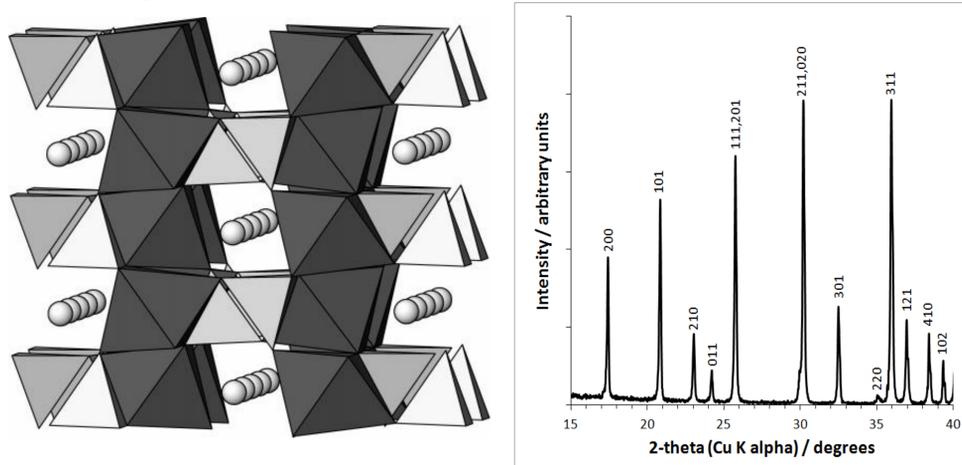


S&T Campaign: Materials Research Energy & Power Energy Storage

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Research Objective

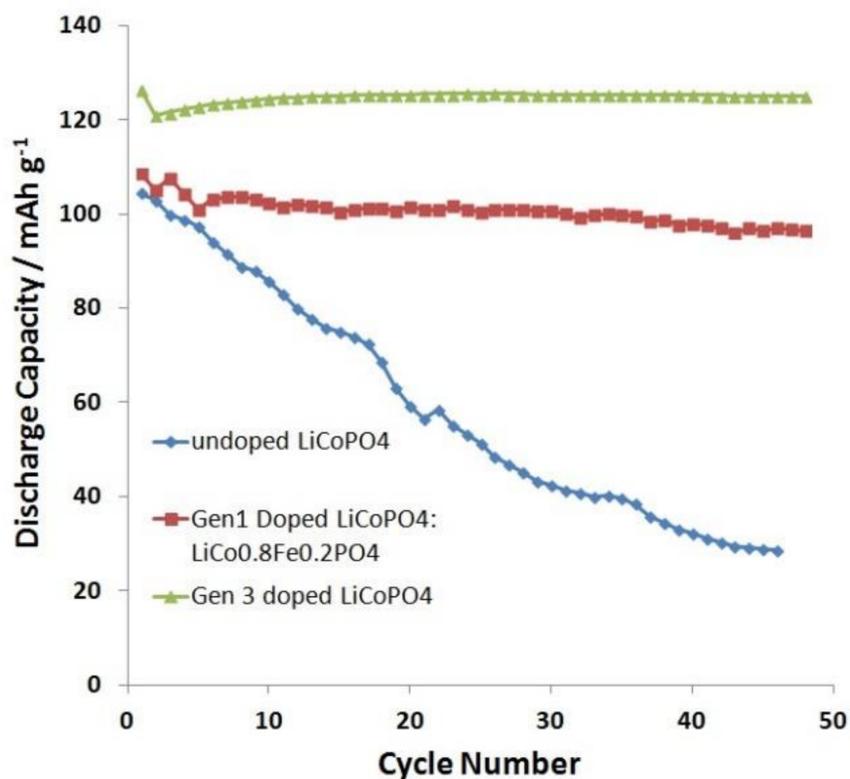
- To develop & understand the basic science of safer, higher energy batteries that operate in all military environments
- Study & develop 5 V Li-ion cathodes, anodes, beyond Li-ion batteries and supporting electrolytes.



LiCoPO₄ crystal structure and X-ray diffraction plot

Challenges

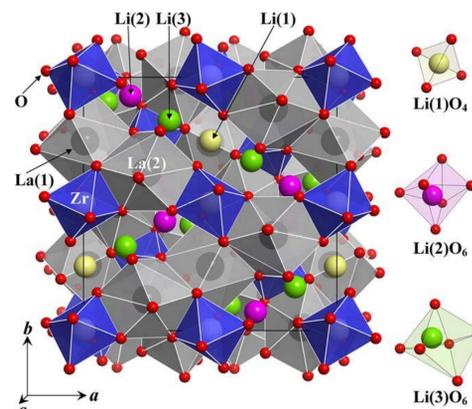
- Electrolytes and electrode materials stable at 5 V and working at temperature extremes
- Scale-up of materials from the laboratory scale to the production scale
- Electrolytes for Li anodes and beyond Li-ion



Cycle life and capacity improvements to LiCoPO₄ made by ARL.

ARL Facilities and Capabilities Available to Support Collaborative Research

- ARL-led Center for Research in Extreme Batteries
- 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 and X-ray diffraction, SEM, Raman, FT-IR, DSC, TGA, XPS
- US Patents 9,356,291, 9,114,779 in high voltage cathode materials
- Unique LiCoPO₄ based electrode, unique electrolyte additives, Li-ion electrolyte & electrode expertise



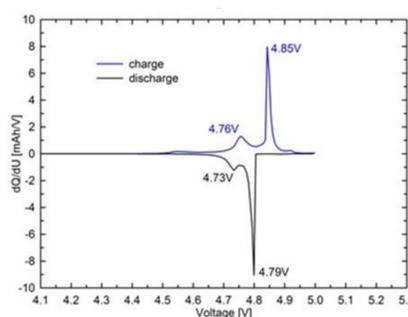
Structure of Li₇La₃Zr₂O₁₂ solid state electrolyte under development at ARL



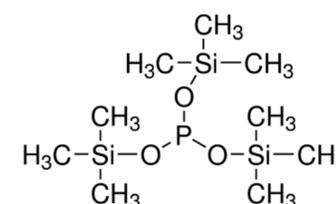
Scale-up of ARL high voltage electrode

Complementary Expertise / Facilities / Capabilities Sought in Collaboration

- Scaled-up synthesis of promising electrode and electrolyte materials
- Synchrotron x-ray and neutron sources for diffraction
- Solid state NMR, unique spectroscopic techniques
- Suggestions for innovative new research approaches to address stated research objectives
- Promising electrode & electrolyte materials for Li-ion



Differential capacity Gen3 LiCoPO₄



Electrolyte additive