



Nano Engineered Li-M Anodes

Precision Lithium-Metal

Versatile - Patented Electrodeposition Process

Leverages direct lithium metal formation from an aqueous solution utilizing ion selective membrane technology

❖ Beyond Li Ion:

- ✓ Solid State
- ✓ Pre-Lithiation
- ✓ Recycling

❖ Customized solutions:

- ✓ Controlled thickness
5 to 50 μm
- ✓ Surface modification

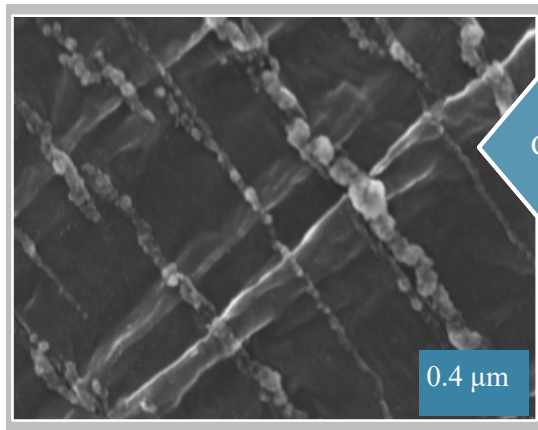
❖ α En's process:

- ✓ High purity Li-M
- ✓ Feedstock flexibility

❖ Green process:

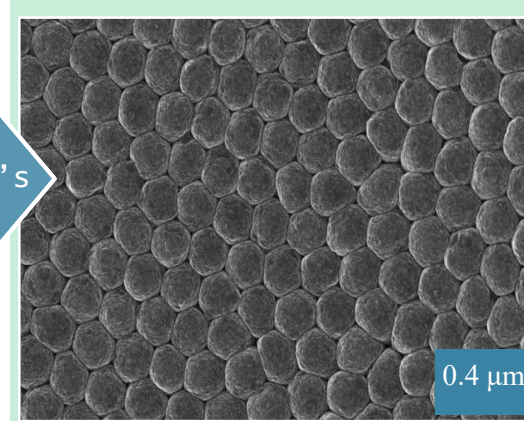
- ✓ Room temperature
- ✓ No harmful emissions

