HAJIM SCHOOL OF ENGINEERING & APPLIED SCIENCES
UNIVERSITY of ROCHESTER

The Department of Chemical Engineering Presents

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"A mechanistic view of reactivity and selectivity during ketone oxidation over solid oxides"

Abstract: The oxidative scission of carbonyl compounds is of interest in the production of carboxylic acids, and homogeneously-catalyzed pathways have been well-studied in condensed media. The reaction can also be performed in the gas phase over solid oxides; however, mechanistic insights about heterogeneous pathways are sparse. To this end, we investigate the oxidative scission of 3-methyl-2-butanone over □-Al_2O_3 and VO_x/□-Al_2O_3 using kinetic analysis and spectroscopic methods. We observe that the oxidative scission of 3-methyl-2-butanone can occur on reducible vanadium oxides and non-reducible aluminum oxides, and we consider the existence of separate pathways mediated by lattice oxygen and gas phase dioxygen. Fourier-transformed infrared (FTIR) and diffuse reflectance ultraviolet-visible (DR UV-Vis) spectra obtained under reaction conditions provide insights into the nature of surface species; the regimes where they form; and the degree of lattice reduction in those regimes. Based on these complementary insights, we propose a mechanism for the gas-phase oxidative scission of ketones on VO_x/g-Al_2O_3. We include elements of Mars-van Krevelen and Eley-Rideal pathways, and we consider the significance of acid-base and redox steps in facilitating the oxidative scission of ketones.

Wednesday December 7, 2022

The Gowen Room, 10:30-11:30 am

Bio: Jesse Bond received his B.S. in Chemical Engineering from Louisiana State University, where he developed an interest in catalysis and reaction engineering. His PhD and Postdoctoral training were under the guidance of Thatcher Root and Jim Dumesic in the Department of Chemical and Biological Engineering at the University of Wisconsin, Madison. He is presently a Professor in the Department of Biomedical and Chemical Engineering at Syracuse University. His research group focuses on developing and understanding catalytic technologies for upgrading abundant natural resources.