UNIVERSITY OF RHODE ISLAND
Department of Chemistry
Ph.D. Seminar

Room 105 Beaupre
2:00 P.M., Friday, March 4, 2022

Nuwanthi Rodrigo
University of Rhode Island
Department of Chemistry

"Investigation of Novel Low Temperature Electrolytes for Lithium-ion Batteries"

HOST

Dugan Hayes
Department of Chemistry
401-874-5516

Investigation of Novel Low Temperature Electrolytes for Lithium-ion Batteries

Nuwanthi Rodrigo
Department of Chemistry
University of Rhode Island

Improving energy storage technology is vital to the worldwide adoption of renewable energy sources as well as the growth of electromobility. Therefore, recent research has been focused on developing rechargeable lithium-ion batteries enabling high energy and power density over a wide temperature range with improved safety. Unfortunately, the performance of lithium-ion batteries is greatly affected by its operating temperatures. At subzero temperature, the performance of lithium-ion battery in carbonate-based electrolytes is decreased by increased cell resistance limiting lithium-ion transportation. Therefore, adjusting the electrolyte composition through use of novel solvents, electrolyte additives, alternative lithium salts and optimized solvent blends has been reported to improve the low temperature performance of lithium-ion batteries. This talk is focused on understanding the performance of lithium-ion batteries in relation to the structure and composition of surface films generated with low temperature electrolytes. The first part of the talk will discuss a novel co-solvent, isoxazole (IZ), which was introduced into a novel electrolyte system composed of lithium difluoro(oxalato)borate (LiDFOB) in fluoroethylene carbonate (FEC) and LiDFOB in ethylene carbonate (EC). This electrolyte was shown to improve reversible cycling at low temperature in Li/graphite cells and generates a stable solid electrolyte interphase (SEI). The later part of the talk will discuss a study of carboxylate esters - methyl acetate (MA) and methyl propionate (MP) - as co-solvents in electrolyte systems composed of carbonate/$LiPF_6$ in $LiNi_{0.5}Co_{0.2}Mn_{0.3}O_2$ (NCM523)/graphite cells with and without electrolyte additives and the effect of surface composition and structure in electrochemical performance over a wide temperature range (-20 °C to 45 °C).