Lecture abstract

Because of the projected shortages of elements used in Li-ion batteries and limited battery recycling, alternative electrode chemistries are gaining interest. Ideally, this future battery would contain materials that are easily sourced with little environmental impact, would be degradable of recyclable, and would bear similar or better energy storage characteristics in comparison to Li-ion batteries. This talk will examine one such promising battery chemistry, that of macromolecular radicals. These polymers generally contain redox-active nitroxide radical groups that reversibly exchange electrons at rates much higher that of current metal oxide cathodes. This manifests as a higher power or a high charging rate. The current challenges for macromolecular radical batteries are to understand the redox mechanism, to increase the energy density in metal-free or aqueous conditions, and to consider a circular life cycle. Insight into the polymer's redox mechanism is provided using electrochemical quartz crystal microbalance with dissipation monitoring, in which mixed electron-ion-solvent transfer is quantified. This knowledge reveals why certain metal-free, aqueous electrolytes are well-suited to this polymer class. Last, an organic peptide battery that degrades on command into amino acids and byproducts provides a path forward toward recycling for a circular life cycle. Collaborative work on polypeptide redox flow batteries with the late Susan Odom is highlighted.

Established In Memory of
Professor Susan A. Odom '03
(1980 - 2021)
UK Chemistry faculty 2011 - 2021

Pioneer in renewable energy storage and champion of undergraduate research.

College of Arts and Sciences
Department of Chemistry

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SUSAN ODOM LECTURE

Redox-active Macromolecular Radicals for Metal-Free, Degradable Batteries

JODIE L. LUTKENHAUS
Professor in the Artie McFerrin Department of Chemical Engineering
TEXAS A&M UNIVERSITY

FRIDAY, APRIL 8, 2022 | 4:00 PM
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University of Kentucky

DR. SUSAN A. ODOM

Professor Susan Odom was an energetic, productive, and driven faculty member in the Department of Chemistry from 2011 to 2021.

Susan Odom, a native of Paducah, Kentucky, always had an intense sense of curiosity and a passion for science. She attended the University of Kentucky for her undergraduate studies, specializing in organic chemistry and performing research in the development of new materials for organic light-emitting diodes. A highly productive researcher from the start, she was listed as a co-author on four peer-reviewed publications, the lead author on one publication, and was a co-inventor on a royalty-generating patent before completing her undergraduate work. She earned her Ph.D. from the Georgia Institute of Technology, supported by a National Science Foundation (NSF) Doctoral Fellowship to work with Professor Seth Marder, in the development of new charge-transporting materials for flexible electronics. She followed her funding success to earn a Post-Doctoral Fellowship from the NSF to work under Professor Jeffrey Moore at University of Illinois Urbana Champagne in the area of self-healing polymers.

Dr. Odom returned to the University of Kentucky as an Assistant Professor in the Department of Chemistry in 2011, and was tenured and promoted to Associate Professor in 2017. Dr. Odom established herself as an unfaltering proponent of undergraduate and high-school research, hosting numerous students in her laboratory and producing peer reviewed publications from their research efforts. She focused on outreach to younger students and the public, showing for example the strong relationships between science and art. Dr. Odom was a co-organizer of the Expanding Your Horizons program, a STEM conference for middle school girls and their parents, to encourage young women to pursue careers in science and engineering. She also was active in the Kentucky American Council of Education Women's Network, which supports the advancement of women in higher education.

Dr. Odom's established a robust and well-funded research program, serving as the principal investigator or co-investigator on numerous research grants, and served key positions in several large-scale collaborative research efforts. Her main research focus was in the area of power storage; when the often-quoted rail against renewable energy was uttered - 'what happens when the sun doesn't shine or the wind doesn't blow?' - her vocal response was always 'batteries!'. Dr. Odom's research efforts were lauded by the scientific community; from 2017 - 2019, she was a Research Corporation for Scientific Advancement Scialog Fellow for Advanced Energy Storage, and in 2020 she was awarded the American Chemical Society's 'Rising Star Award' from the Women Chemists Committee. Dr. Odom pushed for excellence in every task that she undertook, and this lecture series was established to celebrate her spirit and commitment to excellence in materials chemistry.

The Susan A. Odom Endowment has been established to continue Professor Odom's vision of excellence and diversity in materials research.

JODIE L. LUTKENHAUS

Jodie L. Lutkenhaus is the William and Ruth Neely Faculty Fellow and Professor in the Artie McFerrin Department of Chemical Engineering at Texas A&M University. Lutkenhaus received her B.S. in Chemical Engineering in 2002 from The University of Texas at Austin and her Ph.D. in Chemical Engineering in 2007 from Massachusetts Institute of Technology. Following a postdoctoral position at University of Massachusetts Amherst, she joined the faculty at Yale in 2008. In 2010, she moved to Texas A&M University and was promoted to Associate Professor in 2015. Current research areas include polyelectrolytes, redox-active polymers, energy storage, and anti-corrosion coatings. She has received recognitions including World Economic Forum Young Scientist, Kavli Fellow, NSF CAREER, AFOSR Young Investigator, 3M Non-tenured Faculty Award. She is the 1st Vice Chair of the AICHE Materials Engineering & Sciences Division. She serves on the Editorial Advisory Boards for ACS Macro Letters, Macromolecules, ACS Applied Nano Materials, Molecular Systems Design & Engineering, and Materials Today. Lutkenhaus is the Deputy Editor of ACS Applied Polymer Materials.