Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

Supplementary Information

Cu/Graphene Interdigitated Electrodes with Various Copper Thicknesses for UV-illumination-enhanced Gas Sensors at Room Temperature

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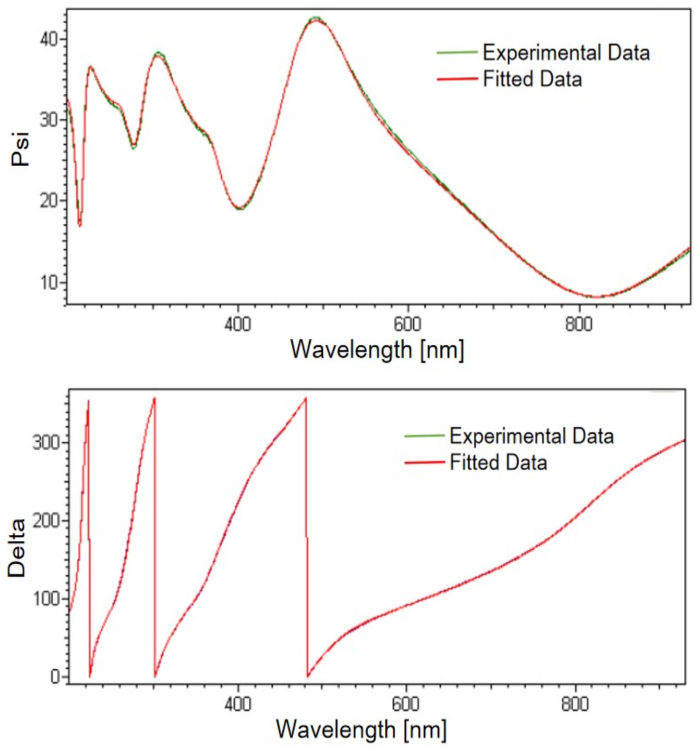


Figure S1. Experimental and fitted ellipsometry curves of the Cu film deposited on graphene in 6 nm Cu/Gr device.

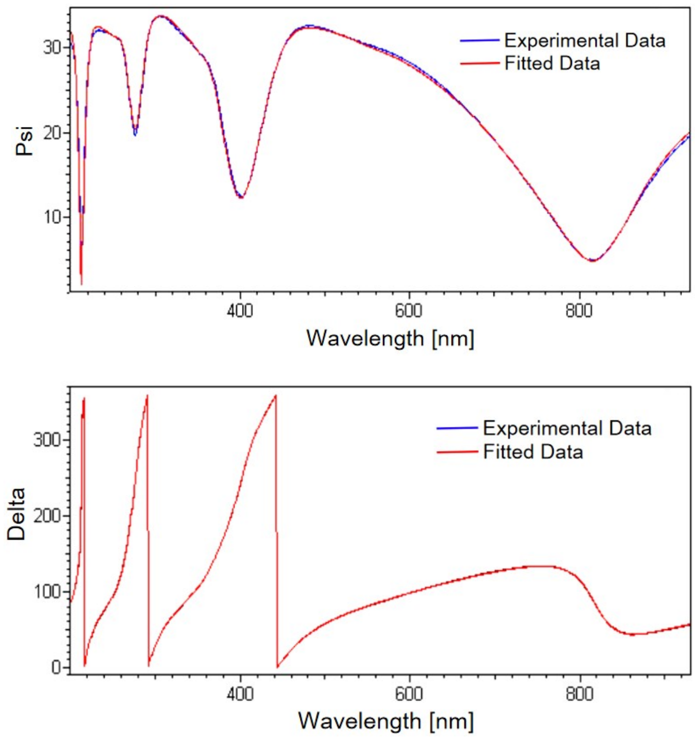


Figure S2. Experimental and fitted ellipsometry curves of the Cu film deposited on graphene in 8 nm Cu/Gr device.

