

**SPRING 2022  
CHEMISTRY  
SEMINAR SERIES**



**DR. DAVID  
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Lemont, IL*

**HOST:  
DR. PROKOPCHUK**

**ALL THOSE  
INTERESTED ARE  
WELCOME TO  
ATTEND**

**“Metal-Surface Stereoelectronic Communication in  
Surface Organometallic Catalysis”**

**Friday, April 22, 2022, 11:30 AM  
Life Science Center II, Room 130**

**Abstract:** Chemisorption of organometallic complexes on inorganic supports is a powerful strategy for developing heterogeneous, single-site, *homogeneous-in-function* catalysts. Typical support materials, most commonly silica ( $\text{SiO}_2$ ) and alumina ( $\text{Al}_2\text{O}_3$ ), play a crucial role in stabilizing reaction intermediates and site-isolating reactive species throughout the catalytic cycle but the inert nature of these catalyst supports precludes direct modulation or augmentation of catalytic processes by manipulation of the support akin to electronic ligand design and “redox non-innocence” in homogeneous catalysis. In this talk our group’s efforts toward the application of Li-ion battery cathode and anode materials as redox non-innocent and tunable catalyst supports will be discussed. In a proof of principle for this approach, a nickel modified lithium manganese oxide ( $\text{Li}_x\text{Mn}_2\text{O}_4$ ) material synthesized by an “oxidative grafting” process is shown to monotonically increase in catalytic activity as a function of reductive lithium intercalation. This approach toward tunable catalyst design as well as catalyst synthesis by oxidative grafting of organometallic precursors is further explored in the context of oxidative coupling of unsaturated hydrocarbons. These studies reveal a complex interplay between bond forming elementary steps at the active site and reoxidation, both of which are dependent on electronic communication between the surface and active site and can be modulated a function of surface lithiation.

**Biographical sketch:** Dr. Kaphan obtained his BS from the University of Rochester and his PhD from the University of California, Berkeley. He is a chemist in the Catalysis Group in the Chemical Sciences and Engineering Division at Argonne National Laboratory. David’s research concerns fundamental studies in supported organometallic catalysis, capture and conversion of atmospheric carbon dioxide, and chemical upcycling of polymer waste. His primary area of research in supported organometallic catalysis focuses on understanding stereoelectronic communication between organometallic complexes and inorganic support materials can be leveraged to modulate reactivity and the development of non-traditional functional materials as catalyst support frameworks.

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