Lithium metal sample morphology under Scanning Electron Microscope

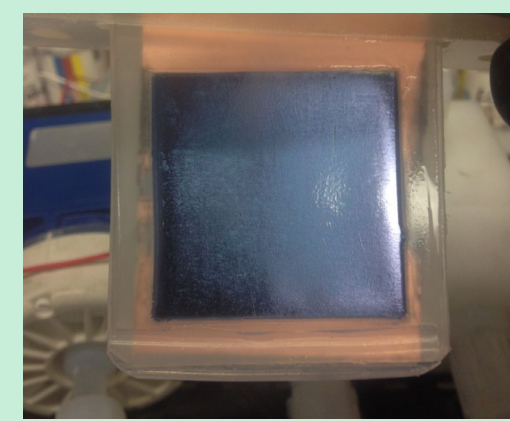


Commercial

α En's



Nano-Rod Morphology



*alpha-En's Lithium Metal
on Copper substrate*

Lithium-Metal Anodes Li-M

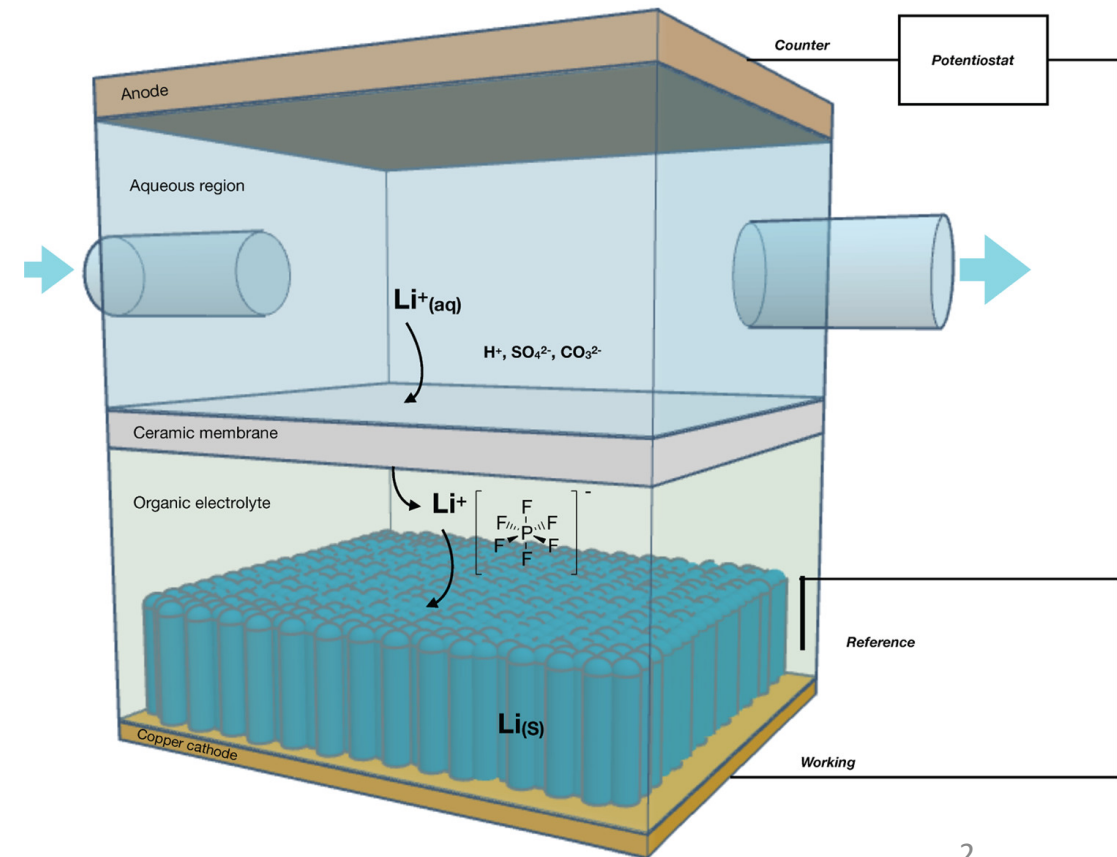
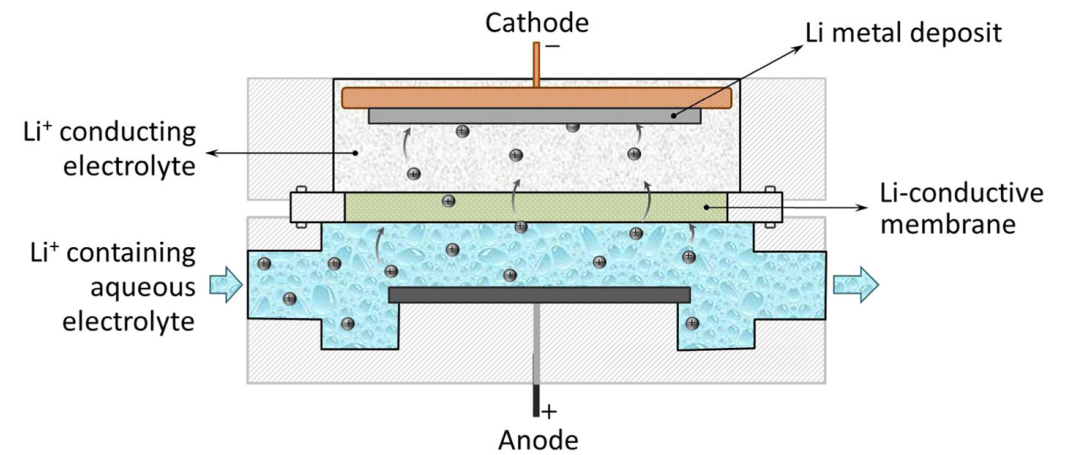
- Electrolytic Deposition of Lithium films
- Feedstock is aqueous LIC (low grade)
- Room temperature
- Deposition Current densities in the range $0.5\text{--}5\text{ mA/cm}^2$
- Control over morphology
- Control over thickness in range $5\text{--}50\text{ }\mu\text{m}$
- High Purity Li with respect to base metals content
- Form factor variability (deposition on graphite/ 3D substrates etc.)

