Title: "Using Surface-Enhanced Raman Spectroscopy to Probe and Understand the Mechanism of Electron-mediated Chemical Reactions on Plasmonic Nanoparticle Catalysts"

An emerging field of heterogeneous catalysis involves the use of plasmonic metal nanoparticles as photocatalysts. These systems take advantage of the excitation of localized surface plasmon resonance (LSPR) in the presence of solar spectrum light to enhance rates of catalytic reactions on plasmonic metal nanoparticles. It has been proposed that these chemical transformations take place through an electron transfer from the plasmonic catalyst to the adsorbate, leading to an electron-driven activation of chemical transformations. While the general features of the process are reasonably well understood, there are certain aspects of the mechanism that are less clear. Among others, the nature of the interaction between the localized surface plasmon states and adsorbate electronic states is still under debate.

In these studies, probe molecules were used along with silver nanoparticle catalysts in a number of Raman spectroscopy experiments to provide further insights into the electron-driven mechanism of photo-chemical reaction on the surface of plasmonic metal nanoparticles. We will shed light on the nature of the interaction between localized surface plasmon states and the excited electronic states of the adsorbate and demonstrate how these interactions can lead to chemical transformations. We will discuss the implications of our studies on the chemical activity and selectivity of plasmon-mediated photo-chemical transformations on metal nanoparticles.