

Supporting Information

Regioregular Poly(3-pentylthiophene): Synthesis, Self-Assembly of Nanowires, High-Mobility Field-Effect Transistors, and Efficient Photovoltaic Cells

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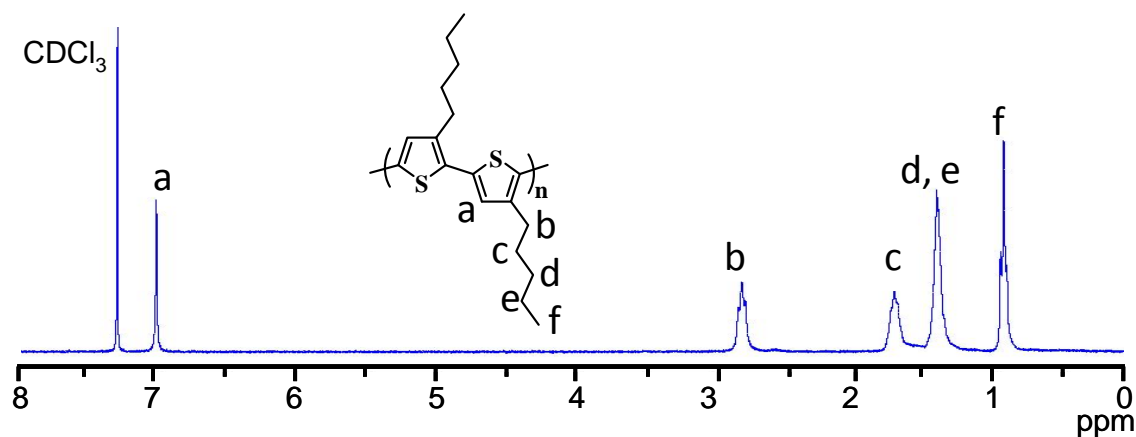


Figure S1. ¹H-NMR of Poly(3-pentylthiophene) in CDCl₃.

¹H NMR (300 MHz, CDCl₃): δ 6.98 (s, 1H), 2.82 (t, 2H), 1.42 (m, 4H), 0.95 (t, 3H). Regioregularity of P3PT-1 is estimated to be 94.3%. The estimation of regioregularity is derived by integration of the methylene (α) protons: A/(A+B), the integral A (range: 2.95 – 2.65 ppm) and the integral B (range: 2.6625 – 2.50 ppm).

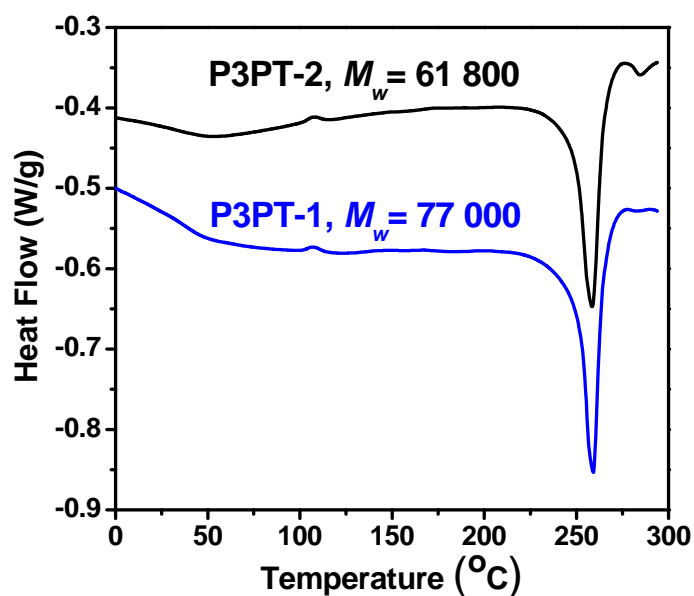


Figure S2. Thermal properties of P3PT samples. (A) The second heating scans of P3PT-1 and P3PT-2 at a heating rate of 10 °C/min. (B) The alkyl chain length dependence of the melting temperatures of regioregular poly(3-alkylthiophene)s for $n = 4 - 12$.

