Yale Institute for Nanoscience and Quantum Engineering

Friday- December 4, 2015

12:00 to 1:00 p.m.

BECTON SEMINAR ROOM

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

Hailiang Wang

Department of Chemistry, Yale University

"Structural Design of Multi-Component Hybrid Materials for Electrocatalysis and Batteries"

We are interested in novel materials, structures and the underlying structure-property correlations that are useful for solving energy challenges. Our research strategy is to design and synthesize multi-component material structures in which each component serves a specific purpose and cooperates synergistically with the other components to achieve superior electrochemical performance for energy storage and conversion. The talk will cover our initial studies on metal/oxide interface nanostructures and metal phosphosulfide nanomaterials for electrocatalytic hydrogen generation. Results on utilizing ternary hybrid structures to realize long cycle life cathode materials for rechargeable lithium-sulfur batteries will also be presented.

Jaehong Kim

Department of Chemical & Environmental Engineering, Yale University

"Two Approaches to Achieve Visible Light Upconversion for Environmental Application"

This talk summarizes our most recent advances in developing antimicrobial/biocidal materials that function through a light frequency amplification process called upconversion (UC). The first approach is based on inorganic luminescent materials doped with lanthanide activators that can convert visible light into germicidal UVC and have been shown to inactivate microorganisms deposited on dry surface and deter biofilm formation under commercial fluorescent light exposure. Upconversion efficiencies of current phosphor systems are too low for practical antimicrobial/biocidal application, however, and methods of enhancing internal optical efficiency are required for further advancement. Various approaches that our lab has developed to enhance the efficiency of phosphors and to realize environmental remediation applications are presented. The second UC approach is based on a completely different mechanism of sensitized triplet-triplet annihilation (TTA) in an organic matrix. In TTA-UC process, a sensitizer excited by absorbing a photon with lower energy transfers absorbed energy to an acceptor/annihilator through triplet−triplet energy transfer (TTET), and two excited acceptors subsequently undergo TTA, emitting an upconverted singlet fluorescence with higher energy. Unfortunately, the application of TTA-UC in the ambient aqueous phase has been severely limited because it typically employs organic and metalloorganic chromophores that are soluble only in organic solvents. Moreover, to prevent triplet-state quenching, the medium must be devoid of oxygen, which is difficult to achieve in practical aqueous-phase scenarios. Various strategies developed in our lab including micro-encapsulation to avoid oxygen quenching and sub-bandgap sensitization of semiconductor photocatalysts for advanced oxidation are presented.

Host: Professor Eric Altman