Supporting Information

Nanotube Optoelectronic Memory Devices

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Materials and Methods

Poly{(m-phenylenevinylene)-co-[(2,5-dioctyloxy-p-phenylene)vinylene]} (PmPV) and regioregular poly(3-octylthiophene-2,5-diyl) (P3OT) polymers were purchased from Aldrich and used as received. PmPV (0.1%) and P3OT (0.02%) polymer solutions in $CHCl_3$ were used for the CVD-grown NT-FET device functionalization. The experimental details for the CVD-grown NT-FET device fabrication have been published previously.[1] Functionalization with polymers was achieved by the drop-casting of 10 μL of solution from a disposable micropipette.

Solution-deposited NT-FET devices were prepared by drop-casting polymer (1 mg) and nanotube (0.06 mg) in $CHCl_3$ on device chips. The carbon nanotube / polymer solution was prepared according to the published procedure.[2] Metal electrodes on silicon substrates were fabricated using standard photolithographic methods. The electrode geometry consists of a geometry consisting of 11 fingers,

each finger having 1 μm width with 50 μm gap between fingers. The substrates were mounted in a standard 40-pin dip package and wire bonded via gold contact pads.

Electronic Measurement Scheme

The devices were biased with a constant voltage, and the resulting currents were detected using a current preamplifier. The output of the current preamplifier was monitored in two ways. First, the signal was measured by a lock-in amplifier, using the gate voltage as reference signal. The lockin measurement, referred to as Iac, corresponds nearly to the difference between the maximum and minimum currents of a device's transfer characteristic. In particular, as the threshold voltage of a device moves, Iac changes relatively little. Thus, Iac measures changes in the conductance of a device. Second, the current preamplifier signal was low-pass filtered and recorded. This measurement, referred to as Idc, changes both as the device conductance changes and as the threshold voltage changes. The ratio between Idc and Iac is relatively insensitive to a device's conductance and highly sensitive to a device's threshold voltage.

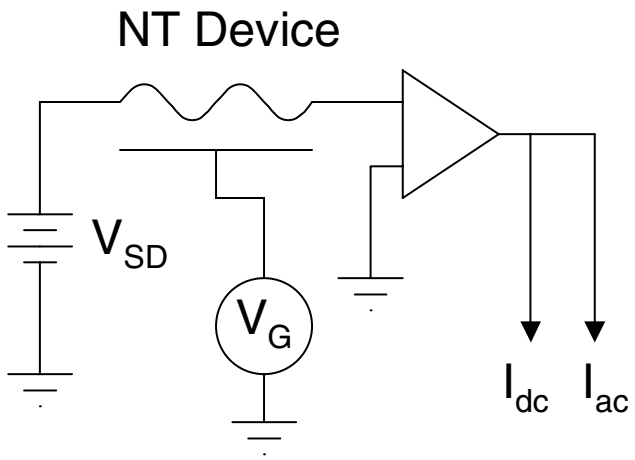

Figure 1S. Schematic circuit diagram for the circuit used Figure 3. A time-varying with frequency of 1 kHz gate voltage is applied to the device, and the resulting current is detected with a current preamplifier. Both I_{dc} and I_{ac} components of the current are monitored in phase.

UV-VIS spectroscopic data

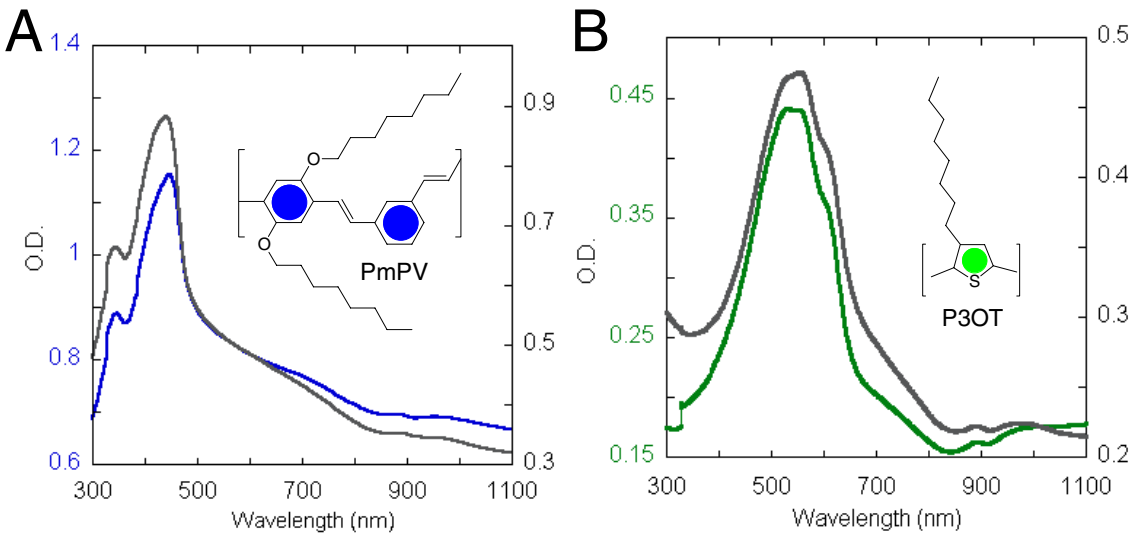

Figure 2S. (**A**) UV-VIS spectra of PmPV polymer (blue trace) and PmPV/NT composite (gray trace) deposited by drop casting from their $CHCl_3$ solutions on a glass slide. (**B**) UV-VIS spectra of thin films P3OT polymer (green trace) and P3OT/NT composite (gray trace).

REFERENCES

(1) Gabriel, J. -C. P.; Large scale production of carbon nanotube transistors: A generic platforms for chemical sensors, *Mat. Res. Soc. Symp. Proc.* **2003**, *776*, Q12.7.1-7.

(2) Steuerman, D. W.; Star, A.; Narizzano, R.; Choi, H.; Ries, R. S.; Nicolini, C.; Stoddart, J. F.; Heath, J. R.; Interactions between Conjugated Polymers and Single-Walled Carbon Nanotubes, *J. Phys. Chem. B* **2002**, *106*, 3124-3130.