

**Stony Brook University
The Graduate School**

Doctoral Defense Announcement

Abstract

Integration of nanostructured semiconducting/conducting polymers in organic photovoltaic devices

By

Htay Hlaing

One of the main difficulties in incorporating nanotechnology into organic electronic devices is the complexity of fabricating nanoscale structures with relatively well-defined order over relatively large areas. Nanoimprint technology offers a promising route to address this problem, because it can be used to the control morphology and molecular orientation of the polymer nanostructures from which functional devices can be built directly.

In this dissertation, the development of novel architectures for organic electronic devices utilizing the polymer nanostructures fabricated by nanoimprint lithography is presented. First, nanoimprinted structures were fabricated with a 100 nm spaced grooves from thin films of poly-3(hexylthiophene), a conjugated semiconducting polymer. These structures have potential applications in the formation of ordered heterojunction organic photovoltaic (OPV) devices. Grazing-incidence wide-angle X-ray scattering studies of the morphology and orientation of the polymer thin films showed that nanoimprinting introduced significant reorientation while Grazing-incidence small-angle X-ray scattering studies demonstrated the excellent fidelity of the pattern transfer. Temperature-dependent scattering measurements indicated that the imprinted induced orientation and alignment remains intact even at temperatures where the imprinted topographical features nearly vanish.

In the second part of the thesis, the integration of conducting polymer, poly (3,4-ethylenedioxythiophene) poly(styrene sulfonate) (PEDOT:PSS), nanostructures in OPV devices was investigated. PEDOT:PSS nanostructures, fabricated by water-vapor assisted nanoimprinting, has potential to improve the device performance through both an increased interfacial area and the reorientation of the electron-donor polymer in the subsequently deposited active layer.

Date: May 07, 2012

Time: 10:00 AM

Place: Physics Building, B131

Program: Physics

Dissertation Advisor: Ben Ocko