WPI MATERIALS SCIENCE & ENGINEERING

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PhD Proposal

June 11, 2020
9:00 am – 10:30 am

Zoom meeting:
https://wpi.zoom.us/j/91776055580

Advisor:
Prof. Yan Wang

Committee:
Prof. Brajendra Mishra
Prof. Pratap M. Rao
Prof. Danielle Lynn Cote
Dr. Jun Wang

Enhanced Electrochemical Performance of Lithium, Manganese-Rich Layered Oxide Cathode

Abstract:

Due to the growing demand of electric vehicles and grid energy storage systems, many ongoing researches are focusing on the improvement of energy density of Li-ion batteries to meet the requirements for practical applications and the ever-increasing demands of electrical energy storage from renewable and clean energy resources (projected to be double by 2050). Consequently, this research is mainly focus on improving the capability of lithium-manganese-rich layered oxide cathode (LMR), which is a derivative of traditional NMC cathodes by varying the composition. LMR is one of the attractive cathode materials since it can provide high energy density for next generation lithium-ion batteries via both cationic and anionic redox, resulting in capacities of over 250 mAh g-1 and energy density of over 1000 Wh kg-1 when cycling in voltage range 2.0 – 4.8V (vs. Li/Li+). However, there are several limitations that need to be overcome before it can achieve commercially widespread success such as low rate capability, voltage decay, large decreased of first cycle efficiency, and short cycle life. Out of various techniques to enhance the cathode performance, doping is one of the desired choice due to its facile and simple procedures.

Herein, doping various ions, both cations (Na) and anions (F/S/Cl), into LMR lattice, aiming to improve the overall cathode performance, will be mainly discussed by providing detailed experimental procedures, material characterizations and electrochemistry results. Additionally, future studies on this material will also be addressed.