Iron phosphate coating for enhanced cycling stability of lithium manganese oxide in aqueous environment.

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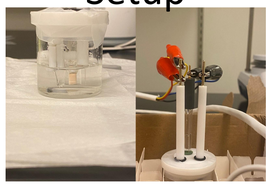
Introduction

Growing demand for lithium requires new and more efficient technologies to extract it from both rock and brine sources. Direct Electrochemical Lithium Extraction is a promising avenue of research for efficient and environmentally friendly lithium extraction[1]. Lithium Manganese Oxide (LMO) is a promising cathode material for direct lithium extraction[2[but suffers from rapid capacity decay in aqueous environments due to the Jahn-Teller Effect and dissolution of Manganese. Surface modification options such as coatings offer a way to shield against degradation of the structure[3]. $FePO_4$ (FP) is a promising coating for LMO[4] but has not been extensively tested for aqueous lithium-ion batteries.

Methodology

Application of the coating was done via coprecipitation of $Fe(NO_3)_3$ and $(NH_4)_2HPO_4$ in an LMO dispersion. Evaluation of the structure and composition of the active material was evaluated with X-Ray Diffraction (XRD) and Laser Induced Breakdown Spectroscopy. (LIBS). Slurry of the coated active material was prepared on titanium foil. Electrochemical Performance was evaluated using a beaker cell connected to LANDT tester.

Figure One: Beaker Cell Setup



Results

Figure Two: Specific Discharge Capacity vs Cycle

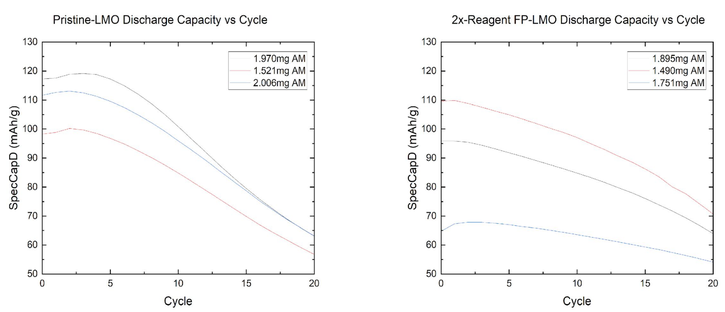


Figure Three: XRD Patterns of LMO

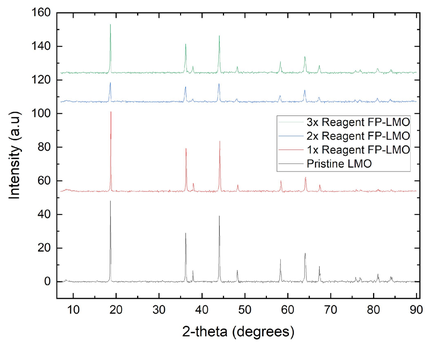
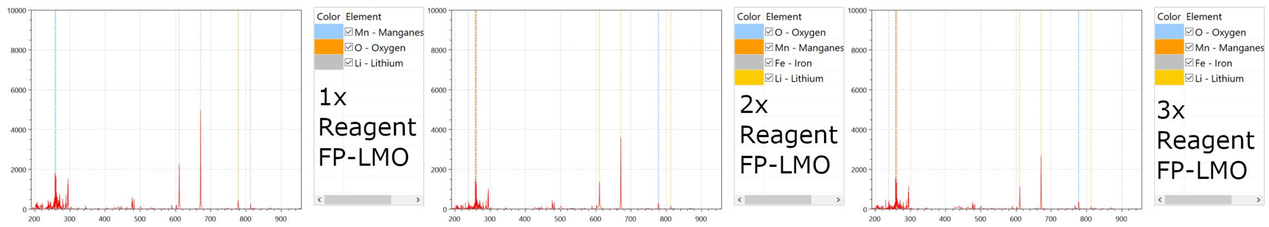


Figure Four: LIBS Spectra of FP-LMO at different coating parameters



Conclusion and Future Work

Research Findings:

- Iron Phosphate coating successfully applied without damage.
- Cells run with the 2x-Reagent FP-LMO had a mean discharge capacity 3% higher than the cells with Pristine LMO at the 20th cycle though with more deviation.

Future Work:

- Evaluating electrochemical performance in environments with less lithium in solution as well as evaluating uniformity of coating.

References

Works Cited

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