COLLEGE OF ENGINEERING

Research Seminar Series

University of Nebraska-Lincoln
Department of Chemical and Biomolecular Engineering

Harnessing molecular control of polymers using directed self-assembly principles for next generation water and energy materials

Dr. Christopher Arges

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Co-Hosted by Dr. Shudipto Dishari, Chemical and Biomolecular Engineeing and Nebraska Center for Materials & Nanoscience UNL

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3:30-4:30p.m.

Jorgensen Hall, Room 110

**Refreshments provided*

Abstract

Directed self-assembly of block copolymers has emerged as a low cost nanomanufacturing platform for realizing sub-10 nm patterns for integrated circuit manufacturing. This process is mature and established and is currently being pursued by numerous semi-conductor manufacturers including IBM and Intel. However, extension of directed self-assembly of block copolymer concepts to other areas of materials research is not as widespread.

In this talk, directed self-assembly of block copolymers was leveraged to make precisely ordered block copolymer electrolytes and well-defined electrocatalyst structures. The technique revealed the importance of tortuosity and defect density on ionic conductivity – a key parameter that controls the thermodynamic efficiency of numerous electrochemical devices. Additionally, the talk will show several new nanomanufacturing methods to make periodic nanostructured electrocatalyst of precious group metals on glassy carbon and flexible membrane substrates – targeted for fuel cell applications. Preliminary catalytic activity of these nanostructured materials for a model reaction - oxygen reduction in alkaline media - will be presented.

The talk will close with our recent efforts on reducing the energy footprint for desalinating brackish water streams with rationally designed ion-exchange membranes. This part of the talk will showcase our approach to make molecular level bipolar junctions on nanoparticle supports. The importance of these bipolar junctions, similar to a p-n type junction seen in semiconductor devices, will be discussed in the context of water purification.

Biography

Chris Arges is the Gordon A. and Mary Cain Assistant Professor in Chemical Engineering at Louisiana State University. Chris earned a B.S. in Chemical Engineering from the University of Illinois at Urbana-Champaign. Afterwards, he spent four years as a product development engineer in the pharmaceutical industry at Hospira and Baxter. While working fulltime, he completed his M.S. in Chemical Engineering at North Carolina State University. He then went on to earn a Ph.D. in Chemical Engineering at the Illinois Institute of Technology followed by a postdoctoral joint appointment at the University of Chicago and Argonne National Laboratory in the Institute for Molecular Engineering.