Electronic Supplementary Information

Improving Charge Transport Performance of Solution-Processed Organic Electronic Devices Using Green Solvent Additives

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Table S1. Summary of the optimized conditions for solution-processed OFETs from different solvents. For TIPS-pentacene, C_8-BTBT, TU-3 and ambipolar semiconductor films, solution-shearing method was used, and for P(NDI2OD-T2) films, conventional spin-coating method was used. For all fabricated films, thermal annealing was employed for 2 hr to remove residual solvent. (TOL: toluene, AA: n-amyl acetate, CF: chloroform, 2-MeTHF: 2-methyl tetrahydrofuran, CB: chlorobenzene, DES: diethyl succinate)

Semiconductor	Used Solvent (Mixing Ratio)	Substrate Temperature (ºC)	Shearing Speed (mm/min)	Annealing Temperature (ºC)
TIPS-pentacene	Single TOL or TOL and AA	60	10	90
C_8-BTBT	Single CF or CF and 2-MeTHF	30	5	50
TU-3	single CB or CB and DES	90	5	105
TIPS-pentacene & P(NDI2OD-T2)	Single TOL or TOL and AA (8:2)	60	10	90

[a] Optimized solution concentrations for each semiconductor solution were 4 mg/mL, 2 mg/mL, 1 mg/mL, 5 mg/mL for TIPS-pentacene, C_8-BTBT, TU-3 and blended solution of TIPS-pentacene & P(NDI2OD-T2), respectively.

Semiconductor[a]	Used Solvent	Spin Rate (RPM)	Spin Time (s)	Annealing Temperature (ºC)
P(NDI2OD-T2)	Single TOL or TOL and AA	600	50	90
P(NDI2OD-T2)	Single CF or CF and 2-MeTHF	600	50	50

[a] Concentration of 6 mg/mL P(NDI2OD-T2) solution was employed for fabrication of optimized n-type polymer film.

Table. S2 Performance parameters of ambipolar OFETs consisting of various semiconductor blending ratio with toxic single TOL and with TOL and AA (8:2) for optimized blending ratio of semiconductor film. (TOL: toluene, AA: n-amyl acetate)

Ratio P:N (solvent)	**P-channel** μ_h **(cm²/Vs)** I_{on}/I_{off} V_{th} **(V)**	**N-channel** μ_e **(cm²/Vs)** I_{on}/I_{off} V_{th} **(V)**
1:1 (TOL)	0.32 2.2×10^{1} -13	not active
1:2 (TOL)	not active	0.0099 1.5×10^{1} 17
1:3 (TOL)	not active	0.016 2.6×10^{3} -3.9
1:4 (TOL)	not active	0.022 7.4×10^{3} 5.3
2:3 (TOL)	0.037 8.2×10^{0} -44	0.0076 1.6×10^{1} 21
2:3 (TOL & AA)	0.075 9.4×10^{0} -28	0.0182 2.0×10^{1} 12

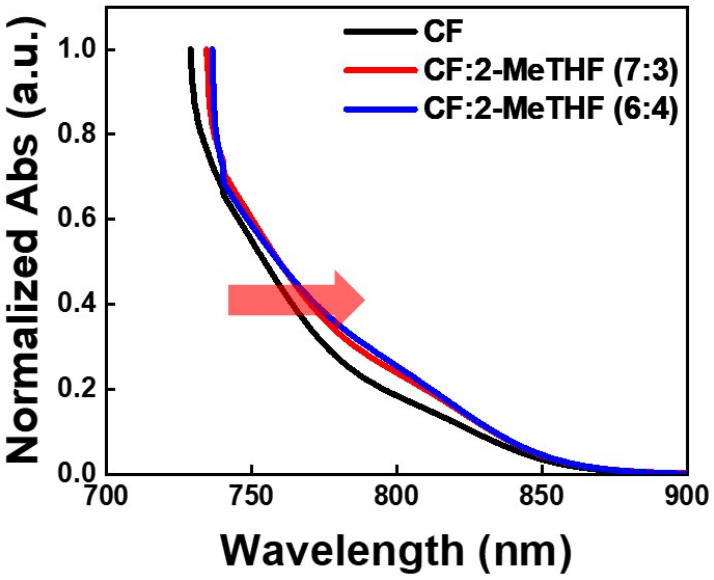

Fig. S1 UV-vis absorption spectra of P(NDI2OD-T2) solution with solution concentration of ~10^{-6} M. (CF: chloroform, 2-MeTHF: 2-methyl tetrahydrofuran).

