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Presents

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Metal-Ligand Chemistry in Multimetallic Nanoparticle Synthesis and Performance

Metal-ligand chemistry is shown to be a pivotal tool in the control of multimetallic nanoparticle formation, structure, and emergent properties. Specifically, small molecule ligand chemistry is used to mediate the incorporation and distribution of metals in and on discrete, colloidal nanoparticle substrates, as well as modulate their emergent optoelectronic features once formed. Here, we focus on the incorporation of 3d transition metals into Au and Pt hosts. The resulting structures are characterized by a wide variety of methods including NMR spectroscopy, electron microscopy, and photoelectron spectroscopy techniques. Specifically, we demonstrate that nanoparticle ligand chemistry may be used to access previously unobserved mixtures of metals, unique distributions of metals at the surface of a colloidal particle, as well as composition-tunable and surface chemistry-controlled photoemission. These concepts and characterization approaches are also extended to degeneratively doped semiconductor nanoparticles. Taken together, the results provide mechanistic platforms for the development of nanoscale architectures that are promising for a wide variety of applications ranging from light-driven catalysis to covert signaling.