Increasing demand of higher energy density

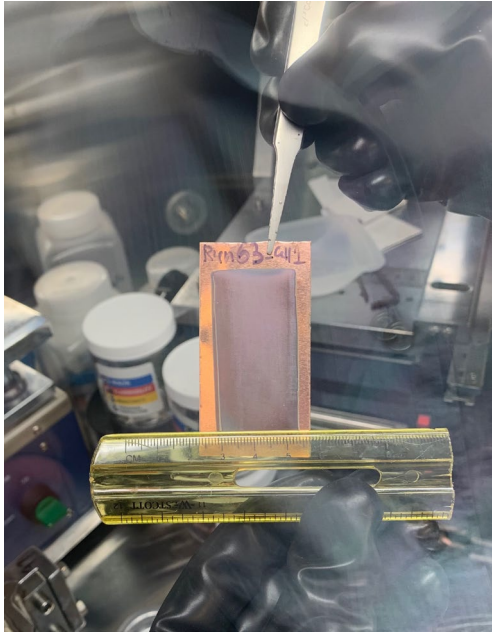
270-300 Wh/Kg
State-of-the art LIB

>350 Wh/Kg

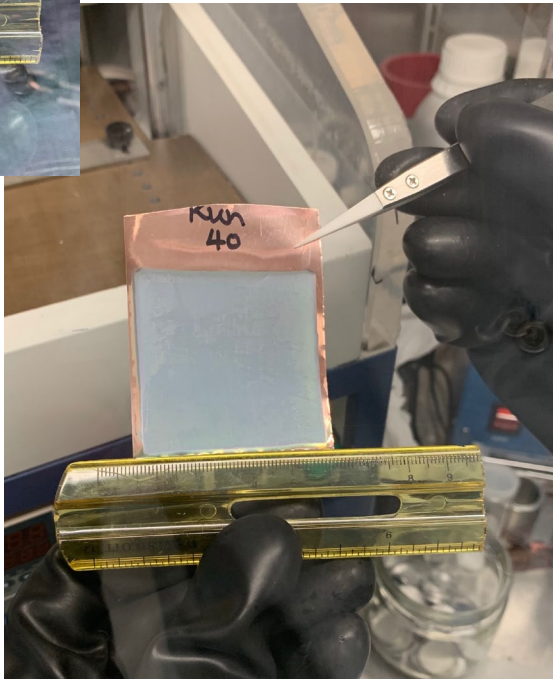
- Replacing graphite in LIB
- Li-M anodes paired with advanced cathode/electrolyte configurations



AE Li-M Films

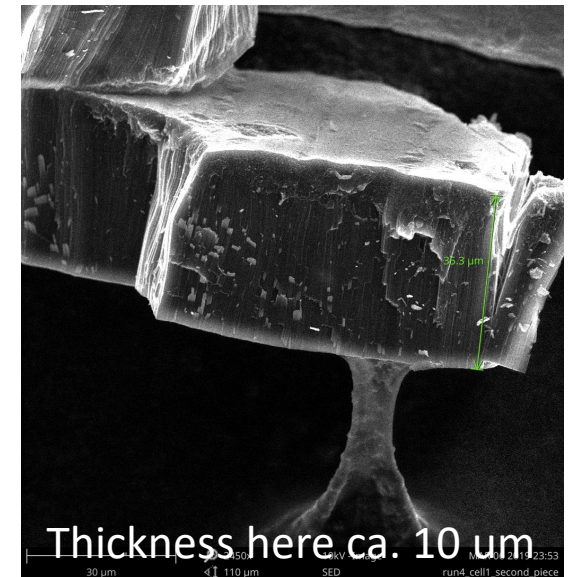
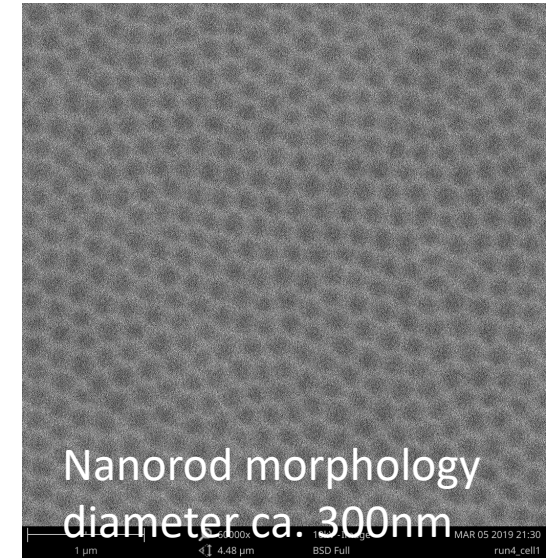


