SURF Student Colloquium

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Name: Chris Torres		**Grant Number**	70NANB16H
Academic Institution: University of New Mexico		**Major:** Chemical Engineering	
Academic Standing (Sept. '17):	Senior		
Future Plans (School/Career):	After I graduate from the University of New Mexico, I will go to graduate school to obtain a PhD and pursue a career in academia.		
NIST Laboratory, Division, and Group:	Center for Nanoscale Science and Technology, Nanofabrication Research Group		
NIST Research Advisor:	Yang, Wei-Chang D.; Wang, C.; Sharma, R		
Title of Talk:	Modelling Al nanoparticle localized surface plasmon resonances and the synthesis of Ru-functionalized Al nanoparticles		

Abstract:

Electron oscillations are known to occur at the interface of a plasmonic metallic nanoparticle (MNP) when an energy source, e.g. incoming light or high energy electrons, resonates with the free electrons on the metal surface at discrete frequencies. As these resultant oscillations establish standing waves governed by particle geometry, they are known as localized surface plasmon resonances (LSPR). It has been previously shown that surface plasmons may act as a source of "hot" electrons which can promote chemical reactions in a catalytic environment. To better understand such systems at the nanoscale our group is exploring LSPR phenomena of various MNPs. Here we model aluminum nanoparticle (NP) LSPRs in Matlab using the metal nanoparticle boundary element method (MNPBEM) toolbox. The MNPBEM toolbox simulates a user defined electron beam passing by or through a MNP, estimates LSPRs, and provides the resultant electron energy-loss spectroscopy (EELS) dataset. This simulated EEL spectra is then compared with experimental EEL spectra of Al NPs obtained using an environmental transmission electron microscope (ETEM). Concurrently, a synthesis was formulated for decorating plasmonic nanoparticles with a catalyst using a revised incipient wetness impregnation technique. We focused on Al NPs functionalized with ruthenium, a known catalyst. These Ru-functionalized Al NPs were then characterized using the ETEM. The Ru loading was characterized using aberration corrected high resolution TEM imaging, while the chemical composition Ru-functionalized Al nanoparticles was confirmed using EELS. Our results represent practical aspects of exploring and characterizing localized surface plasmon promoted catalytic systems, and is an important step towards understanding plasmonic metals' contribution to catalytic processes at the nanoscale when excited by an external energy source.