Supporting Information

Exploring the Chemical Sensitivity of a Carbon Nanotube/Green Tea Composite

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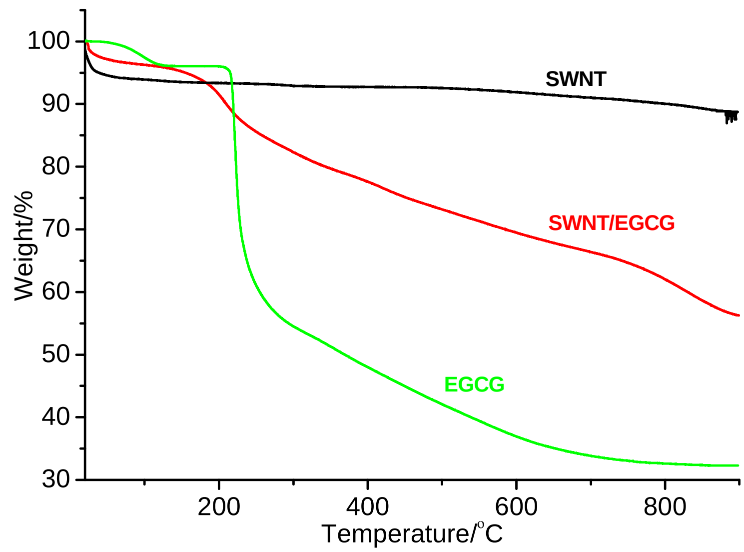

Figure S1. TGA of SWNT (black), EGCG (green) and SWNT/EGCG composite (red).

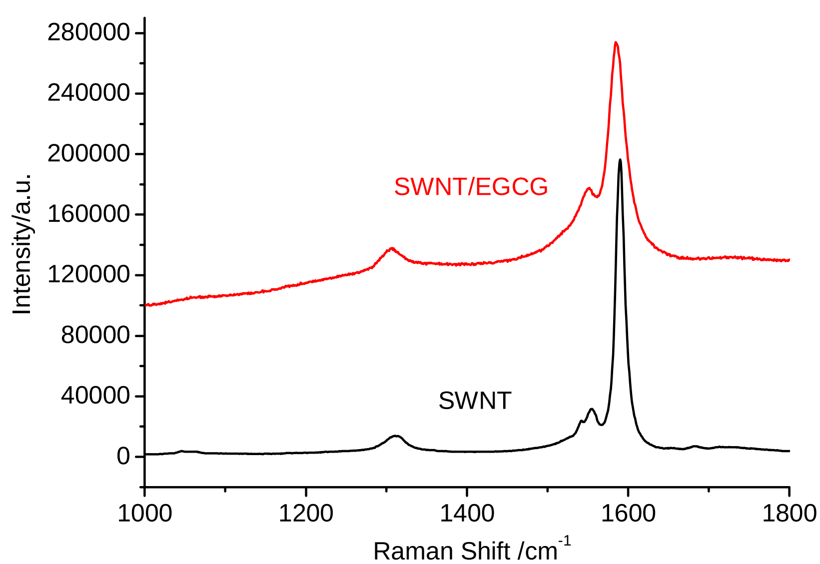

Figure S2. Raman spectra of pristine SWNTs (black) and SWNT/EGCG composite (red).

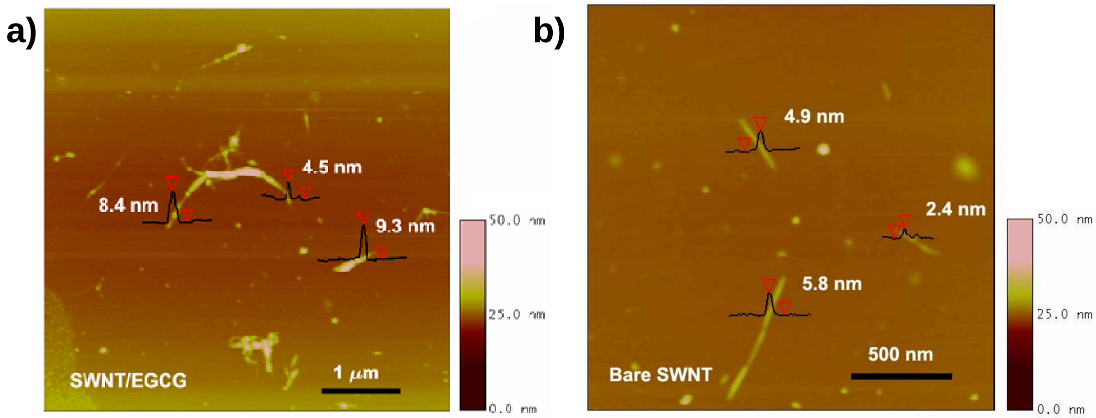

Figure S3. (a) AFM image of SWNTs treated with 4.4×10^{-4} M EGCG. Section analysis reveals that SWNTs appear 4–9 nm in diameter after modification with EGCG. (b) AFM image of bare SWNTs. Section analysis reveals that bare SWNTs exist as small bundles with diameter around 2 – 6 nm.

