CHEMICAL & BIOMOLECULAR ENGINEERING

SEMINAR SERIES

UNIVERSITY OF DELAWARE

CBE.UDEL.EDU

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COLBURN LAB
ROOM 102

CONTROLLING SELECTIVITY IN HETEROGENEOUS CATALYSIS WITH ORGANIC MONOLAYERS

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ABSTRACT

One of the most important factors governing the efficiency of a reaction process is the selectivity to desired products. Achieving high selectivity is necessary in realizing efficient chemical processes that minimize energy inputs and waste, but is a major challenge for complex chemical feedstocks with multiple functional groups. Addressing this problem is important both in conventional production of chemicals and for the conversion of biomass to chemicals and fuels, and requires improved design of the materials that catalyze these reactions.

Our group has investigated several techniques for improving selectivity during the reactions of complex molecules. One approach involves the modification of the catalyst surface with organic monolayers. By changing the functional groups present within these layers, one can precisely control the near-surface environment to enhance specific reactant-surface interactions and thus improve catalyst performance. This presentation will address different ways in which surface functionalization with organic ligands can be used to improve reaction selectivity. These examples span various types of catalysts, including cases where the key reaction steps occur on metal surfaces, on metal oxide surfaces, and at interfaces between metals and metal oxides. The utility of the methods by which organic ligands can be used for selectivity control will be illustrated for reaction chemistries important in biomass refining and in the production of valuable chemicals.

BIOGRAPHY

Will Medlin received his BS and PhD degrees in chemical engineering from Clemson University and the University of Delaware, respectively. After conducting postdoctoral research at Sandia National Laboratories in Livermore, California, he joined the faculty of the University of Colorado, where he now serves as the Denver Business Challenge Endowed Professor in the Department of Chemical & Biological Engineering. His research focuses on the design of solid catalysts for energy and environmental applications. His work has particularly emphasized catalyst surface modification using organic self-assembled monolayers or inorganic thin films to enhance control over catalyst surface and near-surface properties. He has received several research and teaching awards, such as the NSF CAREER award and the AIChE Himmelblau Award. He has been a visiting professor at ETH-Zurich and the Chalmers University of Technology.