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Studying Crystalline Morphology and Texture of Small Molecule Organic Semiconductor Thin Films Using Polarized Optical Microscopy, Grazing-Incidence X-Ray Diffraction and Fluid Dynamics NAN YANG, GAURAV GIRI, University of Virginia — Organic semiconductors (OSCs) promise the advent of multifunctional electronics through the use of low temperature, solution processing methods of fabricating transistors on diverse substrates. OSCs are limited by low charge carrier mobilities and non-uniformity of performance. 2,7-dioctyl[1]benzohieno[3,2-b][1]benzothiophene (C8-BTBT) is a small molecule organic semiconductor that has recently reported to have charge transfer mobilities as high as 43 cm^2 V^{-1} s^{-1}. This OSC can also form uniform thin films transistors (TFTs) by proper control of the crystalline texture and morphology. We form highly crystalline, aligned C8-BTBT thin films using a flow coating process termed solution shearing. Studying the crystal morphology and texture and structure of the resulting thin films, we show that the solution shearing process causes the thin film formation to occur where the blade movement and the evaporation of the solvent occur in similar time scales. Solution shearing C8-BTBT thin films not only demonstrates that fluid dynamics play an important role in the thin film morphology control, but also provides an insight for controlling polymorphism and TFT electrical performance, enabling us to achieving the ultimate goal of a large-area, roll-to-roll coating process.

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