Electronic Supplementary Information

High-performance gas sensors based on functionalized single-wall carbon nanotube random networks for detection of nitric oxide down to ppb-level

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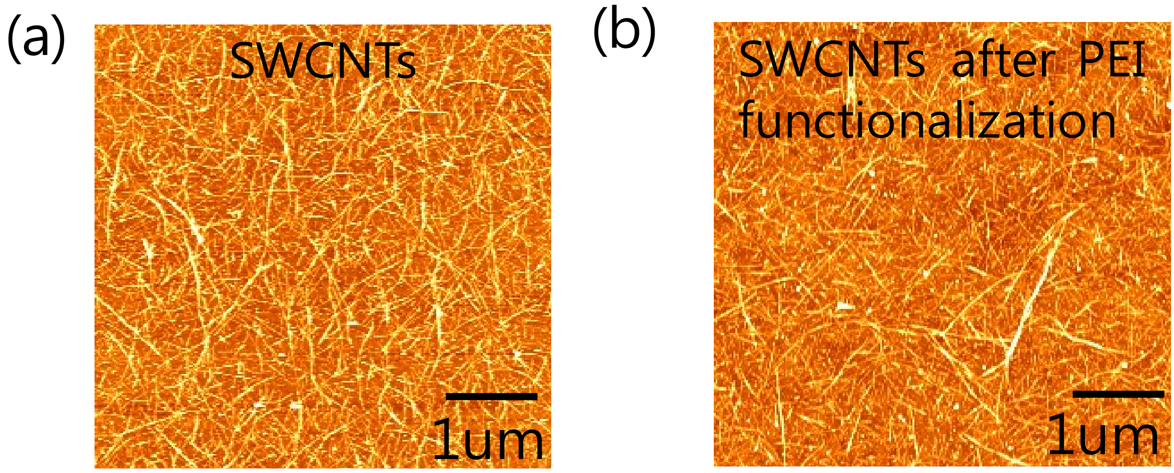

Figure S1. Morphology of SWCNT random networks (a) before and (b) after functionalization with PEI (concentration of 10 wt%), obtained by AFM measurements

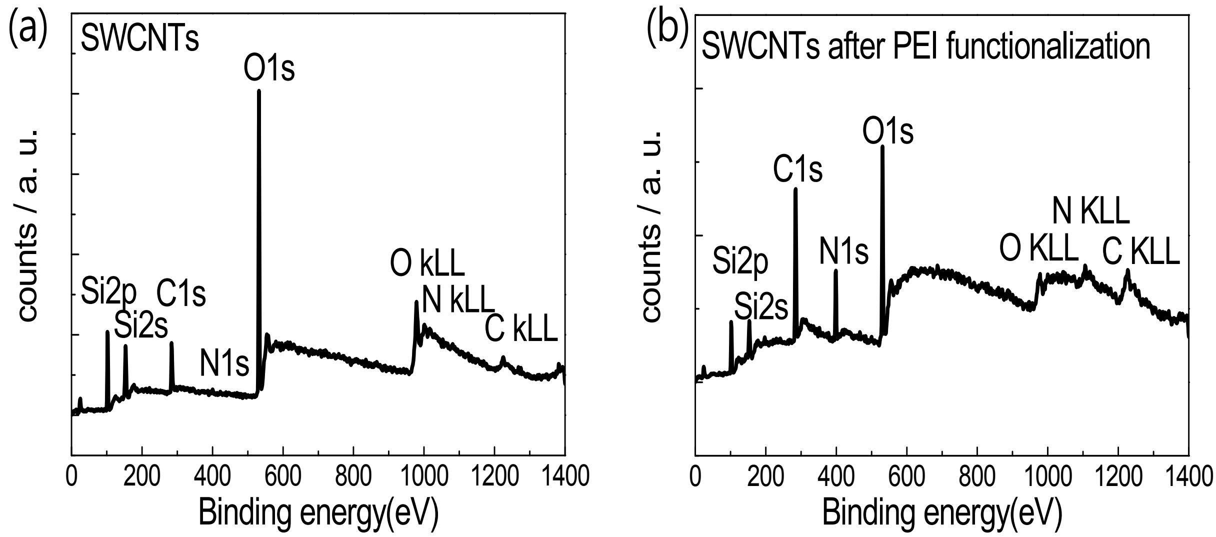

Figure S2. XPS spectra of elements of C, N, and O in the chemical bonding of the SWCNT random networks (a) before and (b) after functionalization with PEI (concentration of 10 wt%)

