Supporting information for:

Printed thin film transistors and CMOS inverters based on semiconducting carbon nanotube ink purified by a nonlinear conjugated copolymer

Wenya Xu[1#], Junyan Dou[1#], Jianwen Zhao[1]*, Hongwei Tan[2], Jun Ye[3], Masayoshi Tange[4], Wei Gao[1], Weiwei Xu[1, 5], Xiang Zhang[1, 5], Wenrui Guo[1], Changqi Ma[1]*, Toshiya Okazaki[6], Kai Zhang[1], Zheng Cui[1]*

[1]Printable Electronics Research Centre, Suzhou Institute of Nanotech and Nano-bionics, Chinese Academy of Sciences, No. 398 Ruoshui Road, Suzhou Industrial Park, Suzhou, Jiangsu Province, 215123, PR China.

[2]College of Chemistry, Beijing Normal University, Beijing, 100875, PR China.

[3]Institute of High Performance Computing, Agency for Science, Technology and Research, 138632, Singapore.

[4]Nanomaterials Research Institute, National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba 305-8565, Japan.

[5]School of Materials Science and Engineering, Shanghai University, Shanghai, 200444, PR China.

[6]CNT-Application Research Center, National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba 305-8565, Japan.

*Email: jwzhao2011@sinano.ac.cn; cqma2011@sinano.ac.cn; zcui2009@sinano.ac.cn

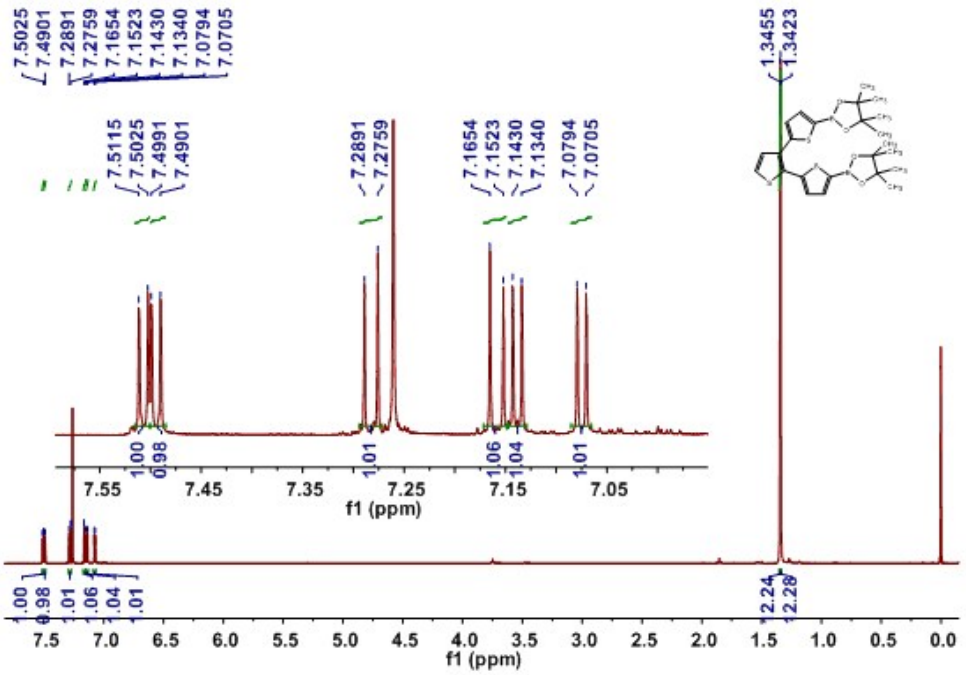

Figure S1. ^{1}H NMR spectra of 3T-B (400 MHz, in $CDCl_3$).

