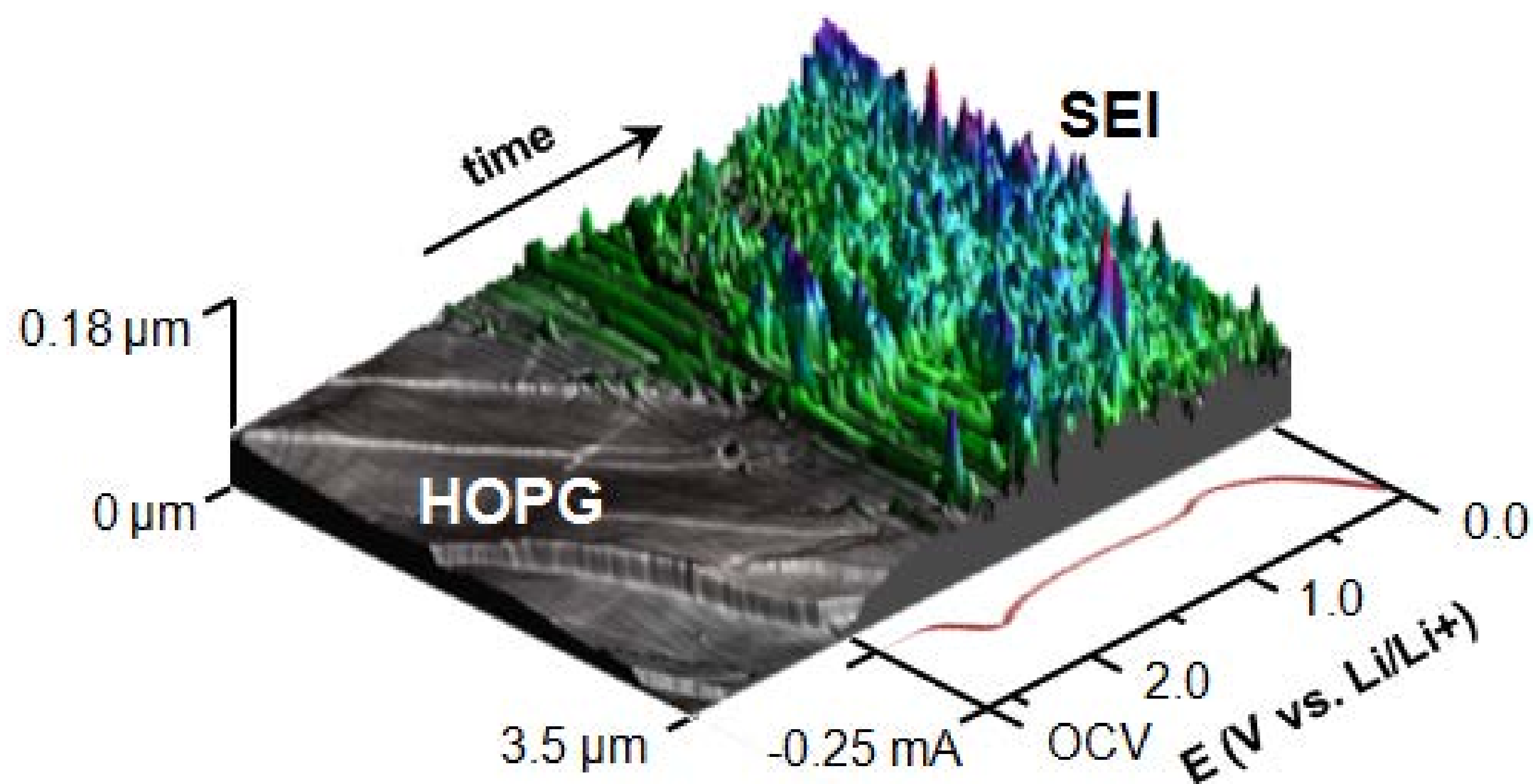


S&T Campaign: Materials Research
Energy & Power
Energy Storage

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Research Objective

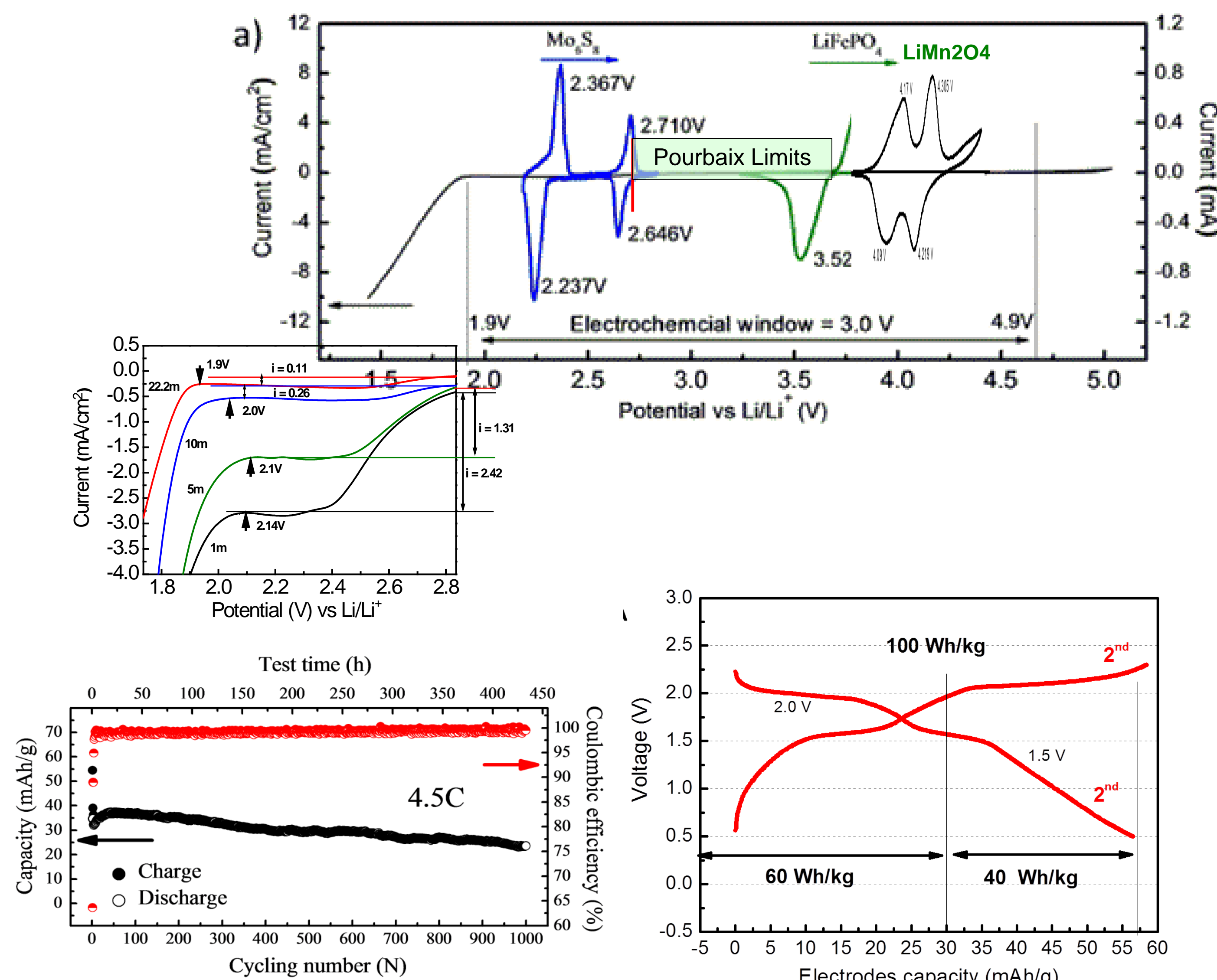
- To develop & understand the basic science of safe, higher energy batteries that operate in all military environments
- Study & develop 5 V Li-ion cathodes, Si Li-ion anodes, beyond Li-ion batteries (Li/S, Aqueous Li-ion, Li-ion capacitors, dual graphite systems) and supporting electrolytes



