

Center Of Super-Diamond and Advanced Films (COSDAF)
Seminar

Inorganic Nanoparticles for Organic Solar Cells

Prof. Julia W.P. HSU

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Date: 23 January 2017 (Monday)

Time: 11:00 am

Venue: CSE Conference Room
(B6605, Academic Building 1)
City University of Hong Kong

General Enquiry: 3442-4204

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ABSTRACT

Organic solar cells represent promising technology for low cost, lightweight solar energy harvesting. The inexpensive, large-area manufacturing methods, e.g. roll-to-roll printing, favor solution deposition techniques. Due to the blended nature of the organic active layer in an OPV device, carrier transport layers at the active layer/electrode interface are necessary to set up the electric field across the device to extract electrons and holes. In addition to appropriate work function, ideal transport layer materials should also have a large bandgap, be reasonably conductive and carrier selective. Furthermore, to facilitate forming a uniform film on top of the organic active layer, solvent compatibility and low (room)-temperature post processing requirements need to be considered. Metal oxides offer a wide range of electrical and optoelectronic properties and can be synthesized in nanoparticles for solution processing. Using nanoparticle suspensions to form films enable us to separate synthesis and processing requirements, resulting in optimized properties. I will discuss solution synthesis of ZnO, MoO_x, WO_x, NiO_x, CoO_x, CuGaO₂ and CuCrO₂ nanoparticles for charge transport layer applications in OPVs. I will also discuss recent results of CuCrO₂ sol gel films made from combustion synthesis at low temperature and their performance as HTLs in OPVs. Furthermore, I will discuss experimental and modeling results on unintentional doping arising from transport layer.

BIOGRAPHY

Julia W. P. Hsu is a Professor of Materials Science and Engineering in the Erik Jonsson School of Engineering and Computer Science of the University of Texas at Dallas (UT Dallas) and holds a Texas Instruments Distinguished Chair in Nanoelectronics. She received her BSE degree from Princeton University and M.S. and Ph.D. degrees from Stanford University. Prior to UT Dallas, she was Assistant and Associate Professor at the University of Virginia Physics Department (1993-1999), Member of Technical Staff at Bell Labs (1999-2003), and Principal Member of Technical Staff at Sandia National Laboratory (2003-2010). Hsu is a winner of a Hertz Foundation Fellowship (1985), the American Physical Society (APS) Apker Award (1986), a National Science Foundation Young Investigator Award (1993), and a Sloan Foundation Research Fellowship (1994). She was elected to Fellow of APS in 2001, American Association for the Advancement of Science (AAAS) in 2007, and Materials Research Society (MRS) in 2011. She was a co-chair for the Fall 2004 MRS meeting. She served as a Member-at-Large on the APS Division of Materials Physics Executive Committee (2004-2007), on the MRS Board of Directors (2005-2007), the Treasurer and Chair of Operation Oversight Committee for the MRS (2006-2007), chaired the MRS International Relations Committee from 2010-2011, and was on the Editorial Board of Solid State Communications. She currently serves on MRS Meeting Assessment Subcommittee. She has served on many external advisory committees, including Princeton University Center for Complex Materials, University of Massachusetts Energy Frontier Research Center, and Department of Energy Experimental Program to Stimulate Competitive Research (EPSCoR) at Idaho State University. She has published approximately 180 peer-reviewed journal papers and holds 5 patents.