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**Semicrystalline high performance poly (thienothiophene) thin films: crystallites and defects** CHENCHEN WANG, Applied Physics, Stanford University, JAVIER DACUÑA, Electrical Engineering, Stanford University, BJÖRN BRÄUER, Stanford Institute of Materials and Energy Science, DAN DARANCIANG, Department of Chemistry, Stanford University, ALBERTO SALLEO, Material science and engineering, Stanford University — Effects of liquid crystalline temperature annealing and surface treatment on Poly(2,5-bis(3-alkylthiophen-2-yl)thieno[3,2-b]thiophenes) (PBTTT) thin films were studied. Time resolved terahertz spectroscopy (TRTS), which measures the local carrier mobility, suggests that the mobility improvement of annealed PBTTT on octadecyltrichlorosilane (OTS), compared with as cast film, is mainly due to superior local carrier mobility. Scanning transmission x-ray microscopy (STXM), which measures the in-plane molecular orientation with 30nm spatial resolution, shows similar domain size of annealed films on both OTS and  $SiO_2$ , and implies that the higher mobility of film on OTS cannot be accounted for by domain size. These results are also supported by the mobility edge model, which extracts trap density and quasi-free carrier mobility in crystallites from transistor characterization. Annealing film on OTS improves mobility in crystallites, but has little effects of reducing trap density. The modeling shows great elimination of interface trap density of film on OTS, compared with film on  $SiO_2$ , which might be the main reason for its higher mobility.

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