UNIVERSITY OF RHODE ISLAND
Department of Chemistry
SEMINAR

Room 105 Beaupre Center
3:00 p.m, Tuesday, December 17, 2019

Dr. Qingfeng Zhang

Rice University

"Plasmonics in molecular sensing: from chiral detection to interfacial catalysis"

HOST

Jason Dwyer
Department of Chemistry
401-874-4648

Plasmonics in molecular sensing: from chiral detection to interfacial catalysis

Qingfeng Zhang

My research has focused on probing the structure and dynamics of interfacial molecules for chiral sensing and catalysis through state-of-the-art optical spectroscopic platforms at the single-particle and single-molecule levels.

In the first half of my talk, I will present my postdoctoral work, where I have harnessed single-particle circular differentiate scattering (CDS) spectroscopy to unravel the origin of chirality from plasmonic nanoparticle-protein complexes. We establish that both chiral aggregates and just a few proteins in interparticle gaps of achiral assemblies are responsible for the ensemble signal, but single nanoparticles do not contribute. We furthermore find that the protein plays two roles: It transfers chirality to both chiral and achiral plasmonic substrates, and it is also responsible for the chiral three-dimensional assembly of nanorods. Understanding these underlying factors paves the way toward sensing the chirality of single biomolecules.

In the second half of my talk, I will discuss my graduate work on *in situ* monitoring of catalytic molecular transformations on metallic nanocatalysts using surface-enhanced Raman spectroscopy (SERS). We developed a unique approach toward the integration of desired plasmonic and catalytic properties on a single metallic nanoparticle. Our synthetic approaches involve judicious tailoring of the atomic-level surface structures and fine-tuning of the plasmonic properties through either seed-mediated growth or selective surface etching. These dual-functional nanoparticles serve as both substrates for SERS and free-standing catalysts. Using SERS as a molecular finger-printing spectroscopic tool, we have been able to track the detailed structural evolution of molecular adsorbates in real time during catalytic reactions. The knowledge gained from the *in situ* SERS measurements shed light on the detailed relationships between intrinsic catalytic behaviors to the surface atomic configurations of metallic nanocatalysts.