Seminar

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

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Time: 4:00 pm, April.10, 2014 (Thursday)

2014 4 10 4 :00

Venue: Conference Room A (607), No. 5 Science Building 607

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