Self-assembly of single walled carbon nanotubes onto cotton to make conductive yarn

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Figures

Fig. 1. Schematic illustration of the experimental principle.

Fig. 2(I). (A) Resistance measurement of one SWCNT functionalized thread; (B) Tying knots in the SWCNT functionalized threads does not alter the measured electrical resistance, showing the SWCNTs to be well adhered and uniform across the cross-section of the threads. Fig. 2(II) Photos of functionalized threads after heat treatment in DI water (a) and ethanol (b).

Fig. 3. SEM images of (a) pristine cotton fibre, (b) PEI treated cotton fibre and (c) SWCNT functionalized cotton fibre, with scale bar being 20 μm .

Fig. 4. Raman spectra of conductive yarn and SWCNTs (excitation at 782 nm).

Fig. 5. TEM images of SWCNTs on conductive yarn.

Fig. 6. Dependence of electrical resistivity on number of immersion and dye concentration (SWCNT concentration: 0.133 mg/cm³).

Fig. 7. (a) Schematic of chemiresistor configuration with the SWCNT functionalized cotton yarn contacting two electrodes on a neoprene rubber substrate; (b) I-V curves of sensors. The initial resistance values of sensors with yarn functionalized with 0.133, 0.267, 0.399 mg/cm^3 dye solutions are around 9 $\text{k}\Omega$, 230 $\text{k}\Omega$, and 6 $\text{M}\Omega$, respectively.

Fig. 8. Change of electrical resistance between two electrodes with the injection of ammonia gas at various flow rates for (a) 0.133 and 0.267 mg/cm^3 ; (b) 0.399 mg/cm^3 dye functionalized sensors (note different scales for y axis). Inset to (b): response of sensors at different ammonia flow rates.