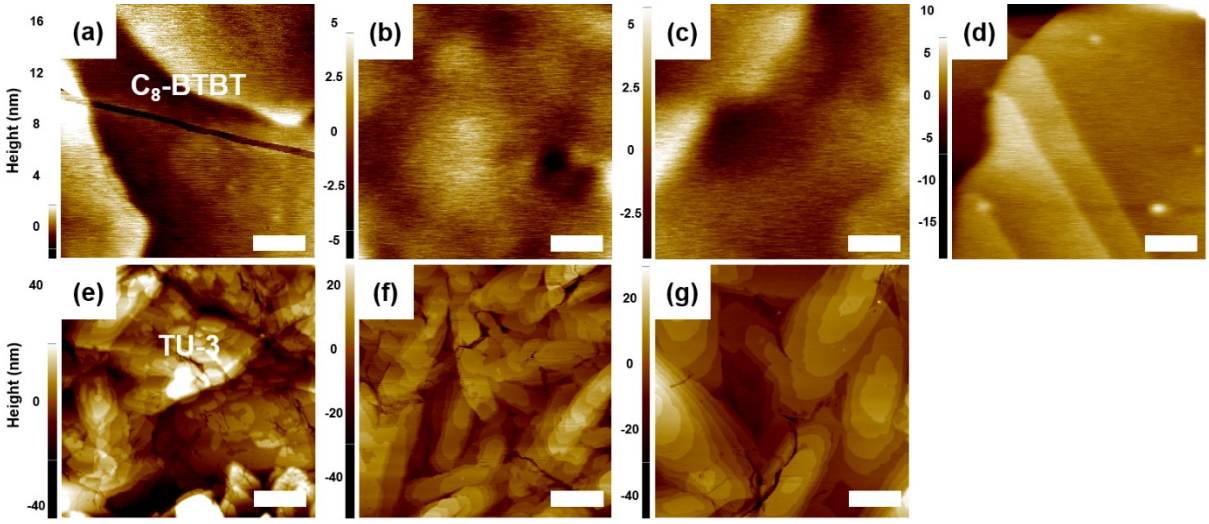

Fig. S2 AFM images (area size 10 μm × 10 μm) of the fabricated OSC films according to mixing ratio of binary solvents for C_8-BTBT (a) single CF, (b) CF and 2-MeTHF (7:3), (c) CF and 2-MeTHF (6:4), (d) CF and 2-MeTHF (5:5), for TU-3 (e) single CB, (f) CB and DES (8:2) and (g) CB and DES (7:3). (CF: chloroform, 2-MeTHF: 2-methyl tetrahydrofuran, CB: chlorobenzene, DES: diethyl succinate).

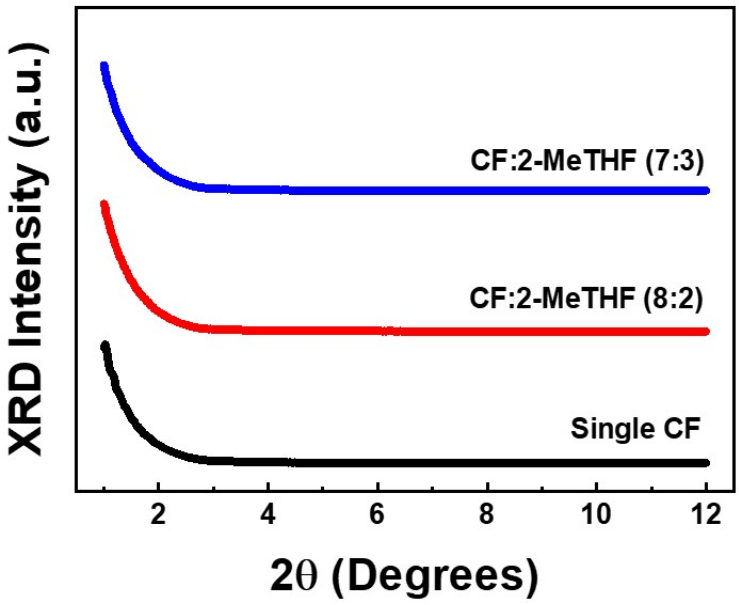

Fig. S3 XRD profiles of the P(NDI2OD-T2) films according to mixing ratio of binary solvents. (CF: chloroform, 2-MeTHF: 2-methyl tetrahydrofuran).

