INORGANIC CHEMISTRY SEMINAR

Dr. Jesse L. Peltier
Department of Chemistry, University of California, Berkeley

“Cyclic (alkyl)(amino)carbenes: from Replacing Metals to Metal Replacement”

Abstract: Stable singlet carbenes are flourishing with a diversity of applications: from ligands in catalysis to the stabilization of otherwise unisolable chemical species. Here, I will showcase the diverse and rich chemistry of cyclic (alkyl)(amino)carbenes (CAACs), a class of stable singlet carbenes known for their high ambiphilic character. Deviating from typical carbene-organocatalysis, which is still dominated by Lewis basic carbenes, I will demonstrate that CAACs allow for the catalytic valorization of carbon monoxide, a small molecule known for its inertness. I will explain how the intrinsic properties of CAACs, carbenes known to mimic the electronic properties of transition metals, enable this traditionally transition metal catalyzed process. Afterward, I will discuss a methodology to achieve the absolute templating of coinage metal clusters by means of galvanic metal replacement. Interestingly, clusters, as opposed to larger nanomaterials, have broadly displayed the opposite process, anti-galvanic exchange (AGR). This can be attributed to a lack of stable active metal clusters and a lack of strong M⁰ character in existing ones. To access low-valent active metal clusters, I will illustrate how CAACs’ ambiphilicity can be exploited to stabilize these highly reactive species and achieve the complete galvanic exchange in metal clusters. Going a step further, I will discuss how these molecular models allowed us to better understand the reactivity of M(111) surfaces further delineating the intermediacy of clusters between homogenous and heterogeneous processes.

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4:00 p.m.  |  Via Zoom

More information: jzabala@chem.ucla.edu