

FALL 2020
CHEMISTRY
SEMINAR SERIES

“HIGHLY REDOX-ACTIVE METAL-ORGANIC
NANOMATERIALS OF 1 – 3 NM DIMENSIONS”

November 20th, 2020 ~ 11:30AM
Seminar Via Zoom



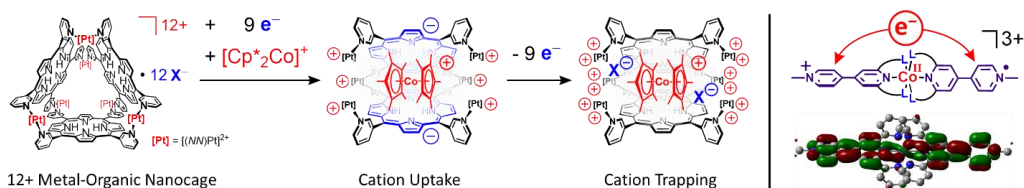
DR. MARK LIPKE

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HOST:
DR. JAEKLE

ALL THOSE
INTERESTED ARE
WELCOME TO ATTEND

Metal-organic (nano)materials are of great interest for applications in catalysis, chemical recognition, electronics, and combinations thereof (e.g. electrocatalysis). Nanoporous structures are particularly promising in these roles since their pores provide chemical access to key functional components while also modifying the environment surrounding these components to elicit new behavior. To better understand the emergent properties of nanoporous materials, we are examining porphyrin-based nanocages that are among the smallest possible structures bringing together a nanoconfined space and multiple distinct functional groups (e.g. cationic groups, redox-active sites). These 1 – 3 nm cages can be studied in solution to provide detailed insight into their dynamics, and this presentation will focus on the electrochemistry of highly redox-active examples. We have developed methods for improving the redox stability of these structures, enabling one cage to reversibly exchange up to 18 e⁻. This cage was found to uptake and trap cationic guests in response to redox cycling, providing unprecedented insight into the alteration of the electrostatic environment in these structures caused by electrochemical changes. Potential implications for the design of electrocatalytic materials will be discussed. The second part of this talk will describe our discovery of extensive electronic delocalization across the ~2 nm length of a cobalt complex featuring redox-active ligands derived from viologen dications. Electronic delocalization between mixed-valence redox sites is important for promoting conductivity in metal-organic materials, and this *cobaltoviologen* stands out for the unique role of the metal spin state on mediating electronic coupling between its ligands, as well as for the observation of multiple delocalized redox states in this complex. These unusual electronic features suggest that related metaloviologens will be highly adaptable for applications in electrocatalysis and electronic materials.



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