Supplementary Information

A Gas Sensing Channel Composited with Pristine and Oxygen Plasma-Treated Graphene

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The limit of detection (LOD) calculation

Due to the limitations of the gas distribution system in this work, it is hard to get the detection limit of NH_3 gas. But the theoretical achievable LOD value (corresponding to signal-to-noise equals 3) can be calculated [38]. The OP-G/G based sensor noise can be calculated using the relative resistance change from the baseline, which can be described as following equation [39]:

$$rms_{noise} = \sqrt{\frac{\sum_{i=1}^{N}(y_i - y)^2}{N}} \tag{S-1}$$

where y_i is measured data and y is the corresponding value from an exponential fit, N is the number of data.

Signal-to-noise (SNR) can be calculated by dividing the gas response by the sensor noise [40] as following equation:

$$SNR = \frac{S}{rms_{noise}} \tag{S-2}$$

where S is NH_3 gas response for the OP-G/G based sensor.

The theoretical measureable LOD (corresponding to a SNR of 3) for the OP-G/G based sensor can be calculated by [41]

$$x_{LOD} = \frac{3rms_{noise}}{slope} \tag{S-3}$$

In this work, we used 126 points in the baseline in Figure S2 (a) to derive the sensor noise. The noise is 0.00022 for the OP-G/G based sensor. The SNR is 147 for the sensor exposure to 20 ppm NH_3. The LOD (corresponding to a SNR of 3) is 0.76 ppm calculated by using Equation S-3.

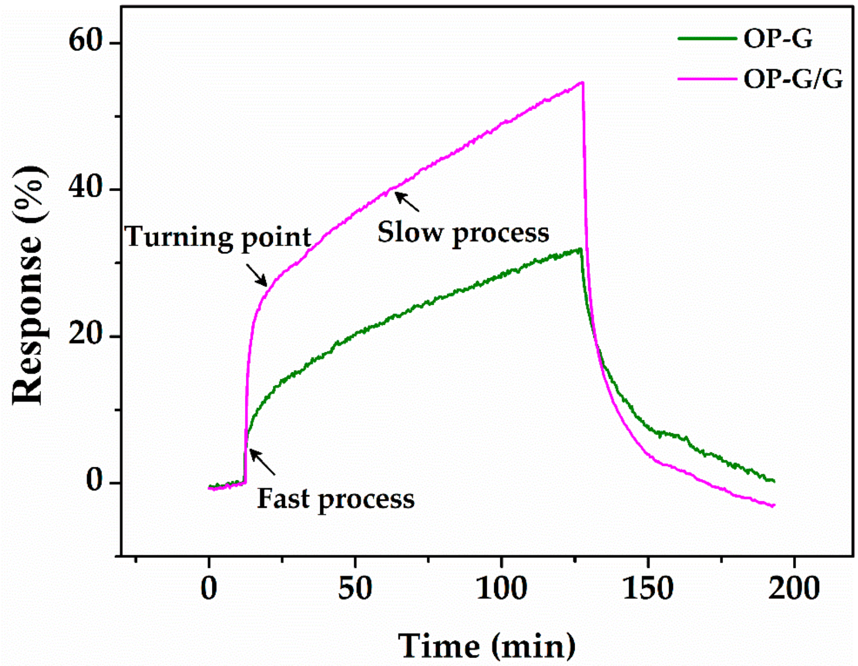

Figure S1. The response curve of OP-G and OP-G/G sensor tested in 1000 ppm NH_3 for 2 hours.