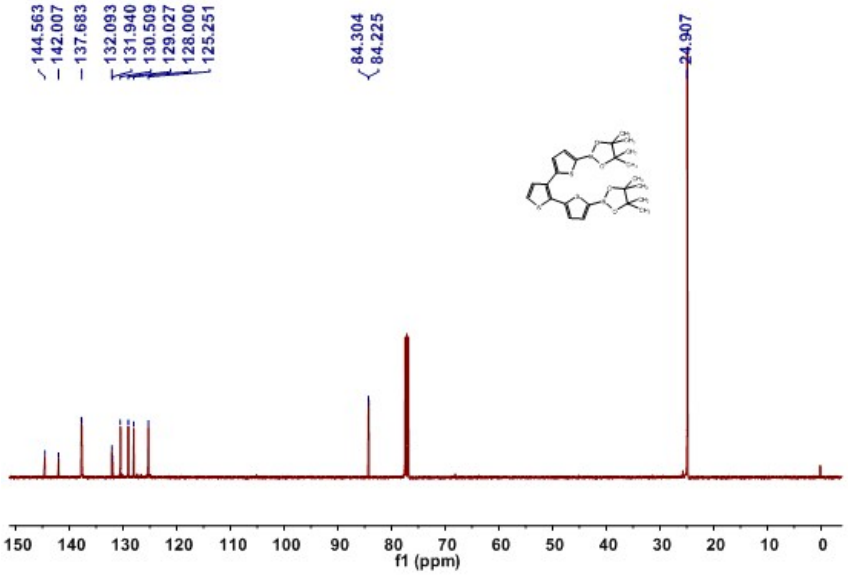

Figure S2. ^{13}C NMR spectrum of 3T-B (100MHz, in $CDCl_3$).

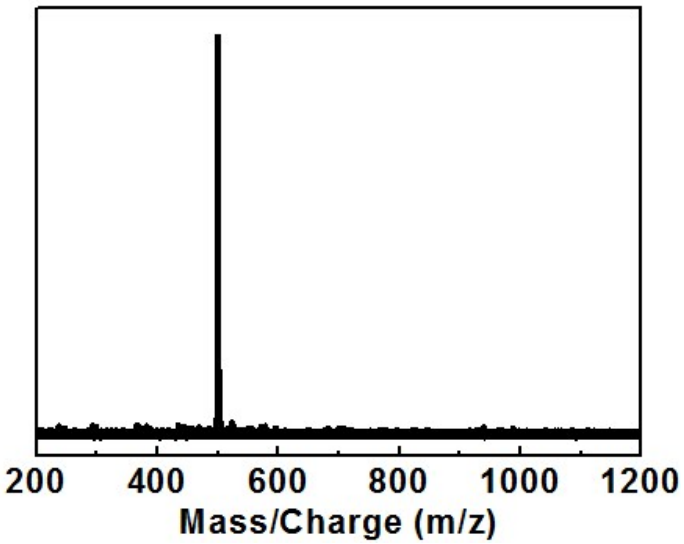

Figure S3. MALDI-TOF-MS spectrum of 3T-B.