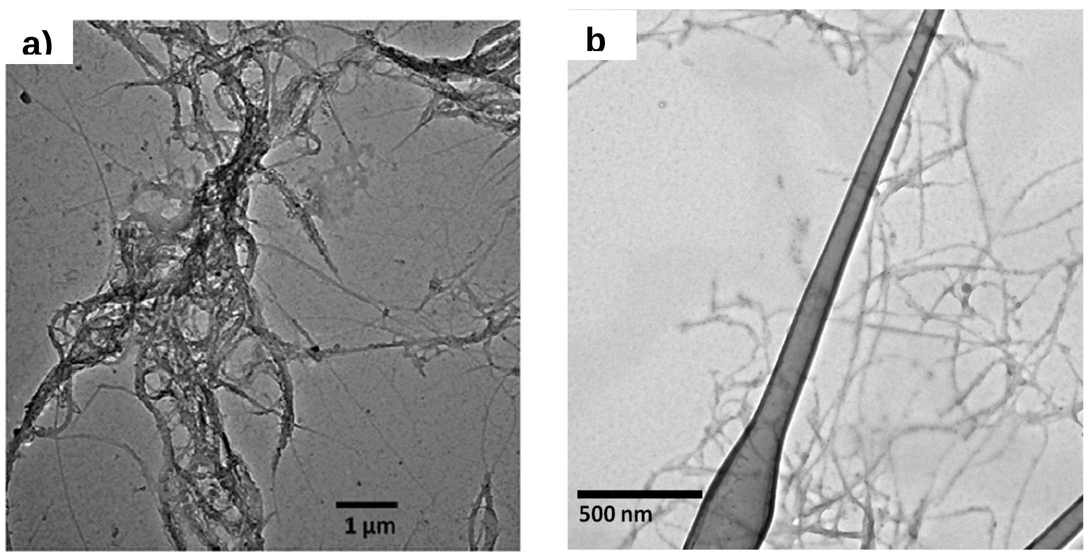

Figure S4. Transmission electron microscopy (TEM) images of SWNTs treated with (a) 4.4×10^{-4}M EGCG in water and (b) bare SWNTs in DMF solution (bare SWNTs cannot be dispersed in pure water).

