

Renewable Chemicals and Fuels: From First Principles to Chemical Manufacturing

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In this talk, an overview of emerging topics in energy will be given followed by an overview of the catalysis center for energy innovation. We will discuss modern technologies that rely on biomass degradation to simple derivatives, such as sugars, followed by a number of reactions, such as Lewis and Brønsted acid catalyst driven isomerization and dehydration to convert sugars to valuable intermediate furans. Diels-Alders and dehydration chemistry will be outlined for the production of renewable aromatics, such as para-xylene. Hydrodeoxygenation of biomass will also be discussed as an effective means to remove oxygen and produce certain platform chemicals. We will introduce new added-value products including adhesives, lubricants, surfactants, and dienes for tires. We will discuss how enabling technologies, such as hierarchical multiscale materials and multiscale modeling, provide insights into novel catalyst selection to facilitate these complex transformations and how process intensification can enable modular chemical manufacturing.