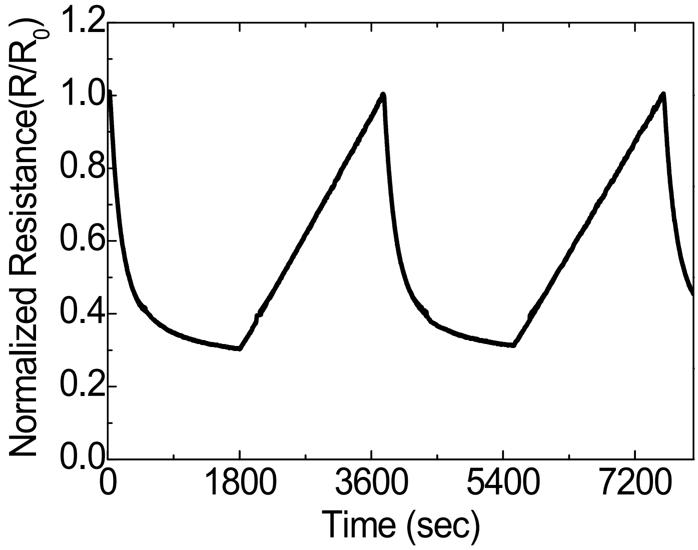

Figure S3. The normalized response of SWCNT random networks after functionalization with PEI as the recovery time was increased and almost 100% of resistance was recovered to the initial

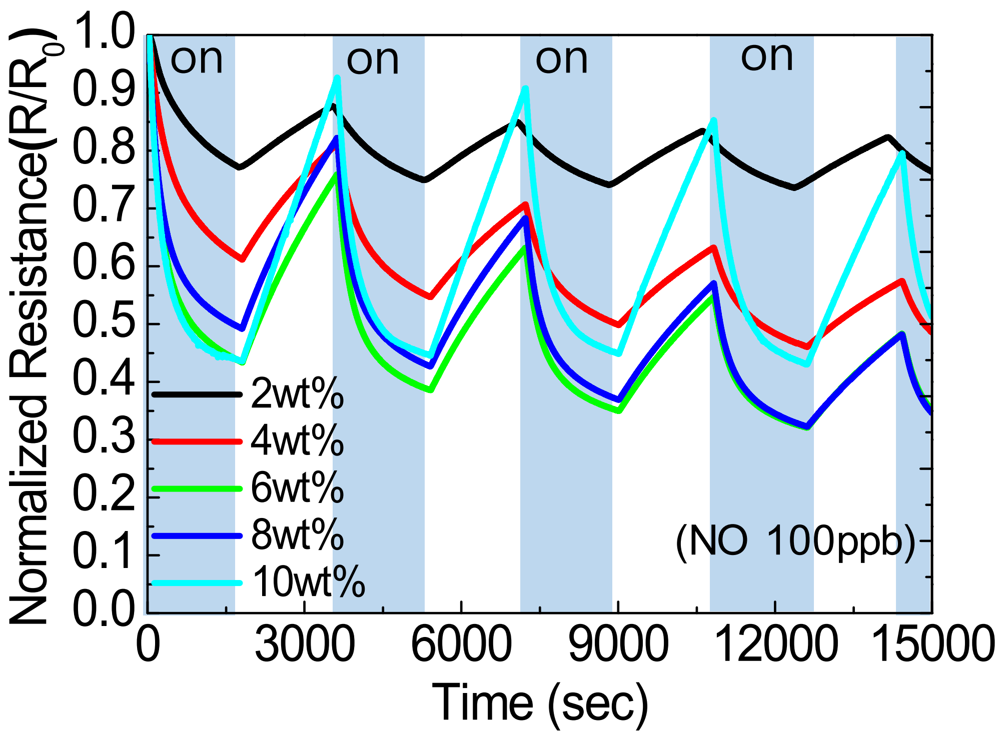

Figure S4. The normalized resistance of the proposed NO gas sensors with different PEI concentrations (0, 2, 4, 6, 8, and 10 wt%)

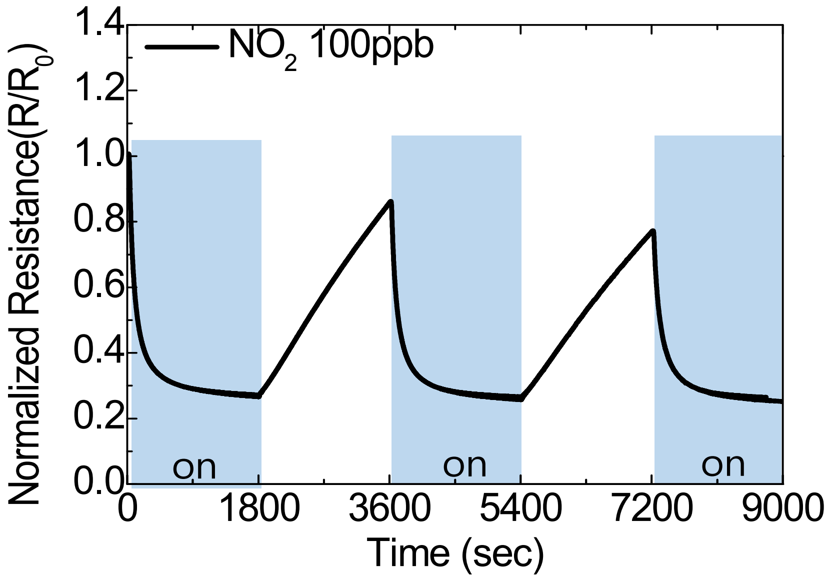

Figure S5. The normalized resistance of SWCNT random networks after functionalization with PEI when exposed to the NO_2 gas at 100 ppb

