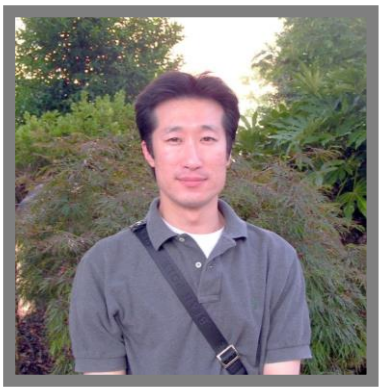
Chemistry Thesis Defense

"Synthesis, Morphological Control, Dispersion Stabilization and in situ Self-assembly of Noble Metal Nanostructures Using Multidentate Resorcinarene Surfactants"



Presented by:

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Metal nanoparticles have received great attention in recent years due to their size- and shape-dependent properties. Their size and shape can be controlled by appropriate choice of metal precursors, surfactants, reducing agent, and other reaction conditions. As nanoparticles have a strong tendency to aggregate due to attractive van der Waals forces, a number of stabilizers are often employed to prevent their agglomeration. The integration of metal nanoparticles with macrocyclic surfactants offers several potential advantages including enhanced stability with wide ranging applications from sensing to nanocatalysis. Despite their potential advantages, only limited studies have (a) focused on the effect of ligand head group on macrocyclic surfactants in influencing the stabilization and properties of metal nanoparticles, and (b) demonstrated their ability in controlling the morphology of the resulting nanoparticles.

In this dissertation, a detailed investigation on the influence of various macrocyclic resorcinarene surfactants in determining the morphology, stabilization and self-assembly of mono- and bi- metallic nanoparticles was undertaken. While resorcinarene thiol yielded anisotropic Pt nanowires, resorcinarene amine surfactant yielded crystalline, anisotropic, Pt rich PdPt bimetallic nanoparticles. The morphology of the anisotropic nanoparticles can be readily tuned by varying the reaction conditions. In addition detailed studies were also undertaken to get a better understanding of Brust-Schiffrin reaction mechanism and the formation of anisotropic structures. Novel multidentate resorcinarene quaternary ammonium salts were developed to stabilize gold nanoparticles in both organic and aqueous medium. Such surfactants showed headgroup dependent stabilization of both phase-transferred and directly synthesized nanoparticles. This work also describes the use of hollow resorcinarene polymeric nanocapsules as 3D template reaction vessels for the *in situ* synthesis and self-assembly of Pt nanoparticles and their utility in catalysis. Finally, this work shows that hollow polymeric resorcinarene nanocapsules of varying thickness can be prepared directly in a template- and surfactant- free synthesis via thiol-ene photopolymerization by varying the valencies of the alkene building blocks.

Wednesday, April 6, 2016 at 9:00 a.m. in Eng. & Comp. Auditorium