

Supporting Information

Enhanced Charge Transport in Polymer Thin-Film Transistors Prepared by Contact Film Transfer Method

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Synthesis of Poly(3-butylthiophene)

2,5-dibromo-3-butylthiophene (500 mg, 1.7 mmol) and 20 mL of anhydrous THF was added to a two-necked 100 mL round-bottom flask. *t*-BuMgCl (1.7 mmol) was then added via syringe in one portion. After the solution was heated to reflux and stirred for 2 h, heating bath was removed and Ni(dppp)Cl₂ (7.7 mg, 0.014 mmol) was added. After 10min stirring 20ml of anhydrous THF was added into reaction mixture to prevent precipitation of polymerized compound. The mixture was further stirred for 0.5 h at room temperature, and the reaction solution was quenched with 5M HCl. The polymer was extracted with chlorobenzene and sequentially washed with 1M HCl, saturated NaHCO₃ aq., and water. After chlorobenzene was evaporated, the residue was precipitated into MeOH and Hexane several times. After filtration, the residue was dried under vacuum to give 85 mg of poly(3-butylthiophene) in 36% yield.

¹H NMR (500 MHz, C₆D₅Cl): 6.97 (s, 1H), 2.84 (t, 2H), 1.66 (m, 2H), 1.39 (m, 2H), 0.88 (t, 3H). Regioregularity (RR) was determined as > 98% by ¹H NMR and *M*_n = 18000 and PDI = 1.4 determined by GPC (Solvent: Chlorobenzene).

Synthesis of Poly(3-octylthiophene), Poly(3-decylthiophene) and Poly(3-dodecylthiophene)

2,5-dibromo-3-octylthiophene (1.5 mmol) and 12 mL of anhydrous THF was added to two-necked 50 mL round-bottom flasks. *t*-BuMgCl (1.5 mmol) was then added via syringe in one portion. After the solution was heated to reflux and stirred for 2 h, heating bath was removed and Ni(dppp)Cl₂ (6.9 mg, 0.013 mmol) was added. The mixture was stirred for 12 h at room temperature, and the reaction solution was quenched with 5M HCl. The polymer was extracted with chloroform and sequentially washed with 1M HCl, saturated NaHCO₃ aq., and water. After dried with MgSO₄, CHCl₃ was evaporated and the residue was precipitated into MeOH. After filtration, the polymer was purified by Soxhlet extraction with MeOH and hexane, sequentially. The polymer was extracted with CHCl₃ and reprecipitated into MeOH. The suspension was filtered and the residue was dried under vacuum to obtain Poly(3-octylthiophene). Poly(3-decylthiophene) and Poly(3-dodecylthiophene) were synthesized by same procedure.

Poly(3-octylthiophene). yield: 47%;

¹H NMR (500 MHz, CDCl₃): 6.98 (s, 1H), 2.80 (t, 2H), 1.71 (m, 2H), 1.42 (m, 2H), 1.34 (m, 8H), 0.87 (t, 3H). RR: > 97% determined by ¹H NMR and *M*_n = 25000 (PDI = 1.2) determined by GPC (Solvent: CHCl₃).

Poly(3-decylthiophene). yield: 41%.

¹H NMR (500 MHz, CDCl₃): 6.98 (s, 1H), 2.80 (t, 2H), 1.70 (m, 2H), 1.41 (m, 2H), 1.35

(m, 2H), 1.27 (m, 10H), 0.87 (t, 3H) RR: > 97% determined by ^1H NMR and $M_n = 22000$ (PDI = 1.2) determined by GPC (Solvent: CHCl_3).

Poly(3-dodecylthiophene). yield: 55%.

^1H NMR (500 MHz, CDCl_3): 6.98 (s, 1H), 2.79 (t, 2H), 1.69 (m, 2H), 1.42 (m, 2H), 1.35 (m, 2H), 1.26 (m, 14H), 0.87 (t, 3H). RR: > 98% determined by ^1H NMR and $M_n = 25000$ (PDI = 1.2) determined by GPC (Solvent: CHCl_3).