Scalable areas, up to 50cm² (so far)



SEM/surface

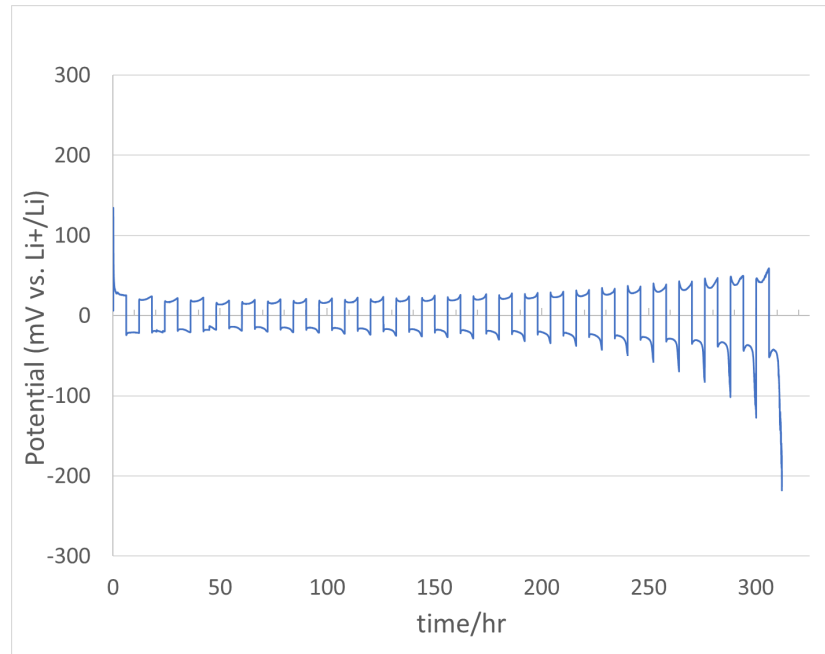
SEM/cross-section



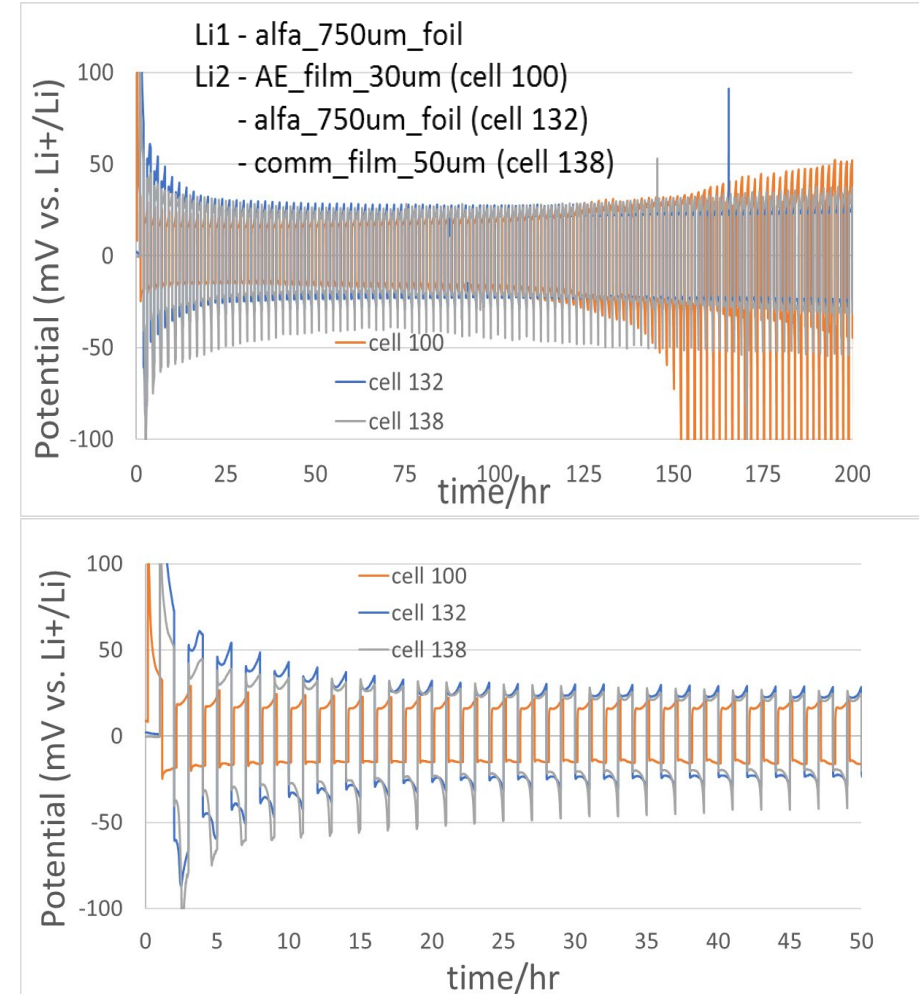
Symmetric Cell

- AE Li-M films compare favorably with commercially available Li films

Representative lithium plating-stripping behavior of AE electrode (35 μm), large capacity limit.



