Supporting Information

Charge Transfer Driven by Redox Dye Molecules on Graphene Nanosheets for Room-Temperature Gas Sensing

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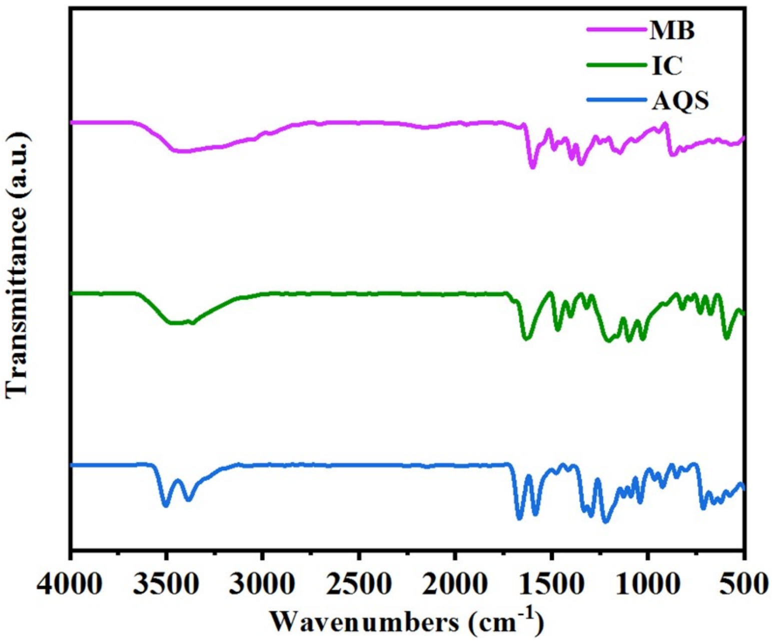

Figure S1. FTIR spectra of MB, AQS and IC.