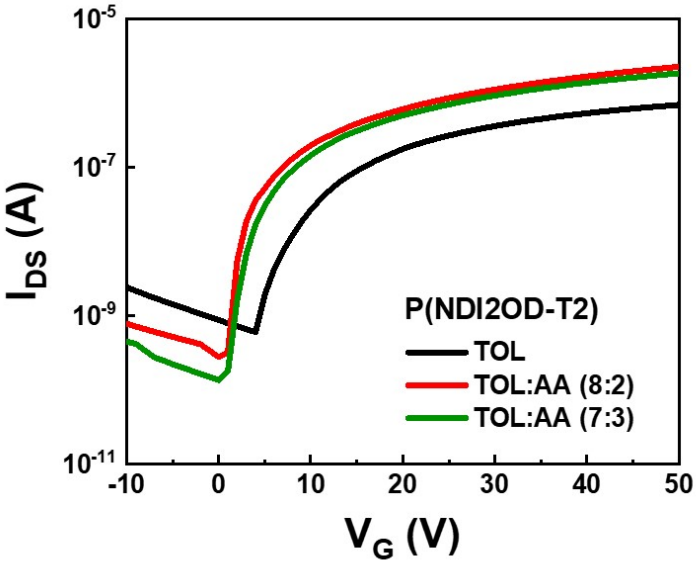

Fig. S4 Transfer characteristics of OFETs depending on mixing ratio of binary solvent for P(NDI2OD-T2) based on single TOL and TOL and AA. Corresponding charge carrier mobilities were 0.026, 0.078 and 0.065 cm^2/Vs for single TOL, TOL:AA (8:2), TOL:AA (7:3), respectively. (TOL: toluene, AA: n-amyl acetate).

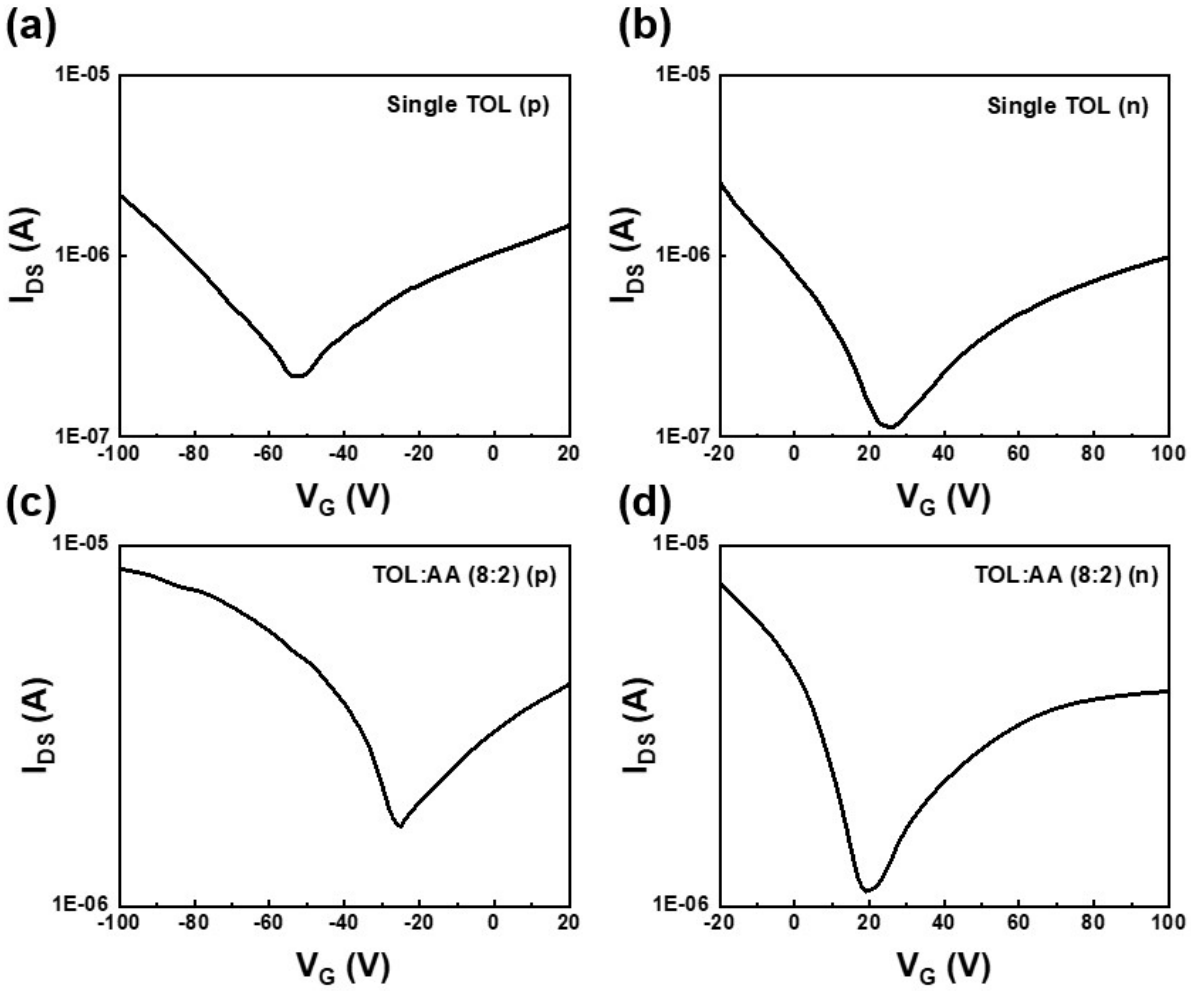

Fig. S5 Transfer characteristics for ambipolar OFETs based on single TOL, (a) p-type, (b) n-type and for ambipolar OFETs based on TOL and AA (8:2), (c) p-type and (d) n-type. (TOL: toluene, AA: n-amyl acetate). $V_G = V_D = -100$ V and $V_G = V_D = 100$ V for p- and n-type OFETs, respectively.

