IOWA STATE UNIVERSITY
DEPARTMENT OF MECHANICAL ENGINEERING

Structure measurements for organic photovoltaics manufacturing

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Tuesday, November 18, 11:00-11:50 a.m.
2004 Black

Abstract:
Organic photovoltaics (OPV) is a promising candidate technology for the low-cost fabrication of modules to harvest solar energy. Although OPV technology has significantly matured over the past few years, there remain significant challenges in addressing the gap between lab-scale devices and real manufacturing. Structure-property-performance relationships for OPV devices are still underdeveloped, and relationships based on one system are not necessarily transferrable to new, higher-performance systems. This talk will describe our efforts to develop measurements that support OPV manufacturing. Using a blade coating process as a prototype for slot-die coating, we have developed several techniques to observe the structure of OPV films in-situ as they dry. Our measurements include synchrotron-based X-ray scattering and a variety of optical methods. We use these techniques to identify the mechanisms by which formulation and processing choices influence the nanoscale structure of the films. Several OPV systems will be described including polymer/fullerene, small-molecule/fullerene, and polymer/polymer. Throughout solidification, we can follow the number of phases, their composition, and the extent of order within them. In-situ techniques provide far more information about the solidification process than can be obtained by measuring already-dried films, providing a valuable tool to guide the selection of formulation and processing parameters.

Biography:
Dean M. DeLongchamp is the leader of the Flexible & Printed Electronics project and a staff member of the Functional Polymers Group in the Materials Science and Engineering Division at the National Institute of Standards and Technology (NIST). His current research is focused on understanding the relationship between the nanoscale structure of organic semiconductors and their device function using advanced measurement methods such as soft x-ray spectroscopy and X-ray scattering. He received a B. S. in Chemical Engineering from the Georgia Institute of Technology in 1998 , a M.S.C.E.P. from MIT in 2000, and a Ph. D. in Chemical Engineering from MIT in 2003.

This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.