Texas Tech University
Department of Chemical Engineering
Seminar Series

David Bergsman
Postdoctoral Associate
Massachusetts Institute of Technology

Atomic Layer Processing for Water and Energy Technologies

Abstract
Rising concern over water and energy security has led to a growing demand for technologies that address water scarcity or enable the use of intermittent energy sources. However, many proposed innovations in areas that could address these issues (e.g. membrane separations, catalysis) will require the ability to cheaply and scalably create nanomaterials with unprecedented structural and compositional control. In this presentation, I will discuss the tremendous potential of using atomic layer processing tools, such as vapor-phase infiltration and molecular layer deposition, to meet these demands while also answering critical questions about the fundamental behavior of molecules in membrane and catalyst systems. I will show how polymer membranes can be made conductive using a combination of laser pyrolysis and alumina infiltration, creating low-cost devices that can leverage electrical current for water treatment and water quality monitoring. I will then discuss molecular layer deposition, an emerging tool for growing ultrathin organic and hybrid films, along with my work to create new chemistries and study the fundamental growth behavior of this process. Lastly, I will describe how molecular layer deposition can be used to grow catalysts for water-to-fuels reactions, highlighting how this tool can open the door to many future improvements in water and energy technologies.

Bio
David Bergsman is a postdoctoral associate in materials science and engineering at the Massachusetts Institute of Technology. He did his undergraduate work in chemical engineering at the University of Washington, a masters in chemical engineering at Stanford University, and his PhD in chemical engineering at Stanford University, which was funded by an NSF GRFP fellowship and the Stanford Gerald J. Lieberman award. His PhD research focused on the development of molecular layer deposition, a layer-by-layer vapor-phase tool for creating ultrathin organic and hybrid organic-inorganic films with sub-nanometer thickness and compositional control, which he completed while working for Professor Stacey F. Bent. His postdoctoral work with Professor Jeffrey C. Grossman aims to make cheap, conductive membranes out of existing polymer membranes, that can be used for advanced water treatment processes, separations, and sensors.

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