

## **Title: Organic Semiconductors: Structures and Applications**

### **Speaker:**

Prof. Renqiang Yang  
Bioenergy and Bioprocess Technology,  
Chinese Academy of Sciences,  
Qingdao Institute

**Date:** Tuesday, 4 May 2010

**Time:** 4:30 pm – 5:30 pm

**Venue:** Room 603, Chow Yei Ching Building

### **Abstract:**

The past decade has seen rapid growth in the study of the organic electronics and optoelectronics properties of organic semiconductors and their application in practical devices. The discovery of semiconducting polymers stimulated the research field of organic electronics. The development of a diversity of organic-based optoelectronics, such as light-emitting diodes, photodiodes, field-effect transistors, memory devices and solar cells has been reported, providing appealing alternatives to inorganic-based electronics. Conducting polymers with a  $\pi$ -conjugated (hetero) aromatic backbone are capable of transporting charge and interacting efficiently with light which enables their utilization in a variety of opto-electronic devices. One of the most important applications of conducting polymer is being fabricated into organic light-emitting diodes (OLEDs). In the sandwich structure of OLEDs, the holes and electrons injected from the device contacts recombine and produce luminescence with a wavelength (i.e. color) dictated by the energy difference between the molecular excited and ground states as the result of an electric current flow through the conducting polymer layer. OLEDs have a lot of advantages, like light weight, no need of backlight, flexible flat panel. This novel save-on energy display technology is poised to become the thinnest and most ecologically-friendly screens on the planet.

Photovoltaic (PV) technology is currently enjoying substantial growth and investment, owing to worldwide sensitivity to energy security and the importance of renewable energy as a means to mitigate carbon emissions. Conducting polymer-based organic solar cells (OSCs) is a significant source of renewable and GREEN energy. Polymer solar cells have attracted great attention in academy and industry because of their advantages of easy fabrication, light weight, low cost, and flexible devices for a variety of potential opto-electronic applications. Polymer-based solar cells are attractive in that they can be coated or printed from solution onto flexible substrates by a variety of techniques and thus inexpensive large-volume manufacturing must be possible, which promotes the development of polymer solar cells of high performance for realizing commercialization. In photovoltaic (PV) devices, bound electron-hole pairs (excitons) are created upon illumination. To convert the harvesting light into electricity, the excitons must first dissociate into the separate charges which then have to be collected at the device contacts (holes at the anode and electrons at the cathode). The principles of this process can be regarded as the inverse of the EL (OLEDs) process.

Flexible plastic solar cell (PSC) is one of the most preferred technologies for large-scale commercial utilization of solar energy. Polymer solar cell must and will make a significant contribution to our energy needs. It will have remarkable and promising economic profits, social and ecological beneficiaries. However, the energy conversion efficiency (ECE) and operating lifetime of the cells are not yet

competitive with inorganic solar cells. They need to be improved for future commercial applications. Many groups around the world are developing extensive investigation on it.

**Biography of the speaker:**

Renqiang Yang, Ph. D., professor, born in Nanchong, Sichuan Province, is "100 Talent Program" endowed professor of Chinese Academy of Sciences (CAS). Dr. Yang graduated in July 2004 from South China University of Technology with a Ph.D. degree, where he was instructed by Prof. Yong Cao, a CAS member. After graduation, Dr. Yang did research from December 2004 to February 2009 in University of California at Santa Barbara, USA. Dr. Yang mainly worked in the field of molecular design and synthesis of organic/polymer opto-electronic materials, device fabrication and property research of OLEDs, OSC and OFET, as well as fluorescent biosensor. Over these years, Dr. Yang has been PI and coordinated nearly 10 Chinese and American scientific projects, such as NSFC, "863 Program", "973 Program", etc. of China and NSF, NIH, DOE, etc. of USA. Dr. Yang has filed one Chinese patent and two U.S. patents. He has published more than 40 peer-reviewed papers in internationally famous journals such as JACS (6 papers), PNAS (1 paper), Advanced Materials (5 papers), etc. In February 2009, Dr. Yang returned to China and joined Qingdao Institute of Bioenergy and Bioprocess Technology, Chinese Academy of Sciences as an enlisted professor of "100 Talent Program". His current researches include molecular design and synthesis of Organic/polymer opto-electronic materials, device fabrication and property research of OLEDs and Organic Solar Cell (OSC), etc.

**Organizer:** Dr. W.C.H. Choy