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Thermal, structural, and electrical characterization of two high performance semiconducting polymers L.J. RICHTER, NIST, Gaithersburg, MD, A.J. MOAD, D.M. DELONGCHAMP, R.J. KLINE, D.J. GUNDLACH, D.A. FISCHER, NIST, I. MCCULLOCH, Imperial College, London, UK, M. HEENEY, Queen Mary University, London, UK — Polymer semiconductors are inexpensive solution processable alternatives to amorphous silicon for applications in flexible large area electronics. Recently, thin films of spun-cast poly(2,5-bis(3-alkylthiophen-2-yl)thieno[3,2-b]thiophene) (pBTTT) have been demonstrated to exhibit exceptional hole mobilities in thin film transistors (TFTs) after heating into a mesophase. Poly(dialkylthieno[3,2-b]thiophene-2,5-bithiophene) (pTTBT) is a newly synthesized isomer of pBTTT with side chains attached to the thienothiophene rather than the bithiophene unit. This subtle structural change results in a very different response to heating. FTIR, spectroscopic ellipsometry (SE), AFM, X-ray diffraction, and NEXAFS were utilized to determine the root of the different thermal behavior. The structural transitions of the isomers are generally similar; however, the side chain melting transition T_m occurs about 50 °C lower in pTTBT than in pBTTT. The significant drop in T_m appears to correlate with a subtle decrease in main chain packing interactions. Both materials exhibit high hole mobility, even in their respective mesophases. The slight overall higher order in pBTTT is reflected in the device performance.

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