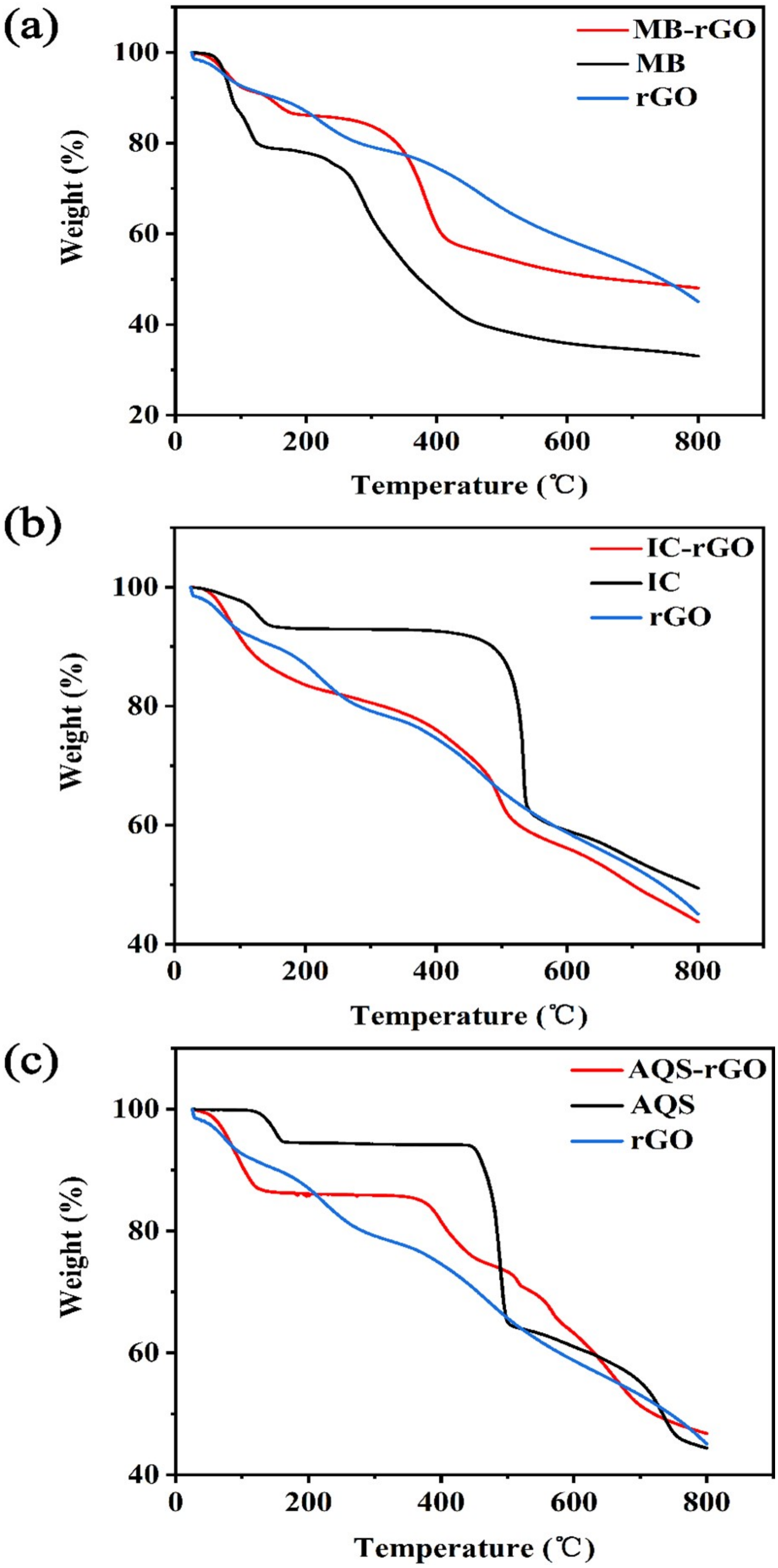

Figure S2. TGA curves of (a) rGO&MB&MB- rGO, (b) rGO&IC&IC- rGO, and (c) rGO&AQS&AQS-rGO composite with different mass ratios from room temperature to 800 °C under N_2 atmosphere.

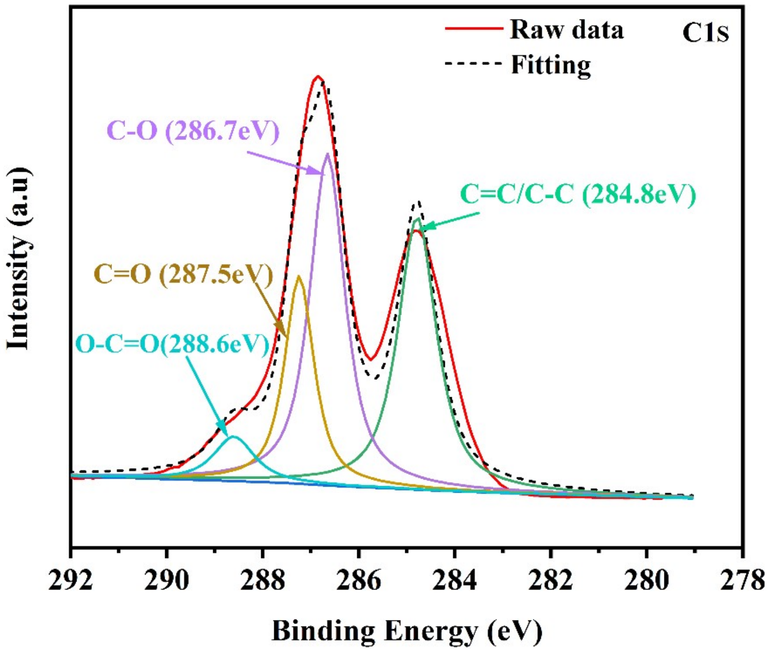

Figure S3. XPS survey spectrum C 1s of GO.

