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High Performance Solution Processable TFTs

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Organic-based electronic devices offer the potential to significantly impact the functionality and pervasiveness of large-area electronics. We report on soluble acene-based organic thin film transistors (OTFTs) where the microstructure of as-cast films can be precisely controlled via interfacial chemistry. Chemically tailoring the source/drain contact interface is a novel route to self-patterning of soluble small molecule organic semiconductors and enables the growth of highly ordered regions along opposing contact edges which extend into the transistor channel. The unique film forming properties of soluble fluorinated anthradithiophenes allows us to fabricate high performance OTFTs, OTFT circuits, and to deterministically study the influence of the film microstructure on the electrical characteristics of devices. Most recently we have grown single crystals of soluble fluorinated anthradithiophenes by vapor transport method allowing us to probe deeper into their intrinsic properties and determine the potential and limitations of this promising family of oligomers for use in organic-based electronic devices. Co-Authors: O. D. Jurchescu^{1,4}, B. H. Hamadani¹, S. K. Park⁴, D. A. Mourey⁴, S. Subramanian⁵, A. J. Moad², R. J. Kline³, L. C. Teague², J. G. Kushmerick², L. J. Richter², T. N. Jackson⁴, and J. E. Anthony⁵ ¹Semiconductor Electronics Division, ²Surface and Microanalysis Science Division, ³Polymers Division, National Institute of Standards and Technology, Gaithersburg, MD 20899 ⁴Department of Electrical Engineering, The Pennsylvania State University, University Park, PA 16802 ⁵Department of Chemistry, University of Kentucky, Lexington, KY 40506-0055