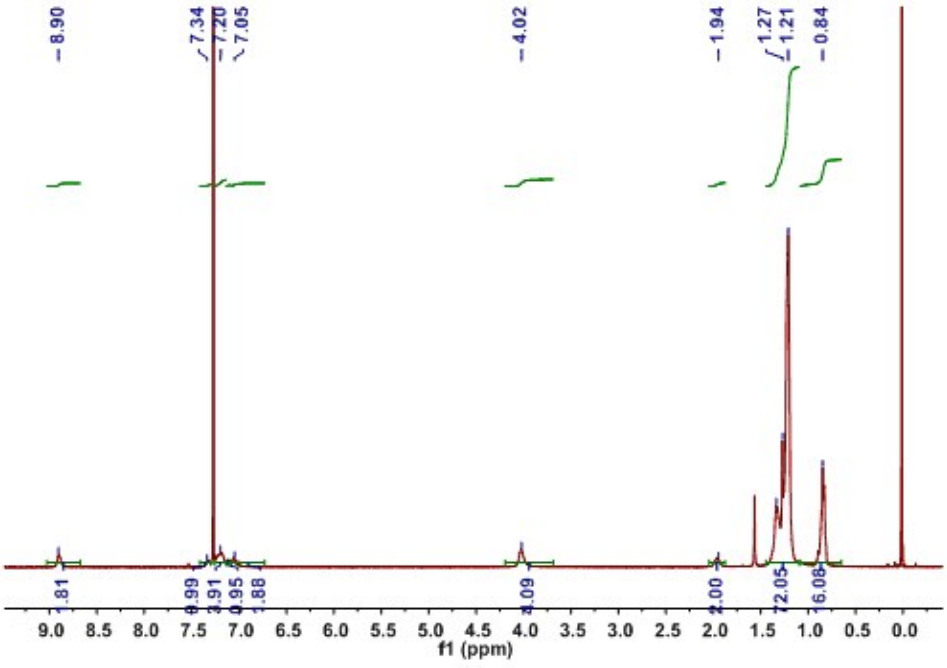

Figure S4. ^{1}H NMR spectra of P-DPPb5T (400 MHz, $CDCl_3$).

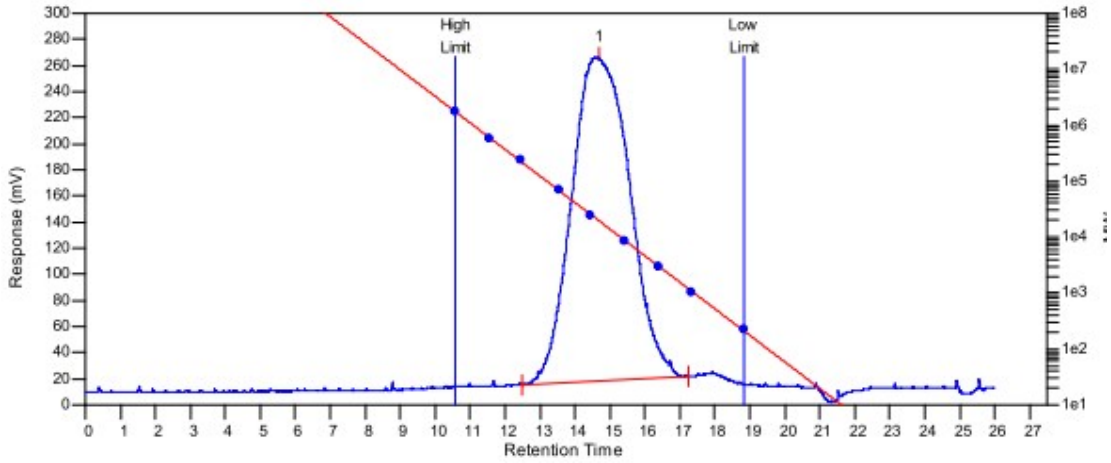

Figure S5. GPC curve of P-DPPb5T.

The molecular weight and polydispersity index (PDI) of P-DPPb5T were estimated by gel permeation chromatography (GPC) analysis relative to polystyrene calibration (PLGPC50, Polymer Laboratories Corporation) using chloroform as eluant at a flow rate of 1.0 mL min^{-1} at 40 °C. The retention time represents the approximate relative molecular weight of the polymer. The preliminary report can be seen in the following. The linear line with different molecular weight of PS is the calibration curve of the instrument.