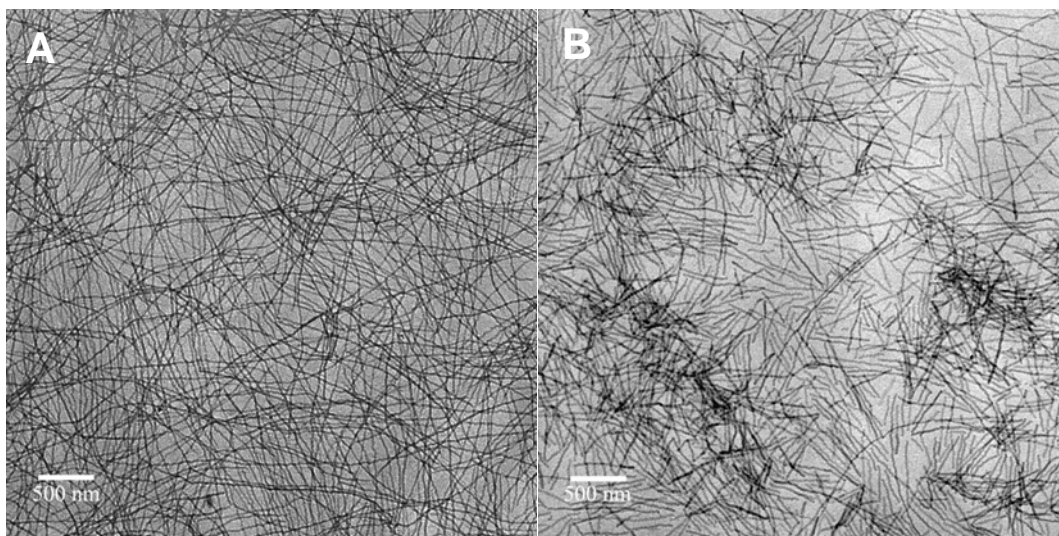


Figure S3. The morphology of P3PT-1e NWs characterized by TEM. (A) Self-assembled P3PT-1e NWs grown at 10 mg/mL. (B) Self-assembled P3PT-1e NWs grown at 20 mg/mL.

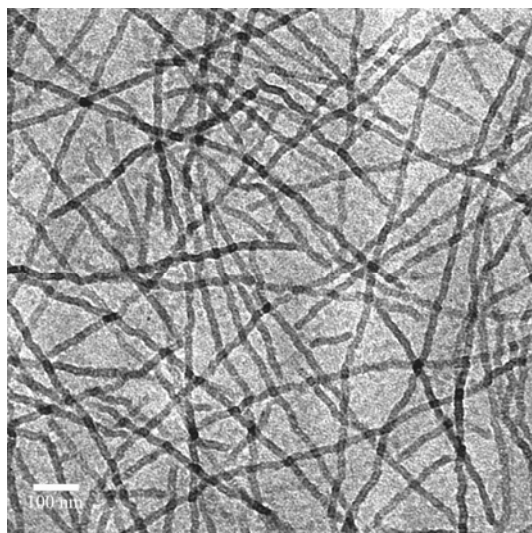


Figure S4. Self-assembled P3PT-1 NWs grown at 6 mg/mL and the pseudo-bicontinuous morphology of P3PT-1 NWs under TEM at 100 kV.

