Research Areas
Catalysis, Separations & Reaction Engineering
Energy

Research Interests
Catalytic science will play a critical role in developing alternative energy sources and new conversion technologies for the 21st century. Our goal is to develop catalytic technologies that solve a key piece of this challenge by efficiently controlling hydrocarbon-based reaction pathways important in energy conversion and use, chemical synthesis, and environmental control. With these goals in mind our research focuses on developing new catalytic conversion technologies for renewable biomass-derived feedstocks and activation of light alkanes that are major constituents of natural gas.

The functional characterization of reactivity is accomplished by isotopic tracer and transient studies, chemical transient methods, and steady-state kinetic measurements to determine the evolution of surface species and reaction intermediates prevalent under reaction conditions. These kinetics and mechanistic studies are complemented by general structural and chemical characterization studies using X-ray diffraction, electron microscopy, porosity measurements, thermal analysis techniques and infrared and NMR spectroscopies. In intimate collaboration with these experimental studies, computational studies using Density Functional Theory (DFT) are done to examine molecule-surface interactions and chemical rearrangements relevant for these chemistries.

Our integrated experimental/ theoretical approach lies at the crossroads of materials synthesis, computational catalysis and catalytic chemistry and aims to advance our ability to understand, design and control chemical transformations using catalysis.

Awards
Associate Editor, Journal of Catalysis, 2017
Young Scientist Award, Acid Base Catalysis Society, 2017
Ipatieff Prize, American Chemical Society, 2016
Richard A. Glenn Award, Energy & Fuels Division (ENFL) American Chemical Society, 2016
US Department of Energy Early Career Award, 2012
Selected Publications

Andrew Hwang; Aditya Bhan; “Bifunctional strategy coupling Y2O3 catalyzed alkanal decomposition with methanol-to-olefins catalysis for enhanced lifetime.” ACS Catalysis 7 (2017) 4417-4422.


Rachit Khare; Zhaohui Liu; Yu Han; Aditya Bhan; “A mechanistic basis for the effects of silicon to aluminum ratio on ethene selectivity in methanol to hydrocarbons conversion on ZSM-5.” Journal of Catalysis 348 (2017) 300-305.


Udit Gupta; Seongmin Heo; Aditya Bhan; Prodromos Daoutidis; “Time scale decomposition in complex reaction systems: A graph theoretic analysis.” Computers & Chemical Engineering 95 (2016) 170-181.

Linh Bui; Reetam Chakrabarti; Aditya Bhan; “Mechanistic origins of unselective oxidation products in the conversion of propylene to acrolein on Bi2Mo3O12.” ACS Catalysis 6 (2016) 6567-6580.

Rachit Khare; Sukaran S. Arora; Aditya Bhan; “Mechanistic consequences of co-feeding acetaldehyde on ethene selectivity in methanol-to-hydrocarbons conversion on MFI.” ACS Catalysis 6 (2016) 2314-2331.


Mark M. Sullivan; Cha-Jung Chen; Aditya Bhan; “Catalytic deoxygenation on metal carbides.” Catalysis Science & Technology 6 (2016) 602-616.