

# Pre-Lithiation of Silicon Anode for High Energy Li Ion Batteries

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## Objective:

Developing facile and practical prelithiation methods to increase first-cycle Coulombic efficiency of Si anodes and synthesizing fully lithiated Si to pair with high capacity lithium-free cathode materials.

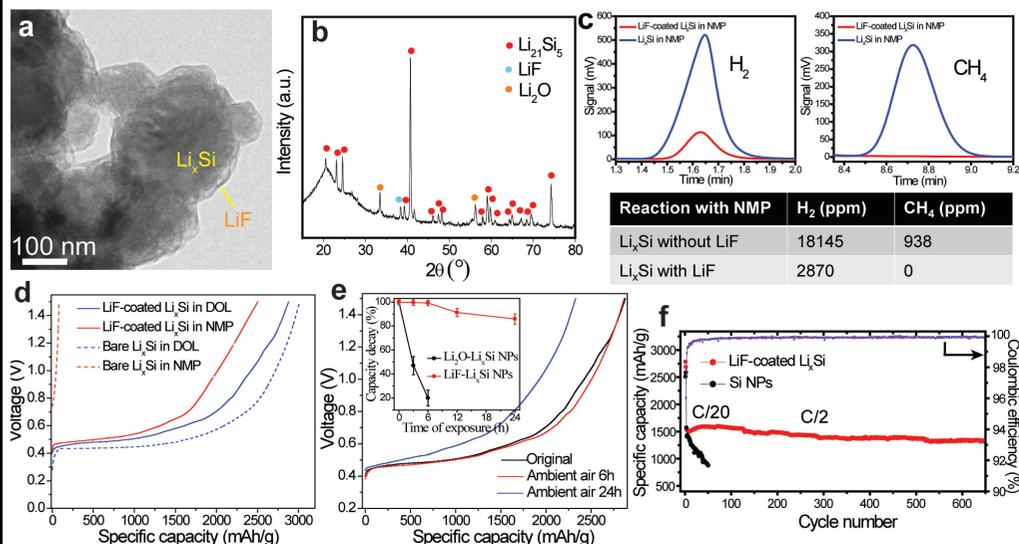
## Impact:

- Compensate for the first cycle lithium loss can improve the energy density of batteries for electric vehicles.
- Pre-storage of lithium can also help compensate for later cycle lithium loss and extend the life time of batteries.

## Accomplishments: (FY17)

- Synthesize  $\text{Li}_x\text{Ge}$  nanoparticles and  $\text{Li}_x\text{Ge-Li}_2\text{O}$  composites for anode prelithiation with improved air-stability
- Synthesize  $\text{Li}_x\text{Sn}$  nanoparticles and  $\text{Li}_x\text{Sn-Li}_2\text{O}$  composites for anode prelithiation with improved air-stability
- Synthesize LiF-coated  $\text{Li}_x\text{Si}$  nanoparticles with improved stability in ambient air and polar solvents
- Fabricate air-stable and free-standing  $\text{Li}_x\text{Si}$ /graphene foil as an alternative to lithium metal anodes

## LiF-coated $\text{Li}_x\text{Si}$ NPs (JACS, 2017, 139, 11550)



## FY 18 Milestones:

- Anode prelithiation reagents processible in N-methyl-2-pyrrolidinone with a high capacity of > 2500 mAh/g
- Anode prelithiation reagents stable in humid air (~40% RH) for one day.
- Pre-lithiated anodes exhibit consistently high Coulombic efficiency during stable and long-term cycling

**FY18 Deliverables:** Quarterly reports, battery cells meeting the desired deliverables

## Funding:

— FY18: \$300,000, FY17: \$300,000, FY16: \$300,000