Lithium-bearing Mixed Polyanion (LBMP) Glasses as Cathode Materials

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**Technical Approach:**
- Design mixed polyanion (MP) glass cathodes that can overcome the shortcomings of promising crystalline cathodes of a similar composition.
- Develop optimal MP glass cathode materials using a combination of predictive thermodynamic modeling, glass processing, and battery testing.

**Status:**
- Based on promising preliminary results, high capacity borate glass cathodes are being pursued.
- One additional boro-vanado-phosphate glass series is being developed to establish the synergistic effect of borate & vanadate substitution.

**Objectives:**
- Produce MP glass cathode with specific energy over 25% greater than LiFePO₄.
- Demonstrate multi-valent MP glass cathode with specific capacity >200 Ah/kg.
- Establish cyclability and high power performance of MP glass cathodes.

**Deliverables:** Produce MP glass cathodes with at least 25% greater specific energy than LiFePO₄ and minimal capacity fade for 100 cycles.

**Funding:**
Duration: 4 yrs (Yr 4)
FY16 Budget: $0K (DOE) (FY15 carryover only)

**Milestones:**
- **Q2:** Produce glass compositions for high energy cathodes giving maximally oxidized transition metals upon first charge.
- **Q3:** Produce unconventional glass cathodes using alternative glass formers or partial crystallinity.

**Technology:**
- Combined vanadate/borate substitution improved 1ˢᵗ cycle reversibility in Cu- & Ag-based glasses.
- Molybdate substitution in phosphate glass produced high-capacity glass cathodes.
- Transmission electron microscopy showed the microstructure produced by a glass-state conversion reaction.