Deposition and control of polymer dielectrics for OTFTs

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Abstract

The breakthrough of flexible electronics depends upon suitable large-scale manufacturing routes, likely requiring very low cost, high-throughput processing techniques. Our approach to development of organic electronics considered high-speed roll-to-roll processing routes already employed industrially. We examined their applicability in creating transistors and circuits. Central to this is the high-throughput deposition of polymeric dielectric using a vacuum deposition route compatible with the preferred processing for molecular semiconductors, metal contacts and ceramic or other semiconducting active components.

This paper will discuss the control of dielectric properties as determined by processing parameters during the thin-film deposition and by the surface segregation of one component of a monomer mixture to control interfacial properties of the dielectric. The dielectric performance will be demonstrated in OTFT devices and circuit elements.

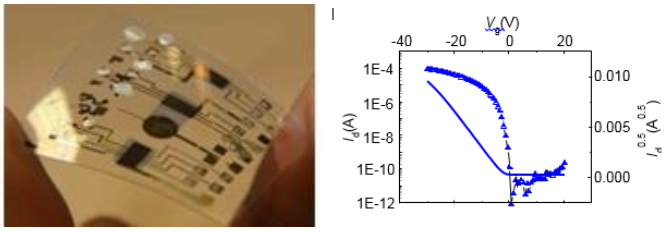


Figure 1 An array of OTFT and capacitor devices with polymer dielectric, and typical OTFT transfer curve.

Recent Publications

1. Abbas G, Ding Z, Mallik K, Assender H. Taylor DM (2013) Hysteresis-free vacuum-processed acrylate-pentacene organic thin film transistors IEEE electron device letters 34:268-270
2. Ding Z, Abbas GAW, Assender HE, Morrison JJ, Sanchez-Romaguera V, Yeates SG, Taylor DM (2013) Improving the performance of organic thin film transistors formed on a vacuum flash-evaporated acrylate insulator. Applied Physics Letters 103:233301
3. Abbas GAW, Ding Z, Assender HE, Morrison JJ, Yeates SG, Patchett E, Taylor DM (2014) A high-yielding evaporation-based process for organic transistors based on the semiconductor DNTT. Organic Electronics 15:1998-2006
4. Avila-Niño JA, Patchett ER, Taylor DM, Assender HE, Yeates SG, Ding Z, Morrison JJ (2016) Stable organic static random access memory from a roll-to-roll compatible vacuum evaporation process. Organic Electronics 31:77-81
5. Ding Z, Abbas, G, Assender, HE, Morrison, JJ, Yeates, SG, Patchett, ER, Taylor, DM (2016) Vacuum Production of OTFTs by Vapour Jet Deposition of Dinaphtho[2,3-b:2',3'-f]thieno[3,2-b]thiophene (DNTT) on a Lauryl Acrylate Functionalised Dielectric Surface. Organic Electronics 31:90-97.



Biography

Prof Hazel Assender has led a research activity at the Department of Materials, University of Oxford, since 1996, with a focus in the area of thin films and coatings both of polymer materials or onto polymer substrates. She graduated from the University of Cambridge, following this with a PhD, and two years of postdoc in the Department of Materials Science & Metallurgy in Cambridge before moving to an academic post in Oxford. Her research spans fundamental studies of the thin film and near-surface properties of polymers, through to materials engineering of thin films and device structures in large area on polymer substrates. Particular areas of interest include roll-to-roll deposition, gas barriers, photovoltaics, and transistors/circuits. Her research has a technology-facing approach bringing underpinning scientific understanding to development of materials and technologies that integrates research relevant to industrial processing such as scale-up of manufacture with the development of new materials and structures.

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