

Talk Title: Development of Cost Effective Organic Solar Cells

Abstract of the talk: The presentation will focus on the development of cost effective solar cells including dye-sensitized solar cells (DSCs) and polymer solar cells (PSCs) that are currently being conducted in Qiao group. In dye-sensitized solar cells, carbon nanofibers are used as a low cost alternative to Pt counter electrode and achieved comparable cell performance at a lower cost. Also TiO_2 nanofiber/nanoparticle composite is used as an innovative photoanode for high efficiency DSCs. The introduction of TiO_2 nanofibers into the photoanode increased light absorption by forward light scattering and improved charge transport efficiency due to highly crystalline grains with fewer grain boundaries in TiO_2 nanofibers. In polymer solar cells, current cell efficiency is still low for commercial applications. New materials and device designs are needed to increase the efficiency. The major issues in polymer solar cells include narrow spectral light harvesting and inefficient charge transport. To solve these issues, new conjugated polymers with optimized bandgaps and energy levels (HOMO and LUMO) need to be designed for significantly higher efficiencies in both single and multijunction solar cells. The dependence of cell efficiency on polymer bandgaps and energy levels in organic and organic/inorganic hybrid single and multijunction solar cells will be presented, which will provide guidance for the engineering of new conjugated polymers and photovoltaic devices.