Topographic AFM image of SEI image on Graphite anode

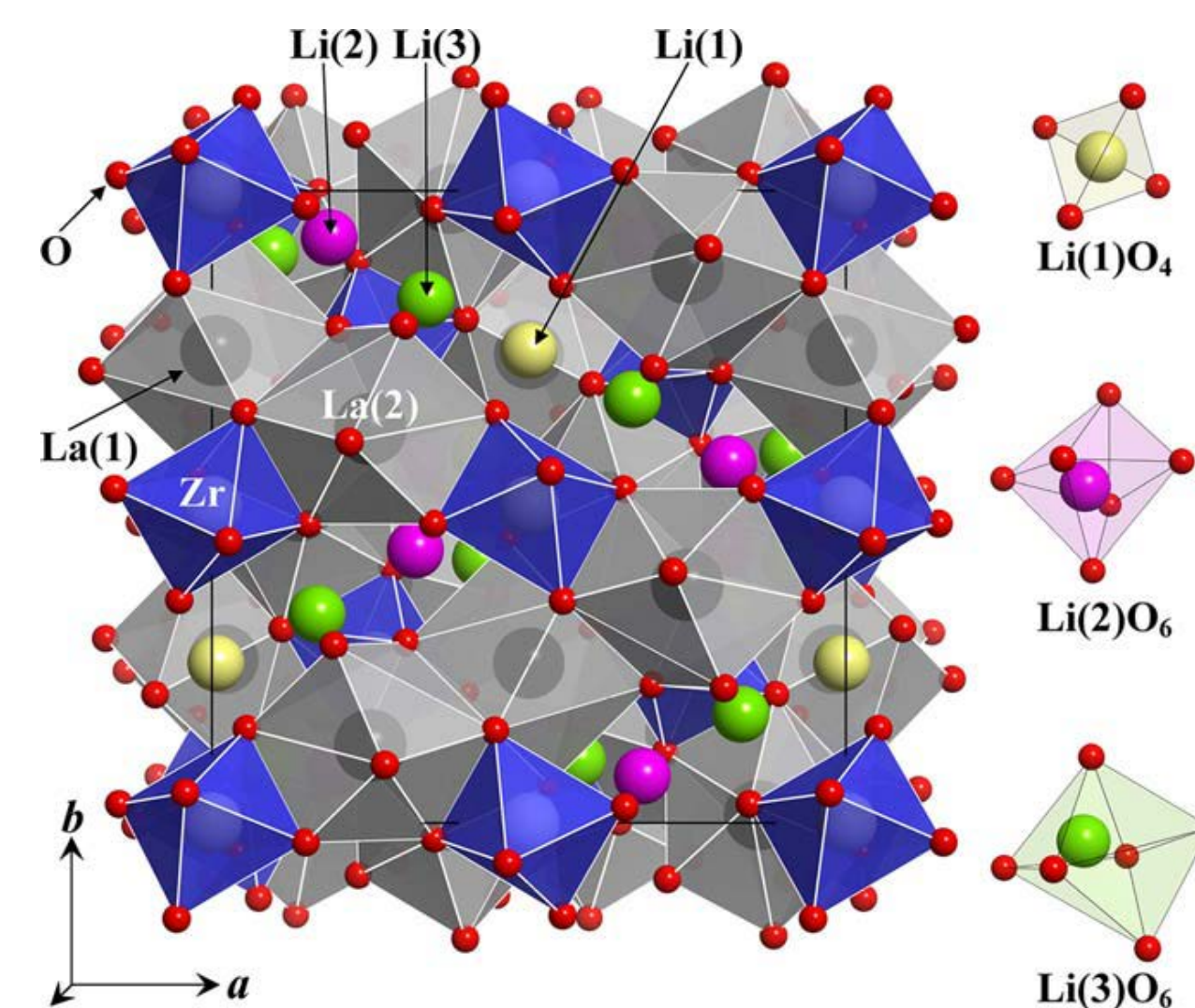
Challenges

- Electrolytes and electrode materials stable at 5 V and working at temperature extremes
- Scale-up of materials from the laboratory scale to the production scale
- Electrolytes/ electrode materials for Si anodes and beyond Li-ion chemistries



ARL Facilities and Capabilities Available to Support Collaborative Research

- ARL-led Washington Area Battery Center of Excellence
- Dry room, glove boxes, coating equipment for prototyping batteries, ballistic abuse testing (POC, Dave Lowry, SLAD)
- Electrochemical instrumentation for impedance, capacity voltammetry measurements
- In situ electrochemical AFM, X-Ray diffraction, SEM, Raman, FT-IR, DSC, TGA, XPS
- U.S. patent applications: 13/153,577, 14/281,924, ARL-14-51, 20120208067, 20120225359, 20120009485
- Unique LiCoPO₄ based electrode, unique electrolyte additives, Li-ion electrolyte & electrode expertise



