"Mechanisms of Cellulose Activation and Implications for Bioenergy"

Wednesday
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3:00 pm
Wu and Chen Auditorium
Levine Hall

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Abstract

As the most bountiful polymer on earth, cellulose stores solar energy with atmosphere-derived carbon as a semi-crystalline solid with structural capability to physically support trees and grasses. With its counterpart lignin, the composite material of lignocellulose evolved to become resistant to biological decomposition (and utilization). Human development has instead harvested the captured energy of cellulose through extreme chemical reaction (e.g., cow digestion) or thermal activation (e.g., fire). In this presentation, the behavior of cellulose via thermal activation is linked to the chemistry and kinetics of several chain scission mechanisms, including the role of natural metal catalyst impurities obtained by plants from soil. Cellulose is shown to interact via hydrogen bonding with itself and neighboring chains, leading to catalytic activation mechanisms dependent on the extent and orientation of the local hydrogen bonding network. The conditions leading to cellulose chain scission ultimately dictate the design of bioenergy chemical reactors, which aim to maximize the formation of volatile molecules for downstream chemical refining to biofuels and biochemicals.

Bio

Paul J. Dauenhauer is an Associate Professor of Chemical Engineering and Materials Science at the University of Minnesota. He serves as Co-director of the Catalysis Center for Energy Innovation. He received his B.S. in Chemical Engineering and Chemistry from the University of Wisconsin-Madison, and his Ph.D. in Chemical Engineering from the University of Minnesota. He worked for the Dow Chemical Company as a Senior Research Engineer in Midland, MI, and Freeport, TX. His work on catalysis and reaction engineering of renewable feedstocks has been highlighted by numerous awards, including the DOE Early Career, the NSF CAREER award, the Rutherford Aris Excellence in Reaction Engineering Award, the AIChE CRE Young Investigator Award, and the Camille Dreyfus Teacher-Scholar Award. He is the co-founder of Sironix Renewables, and inventor of the flagship technology for Activated Research Company.

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