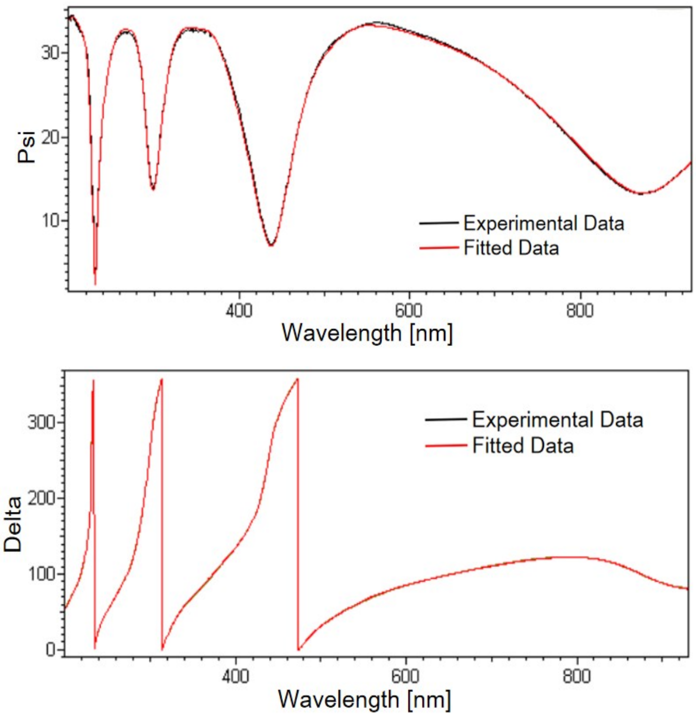
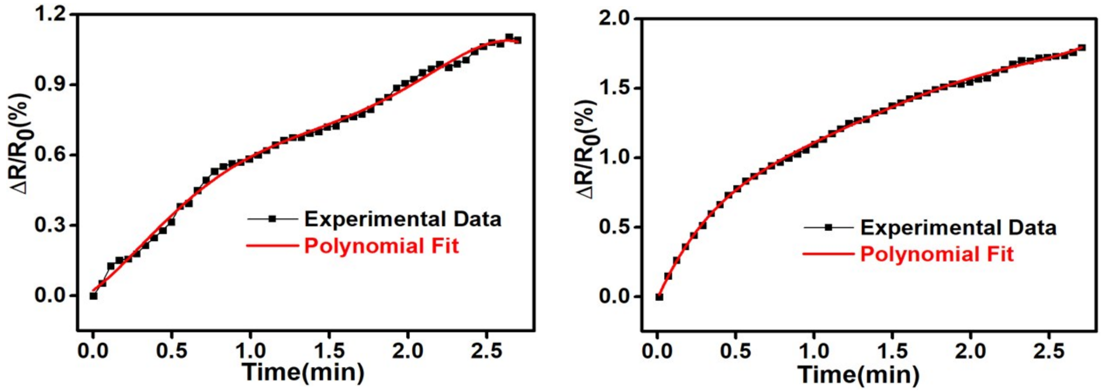


Figure S3. Experimental and fitted ellipsometry curves of the Cu film deposited on graphene in 10 nm Cu/Gr device.

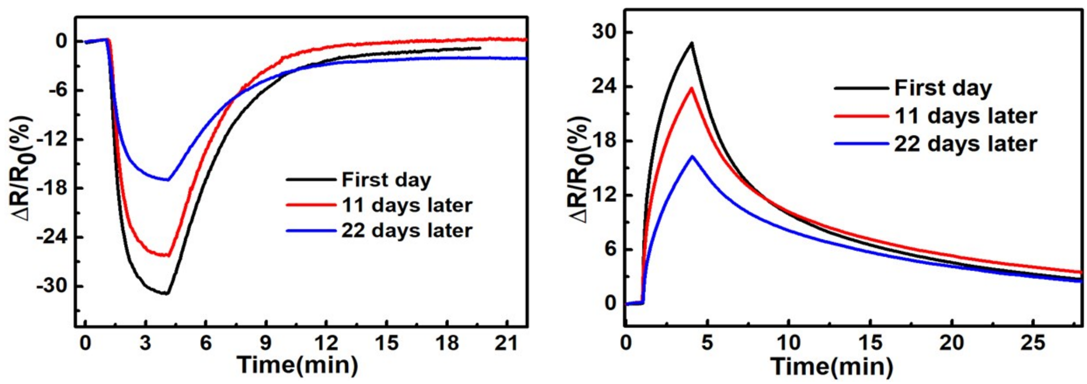
Table S1. Fitted parameters derived from ellipsometry data in Fig. S1-S3.

	Thickness of Layers in Fitting [nm]				Mean square error of fitting
Device	Air Roughness of Copper oxide	Copper	Graphene	SiO_2	
6 nm Cu/Gr	2.76	5.29	0.34	319.47	0.708
8 nm Cu/Gr	2.64	7.45	0.34	312.05	0.801
10 nm Cu/Gr	2.86	8.61	0.34	343.54	0.599



(a) (b)

Figure S4. Polynomial fittings of $\Delta R/R_0$ versus time plots at baseline for 8 nm Cu/Gr device exposed to (a) NO_2, and (b) NH_3, under UV light illumination.