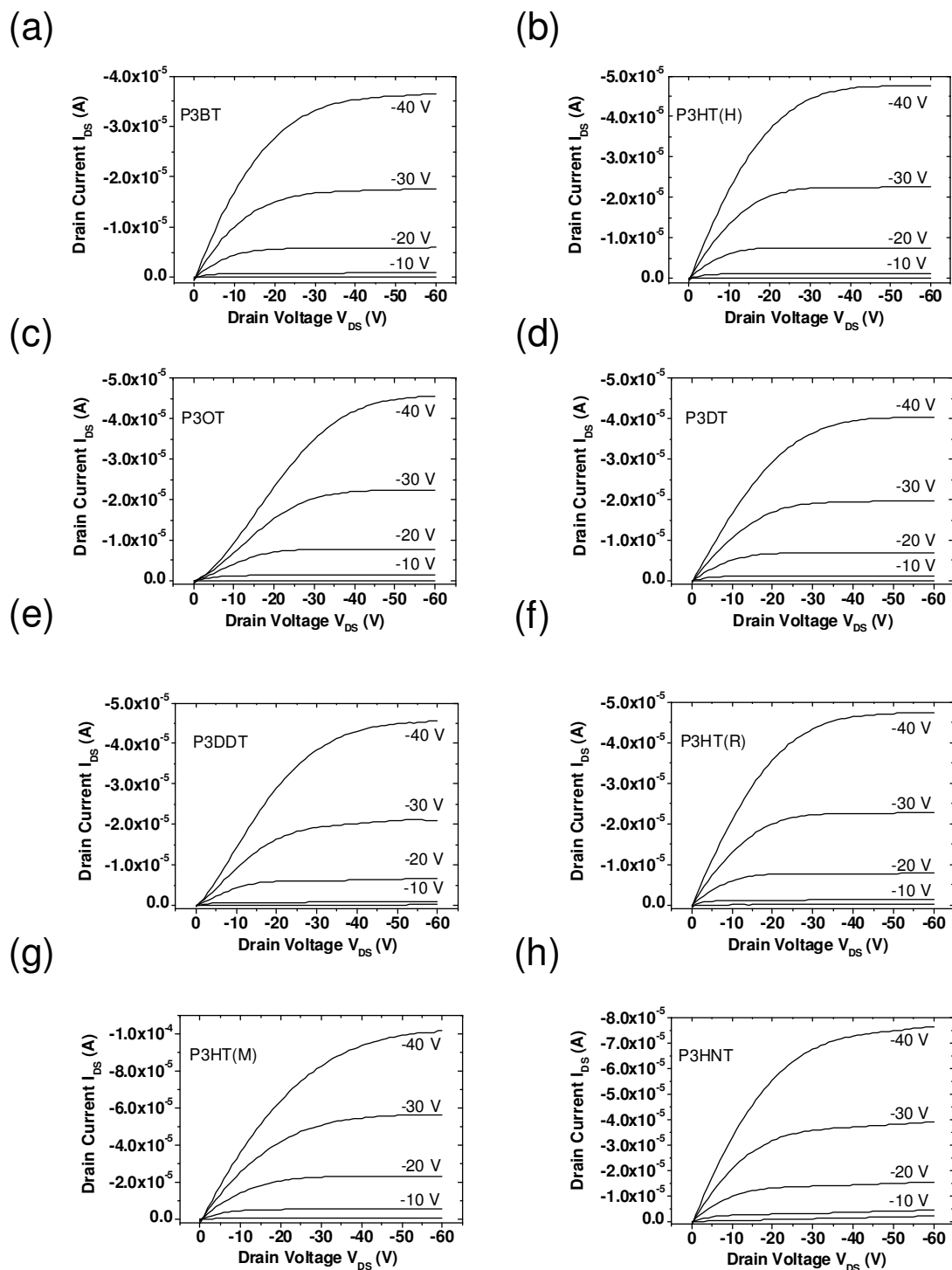


Figure S1. Output characteristics of the transistors prepared by the contact film transfer: a) P3BT; b) P3HT (Home); c) P3OT; d) P3DT; e) P3DDT; f) P3HT (Rieke); g) P3HT (Merck); h) P3HNT.

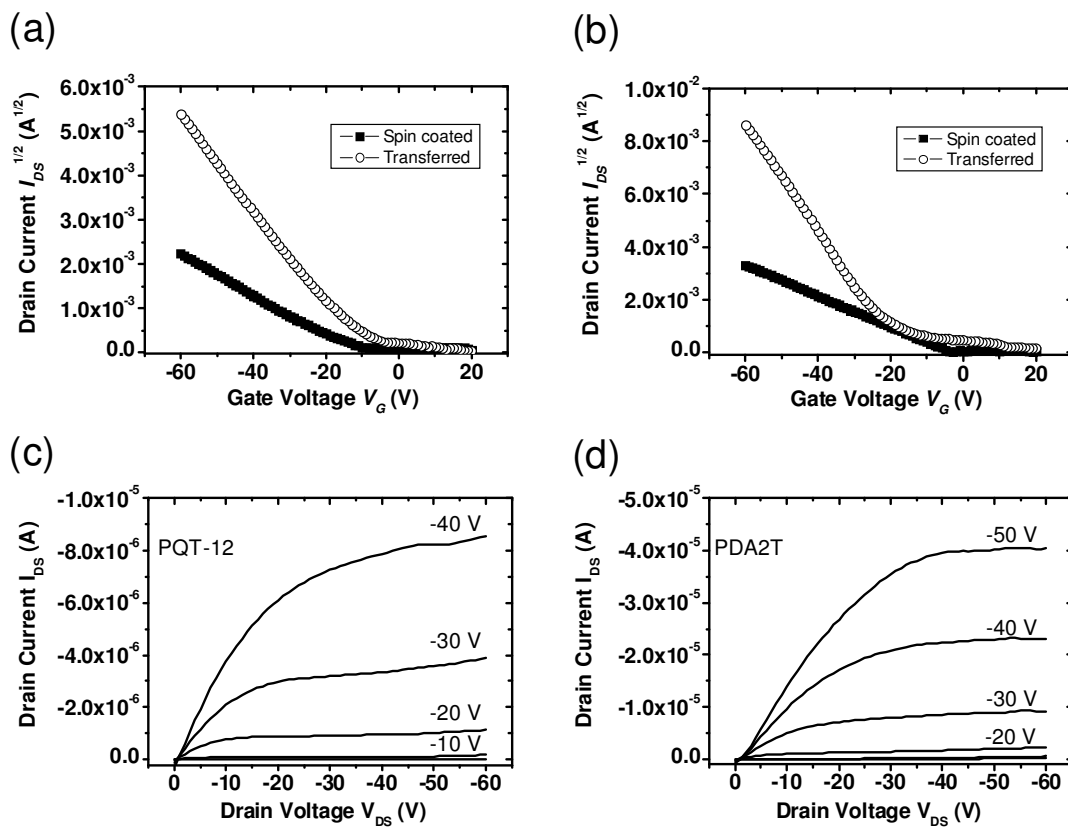


Figure S2. Transfer characteristics of the transistors prepared by the spin coating (closed squares) and by the contact film transfer (open circles): a) PQT-12 and b) PDA2T; Output characteristics of the transistors prepared by contact film transfer: c) PQT-12 and d) PDA2T.