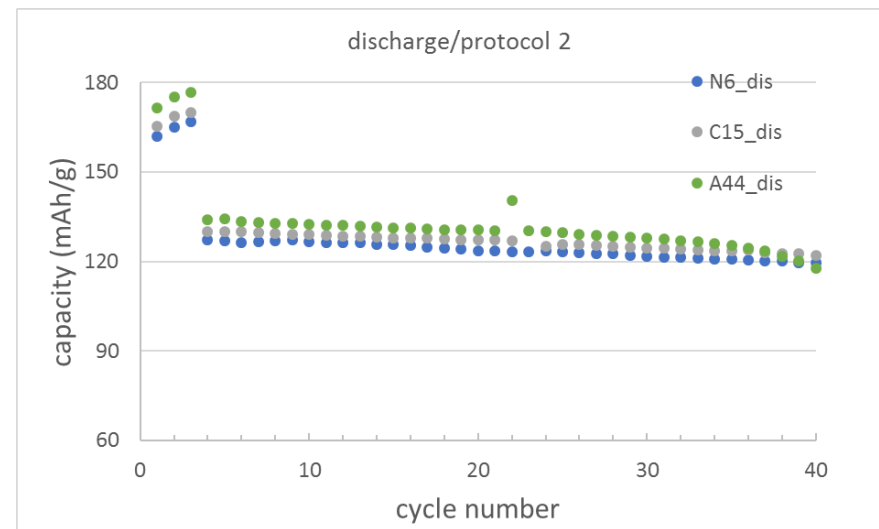
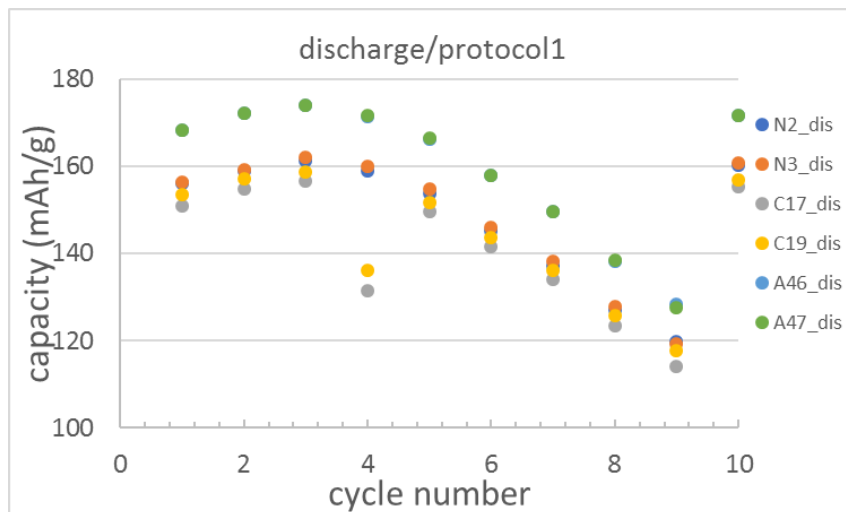
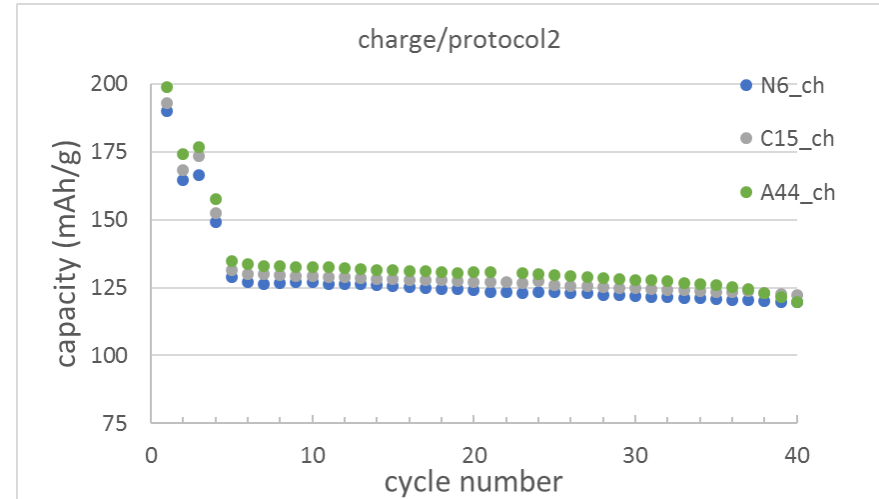
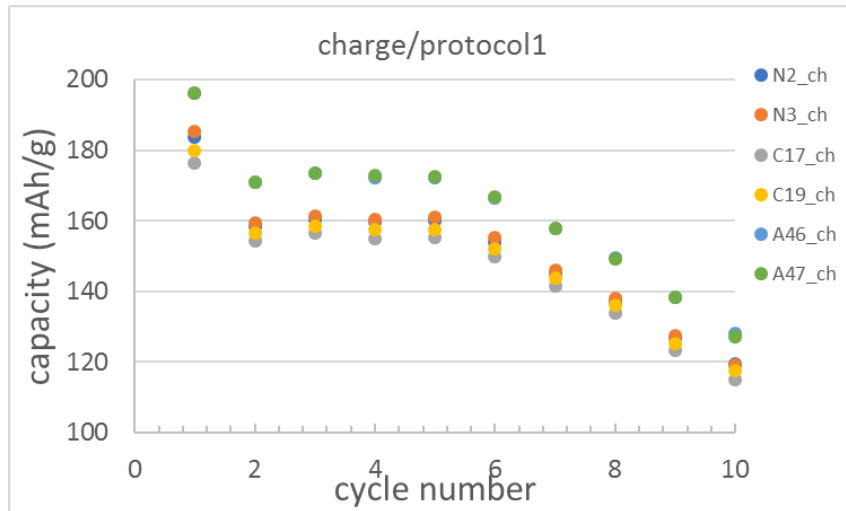
Representative lithium plating-stripping behavior of AE electrode (30 μm), lower capacity limit extended cycling.



Coin Cell Testing (initial phase)

Evaluating lithium against LIB type cathodes (NMC622), 4.3-3 V full depth of discharge. Plating/stripping: no inconsistency is observed and favorable comparison of AE with other lithium sources

Discharge rate mapping – discharge rate gradually increased in each cycle



N-cells : commercial lithium foil (500 μm) anode, C-cells: commercial lithium film (50 μm) anode, A-cells: AE lithium film (30 μm) anode



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