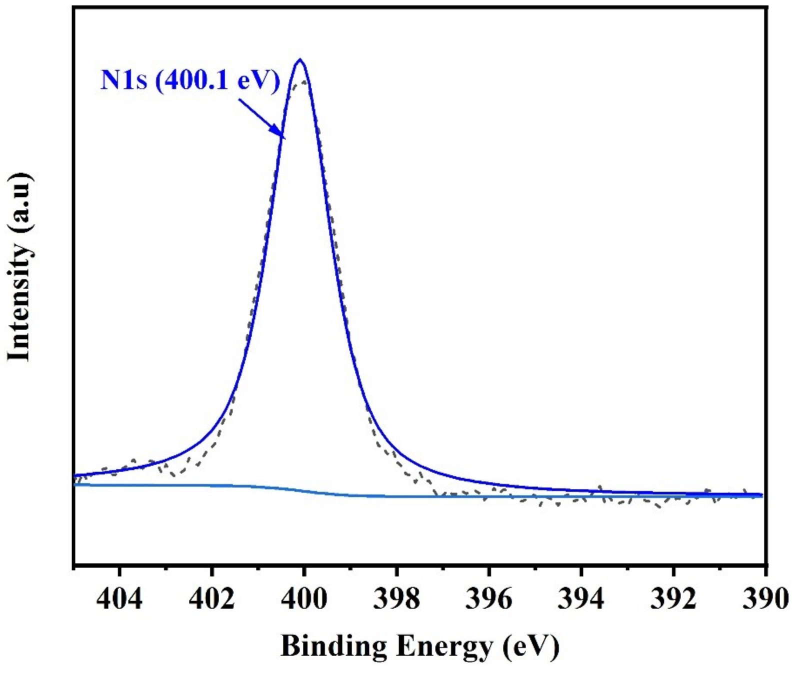

Figure S4. XPS survey spectrum N 1s of IC-rGO.

The appearance of the characteristic peak N 1s at 400.1 eV in the XPS spectrum confirms the successful complexation of IC molecules with rGO via π-π stacking (Figure S4).

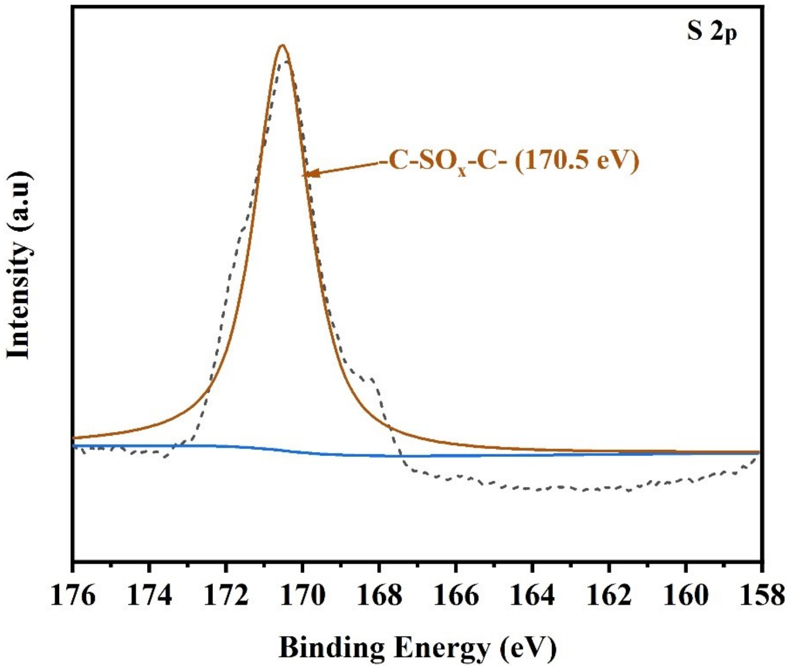

Figure S5. XPS survey scan spectrum S 2p of AQS-rGO.

