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Molecular order in MAPLE-deposited conjugated polymer thin films and the implication for carrier transport characteristics BAN DONG, ANTON LI, University of Michigan, JOSEPH STRZALKA, Argonne National Laboratory, GILA STEIN, University of Tennessee, PETER GREEN, University of Michigan — The morphological structure of poly(3-hexylthiophene) (P3HT) thin films deposited by both Matrix Assisted Pulsed Laser Evaporation (MAPLE) and solution spin-casting methods are investigated. The MAPLE samples possessed a higher degree of disorder, with random orientations of polymer crystallites across the side-chain stacking, π-π stacking, and conjugated backbone directions. Moreover, the average molecular orientations and relative degrees of crystallinity of MAPLE-deposited polymer films are insensitive to the chemistries of the substrates onto which they were deposited; this is in stark contrast to the films prepared by the conventional spin-casting technique. Despite the seemingly unfavorable molecular orientations and the highly disordered morphologies, the in-plane charge carrier transport characteristics of the MAPLE samples are comparable to those of spin-cast samples, exhibiting similar transport activation energies (56 meV versus 54 meV) comparable to those reported in literature for high mobility polymers.This suggests that the film morphology near the buried interface is different from the bulk or that the molecular order measured by GIWAXS and ellipsometry plays only a secondary role in dictating transport in organic thin film transistors.

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