

Air-Flow Guided Crystal Growth for TIPS Pentacene-Based Organic Thin-Film Transistors

Zhengran He¹, Zhenzhong Sun¹, Greg Szulczewski², and Dawen Li^{1*}

Center for Materials for Information Technology (MINT)

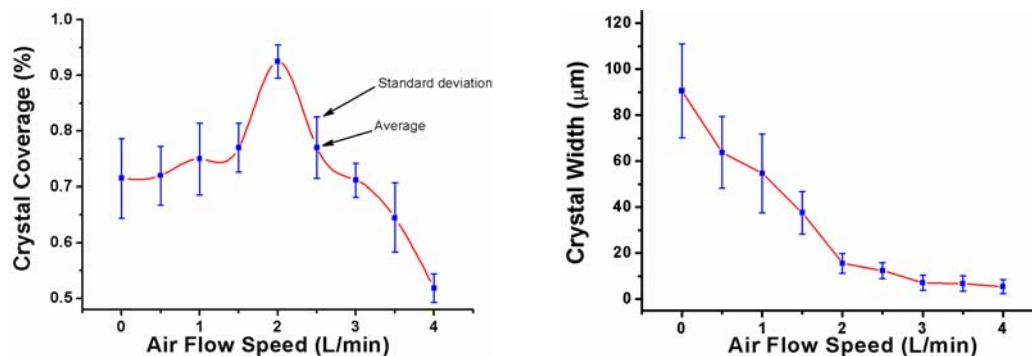
¹Department of Electrical and Computer Engineering

²Department of Chemistry

University of Alabama

Tuscaloosa, AL, U.S.A.

6,13-bis(triisopropylsilylethynyl)pentacene (TIPS pentacene) is a promising active channel material of organic thin-film transistors (OTFTs) due to its solubility, stability, and high mobility. However, growth of TIPS pentacene crystal is intrinsically anisotropic and thus leads to significant performance variation of OTFTs. In this paper, air flow is utilized to effectively reduce the TIPS pentacene crystal anisotropy and enhance performance consistency in OTFTs. Under air flow navigation (AFN), TIPS pentacene drop casted from toluene solution has been observed to form thin films with improved morphological uniformity and crystal orientation. The OTFTs show an increase of average mobility and a reduction in the ratio of measured mobility standard deviation (μ_{StdDev}) to average mobility (μ_{Avg}). X-ray diffraction and optical microscopy were used to investigate the TIPS pentacene crystallization and orientation under air flow navigation. The results show that AFN is an effective method to reduce the undesirable crystal misorientation while simultaneously enhancing TIPS pentacene crystallinity.



Crystal coverage change (Left) and crystal width change (Right) with air flow speed.