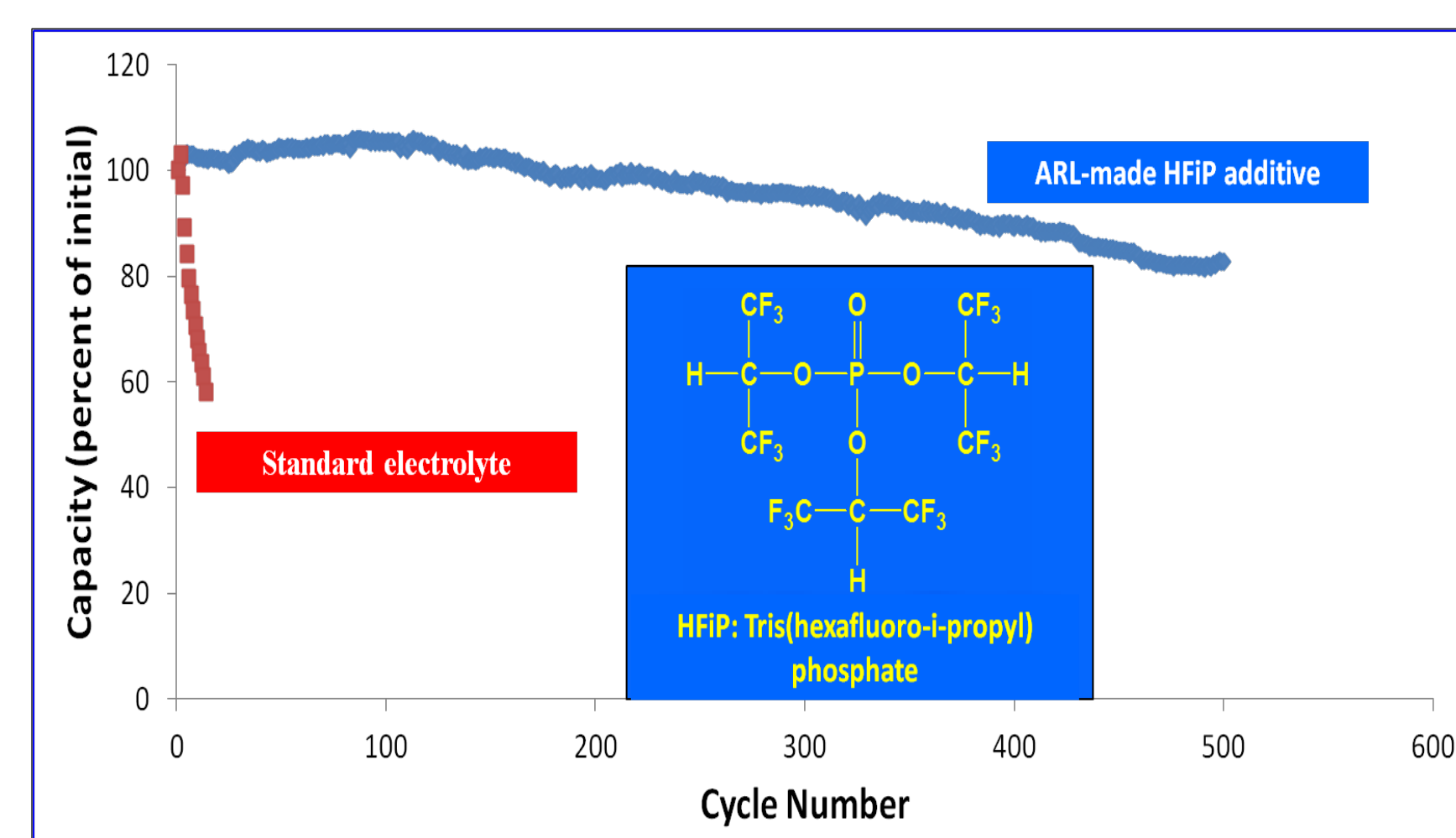
Structure of Li₇La₃Zr₂O₁₂ solid state electrolyte under development at ARL



Scale-up of ARL high voltage electrode

Complementary Expertise / Facilities / Capabilities Sought in Collaboration

- CVD growth of large-area electronic grade diamond
- Plasma hydrogenation of diamond surface
- Solid-state acceptor deposition on diamond
- Two-photon photoemission spectroscopy to map out band structure of 2D/3D heterostructures
- LEEM measurements to identify orientation between MoS₂ and GaN



ARL developed high voltage electrolyte additive



Scale-up of ARL high voltage electrolyte additive