Yale Institute for Nanoscience and Quantum Engineering

Friday- September 5, 2014

12:00 to 1:00 p.m.

Mann Student Center- Dunham Lab

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

Professor Jans Schroers

Department of Mechanical Engineering and Materials Science
and Center for Research on Interface Structures and Phenomena, Yale University

"Materials Science and Development of Complex Materials"

The increasing demands on materials across fields poses a grand challenge and requires the development and therefore understanding of increasingly more complex materials. Current material development and characterization methods are challenged and often unsuited for complex and technological relevant materials. This is quantified by an order of magnitude analysis revealing that only a minute fraction of possible materials have been considered thus far. Complex materials span across all sorts of fields. We are focusing on metallic glasses, thermal liquids, electrochemical catalysts materials, colorful metals, and biocompatible and biodegradable alloys.

To deal with the increasingly complex chemistry of materials we are developing combinatorial strategies and high throughput characterization methods. We use a custom designed sputtering system that allows us to create approximately 1000 different alloys of multicomponent nature simultaneously. One focus is the development of high throughput characterization methods specific for the effective determination of properties, often in a massive parallel manner. Such methods are used to correlate alloys' chemistry with properties such as liquidus temperature, microstructure, phases and their stability region, structure, glass forming ability in metallic glasses, color, biocompatibility and degradability, and electrochemical activity.

Professor Mark A. Reed

Departments of Electrical Engineering and Applied Physics
Institute for Nanoscience and Quantum Engineering, Yale University

"Molecular Transistors"

Electron devices containing molecules as the active region have been an active area of research over the last few years. In molecular-scale devices, a longstanding challenge has been to create a true three-terminal device; e.g., one that operates by modifying the internal energy structure of the molecule, analogous to conventional FETs. Here we report[1] the observation of such a solid-state molecular device, in which transport current is directly modulated by an external gate voltage. We have realized a molecular transistor made from the prototype molecular junction, benzene dithiol, and have used a combination of spectroscopies to determine the internal energetic structure of the molecular junction, and demonstrate coherent transport.[2,3] Resonance-enhanced coupling to the nearest molecular orbital is revealed by electron tunneling spectroscopy, demonstrating for the first time direct molecular orbital gating in a molecular electronic device.

HOST: Paul Fleury