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Controlling charge transfer processes in CdSe based quantum dot solar cell

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Inorganic quantum dots with their well defined properties such as size-tunable band gaps, high luminescence quantum efficiency, excellent photostability, and narrow emission line widths, have been successfully used as sensitizers in the photoelectrochemical solar cells. The efficiency in such devices is primarily determined by the intricate balance achieved between the various charge separation and recombination reactions. Large differences in the timescales between electron injection (femto- second) and transport (milli second) processes, amplifies the rate of recombination. Thus, improvement in the performance requires precise estimation and tuning of rate constants for all the charge injection and recombination processes. This talk will elucidate the charge injection and recombination dynamics of CdSe quantum dots anchored on TiO_2 and SiO_2 in the presence of various liquid electrolytes and its influence on the light conversion efficiency. The ability to alter the energy gap between CdSe and TiO_2 as well as CdSe and redox couple has profound influence on the interfacial charge transfer kinetics. Femto second absorption spectroscopy and photoluminescence lifetime measurements can enable one to monitor the charge injection kinetics in various electrolytes as a function of redox couple with different redox potential, concentration and pH of the medium. Various strategies to maximize photoinduced charge separation and electron transfer processes for improving the overall efficiency of light energy conversion will be discussed.

Biography

Vidhya Chakrapani is currently an Assistant Professor in Rensselaer Polytechnic Institute. She completed her PhD from Case Western Reserve University in 2007 and Postdoctoral studies from Georgia Institute of Technology and Notre Dame Radiation Laboratory. The central focus of her research theme for the past 13 years has been on the various fundamental and applied aspects of semiconductor electrochemistry. For her work on diamond electrochemistry, she was awarded the “outstanding young researcher” award from Sigma Xi Research Society, Louisville in 2008. She has published more than 20 papers in this field along with 2 patents that are pending.

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