Northeastern University
College of Engineering

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Distinguished Seminar Speaker

Organic Batteries for a More Sustainable Future

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Abstract: Cobalt, nickel, and lithium are essential ingredients in today's lithium-ion batteries (LIBs), but their continued use presents economic, ethical, and environmental challenges. Society must now begin to consider the implications of a LIB's full life cycle, including the carbon footprint, the economic and environmental costs, and material access. These challenges motivate the case for degradable or recyclable batteries sourced from earth-abundant materials whose life cycle bears minimal impact on the environment. This presentation considers organic polymer-based batteries, which have the potential to address many of these issues. Redox-active polymers form the positive and negative electrodes, storing charge through a reversible redox mechanism. We demonstrate polypeptide radical batteries that degrade on command into amino acids and by-products as a first step toward circular organic batteries. Further, we show the recycling of redox-active polymer electrodes using a solvent-based approach. Polymer-air batteries are examined as high-capacity alternatives to metal-air batteries. The molecular mechanism for each case is investigated, revealing pathways forward for improving each polymer's performance. Taken together, organic batteries offer the promise of a circular platform free of critical elements.

Biography: Jodie L. Lutkenhaus is a Professor, Associated Department Head, and holder of the Axalta Chair in the Artie McFerrin Department of Chemical Engineering at Texas A&M University. Lutkenhaus received her B.S. in 2002 from The University of Texas at Austin and her Ph.D in 2007 from Massachusetts Institute of Technology. Current research areas include polyelectrolytes, redox-active polymers, energy storage, and composites. She has received recognitions including World Economic Forum Young Scientist, Kavli Fellow, NSF CAREER, AFOSR Young Investigator, and the 3M Non-tenured Faculty Award. She is the past-Chair of the AICHE Materials Engineering & Sciences Division. Lutkenhaus is the Deputy Editor of *ACS Applied Polymer Materials* and a member of the U.S. National Academies Board of Chemical Sciences & Technology.

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