Yale Institute for Nanoscience and Quantum Engineering

Friday- February 14, 2014

12:00 to 1:00 p.m.

Becton Seminar Room

Light lunch will be served at 11:45 a.m.

Professor Robert Crabtree

Department of Chemistry, Yale University

" Hydroxamates as Robust, Conductive Anchors for Semiconductor Oxide Surfaces "

Working in the Yale Solar Group (YSG PIs: Batista, Brudvig, Crabtree, Schmuttenmaer) in the Chemistry Dept., we have introduced a more robust anchor to attach molecular components to semiconductor oxide surfaces such as to TiO_2 nanoparticles (*n*-TiO_2). The goal of the YSG, generation of fuels from solar-driven water splitting, required that the dye and catalyst components be attached to the *n*-TiO_2 electrode in a way that resists hydrolytic release yet allows passage of electrons. Inspired by the well known ability of hydroxamates to act as high affinity ligands for Fe in siderophores (Fe scavenger molecules secreted by microorganisms), we expected that they would also bind to Ti(IV) at the *n*-TiO_2 surface. This proved well founded and a variety of experiments has established the robustness of linkage and its ability to transmit electrons. Most notably an MK2 dye sensitized solar cell with a conventional carboxylate anchor, easily degraded by humidity, was replaced with a hydroxamate anchor; the modified cell proved not only to be robust but even to work better in the presence of water. If time permits, some recent results on water oxidation catalysts may be presented.

Professor Judy J. Cha

Department of Mechanical Engineering and Materials Science, Yale University

"2D Electronic Nanomaterials and Analytical STEM "

Two dimensional (2D) chalcogenides have gained renewed interest due to their interesting electrical properties such as topological surface states in BI_2Se_3 and hydrogen evolution catalytic activities in MoS_2. Our ability to thin them down to a single layer and their anisotropic bonding nature opens up possibilities for novel heterostructures where we can tailor their electronic properties. I will present chalcogenide nanostructures my group synthesizes and discuss a few promising future research directions on these nanostructures. In the second part of the talk, I will present detailed atomic structure characterizations of InGaAs quantum dots using analytical electron microscopy, in collaboration with Prof. Lee group. In particular, nanoscale 2D elemental maps will show that these quantum dots are not In-rich, challenging the current understanding of the band structure.

HOST: Paul Fleury