DREXEL UNIVERSITY
Materials Science and Engineering
College of Engineering

Department of Materials Science and Engineering
Spring Seminar Series

2:45 PM, Wednesday, May 2
PISB 106

"On the Design of Organic Molecules for Redox Flow Batteries"

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Abstract:
The development of charge-storage materials for use in redox flow batteries (RFBs) requires possession of a diverse property set that will lead to high capacities, voltages, and lifetimes for large-scale stationary storage application. High capacities require high solubilities in all states of charge. High voltages stem from large differences in redox potentials. Long lifetimes require stability far greater than the timescales at which many chemists are used to operating, who rarely have the need to isolate a charged species at high concentration in diverse environments for a decade or more. None of these properties may be compromised in realizing a commercial battery, on top of which low cost and scalability are paramount. Given the demands in materials design, cost, and scale, it's a small wonder that the variety of redox couples utilized in commercial redox flow batteries are few. While the challenge of meeting these requirements may at first seem daunting, to the right organic chemist, an opportunity is presented. The flexibility in design and tunability of properties of organic materials presents a cornucopia of choices to evaluate as electrolyte candidates. The most challenging question is "Where do we begin?" In this presentation, I will focus on the design and characterization of organic molecules as candidates for charge-storage species in non-redox flow batteries, covering both aqueous and nonaqueous electrolytes, with focused results in the latter environment. I hope to provide a general represent of accomplishments as well as examples of the many remaining opportunities in this nascent field of research and development.

Bio:
Susan Odom is an Associate Professor of Chemistry at the University of Kentucky, the same institution from which she obtained a B.S. in Chemistry in 2003. There Prof. Odom worked as an undergraduate research under the guidance of Prof. John Anthony where she synthesized light-emitting materials and fabricated organic LEDs containing these emissive components. Prof. Odom moved to Atlanta, GA, where she received a Ph.D. from Georgia Institute of Technology under the guidance of Prof. Seth Marder and Dr. Stephen Barlow, studying triarylamine radical cations as mixed-valent species. A stint at the University of Oxford as a visiting student in Prof. Harry Anderson's research group (2005) sparked a few projects on chromophores containing zinc porphyrins with squaraine or perylene diimide acceptor moieties for nonlinear optical studies and photo-induced electron transfer studies. Prof. Odom joined the chemistry department at the University of Kentucky in 2011 after a position as a postdoctoral researcher at the University of Illinois, Urbana-Champaign where she developed self-healing electronic materials and damage-indicating microcapsules under the guidance of Prof. Jeffrey Moore. She also worked with researchers (Khalil Amine, John Zhang) at Argonne National Laboratory studying capsules and electrolyte additives in lithium-ion batteries. Prof. Odom's professional interests include research in organic and materials chemistry for energy storage applications. Her initial focus included redox shuttles for overcharge protection of lithium-ion batteries. More recently, her research scope expanded to include redox-active organic materials for non-aqueous redox flow batteries. She is currently a visiting scholar in the Brushett (MIT) and Aziz (Harvard) laboratories where she is working on fabricating a prototype non-aqueous flow battery and evaluating new organic compounds in aqueous electrolytes, respectively. Outside of research, Prof. Odom is involved in educational and outreach activities, and is serving in her second year as a co-organizer of the Expanding Your Horizons Conference at the University of Kentucky.

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