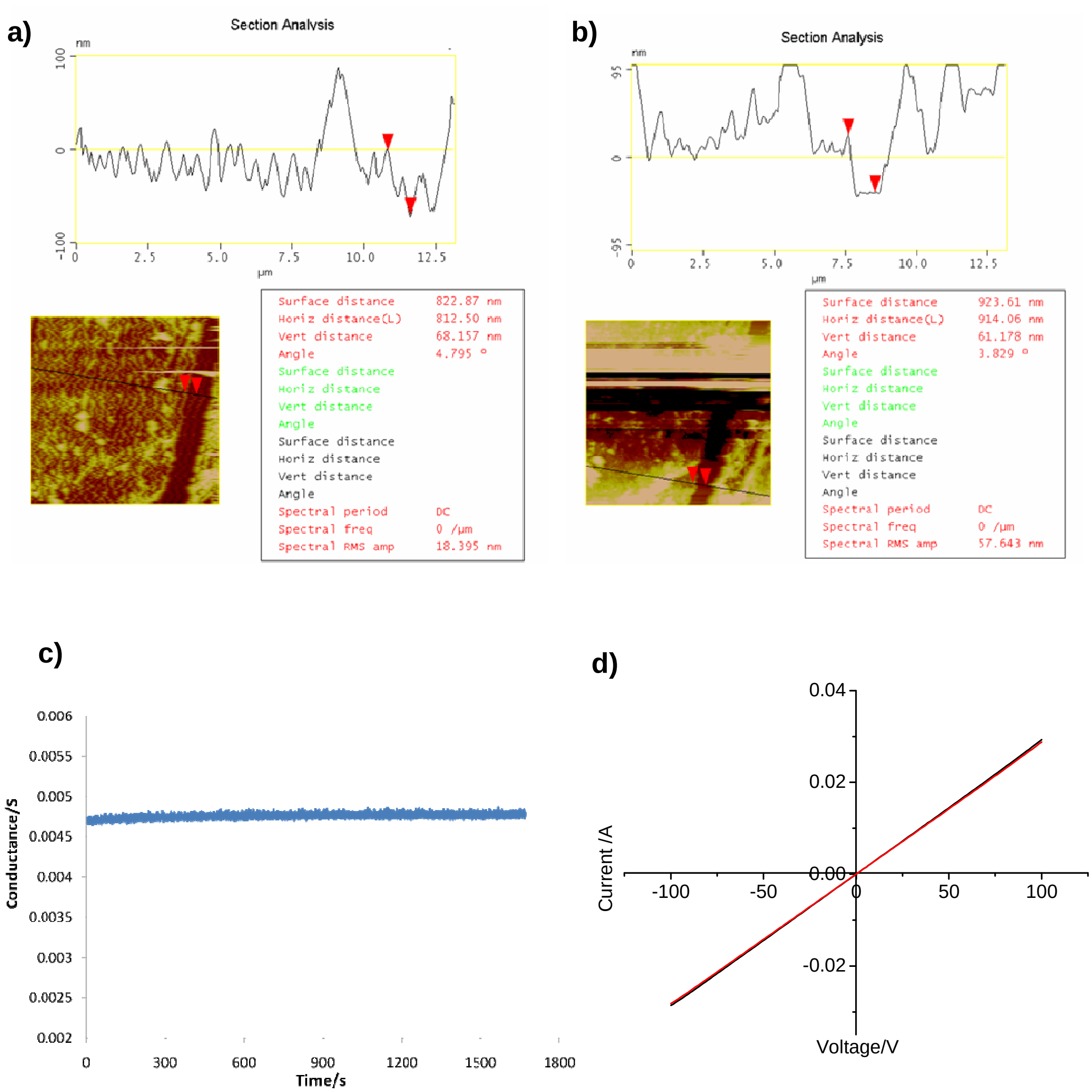

Figure S5. Atomic Force Microscopy (AFM) images of the SWNT/EGCG composite thin film (a) before and (b) after incubation in water for 4 hours. AFM section analysis demonstrates 10% decrease in the film thicknesses from 68 nm to 61 nm after incubation in water, indicating insignificant leaching over the tested time period. (c) Electrical conductance of SWNT/EGCG composite device versus time after addition of water. The device demonstrates a stable baseline while it is immersed in water. (d) Current vs. voltage measurement of bare SWNTs thin film before addition of water (black) and after the added water is dried (red), showing no change in the film conductance.