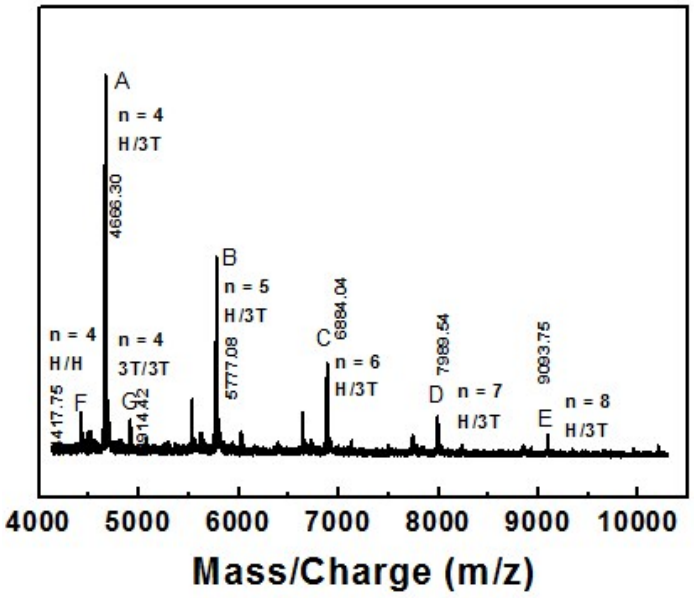

Figure S6. MALDI-TOF-MS spectrum of P-DPPb5T.

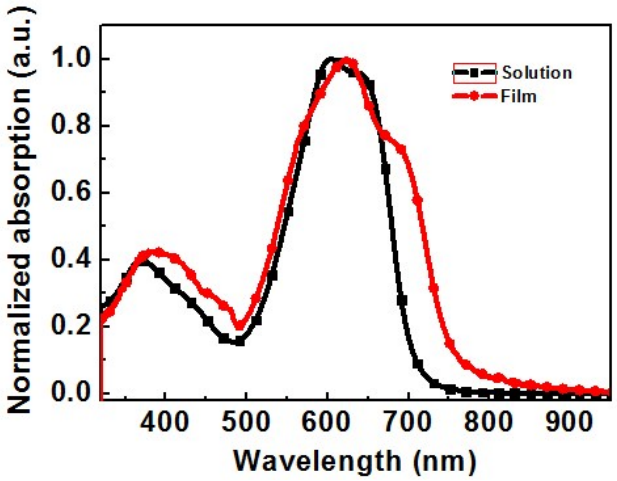

Figure S7. UV-Vis absorption spectra of the P-DPPb5T solution and P-DPPb5T thin film, respectively.

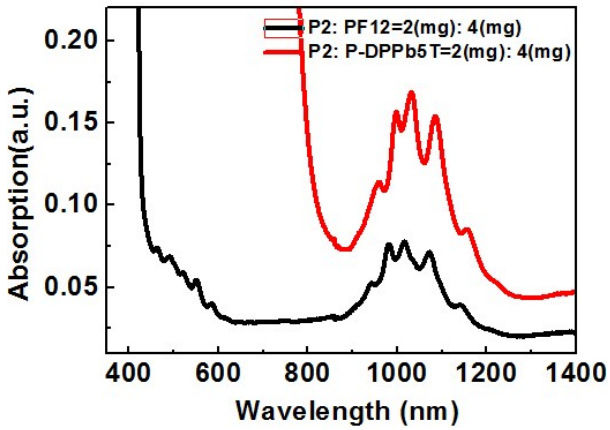

Figure S8. The absorption spectra of arc discharge SWCNTs after sorted by P-DPPb5Ts and PF12.

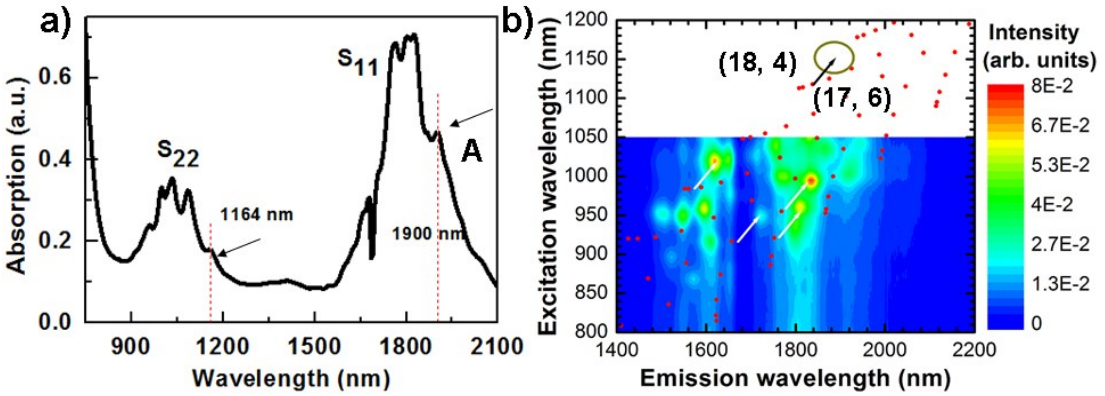

Figure S9. a) UV-Vis-NIR absorption spectrum and b) the relative peak positions in PLE spectrum of a sorted sc-SWCNT ink.

