

THE DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING SPEAKER SERIES

PRESENTS

Solid Electrolyte Interphase (SEI) of lithium ion batteries: Role of additives and crossover reactions on stability and performance



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ZOOM meeting room (Meeting ID: 976 269 9678 | Passcode: K91Bwy):

<https://zoom.us/j/9762699678?pwd=RUUp5ZmN3cHUyQ1FvUEExVQjVsc1hVUT09>

LECTURE ABSTRACT

A solid electrolyte interphase (SEI) is generated on the anode of lithium ion batteries during the first few charging cycles. The presence and stability of the SEI is critical to the performance of the battery. However, despite thorough investigation of the SEI for the last few decades, the SEI remains poorly understood. Over the last several years additional investigations of the structure of the initial SEI formed on graphite electrodes along with changes which occur to the SEI upon additional cycling have been conducted. The investigations provide significant new insight into the structure and evolution of the anode SEI. The initial reduction products of ethylene carbonate (EC) are lithium ethylene dicarbonate (LEDC) and ethylene. However, the instability of LEDC generates an intricate mixture of compounds which greatly complicates the composition of the SEI. The reduction products and their subsequent decomposition products have been thoroughly investigated via a combination of NMR, XPS, IR-ATR, TGA, GCMS, and OEMS. Mechanisms for the generation of the complicated mixture of products are presented along with the differences in the SEI structure and function in the presence of electrolyte additives vinylene carbonate (VC) and fluoroethylene carbonate (FEC). While transition metal catalyzed degradation of the anode SEI has been widely proposed as a primary source of capacity loss for high voltage lithium ion batteries, we propose a related acid induced degradation of the anode SEI. The role of potential on the generation of soluble acidic fluorophosphates crossover species and the impact of these species on the structure and stability of the SEI will be presented.

SPEAKER BIOSKETCH

Brett Lucht obtained a Ph.D. in Chemistry in 1996 from Cornell University and then moved to the University of California for post-doctoral research. He arrived at the University of Rhode Island in 1998, was promoted to Associate Professor with tenure in 2002 and Professor in 2006. He is currently an Associate Editor for the Journal of Electrochemical Society and is the Treasurer for the Battery Division of the Electrochemical Society. His research is focused on novel electrolytes and electrolyte electrode interfaces for Lithium-Ion batteries for electric vehicle applications which includes extending the calendar life of lithium ion batteries, improving the performance of novel high capacity or high voltage electrode materials, and developing non-flammable electrolytes. He has numerous awards for research and intellectual property at URI, is an Associate Editor for the Journal of the Electrochemical Society, the Vice Chair of the Battery Division of the ECS, and is a Fellow of the Electrochemical Society. He has published over 160 manuscripts in peer reviewed journals, his manuscripts have been referenced over 11,000 times, and he has an h-index of 64 (Google Scholar). He has also published two book chapters and has nine patents. He has been an invited or keynote speaker at over 150 companies, universities, national laboratories, and national or international conferences.

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