UNIVERSITY OF RHODE ISLAND
Department of Chemistry
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SEMINAR

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URI

Performance Analysis of Separators and Electrolyte and Effects on Solid Electrolyte Interface

HOST

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Much of the mobile technology used today (*e.g.* smartphones, tablets, and laptops) is possible because of the lithium ion battery. Because of the high energy density of lithium ion batteries and the continuous improvements in all facets of the technology, larger and more sophisticated batteries are becoming more common for high energy applications such as energy storage for green energy production, electric vehicles (EVs), and hybrid-electric vehicles (HEVs). Despite early success for larger applications, there are some serious problems that still need to be addressed such as cost, safety, and battery life. These issues are the motivation for this research.

Utilization of different separators and electrolyte formulations can help achieve good cycling performance, lower cost, and better safety. The impact on cell performance of electrodes made by a new method to manufacture lithium ion batteries that utilizes ceramic separators is explored, which promises to streamline the manufacture process to lower costs and allow for better performance. Electrodes built using a layer by layer deposition method were cycled and analyzed, including SEM images of the cross section to understand the impact of cycling on the layer interfaces. In addition to knowing how the new manufacturing method can impact the performance of a battery, it is also desired to understand how the separator impacts the performance of the battery. Batteries with ceramic separators are thought to perform better than batteries with polyolefin separators. Cells with ceramic and polyolefin separators were built and cycled extensively at elevated temperature to look for performance differences. In a separate effort to make lithium ion batteries cheaper, safer, and perform better, manipulating the electrolyte formulation may be key, especially if ethylene carbonate can be replaced with GBL, and $LiPF_6$ could be replaced with a more thermodynamically stable salt such as lithium difluoro(oxalato)borate (LiDFOB). Various LiDFOB electrolyte solutions were made and tested against a standard electrolyte for cycle performance, taken apart, and the surfaces analyzed. The development of a carbonate free electrolyte can be very beneficial to the lithium ion battery, and with thinner and better performing separators, lithium ion battery technology can be better situated for use in large scale applications.