Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

In-situ observation of dynamic processes during organic semiconductor thin film deposition and strain-stabilization of metastable states
YANG LI, JING WAN, Department of Physics and Materials Science Program, University of Vermont, DETLEF-M. SMILGIES, Cornell High Energy Synchrotron Source, Cornell University, NICOLE BOUFFARD, Microscopy Imaging Center, College of Medicine, University of Vermont, RICHARD SUN, Angstrom Sun Technologies Inc., RANDALL HEADRICK, Department of Physics and Materials Science Program, University of Vermont — In-situ optical spectromicroscopy in reflection mode is used to study the growth mechanisms and thermal stability of 6,13- bis(trisopropylsilylethynyl)-pentacene (TIPS-pentacene) thin films. The results show that the films form in a supersaturated state before transforming to a solid film. Molecular aggregates are observed by optical spectroscopy in this supersaturated region corresponding to subcritical nuclei in the crystallization process. During deposition on a heated substrate, a progressive blue shift of optical absorption peaks of the solid film is observed at higher deposition temperatures due to a continuous thermally driven change of the crystalline packing. As crystalline films are cooled to ambient temperature they becomes strained although cracking of thicker films is observed, which allows the strain to partially relax. Below a critical thickness of 30 nm, cracking is not observed and the films are constrained to the lattice constants corresponding to the temperature at which they were deposited. An high averaged hole mobility about 2 $cm^2v^{-1}s^{-1}$ is obtained for strained TIPS-pentacene thin films deposited at 135C.

Yang Li
University of Vermont

Date submitted: 06 Nov 2015 Electronic form version 1.4