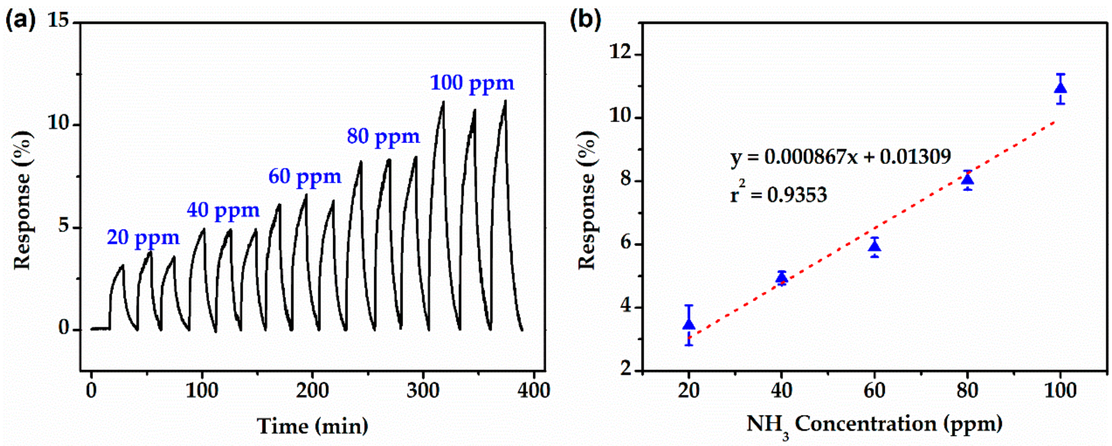

Figure S2. (a) The response curve of OP-G/G based sensor to low concentration of NH_3. (b) The linear fitting to the response of OP-G/G based sensor after 800 s exposure in different concentrations of NH_3.

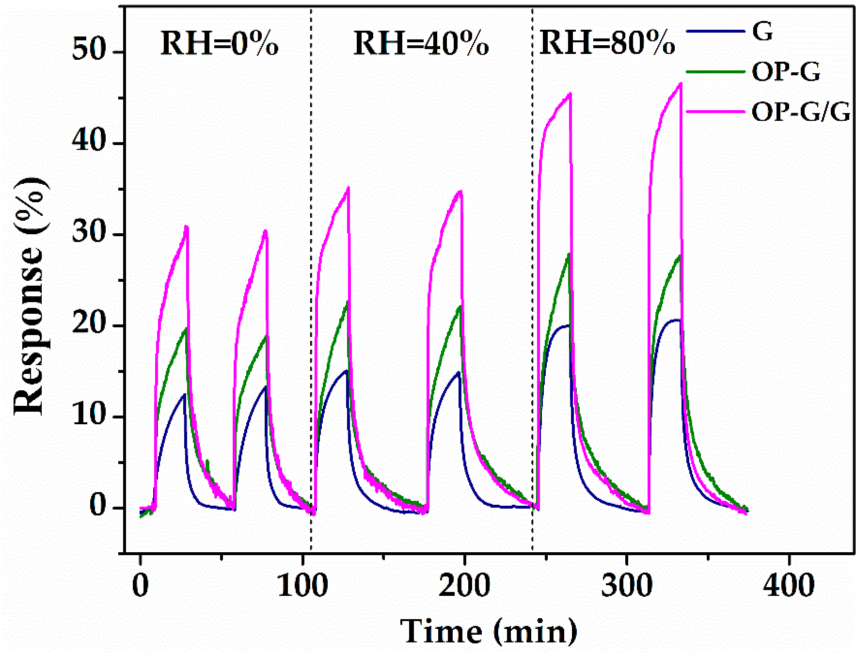

Figure S3. The gas sensing test to 1000 ppm NH_3 with different RH: 0%, 40% and 80%.

Table S1. Comparison of performances between different NH_3 sensors.

Materials	Handling method	Concentration of NH_3 (ppm)	Detecting temperature	Response ($\Delta R/R_0$) (%)	LOD (ppm)	Testing time (min)	Recovery Time (min)	Ref.
CVD graphene	OP-G/G	1000 100	RT RT	29.3 4.1	<20	20 2	38 1.33	This work
CVD graphene	Aluminum oxide substrate	1300	RT	1.5	-	2.6	2.2	30
CVD graphene	Ag decoration	500	RT	9	-	10	-	31
CVD graphene	Pd decoration	100	150	2	-	5	>20	32
RGO	Pt decoration	1000	RT	10	-	2.7	4.8	33
GO	RGO/3-CuPc hybrids	3200	RT	15.4	-	15	>80	34
GO	P doping	100	RT	5.5	-	2.2	13.6	35
$NiO–SnO_2$	-	100	220	95	10	5.8	5.8	36
Pd-ZnO	-	100	210	85	5	1	1.33	37