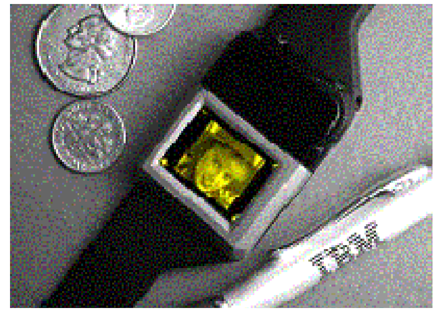
Stabilization of Polymeric Semiconductor-Insulator Interfaces - Meredith

The incorporation of polymeric semiconductors into logic devices, data storage, and sensors is a critical step for 'portable', 'durable' or 'expendable' micro- and nanoelectronics applications, e.g., real-time biosensors in food packaging or medical diagnostics or organic light-emitting diodes (OLEDs). As the need for more computing speed and storage grows, the scale of device structures will shrink into the nanoscale regime: less than 100 nm. A major roadblock to polymeric semiconductors is the inherent instability of nanoscale thin films and interfaces with dissimilar materials like insulators or strong conductors.Researchers at the Georgia Institute of Technology are working on a solution to this dilemma. J. Carson Meredith (Asst. Professor, Chemical and Biomolecular Engineering) and post-doc Santanu Chattopadhyay are applying combinatorial screening techniques to investigate and optimize the stability of semiconducting poly(3-octylthiophene) and its interfaces with simple insulators like poly(styrene). The high-throughput characterization of large numbers of thickness combinations is based upon the creation of thin-film libraries with two-dimensions of thickness variation, shown in Figure 1. A major discovery is that dramatic changes in wetting behavior occur over ranges of P3OT thickness in which molecular alignment is changing (Fig 2). Current theories of film instability do not capture this type of thickness dependent interfacial energy.



OLED Displays

Figure 1

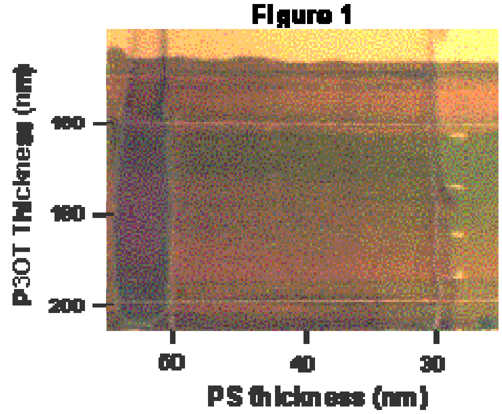
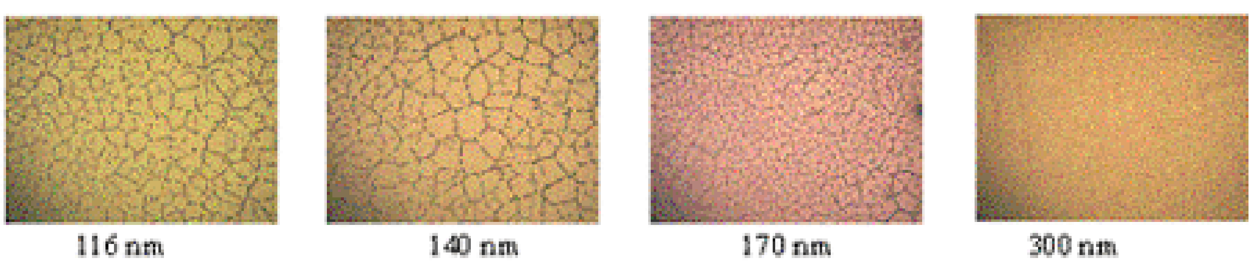


Figure 2



Polymer Semiconductor Layer Thickness

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