(a) (b)

Figure S5. Stability behavior of 8 nm Cu/Gr device when exposed to (a) 5 ppm NO_2, and (b) 105 ppm NH_3, under UV light illumination.

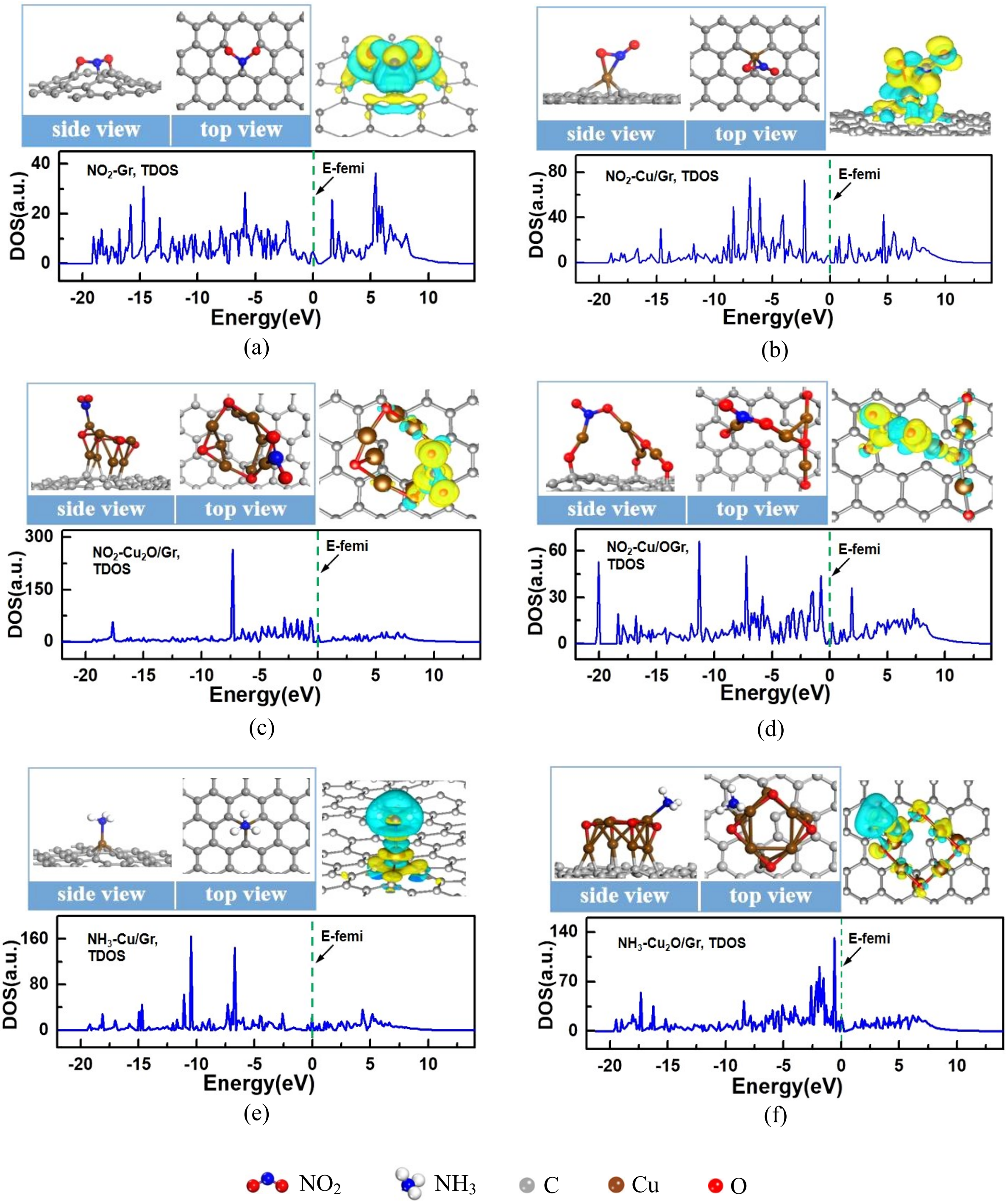


Figure S6. Optimized configurations including top view, side view, charge difference densities and TDOS for NO_2 molecule adsorbed on surface of (a) defective graphene, (b) Cu/Gr, (c) Cu_2O/Gr, (d) CuO/Gr. Optimized configurations including top view, side view, charge difference densities and TDOS for NH_3 molecule adsorbed on surface of (e) Cu/Gr, (f) Cu_2O/Gr.

