Seminar

New Materials and Catalysts for Solar Fuels: p-Type Semiconductors Photocathodes

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Time: 4:00 pm, April.10, 2014 (Thursday)
时间: 2014年4月10日（周四）下午4：:00
Venue: Conference Room A (607), No. 5 Science Building
地点: 理科五号楼607会议室

Abstract

Presently the conversion of optical energy to stored chemical energy focuses on two chemical transformations: the splitting of water to hydrogen and the reduction of carbon dioxide to C_1 organic products. Both of these reactions are kinetically challenging, and tend to compete with solid-state photochemical reactions that decompose the cathode materials when a photoelectrochemical cell is employed to carry out the transformation. Thus, materials that behave as stable photocathodes are needed. Similarly, electrocatalysts that enhance the multielectron reduction of H_2O or CO_2 are also desirable.[1] To these ends, we have considered both III-V materials and metal oxides having a delafossite structure as photocathodes for the reduction of CO_2.[2-3] These materials are found to provide a reasonable level of stability and good efficiency for the conversion of CO_2 to either formic acid or methanol. The reactivity of III-V electrodes is strongly enhanced by the use of an aromatic amine co-catalyst. We also find that $CuFeO_2$ is an excellent cathode material for the reduction of CO_2 to formate,[4] while the related $CuRhO_2$ is an excellent material for splitting water.[5] This latter material is found to be self-healing in the presence of oxygen providing for a superior photocathode response.

About the Speaker

Education:
Massachusetts Institute of Technology - PhD - June 1980
Major Field: Physical Inorganic Chemistry
Thesis Advisor: Professor Mark Wrighton
Thesis Title: “Characterization and Manipulation of Charge Transfer Processes at the Semiconductor Electrolyte Interface”
University of California at Los Angeles, B.S., Magna Cum Laude with Departmental Honors in Chemistry - June 1976
Major Field: Double Major in Chemistry and Physics
Research Advisor: Professor John Gladysz
Research Area: “Metal Atom Cocondensations for Organometallic Synthesis”

Present Research Interests:
Elevated Temperature Proton Exchange Membrane Fuel Cells
Non-hydrogen Based Fuel Cell Catalysts
Photoelectrochemical and Electrochemical Conversion of CO2 to Alcohols
The Photochemistry of Multielectron Intervalent Charge Transfer Complexes
Cyanogels: Hydrogel Coordination Polymers as Materials Precursors