



# BIG energy seminar series

Addressing the scale and complexity of the global energy challenge.



## FUNCTIONAL ORGANIC MOLECULES AND CONJUGATED POLYMERS FOR OPTOELECTRONIC AND BIOSENSOR APPLICATION

Jinsang Kim, Dep't. of Materials Science and Engineering, Chemical Engineering, Biomedical Engineering, and Macromolecular Science and Engineering, University of Michigan, Ann Arbor

Thursday, April 19, 2012  
3:30 – 4:30 p.m., ECCR 1B40

**Summary:** Conjugated polymers (CPs) are emerging materials for many useful applications due to their readily tunable properties by variation of their chemical structure. Their optoelectronic applications such as solar cells and LED have gained much interest recently. We have investigated molecular design principles to precisely modulate HOMO and LUMO levels of CPs and the exciton binding energy of energy harvesting organic dyes in order to realize high power conversion efficiency from organic photovoltaic cells. Our empirical/computation approach to establish such a molecular design principle will be discussed. Our recent development of highly emissive pure organic phosphorescence materials will also be presented. Sensors are another interesting application of CPs. We have developed conjugated polymer-based biosensors to detect various chemicals and clinically important biological molecules such as mercury, warfare agents, melamine, antibiotics, DNA, potassium, and prostate specific antigen. Our signal amplifying sensors are designed to achieve high sensitivity by means of the energy harvesting property and highly emissive property of conjugated polymers. The concept, design principles, and applications of conjugated polymers for self-signal amplifying biosensors and sensor arrays will be discussed.

### Jinsang Kim, Ph.D.

Jinsang Kim is an associate professor having a joint appointment in the Department of Materials Science and Engineering, Chemical Engineering, Biomedical Engineering, and Macromolecular Science and Engineering at the University of Michigan, Ann Arbor. He holds a M.S (1993) and a B.S. (1991) from Seoul National University, Korea, both in Fiber and Polymer Science. He earned his Ph.D. in 2001 in Materials Science and Engineering from MIT, where he studied the design, synthesis, and assembly of conjugated sensory polymers and energy transport properties in the controlled structures. He is also an expert in genetically engineered protein research. His postdoctoral work in this area at Caltech involved the expression of artificial genes to determine the extent to which artificial genetic information can be used to encode supramolecular assembly in macromolecular systems.

He has won several prestigious awards including 2007 NSF CAREER Award, 2006 Holt Award for excellent teaching, 2002 IUPAC Prize for Young Chemist, 2002 ACS ICI Award, and 2000 MRS Graduate Student Gold Award. He was also named one of emerging investigators by the journal of materials chemistry in 2007. His current research interests at the UM are self-signal amplifying molecular biosensors, flexible solar cells, highly emissive organic emitters, and negative index materials. His research has been sponsored by NSF BES, NSF ECS, NSF DMR, AFOSR, ARO, DoE, ACS, KIMM, KRF, NVRQS, and Center for Chemical Genomics.

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