NCMN

NEBRASKA CENTER FOR MATERIALS AND NANOSCIENCE
2011 SEMINAR SERIES PRESENTS

NCMN

Dr. Valery Bliznyuk

Materials Science and Engineering Department
College of Engineering and Applied Sciences
Western Michigan University, Kalamazoo, Michigan

Nanostructured polymer materials for molecular electronics, sensors, and organic photovoltaics

Emerging fields of molecular and printed electronics put new challenges for the development of solution processable polymers with desirable electrical characteristics (high carrier mobility, stability of properties, etc.). In my presentation, I will address the structure, physical properties, and prospective applications for several nanostructured conducting polymer composite systems. Particularly, so-called multifunctional materials that are based on polymer-carbon nanotubes nanocomposites, core-shell nanoparticles, or polymer-dye systems will be discussed. Polymer-carbon nanotube composites can be prepared as ultrathin films with anisotropy of electrical properties and variable conductivity. In my presentation, I'll discuss the questions of nanotubes dispersion, phase separation, and orientation in the polymer matrix. The core-shell nanostructures are attractive as a versatile universal approach for combining otherwise incompatible components - such as inorganic and organic semiconductors or ferroelectric polymer poly(vinylidene fluoride) (PVDF) and conjugated polymers like polythiophenes or polyaniline (PANI). PANI has an ability to vary its electronic properties in a broad range (from semiconducting to metallic) depending on its structural organization and the type and degree of doping. The latter is strongly tied to the very important ability of PANI to reversibly change its protonation degree through reaction with basic or acidic environments without changes in the redox-state - unlike it happens with most of other conducting polymers. PANI is, therefore, a well established and environmentally friendly material, which can be used in electronics and sensor devices. Being employed as an active component in chemical sensors, nanostructured polyaniline-based systems offer superior (ppb range) sensitivity to an analyte. Polythiophene-based nanocomposites have been proven to be a crucial component in so-called bulk heterojunction type polymer solar cells.

The structural organization and physical (mainly electrical and photovoltaic) properties of the nanostructured polymer semiconductors have been addressed with several modes of scanning probe microscopy, helium ion microscopy, Raman spectroscopy, and surface conductivity characterization techniques. We believe, our approach can be extended to other polymer systems to create advanced polymer materials with tunable electrical properties for molecular electronics applications.

Host:
Dr. Christian Binek
Department of
Physics & Astronomy

Wednesday, October 5, 2011
3:30 pm - Room 151, Jorgensen Hall
Refreshments served

Please Post