Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Controlling Grain Size in Solution-Processed Organic Semiconductors for Thin-Film Transistors STEPHANIE LEE, CHANG SU KIM, ENRIQUE GOMEZ, Princeton University, CHENG WANG, ALEXANDER HEXEMER, Lawrence Berkeley National Laboratory, MICHAEL TONEY, Stanford Synchrotron Radiation Laboratory, JOHN ANTHONY, University of Kentucky, YUEH-LIN (LYNN) LOO, Princeton University — We present a novel method for controlling the grain size in solution-processed triethylsilylethynyl anthradithiophene (TES-ADT) films through the addition of fractional amounts of fluorinated 5,11-bis(triethylsilylethynyl) anthradithiophene (FTES-ADT). FTES-ADT can seed the crystallization of TES-ADT during solvent-vapor annealing. The grain size in these films follows an exponential dependence on the concentration of FTES-ADT; varying the FTES-ADT concentration by 2-fold induces a 3-order of magnitude change in the grain size. For channels in which the average grain size is 29 μm, device mobility of the organic thin-film transistors (OTFTs) is 0.05 cm^2/V-s. For channels in which the average grain size is 2700 μm, the device mobility is 0.35 cm^2/V-s. The relationship between device mobility and grain size is well described by a composite mobility model, which assumes a high intrinsic grain mobility and a low grain boundary mobility. Grazing incidence x-ray diffraction indicates that the crystal lattice of TES-ADT is preserved despite the addition of FTES-ADT.

Stephanie Lee
Princeton University

Date submitted: 19 Nov 2008 Electronic form version 1.4