Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Modifying growth of perylene diimide nanocrystals with poly(3-hexyl thiophene) as additives LAJU BU, RYAN HAYWARD, UMass — The shape, size, and crystallinity of organic semiconductors play vital roles in their applications in optoelectronics. Various methods to control crystallization of organic semiconductors, including thermal/solvent annealing, addition of poor solvents, and chemical structure modification, have been applied to improve the performance of organic photovoltaics. While soluble additives controlled crystallization are commonly found in biomineralization, pharmaceutics, and food science, they have rarely been applied to organic semiconductors. Here, we show that a p-type polymer, P3HT, serves as a soluble additive in crystallization of a n-type semiconductor, perylene diimide (PDI), by preferentially adsorbing on lateral crystal faces, which reduce lateral growth of PDI crystals relative to longitudinal growth, yielding extended 1-D nanofibers. Upon subsequent crystallization of P3HT, the PDI nanofibers serve as efficient nucleation sties, resulting in shish-kebab like p/n heterostuctures. Using ultrasound to enhance nucleation of PDI crystals, variations in P3HT molecular weight and concentration, and sonication temperature, allow PDI nanocrystal size and uniformity to be tuned. The uniform PDI nanocrystals can act as seeds to crystallize additional PDI to get segmented nanocrystals.

Laju Bu
UMass

Date submitted: 12 Nov 2013 Electronic form version 1.4