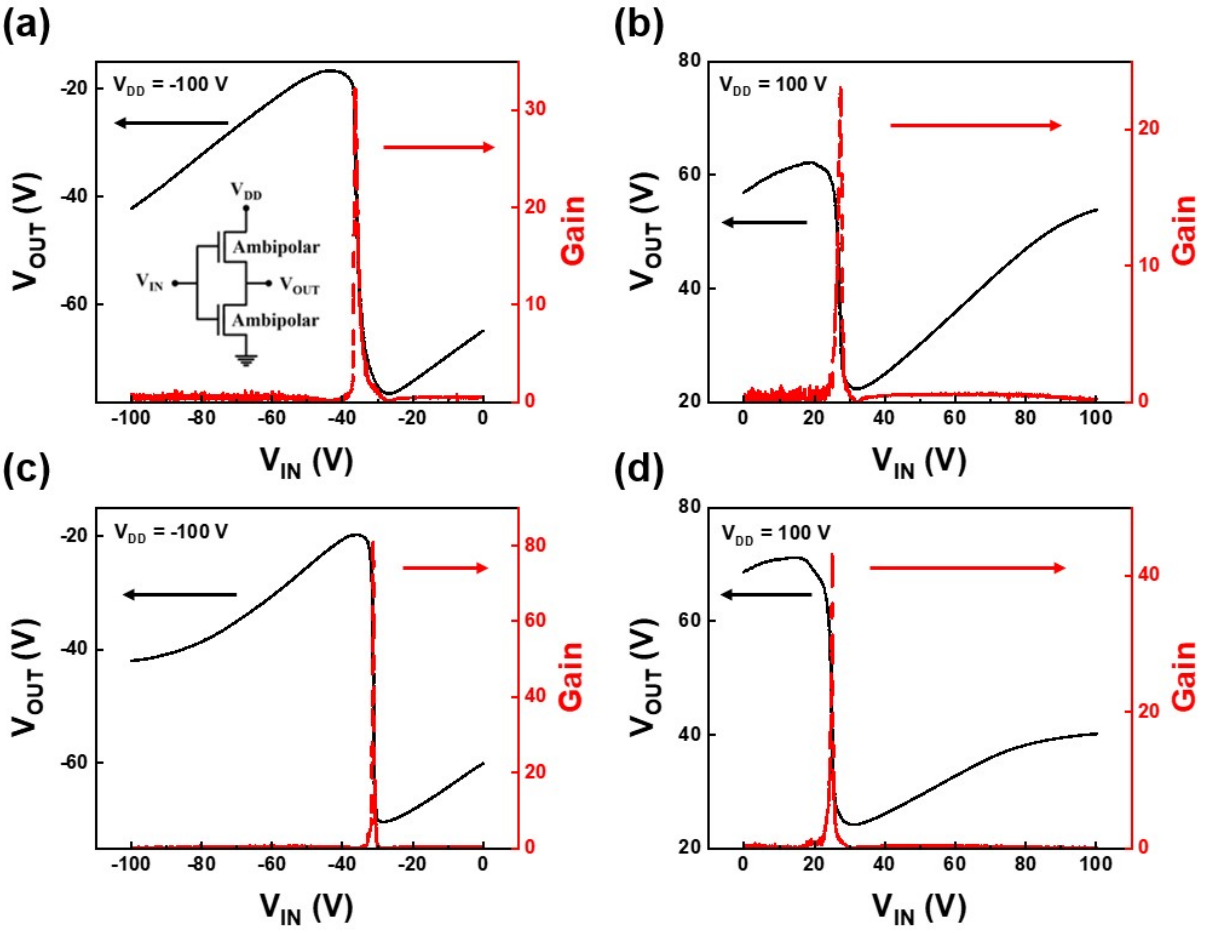

Fig. S6 Voltage transfer characteristics of complementary-like inverter using two ambipolar OFETs based on TIPS-pentacene and P(NDI2OD-T2) blend (a), (b) with single TOL and (c), (d) with binary solvent consisting of TOL and AA (8:2). The inset shows the circuit diagram. (TOL: toluene, AA: n-amyl acetate).