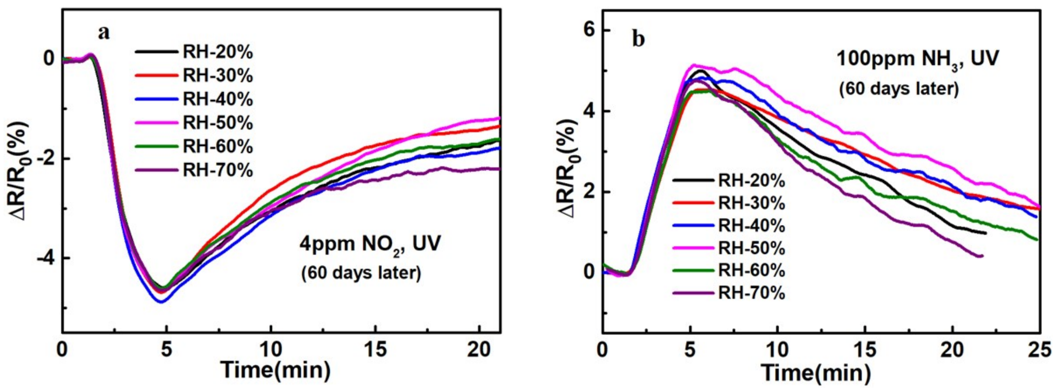


Figure S7. Response curves of 8 nm Cu/Gr device at RT exposed for 3 min to (a) 4 ppm NO_2, and (b) 100 ppm NH_3 with various relative humidity (RH) within the range of 20-70% under UV light illumination.

Table S2. Comparison of sensing performances to NO_2 gas for 8 nm Cu/Gr device in this work with those graphene-based gas sensors reported in the literatures.

Sensing materials	Concentration of NO_2	Operating temperature	Response time	Response ($\Delta R/R_0$)	Recovery time	References
Al-decorated CVD graphene	1.2 ppm	150℃	3 min	-3%	>20 min	1
ZnO-decorated CVD graphene	10 ppm	200℃	13 min	-30%	>80 min	2
SnO_2-decorated RGO	1000 ppm	RT	4 min	-22.87%	1 min	3
MoS_2-RGO	0.5 ppm	200℃	9 min	-9.1%	2 min	4
3D Graphene Hydrogel	4 ppm	RT	9 min	-23.5%	11 sec	5
MoS_2-RGO	3 ppm	160℃	27 sec	-18.6%	20 sec	6
SnO_2 nanofiber decorated RGO	0.5 ppm	RT	10 min	+23%	7.3 min	7
rGO-Cu_2O mesocrystal	2 ppm	RT	15 min	+67.8% ($\Delta I/I_0$)	>25 min	8
CuO/rGO nanohybrids	1 ppm	RT	1 min	14% ($\Delta I/I_0$)	0.57 min	9
Cu-decorated CVD graphene	5 ppm	RT	1.4 min	-30.9%	6.8 min	This work

Table S3. Comparison of sensing performances to NH_3 gas for 8 nm Cu/Gr device in this work with those graphene-based gas sensors reported in the literatures.

Sensing materials	Concentration of NH_3	Operating temperature	Response time	Response ($\Delta R/R_0$)	Recovery time	References
Pt-decorated RGO	1000 ppm	RT	2.7 min	+10%	4.8 min	10
CVD graphene on aluminum oxide substrate	1300 ppm	RT	2.6min	+1.5%	2.2 min	11
Graphene -ssDNA	10 ppm	RT	25 min	+22%	Incomplete	12
Ti-decorated CVD graphene	400 ppm	RT	2.5 min	+17.9%	3 min	13
Graphene -porphyrin	160 ppm	RT	1 min	-8.34%	Incomplete	14
Graphene Platelets	150 ppm	RT	12 min	+29%	>20 min	15
CVD graphene	100 ppm	300℃	25 min	+54%	10 min	16
Cu_2O-function-alized-graphen e-sheets	25 ppm	RT	—	+2%	—	17
Cu_2O nanorods modified RGO	100 ppm	RT	0.47 min	+70%	3.43 min	18
Cu-decorated CVD graphene	105 ppm	RT	2.3 min	+29.1%	22.4 min	This work

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