Figure S5 shows that the peak position of the S 2p spectrum at 170.5 eV is attributed to the sulfonate functional group (-C-SO_x-C-).[1] indicating the successful complexation of AQS with rGO.

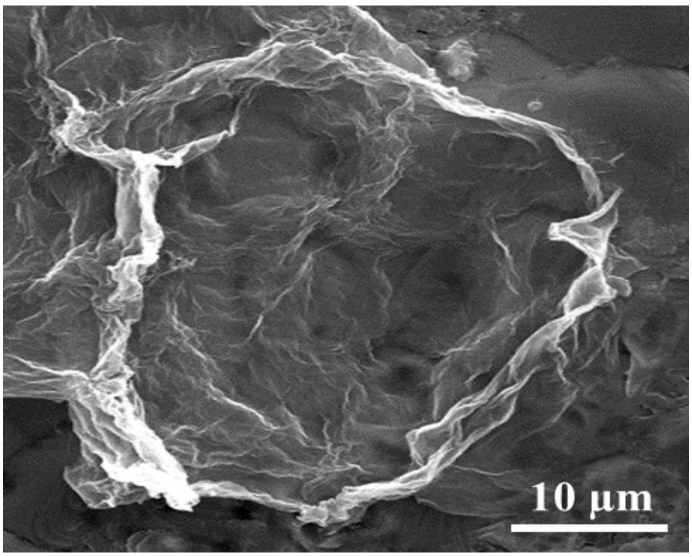

Figure S6. SEM images of rGO deposited on the surface of IDEs.

The gas sensors are made by the drip-drying method (Figure S7a). Using Keithley 2450 source meter to record changes in sensors' resistance before and after NO_2 exposure, and the response is calculated by the ratio of resistance captured in an atmosphere of air (R_a) and NO_2 (R_g) respectively, i.e. $S=R_a/R_g$. The schematic illustration of gas sensing tests is shown in Figure S7b.

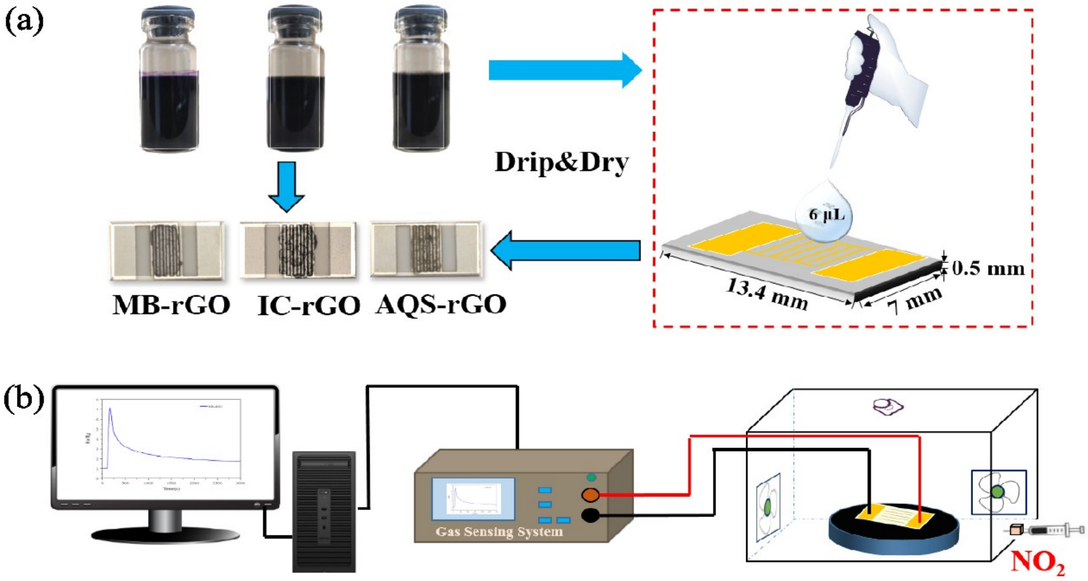

Figure S7. Schematic diagram of (a) the preparation of typical graphene-based gas sensors and (b) the home-built gas sensing test system.

