

# INVITED SEMINAR

## Molecular Engineering of Conjugated Polymers towards Bulk Heterojunction Solar Cells of High Efficiencies: Accomplishments and Future Directions

- Speaker : **Prof. Wei You**, University of North Carolina at Chapel Hill, USA
- Host : Department of Energy Systems Engineering
- Date : **13:30, Monday, June 4, 2012**
- Place : Room 301, Building 2, DGIST
- Abstract

In the past two decades, the bulk heterojunction (BHJ) organic photovoltaic cells, arguably one of the hottest research field, has attracted tremendous amount of research efforts. Impressive progress has been made through synergistic efforts of chemists, physicists, and engineers. For example, regioregular poly(3-hexylthiophene) (RR-P3HT) and [6,6]-phenyl C61-butyric acid methyl ester (PCBM) represent one of the most successful systems with reproducible efficiencies approaching 5% after careful optimization. Further, polymers of smaller band gaps have demonstrated over 7% efficiencies in their BHJ devices. Nevertheless, the research community is actively looking for answers to the central question: how to **rationally** design ideal polymers to approach 10% efficiency and beyond?

I will summarize the design criteria for “ideal” polymers to be used with PCBM to further improve the efficiency of BHJ photovoltaic devices. Specifically, I will focus on three main topics: (a) design of new conjugated backbone to control the band gap and energy levels; (b) the significant influence of “trivial” side chains; (c) the impact of substituents such as F. A number of new polymers will be discussed in detail to elaborate these topics. A design motif has been proposed, which successfully produced polymers that demonstrated over 7% efficiency in BHJ devices.

But the grand challenge still remains: can we reach an even **higher** efficiency of BHJ solar cells with intelligently designed new (and better) materials? To answer this question, I will further discuss a few outstanding issues, and make recommendations.

### ▪ Short Bio



Dr. Wei You obtained his BS from University of Science and Technology of China in 1999. He graduated with his PhD from the University of Chicago in 2004 with Professor Luping Yu, and finished his postdoctoral training at Stanford University in 2006 with Professor Zhenan Bao. In July 2006, Dr. You joined the University of North Carolina at Chapel Hill as an Assistant Professor in Chemistry. He has published over 30 papers in leading journals such as JACS, Angew. Chem., Int. Ed., Macromolecules, Advanced Materials, among others. He has been awarded a DuPont Young Professor Award (2008), a NSF CAREER Award (2010), a Camille Dreyfus Teacher-Scholar Award (2011), a Tanner Award for Excellence in Undergraduate Teaching (2011), and a CAPA Distinguished Junior Faculty Award (2012). His group is currently investigating organic solar cells, molecular spintronics/electronics and devices, new methods for nanofabrication (microfabrication), and new materials for dental applications.

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