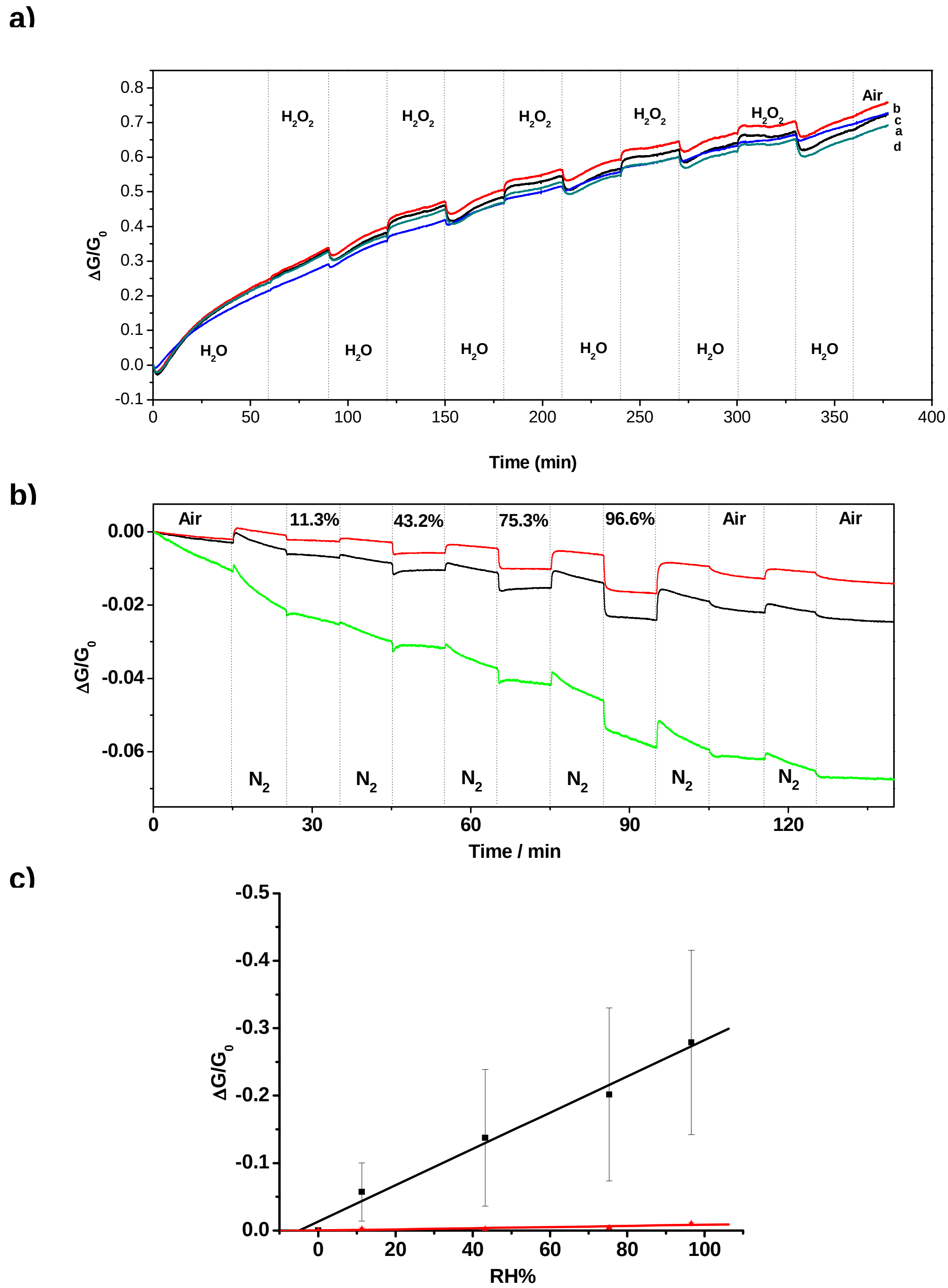

Figure S6. (a) Relative conductance response versus time dependence of four interdigitated devices coated with bare SWNTs exposed to H_2O_2 vapor pulses. (b) Relative conductance response versus time dependence of three interdigitated devices coated with bare SWNTs and exposed to varying relative humidity pulses. (c) Relative humidity (RH) calibration plot of SWNT/EGCG composite material (black) and bare SWNTs (red).

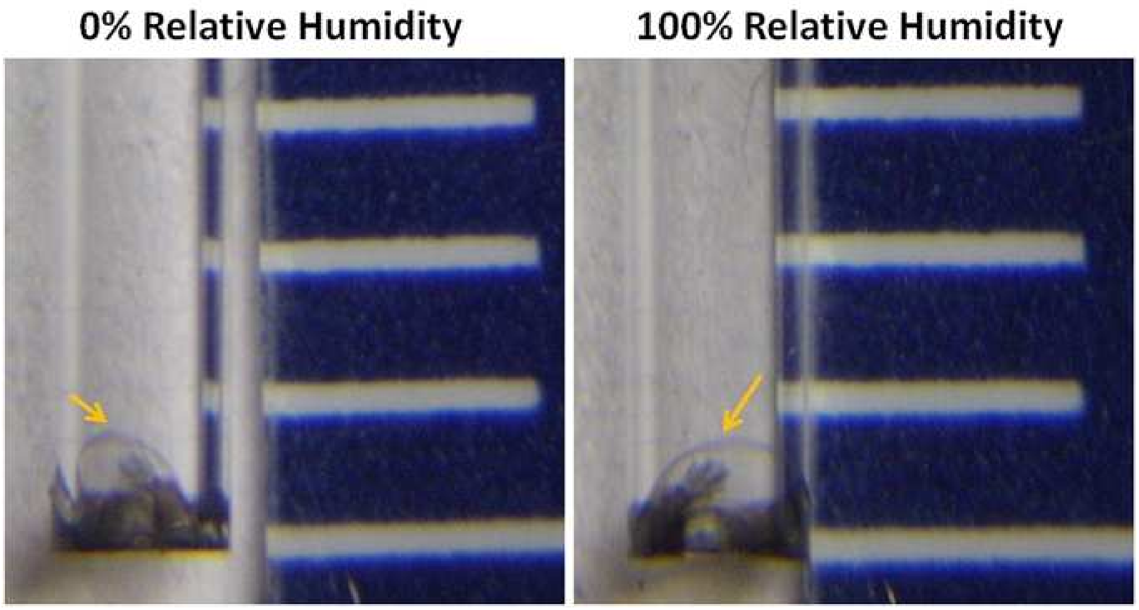

Figure S7. Optical image depicting the swelling of a SWNT/EGCG composite because of increasing relative humidity (scale in millimetres).