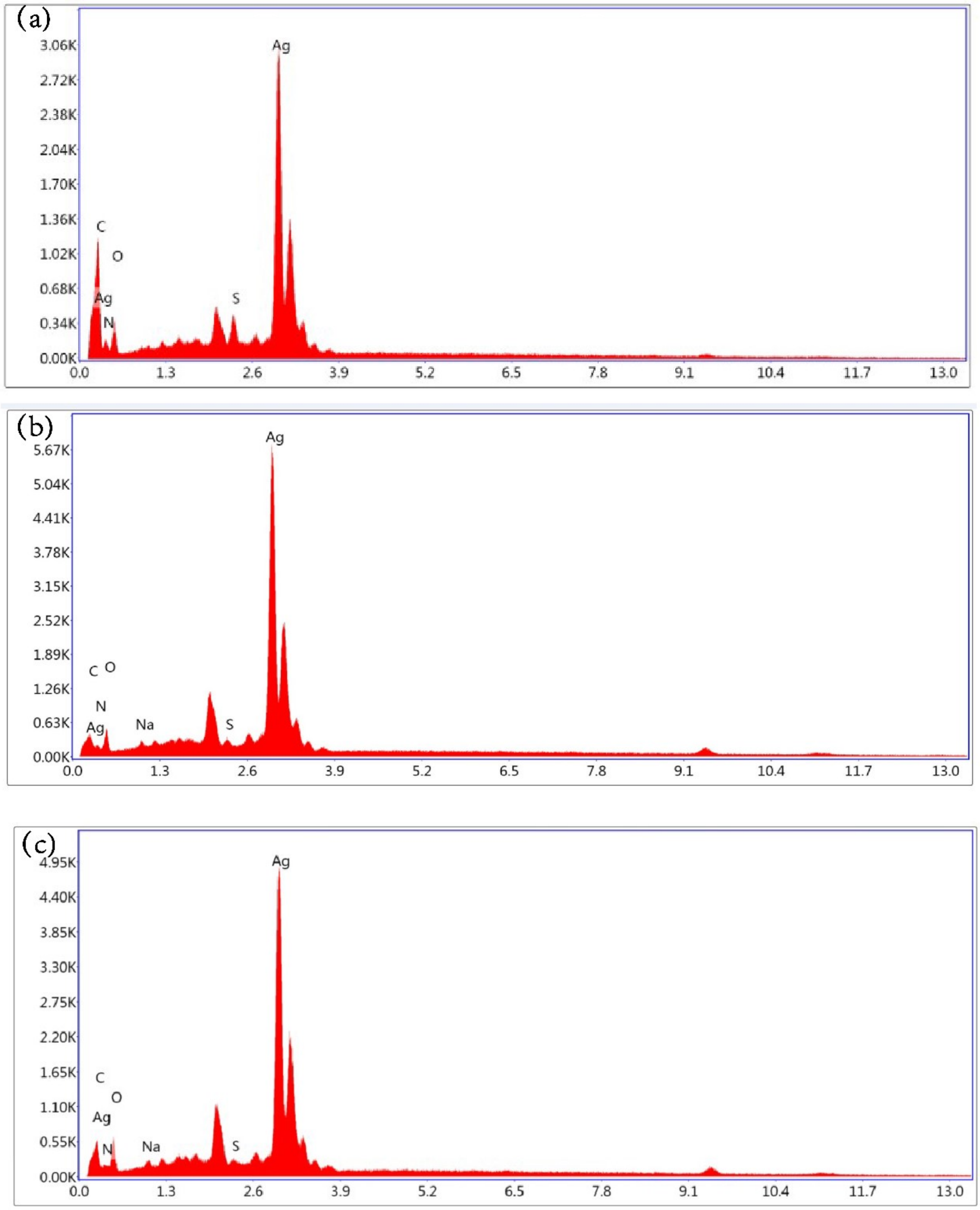

Figure S8. The EDS spectra of (a) MB- rGO, (b) IC- rGO and (c) AQS-rGO.

