Dissertation Announcement

Announcing the Final Examination of Hemma Mistry for the Degree of Doctor of Philosophy in Physics

Date: Thursday, November 17, 2016
Time: 8:00 a.m.
Room: PSB 161
Dissertation title:
Model Nanocatalysts with Tunable Reactivity: Tailoring the Structure and Surface Chemistry of Nanomaterials for Energy and Alternative Fuels Catalysis

Abstract:

One of the most pressing challenges of our time is meeting growing global energy demands while limiting human impact on the environment. To meet this challenge, new catalysts are needed to enable carbon neutral energy production processes and low cost synthesis of alternative fuels. In order to design new catalysts for such processes, fundamental understanding is needed on how the structural and chemical properties of nanostructured materials influence their surface chemistry. In this dissertation, I explore how the properties of nanoparticles, such as particle size, shape, composition, and chemical state, can be used to tune their reactivity. For this work, model nanoparticles were synthesized with well-defined structural and chemical properties, and a variety of surface science approaches were used for catalyst characterization. In particular, emphasis was placed on understanding the changes which may occur in the catalyst structure and chemical state during a reaction using advanced *in situ* techniques and correlating these changes to reactivity. After exploring how nanostructuring the catalyst surface can be used to tune reactivity and how dynamic changes can occur to nanocatalysts in reactive environments, these general principles are applied to a model reaction, the electroreduction of carbon dioxide, which is a promising process for synthesizing valuable products using renewable energy while consuming waste carbon dioxide. I explore the mechanisms behind how catalyst particle size, composition, and oxidation state can be used to improve activity and tune selectivity towards different carbon dioxide reduction products. Such fundamental mechanistic insights are critically needed to design efficient catalysts for this reaction.

Outline of Studies:
Major: Physics

Educational Career:
B. S. University of California, Berkeley, 2010

Committee in Charge:
Dr. Beatriz Roldan Cuenya (Chair)
Dr. Lee Chow
Dr. Sergey Stolbov
Dr. Lei Zhai (External Committee Member)

Approved for distribution by Dr. Beatriz Roldan Cuenya, Committee Chair, on November 3, 2016.

The public is welcome to attend.