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Wednesday, Sept 22nd, 2021 at 4:00pm EST
Virtual Meeting: Zoom

Dr. Nirala Singh

Assistant Professor
Chemical Engineering
University of Michigan, Ann Arbor

Connecting adsorption energies with kinetics for liquid-phase and electrocatalytic fuel and chemical production

The need to produce fuels and chemical sustainably and the decreasing cost of renewable electricity is leading to opportunities in heterogeneous electrocatalysis. In this talk I will discuss two aqueous-phase reactions relevant to the production of fuels and wastewater remediation: phenol hydrogenation (as a model of bio-oil upgrading) and nitrate reduction (for conversion of toxic nitrate to ammonia). Both of these reactions on platinum group metals are rate-controlled by a surface reaction step, and as such the adsorption energetics of the reacting species are expected to significantly impact the reaction rate. Over the past several years, through employing traditional heterogeneous catalytic methods developed for gas-phase reactions, we have been able to better understand the link between aqueous-phase adsorption energies and kinetic trends as expected from the Sabatier principle.[1-10] I will go over the importance of solvent displacement in aqueous-phase

adsorption, and show how a simple bond-additivity model can accurately account for these effects for a range of molecules. I will also discuss tools to study liquid-phase catalytic reactions under operating conditions to build a more complete story of the role of coverage on reaction kinetics. Lastly, we will discuss how we have used the link between adsorption and activity to better understand catalyst performance and design new catalysts for these important reactions. In the end I hope to show how traditional catalytic methods and gas-phase intuition strongly benefit the understanding of liquid-phase catalysis and electrocatalysis.

References:
1. Singh et al., ACS Catalysis 6, 7466, 2016
2. Singh et al., J. Catalysis 368, 8, 2018
3. Singh et al., ACS Catalysis 9, 1120, 2019
4. Singh et al., ACS Catalysis 9, 6869, 2019
5. Liu et al., ACS Catalysis 9, 7052, 2019
6. Singh and Campbell, ACS Catalysis 9, 8116, 2019
7. Singh et al., J Catalysis 382, 372, 2020
8. Akinola et al., ACS Catalysis 10, 4929, 2020
9. Akinola and Singh, J Applied Electrochemistry, 51, 37, 2021
10. Wang et al., J Catalysis, 395, 143, 2021

Speaker Bio

Nirala Singh is an Assistant Professor of Chemical Engineering at University of Michigan, Ann Arbor. He joined the faculty at Michigan in 2018 after completing a Washington Research Foundation Innovation Fellowship at the University of Washington and Pacific Northwest National Laboratory with Charlie Campbell and Johannes Lercher. He received his BS in Chemical Engineering from the University of Michigan and received his PhD in Chemical Engineering from the University of California Santa Barbara in 2015 with Eric McFarland and Horia Metiu. Singh's lab uses experimental kinetic measurements, adsorption models, and spectroscopy to understand electrocatalytic reactions for energy storage, sustainable chemical and fuel production, and wastewater remediation.

Website: https://cheresearch.engin.umich.edu/singh/index.htm

Please refer to email announcement for login details.

Presentation	**4:00 PM**	**Annual Membership Dues**	**$35 (*Students* = $15)**

Deadline for reservations is **4:00PM Monday, February 22nd, 2021**

To make your reservation, fill out the online form.