UC Irvine Samueli
Department of Chemical and Biomolecular Engineering

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# Batteries: How Did We Get Here and Where Are We Going?


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**Abstract**: It is easy to think of batteries as a modern invention. Just in our lifetime, the development of high energy, high power rechargeable consumer batteries transformed mobility and communications. Those advantages were leveraged to impact transportation infrastructure. Now, we are on the precipice of a revolution in grid-scale efficiency and resiliency. But, batteries have been transformative to human life for literally hundreds of years, even when they faced some of the same issues has today: low energy content, high environmental impact, supply chain uncertainty, etc.

For context, this talk will start with a brief history of the most impactful battery technologies since their inception – from possibly enabling gold plating in early civilization (controversial!!) to the first commercially successful batteries to operate telegraphs, high energy primary batteries, and then secondary lithium batteries. The talk will then shift to trends in Li-ion chemistry, which has led to compromises in energy density and safety, which has led to the development of new technologies either in the early stages of or on the verge of commercialization. Another important aspect as Li-ion batteries have become ubiquitous is control over the supply chain for critical minerals, which will also be discussed.

The last part of the talk will focus on the complexity of manufacturing, the dominant players in the field and the activities going on at the University of South Carolina in the Carolina Institute for Battery Innovation (CIBI) to help to support domestic battery production.


For more information about active projects in the Mustain group: https://www.mustainlab.com

For more information about the Carolina Institute for Battery Innovation: https://research.cec.sc.edu/cibi/

**Bio:** William Mustain is a Professor in the Department of Chemical Engineering and the Director of the Carolina Institute for Battery Innovation. He works in several areas related to electrochemical energy generation and storage, including: high capacity materials for Li-ion batteries, novel electrode structures for Li-S batteries, battery recycling, corrosion and passivation of materials, catalysts and supports for proton exchange membrane and anion exchange membrane fuel cells and electrolyzers, electrochemical reactor design and electrochemical synthesis of fuels. He has published over 160 peer reviewed articles (h-index 56) and has over 100 invited lectures. He has served as the chair of the Energy Technology Division of the Electrochemical Society and AIChE Area 1E: Electrochemical Fundamentals. He has been the recipient of several awards including the U.S. Department of Energy Early Career Award, Electrochemical Society Energy Technology Research Award,

Connecticut Quality Improvement Platinum Award, Supramaniam Srinivasan Young Investigator Award (Awarded by the Energy Technology Division of the Electrochemical Society), UConn Chemical Engineering Faculty of the Year Award, USC Chemical Engineering Publication Award, USC CEC Research Achievement Award, Illinois Institute of Technology Young Alumnus Award, and Fulbright Scholar Fellowship.

***Hosted by:*** *Prof. Plamen Atanassov*