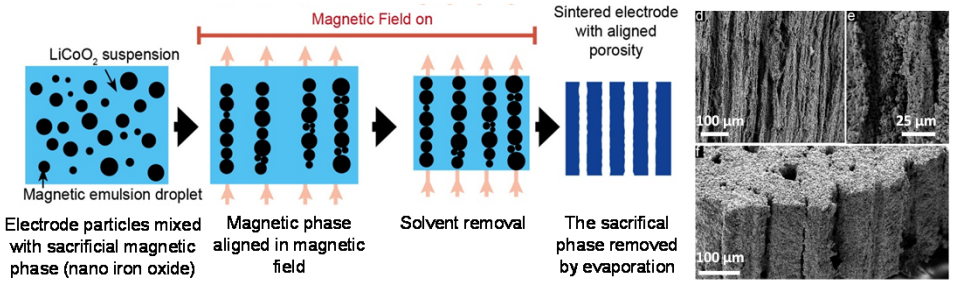
- Fabricate aligned-pore electrodes by *directional freeze-casting* and *magnetic alignment*
- Measure and model electrochemical performance in continuous and pulse discharge

Status:

- Demonstrated that sintered electrode of 12.7 mAh/cm^2 theoretical capacity can achieve 11.5 mAh/cm^2 available capacity under USABC DST cycling conditions
- Demonstrated two variants of magnetic alignment process for producing low tortuosity porosity

Technology:

Scalable methods for fabricating pore structures with low tortuosity normal to the electrode plane are developed.

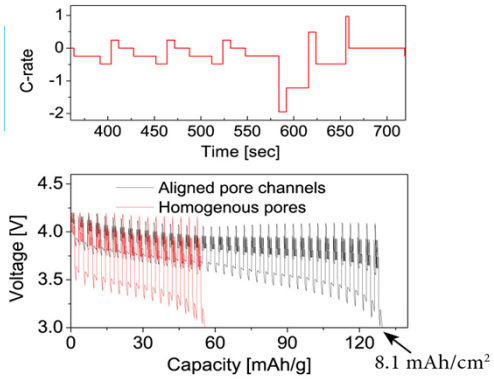


Objectives:

- Maximize active material utilization and lower the cost of Li-ion cells for EVs
- Develop scalable process for fabrication of thick high area capacity, low-tortuosity cathodes and anodes
- Test electrochemical performance of resulting electrodes in USABC model drive cycles such as HPPC and DST

Deliverables:

Discharge by repeated looping of the Dynamic Stress Test (DST) profile yields high area capacity in aligned porosity $LiCoO_2$ cathode compared to homogeneous cathode of same density.



Funding:

Duration: 4 yrs (Yr 4)
FY16 Budget: $382K (DOE)

Milestones:

- **Q1:** Obtain 2, 10 and 30 sec pulse discharge data for an electrode of at least 10 mAh/cm^2 area capacity.
- **Q2:** Test at least one cathode and one anode each having at least 10 mAh/cm^2 area capacity under an accepted EV drive cycle.
- **Q3:** Go/No-Go: Demonstrate a cathode or anode having at least 10 mAh/cm^2 area capacity that passes an accepted EV drive cycle.
- **Q4:** Construct and obtain test data for full cell in which area capacity of both electrodes is at least 10 mAh/cm^2.