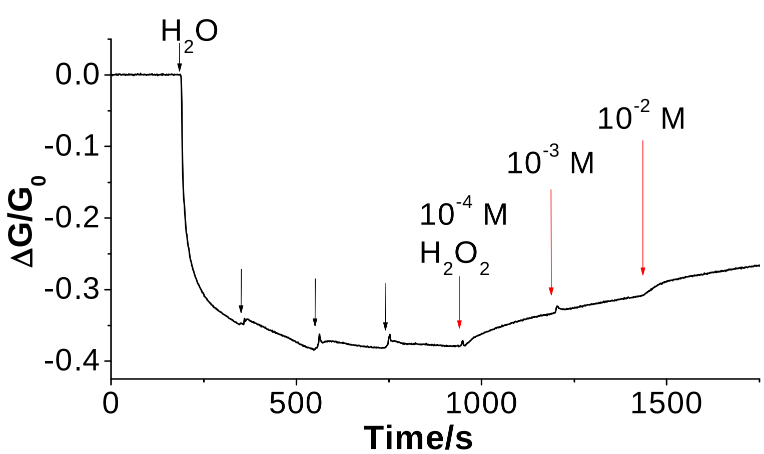

Figure S8. Relative conductance versus time response to varying concentrations of H_2O_2 of SWNT/EGCG/(Fe_2O_3 Nanoparticle) composite. The composite was prepared by mixing and sonicating the components together.

Calculation of the Thin Film Conductivities:

We measured the conductances of the thin films of SWNT/EGCG or SWNT spray-coated on quartz slides (1 in × 1 in) (Figure S9a). To calculate the conductivity, we can visualize the thin film as illustrated by Figure S9b.

Conductivity $\sigma = \frac{1}{\rho}$, where ρ is the Resistivity. (1)

Resistivity $\rho = \frac{RA}{L}$, where R is the electrical resistance,(2)

Electrical resistance $R = \frac{1}{G}$, where G is the electrical conductance,(3)

Conductivity $\sigma = \frac{1}{\rho} = \frac{L}{RA} = \frac{GL}{A}$, where L is the length of the film and A is the cross-sectional area. (4)

As can be seen from Figure S9a, L is 1.5 cm. The thickness of thin film was measured to be approximately 70 nm (Figure S5) and the width is 2.54 cm (1 inch), so the area A is 1.78×10^{-5} cm^2. Using the equation (4) above, we can convert the measured electrical conductance into conductivity. The conductivity of the SWNT/EGCG thin film is 22.9±5.1 S/cm and the conductivity of the SWNT thin film is approximately 27.4±8.9 S/cm.

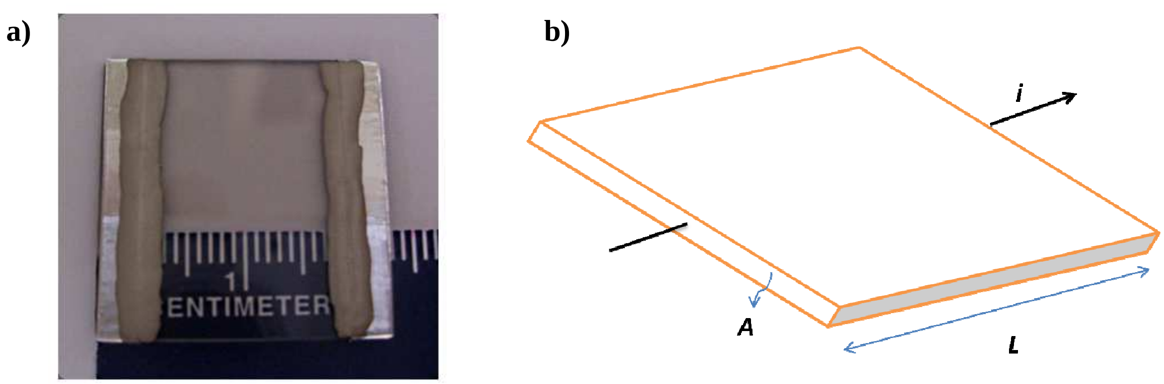

Figure S9. (a) A photograph of transparent and conductive SWNT/EGCG film on a quartz slide. (b) Schematic illustration of thin film. The black arrow shows the direction of the current i, L is the length of the film and A is the cross-sectional area.