

Dual Function Solid State Battery with Self-forming Self-healing Electrolyte and Separator

U.S. DEPARTMENT OF

ENERGY

Energy Efficiency &
Renewable Energy

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- **Objective:** Demonstrate a solid state rechargeable battery with *in situ* generation of a lithium metal anode and iodine cathode

Impact:

- Opportunity to meet or exceed the target of 250 Wh/kg with a high energy density battery with a self-forming, self-healing solid state electrolyte / separator
- Gain technical insight regarding control of electrode-electrolyte interfacial properties and improved conductivity solid electrolyte with self-healing nature

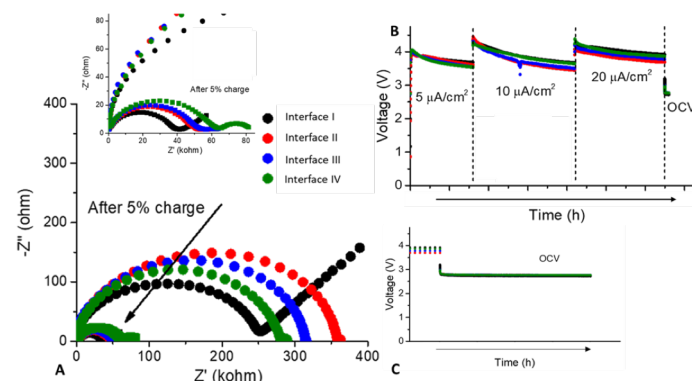
Accomplishments:

- Developed methodology of AC impedance measurement as a function of temperature
- Identified solid electrolytes with conductivity $\geq 10^{-3}$ S/cm
- Modified the electrolyte/substrate interface to reduce the total measured resistance, a key feature in cell design
- Demonstrated feasibility of successful *in situ* formation of solid electrolyte cells
- Demonstrated step-wise charging with increasing current levels that decreases total charge time
- Demonstrated OCV stability for cells after charge showing successful *in situ* formation of an active Li/I₂ cell

Development of solid electrolyte & demonstration of feasibility: *In situ* formation of Li/I₂ cell

Sample	σ , 30° C (S/cm)
LiI + additive A	1.0×10^{-3}
LiI + additive B	1.1×10^{-3}

ACI of solid electrolytes successfully met conductivity goal $\geq 10^{-3}$ S/cm



A) Cells successfully charged, *in situ* formation of anode, cathode. Interface plays critical role. B) initial step-wise charging. C) stable OCV.

FY 17 Milestones:

- Materials procured, prepared and characterized.
- Methodology for AC impedance measurement as a function of temperature demonstrated
- Four most promising solid electrolytes for further study identified
- All milestones met on time

FY17 Deliverables:

- At least one electrolyte with conductivity $\geq 10^{-3}$ S/cm

Funding:

— FY17: \$400,000