University of Central Florida

NanoScience Technology Center
Advanced Materials Processing & Analysis Center

GRADUATE RESEARCH SEMINAR SERIES

Friday
January 30, 2015

12:00 PM — 1:00 PM

Research Pavilion
NSTC
Conference Room 475

Pizza and drinks will be provided

Hybrid Plasmonic-Photonic System for Enhanced Light-Matter Interaction

Abraham Vázquez-Guardado (12:00 PM – 12:30 PM)
Dr. Debashis Chanda Group

Abstract: Light-matter interaction is a mechanism in which microscopic properties of matter can be probed and can manifest macroscopically. In the process elastic or inelastic energy exchange takes place and depends on different material, system configuration properties and stimulations condition. Hence, the fundamental understanding of this fundamental interaction can lead to interesting applications. Hybrid plasmonic-photonic systems have emerged to circumvent fundamental limitations and, at the same time, take advantage of both constituent entities. The photonic cavity-coupled plasmonic system is an example. While the isolated systems are well understood, their coupling can result in additional properties leading to the enhancement of the plasmonic resonance and, therefore, enhancement properties of its inherited niche of applications. However, deep understanding of these systems is needed especially in systems that support photonic, plasmonic and diffraction modes that overlap in space and frequency. In this seminar I will talk about cavity-coupled plasmonic systems, fundamentals and applications.

Bottom-up Assembly of Poly(3-hexylthiophene) Nanowires from Graphitic Surfaces

Matthew D. McInnis (12:30 PM—1:00 PM)
Dr. Lei Zhai Group

Abstract: Using organic polymers to produce electronic devices such as field-effect transistors (FETs) and organic photovoltaic (OPV) cells could be a viable replacement for traditional silicon-based technologies owing to the ease in their processing, low cost and tunable properties. Necessary hurdles to overcome for this technology include the reproducible incorporation of highly crystalline semi-conducting polymers into strict device geometries and poor metal-organic electronic interface. Conductive polymers, due to their conjugated backbone, have been shown to exhibit one-dimensional fibril growth due to the relatively strong Van der Waals force of pi-pi intermolecular interaction. Graphite is assembled from many two dimensional, atomically thin sheets of conjugated carbon-carbon bonds adhered through similar pi-pi interaction. Because of the similar surface chemistry, conjugated polymers adsorb to the surface of graphene, creating a nucleation site for further crystallization. Poly(3-hexylthiophene) (P3HT) is a well-studied, conductive polymer that can be crystallized from hot marginal solvent to form nanowires wires that are ~10 nm in width, and microns in length in the pi-pi stacking direction. Through a facile, bottom-up and readily scalable approach, we have shown ordered crystallization of P3HT, nucleated from the graphene surface from solution. This process allows for the self-assembly of conducting and semi-conducting materials into hierarchical structures. Direct growth of P3HT provides an excellent electronic contact with graphene, and the induced ordering during crystallization is enough to permit placement and directionality of P3HT in devices. This should produce FETs with reduced short channel effect and OPV cells with nearly optimal morphologies .