

Department of Chemical and Environmental Engineering

2014—2015 Seminar Series

Friday, January 30, 2015

9:10—10:00 AM

WCH 205/206



Lynden A. Archer

Professor

School of Chemical and
Biomolecular Engineering

Cornell University

Nanoporous Hybrid Electrolytes for Lithium Metal Batteries

Secondary batteries capable of reliably storing and delivering large amounts of electrical energy are key components in various contemporary and emerging technologies, such as electric vehicles, autonomous aircraft and advanced robotics. Batteries based on lithium metal anodes are understood to be among the most promising for achieving high specific electrochemical storage capacities and high cell voltages. Development of practical rechargeable lithium metal batteries (LMBs) remains a challenge, however, due to unstable electrodeposition of lithium and dendrite formation during repeated cycles of charge and discharge.

Using a continuum transport model for lithium deposition in a binary electrolyte, I will show that electrodeposition at the lithium anode in a LMB can be stabilized through rational design of the electrolyte, salt, and anode/electrolyte interface. Building upon these ideas, the talk will explore structure, dynamics and electrochemical properties of novel nanoparticle salts and nanoporous hybrid electrolyte configurations that stabilize the lithium metal anode against dendritic electrodeposition and failure. Finally, I will show that application of these electrolyte/separator designs to full-cell LMBs lead to simple battery configurations that offer enhancements in storage capacity and cell lifetime relative to state-of-the-art lithium ion batteries.

BioSketch: Lynden Archer is the William C. Hooey Director and Professor of Chemical and Biomolecular Engineering and co-Director of the KAUST-Cornell Center for Energy and Sustainability at Cornell University. His research focuses on transport properties of polymers and polymer/particle hybrids with applications in electrochemical energy storage. Archer received his Ph.D. in chemical engineering from Stanford University in 1993 and the bachelors of Science degree in chemical engineering (polymer science) from the University of Southern California in 1989. He is a fellow of the American Physical Society and has been recognized with various awards, including the National Science Foundation Award for Special Creativity, the James & Mary Tien Excellence in Teaching Award, and the American Institute of Chemical Engineer's MAC Centennial Engineer and Nanoscale Science and Engineering Forum (NSEF) awards.