The emissions of the polymer-wrapped SWCNTs are red-shifted relative to the predicted peaks owing to the dielectric screening effect, as indicated by the arrows in the Figure S8. Peak A in Figure S4a is probably (18,4) and/or (17,6) sc-SWCNTs with the diameters of ~1.6 nm according to the peak positions predicted by Weisman and Bachilo (Nano. Lett., 2003, 3, 1235) because the S_{11} band at 1900 nm and S_{22} band at 1160 nm appear in the absorption spectrum.

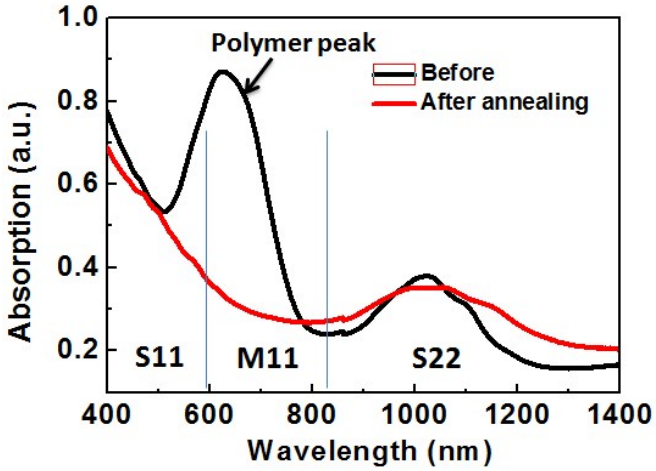

Figure S10. Absorption spectra of sorted sc-SWCNT thin films before and after annealing at 450 °C under Ar/H_2(5% H_2) for 5 min.

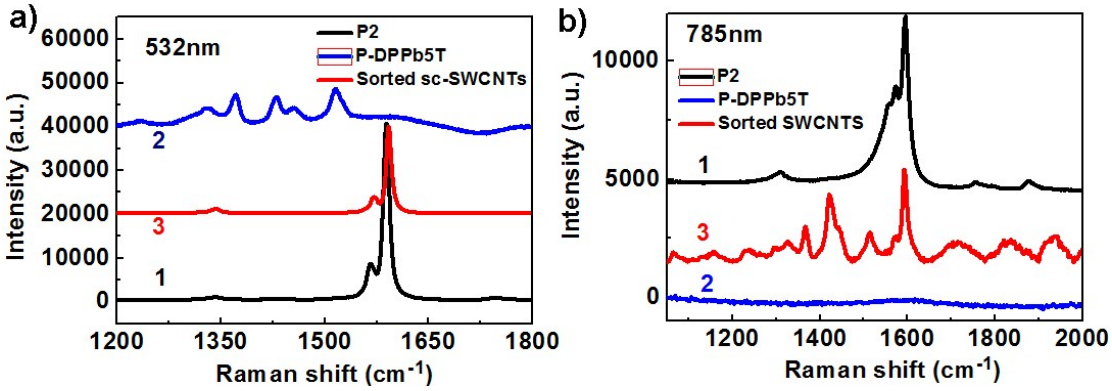

Figure S11. Raman spectra of arc discharge SWCNTs before and after sorted by P-DPPb5T with a) 532 and b) 785 nm laser

