UNIVERSITY OF RHODE ISLAND
Department of Chemistry
VIRTUAL SEMINAR

2:00 P.M., Friday, May 1, 2020
Please email dugan@uri.edu for link

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"Understanding the role of electrode and electrolyte modifications in improving lithium ion battery cycle-life"

HOST

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The continued development of energy storage technology is of high importance in order to facilitate the wide adoption of intermittent renewable energy sources as well as the expansion of electromobility and longer lasting portable electronics. Currently, the lithium ion battery fills many of these roles. These applications require a rechargeable cell with high energy density and long cycling life, which can be achieved with modifying the cell chemistry and construction.

One route to achieve a high energy density lithium ion battery is to increase the nickel or lithium content of the layered lithium nickel-manganese-cobalt-oxide positive electrode (NMC cathode) materials. Unfortunately, alongside the improved capacity, these changes result in new challenges to overcome such as surface reconstruction, gas evolution, and transition metal dissolution. Surface modification of the cathode material can help alleviate detrimental reactions; however, the source of the improvements remains unclear. We investigated the effect of ALD-deposited Al_2O_3 coatings on cycling performance of full graphite|$Li_{1.33}Ni_{0.27}Co_{0.13}Mn_{0.60}O_{2+d}$ cells, effect on the molecular composition of the anode solid-electrolyte interphase (SEI), and extent of transition metal deposition on the anode material using XPS, ICP-MS, and ATR-FTIR analyses.

Additionally, enabling the reversible plating and stripping of lithium metal on the negative electrode substrate – a lithium metal anode – allows for a higher gravimetric capacity necessary for a lightweight battery. However, the application of the lithium metal anode in carbonate-based electrolytes is plagued by the highly reactive nature of lithium metal, and difficulty in controlling plating morphology. Novel electrolyte additives, difluoroacetic anhydride (DFAA) and trifluoroacetic anhydride (TFAA), are investigated in carbonate-based electrolytes which improve the reversibility of lithium metal plating in Cu|$LiFePO_4$ cells.