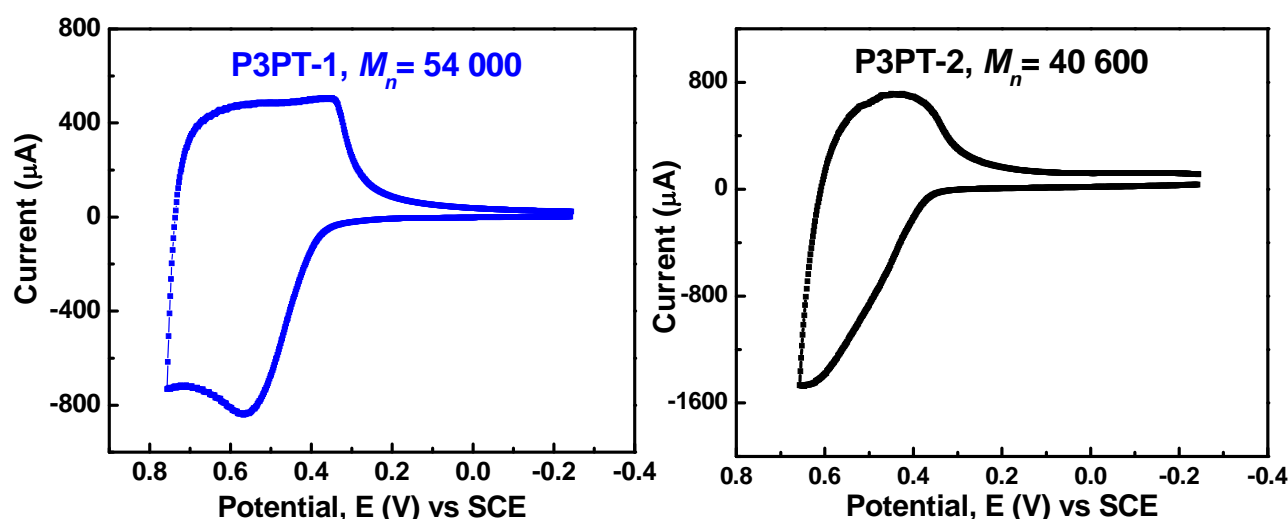


Figure S5. Cyclic voltammogram of P3PT: the oxidation scan of P3PT film on platinum wire in 0.1 M Bu_4NPF_6 solution in acetonitrile at a scan rate of 50 mV/s. The onset of oxidation potential is estimated to be 0.38 V (vs SCE), corresponding to an ionization potential of 4.78 eV. Cyclic voltammetry experiments were done on an EG&G Princeton Applied Research Potentiostat/Galvanostat (Model 273A) using 0.1 M tetra-*n*-butylammonium hexafluorophosphate (Bu_4NPF_6) in acetonitrile as electrolyte. A three-electrode cell was used in all experiments. Platinum wire electrodes were used as both counter and working electrodes and silver/silver ion (Ag in 0.1 M AgNO_3 solution, Bioanalytical System, Inc.) was used as a reference electrode. The Ag/Ag^+ (AgNO_3) reference electrode was calibrated at the beginning of the experiments by running cyclic voltammetry on ferrocene as the internal standard. The potential values obtained in reference to Ag/Ag^+ electrode were then converted to the saturated calomel electrode (SCE) scale. The films of the polymers were coated onto the working electrode by dipping a Pt wire into a 3 wt% solution in chloroform and chlorobenzene and drying under vacuum at 60 °C for 1 h.

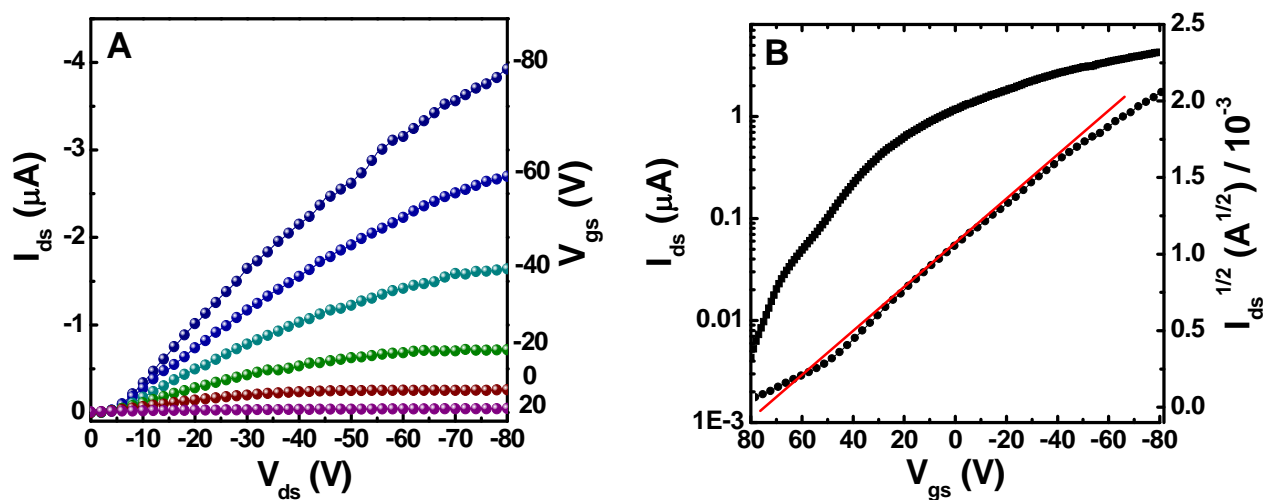


Figure S6. Output (A) and transfer (B) characteristics of one OFET based on P3PT-1:PC₇₁BM (1:1) exhibiting a hole mobility of $9.3 \times 10^{-4} \text{ cm}^2/\text{V s}$.