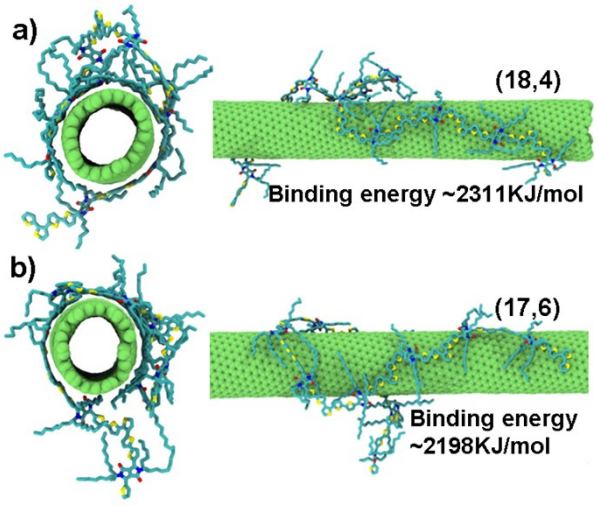

Figure S12. The cross-sectional and the horizontal views of the wrapping configurations of P-DPPb5T on a) (18, 4) (~1.59 nm) and b) (17, 6) (~1.62 nm).

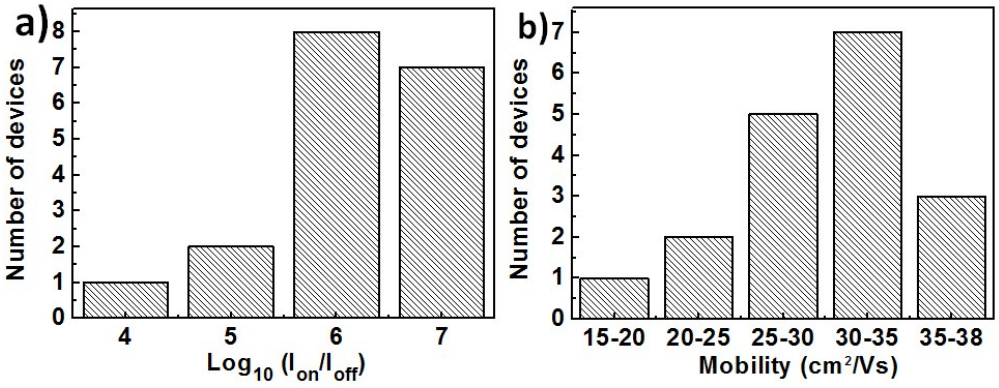

Figure S13. Histograms of on/off ratios and mobilities of printed TFTs.

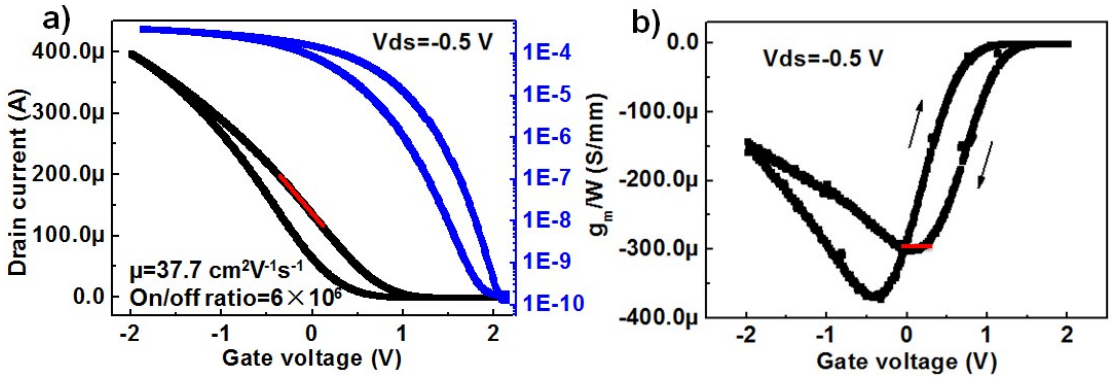

Figure S14. a) The transfer curve and b) width normalized transconductance curve (g_m/W) of a SWCNT TFT with mobility of 37.7 cm^2 $V^{-1}s^{-1}$ and on/off ratio of 6×10^6.