Table S1. The atomic content (%) of C, O, N, and S in GO, rGO, AQS-rGO, IC-rGO and MB-rGO samples calculated by the XPS results.

Sample	C At%	O At%	N At%	S At%
GO	68.5	30.9	0.1	0.5
rGO	82.8	16.5	0.2	0.5
AQS-rGO	66.9	29.9	0.2	3.0
IC-rGO	59.7	32.6	4.5	3.2
MB-rGO	80.4	11.3	5.2	3.1

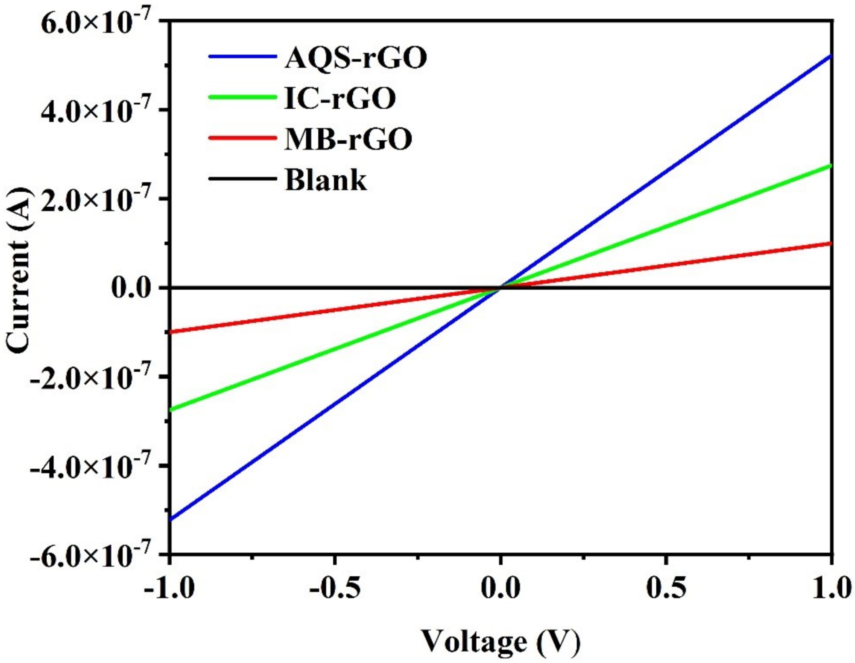

Figure S9. Current versus voltage curves of the blank, MB-rGO, IC-rGO and AQS-rGO sensor.

The relationship between current and voltage (I-V) was linear from -1 V to 1 V, showing good ohmic contacts between the gas sensing materials and IDEs (Figure S9). In other words, there is no Schottky barrier between these three graphene-based gas sensing materials and IDE.

Table S2. Electrochemical properties of the three molecules

Molecule	λ_{onset}	$E_g^{opt[a]}$/eV	E_{ox}/V	HOMO/eV	LUMO/eV
MB	745	1.66	0.21	-4.61	-2.95
IC	710	1.74	-0.01	-4.39	-2.65
AQS	380	3.26	-0.12	-4.28	-1.02

[a] Eg^{opt} was calculated from 1240 nm/λ_{onset}, [b] HOMO = - (Eox^{onset}+ 4.80-$E_{Fc/Fc+}$) eV; [c] LUMO = HOMO + Eg^{opt}.

1. Choi, C. H.; Park, S. H.; Woo, S. I., Heteroatom doped carbons prepared by the pyrolysis of bio-derived amino acids as highly active catalysts for oxygen electro-reduction reactions. Green Chemistry, 2011, 13, 406-412.