Announcing the Final Examination of Johan Rodriguez for the degree of Master of Science

Time & Location: July 2, 2015 at 2:30 AM in Engineering 1 307
Title: Enhanced Structure and Crystallinity of Semiconducting Polymer Films Through Electrospray Deposition

Electrospray atomization is a method that uses electrical stresses as the means of generating droplets. The fundamental working principles of electrospray have been previously studied and demonstrated to have monodisperse droplet size distribution, good stability and scalability. Electrospray is a bottom-up deposition method which opens up the possibility of a roll-to-roll compatible process and is functional at regular atmospheric conditions. Due to this set of positive qualities, this atomization method holds promise as a means of solution based material processing that is cost effective and scalable. Conjugated polymers are among the solution processable materials of most interest, poly(3-hexylthiophene) (p3ht) standing out as one of the most extensively studied. Applications of p3ht as a p-type semiconductor have been demonstrated for devices like organic solar cells, light emitting diodes and transistors. Improvements in the performance of the mentioned devices have been correlated with a higher degree of crystallinity as well as the film structure in the case of organic solar cells.

The effects of different electrospray process parameters are investigated and various p3ht film structures are presented in this study. Electric repulsion present within the droplets in electrospray and evaporation of the solvent were used to obtain high aspect ratio features on the p3ht films. A clever design for the electrospray nozzle devised to improve the process stability is presented. Also, the crystallinity of the films was characterized using grazing incidence x-ray diffraction (GIXRD) and ultraviolet visible spectroscopy. All results in this study are presented as a comparison to spin coated control process. The GIXRD results suggest that the electrospray process produces crystallites that have an orientation opposite of the orientation observed in the spin coated process. Analysis of the ultraviolet visible spectroscopy absorption spectrum shows a red-shift, signaling an increase in the crystallinity. Lastly, good contact between the deposited p3ht and the substrate was confirmed using conductive atomic force microscopy (CAFM).

Major: Mechanical Engineering

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Bachelor’s of Mechanical Engineering, BA, 2012, University of Central Florida

Committee in Charge:
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Approved for distribution by Dr. Weiwei Deng, Committee Chair, on June 17, 2015.

The public is welcome to attend.