Pauling Medal Award and Symposium, 2010
Abstracts of Talks

Paul Alivisatos:

Multi-component nanocrystals for solar fuel generation

There is a great need to be able to harvest the energy of the sun and to store the energy in a fuel. To be of practical use, that must be done at low cost and in a sealable manner, while also achieving reasonable efficiency. This talk will describe our recent work exploring multi-component nanocrystals, which are designed to absorb light, separate charges, and funnel the charges to catalysts to drive subsequent chemistry.

Mostafa A El-Sayed:

Confining resonant photons to the nano-gold length scale: the new properties and applications in material science, nano-biology, and cancer nano-medicine

New fields such as optoelectronics, sensors, nanocatalysis, nanomotors and nano-medicine use the new exciting properties [1-3] of gold and silver nanoparticles. Some of the most exciting properties arise when resonant photons are captured by these nanoparticles of the right size and shape. This excites the localized surface plasmon oscillation resulting from the coherent excitation of the free electrons in the conduction band. This greatly enhances the electro-magnetic fields of the captured photon on the surface of the nanoparticle which strongly enhances their Radiative properties as well as that of any electronic system that falls within the range of this field. The effect of the coupling between close nanoparticles change their color (used as nano-ruler[4]), increase or decrease the Raman scattering intensity of adsorbed molecules[5], enhance the nonradiative properties of near electronic systems like the relaxation of hot electrons in semiconductors[6,] the rate of exciton annihilation in conducting polymers[7] or the rate of retinal photo-isomerization and proton pump in Bacterio-Rhodopsin photosynthesis[8.]

The strong Radiative properties of gold nano-particles are used in imaging and the sensitive detection of cancer cells in vitro[9] and in-vivo[11]. The strongly absorbed photon energy is rapidly converted into heat. This localized heating of the gold nanoparticles can heat and destroy attached cancer (or sick) cells and is thus used in Vitro and in-Vivo cancer therapy [10,11]. Very recently, non-photo-thermal techniques of using gold nano-particles in Cancer Therapy have been developed.[12]

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Yi Cui:

Energy Nanoscience

In the past two decades, much fundamental understanding on nanoscale property has been established with chemically synthesized and lithographically patterned nanostructures. Rationally designed nanomaterials such as nanowires and nanocrystals afford the great opportunities for controlling electronic, photonic, mechanical and ionic processes, which are important for energy applications. Here I will present examples on how to design and fabricate nanomaterials for high performance and/or low-cost energy conversion and storage applications including transparent electrodes, photovoltaics, batteries, supercapacitors and large-scale energy storage devices.