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Classification of Semiconducting Polymeric Mesophases to Optimize Device Post-Processing CHAD SNYDER, RYAN NIEUWENDAAL, LEE RICHTER, R. JOSEPH KLINE, DEAN DELONGCHAMP, NIST, MARTIN HEENEY, IAIN MCCULLOCH, Imperial College of London — Semiconducting polymers form a variety of phases and mesophases that respond differently to post-deposition solvent or thermal treatments. Here it is shown that classification of these materials into their appropriate mesophases can be a useful tool to optimize their post-deposition treatments. Calorimetry is used to quantify differences between very similar materials, using a well-established framework based on the kinetics and thermodynamics of phase changes. By way of example, this classification scheme is used to identify differences in three polymers, poly(3-hexylthiophene) and two isomeric bithiophene-thiophene copolymers (pBTTT and pATBT). It is demonstrated that poly(3-hexylthiophene) is a conformationally disordered (condis) crystal, and that the two bithiophene copolymers are liquid crystals. The condis state is used to help explain the wide range of reported values for poly(3-hexythiophene), as two separate glass transitions are clearly resolved. The diverse phase structure is notable in light of the molecular similarity of the three polymers, and it has impact on optimum post-processing conditions for maximum electrical performance in thin film transistor devices.

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