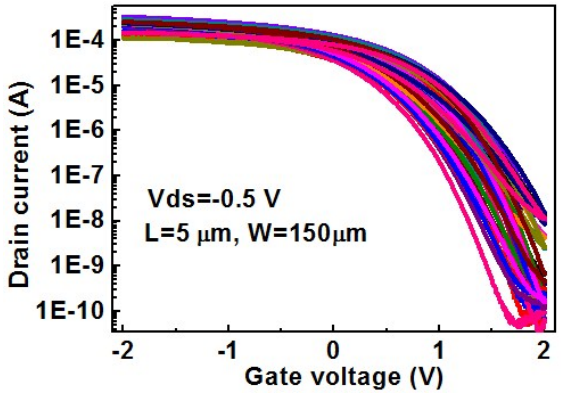

Figure S15. Typical electrical properties of TFTs with channel length of 5μm.

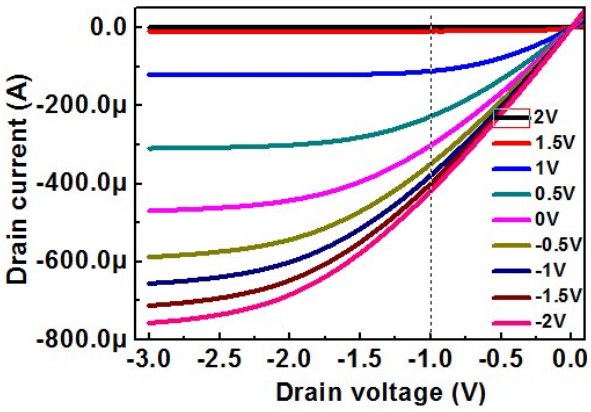

Figure S16. Typical output curves of printed SWCNT TFTs.

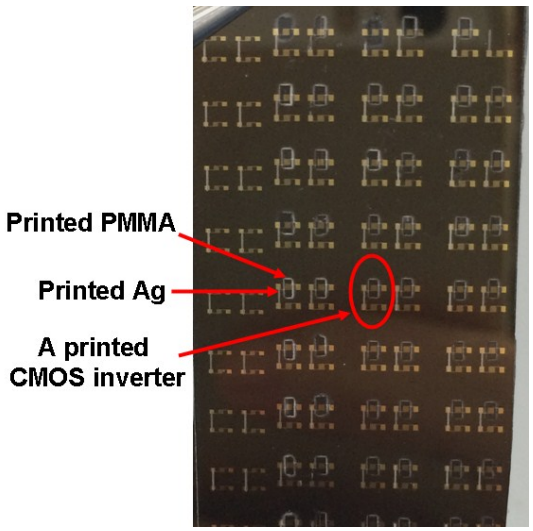

Figure S17. Optical image of printed CMOS inverter arrays on the HfO_2/Si substrate.

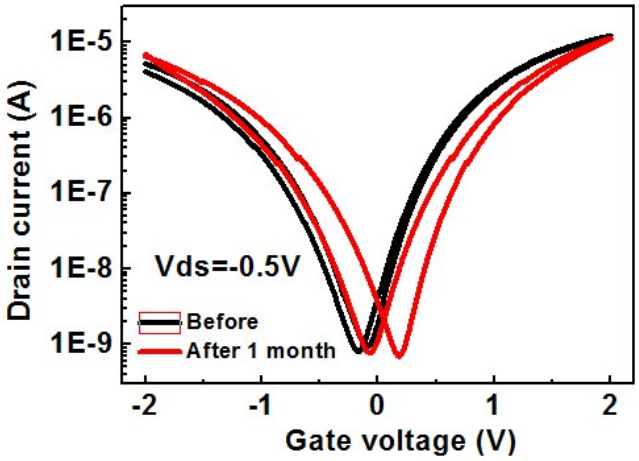

Figure S18. Transfer curves of ambipolar TFTs before and after exposure to air for 1 month.