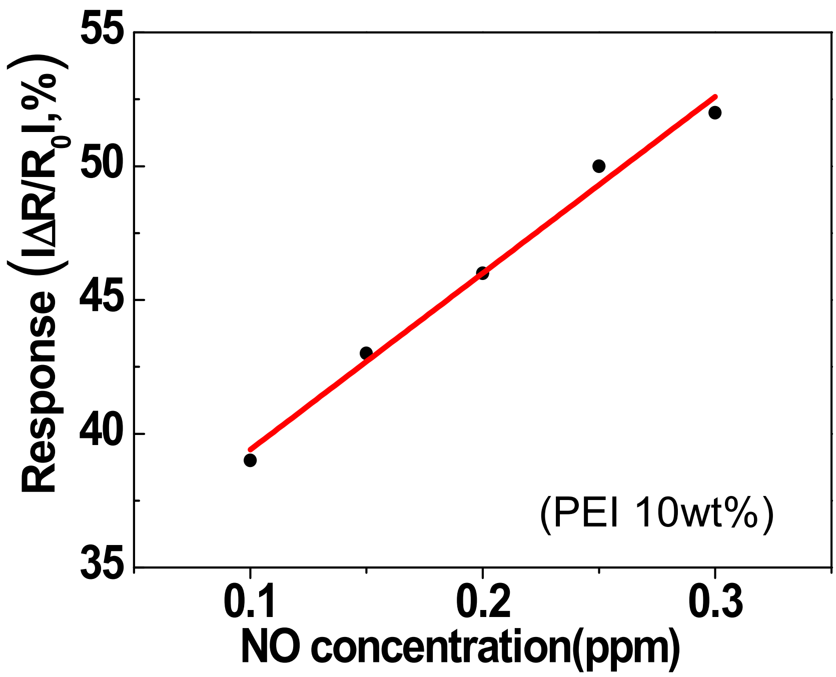

Figure S6. The theoretical detection limit of the proposed NO gas sensors by linear extrapolation from the response slope in the linear regime at low ppb level

Table S1. 5th order polynomial fitting implemented within data-point range

*Time (sec)	$(Y_i - Y)$	$(Y_i - Y)^2$
200	0.00130	1.70×10^{-6}
210	-0.00418	1.74×10^{-5}
220	0.00331	1.09×10^{-5}
230	0.00199	3.97×10^{-6}
240	-0.00113	1.28×10^{-6}
250	-0.00462	2.13×10^{-5}
260	0.00224	5.02×10^{-6}
270	0.00298	8.88×10^{-6}
280	-0.00144	2.09×10^{-6}
290	-0.000904	8.18×10^{-7}
300	-0.000462	2.14×10^{-7}

*** The time when the resistance is measured.**

1. We carried out the linear fitting on the sensitivity of the proposed NO gas sensors as a function of NO concentration, as shown in Fig. S4,
2. We extracted the measured values of electrical resistance in the proposed NO gas sensors (from 11 points).
3. We conducted a 5th order polynomial fitting implemented within data-point range (see Table S1) where Yi is the measured data point and Y is the corresponding value calculated from the curve-fitting equation

$$V_{x^2} = \sum (Y_i - Y)^2$$

4. We calculated the RMSnoise from the following equation

$$RMS_{noise}(ppm^{-1}) = \sqrt{V_{x^2} / (N-1)}$$

where N is the number of data points used in the curve fitting

5. We extracted the detection limit by using the following equation.

$$Detection\ limit = 3 \times \frac{RMS_{noise}}{slope}$$

Table S2. Sensing performance of NO gas sensors in previous studies based on various materials, such as metal oxide, polymer, or carbon-based material

material	Response (%)	NO concentration (ppm)	Response time (min)	Reference
zinc oxide	7.3	10	5	1
Nickel phthalocyanine	0.4	5	20	2
WO_3/Cr_2O_3	10	5	60	3
poly[N-9′-heptadecanyl-2,7-carbazole-alt-5,5-(4′,7′-di-2-thienyl-2′,1′,3′-benzothiadiazole)](PCDTBT)	5	5	5	4
Multi wall carbon nanotube	1	2	30	5
Single wall carbon nanotube	12	1	10	6
Tin dioxide (SnO_2)	28.7	1	6	7
PEDOT:PSS	2.2	0.35	10	8
zinc oxide	8.25	0.25	15	9
indium gallium zinc oxide	0.02	0.1	2	10
Single wall carbon nanotube	9	0.005	1	11
Single wall carbon nanotube	50	0.1	30	Thiswork

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