

Spring 2023 Joint Colloquium

Materials Department & Materials Research Laboratory

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University of Chicago
Pritzker School of Molecular
Engineering

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11:00 am | ESB 1001



Leveraging the Electrochemically Properties of Redox-Active Particles for Energy Storage

This presentation will discuss the design of redox-active microparticles for energy storage, with a focus on two research thrusts. The first part will cover redox-active microparticles crosslinked with organic disulfide redox centers (DS-RAPs) and the application of electrochemical stimulus to drive their redox reactivity and dynamic nature. Our team has demonstrated that DS-RAPs exhibit improved electrochemical reversibility compared to their small molecule disulfide counterparts. Furthermore, by taking advantage of the electrochemical stimulus response, we have shown that DS-RAPs can be cleaned from a fouled electrode surface under reductive potential and convective fluid flow, which introduces a novel particle design strategy with intrinsic cleaning functionality. The second part of the talk will focus on our ongoing work on redox targeting flow batteries. We are investigating the interplay between ferrocene-based microparticles and small molecule mediators to expand the limits of accessible charge capacity in operating flow batteries. Our goal is to enhance the performance of flow batteries by developing strategies that increase their efficiency and capacity for energy storage.

Bio

Shrayesh Patel is an assistant professor in the Pritzker School of Molecular Engineering (PME) at the University of Chicago and holds a joint appointment in the Chemical Sciences and Engineering Division at Argonne National Lab. His research interests focus on polymers for sustainable energy systems. He is specifically interested in the fundamental understanding and the applications of charge transporting polymers (ions and/or electrons) on energy storage and conversion devices such as lithium-ion and beyond lithium-ion batteries, redox flow batteries, and thermoelectrics. Overall, his research expertise lies at the interface of polymers and electrochemistry. Shrayesh has received the ACS Polymers Au Rising Star Award (2022) and the ACS PMSE Early Stage Investigator Award (2023).

Shrayesh completed his undergraduate degree at the Georgia Institute of Technology in Chemical and Biomolecular Engineering in 2007, then received his PhD in chemical engineering from the University of California, Berkeley in 2013. Before joining the PME in Sept. 2016 as an assistant professor, he was a postdoctoral research associate in the Materials Research Laboratory at the University of California, Santa Barbara.

<https://pme.uchicago.edu/group/patel-group>