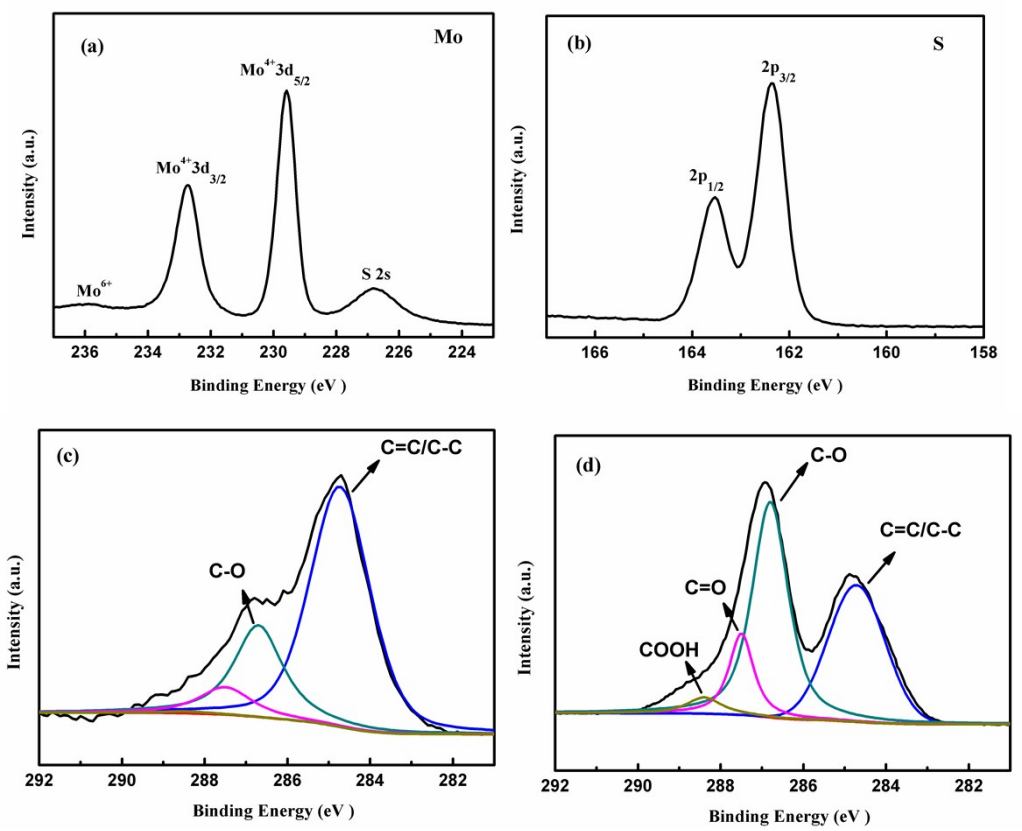
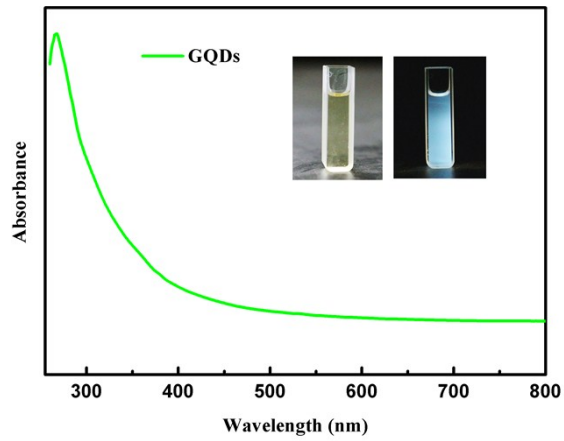
Supporting information

Materials. Graphite powder (500 μm) was obtained from Shenzhen Nanotech Port Co., Ltd. Bulk molybdenum disulfide, Dimethyl Formamide (DMF), concentrated sulfuric acid (98%), hydrogen peroxide (30%), potassium permanganate were purchased from J&K Scientific, and used as received.

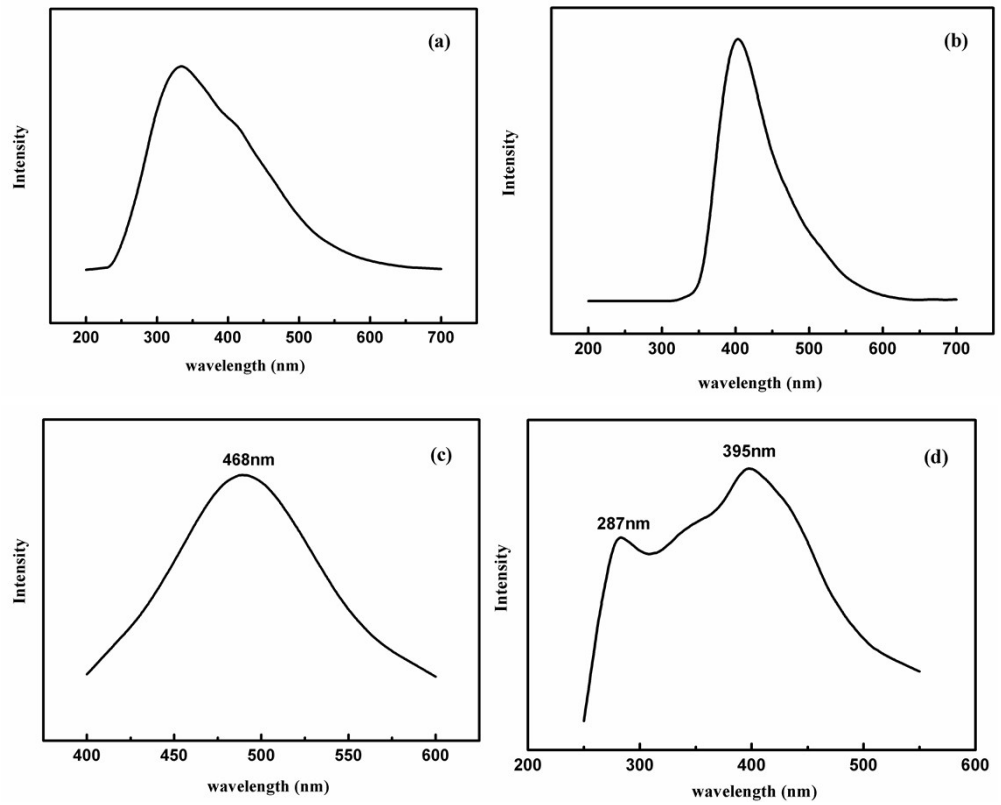
S1 Synthesis of GO. GO was prepared by oxidation of natural graphite powder according to a modified Hummers method. Briefly, 1.0 g graphite powder was added to 23 mL concentrated sulfuric acid under stirring for 50 min at -1 ~ 1 °C. Then 6g potassium permanganate was added slowly and gradually to keep the temperature of suspension below 5 °C. After magnetic stirring for 3 h, the mixture was transferred into 40 °C water bath and kept for 45 min. After that, the temperature was heated to 80 °C and 80 mL DI water was added step by step to maintain the temperature and the solution was stirred for another 15 min. An additional 120 mL DI water and 10.81 mL hydrogen peroxide were added, turning the color from brown to golden yellow. The obtained dispersion was washed and centrifuged for several times to remove the impurities.



S2 (a-c) XPS spectra of G/MQDs; (d) C1s spectrum of GO nanosheets



S3 UV–vis spectra of GQDs prepared in DMF. The photographs of GQDssolution taken under visible and UV lights are also shown in theinsets.



S4 (a) PL spectrum of MQDs excited at 339 nm; (b) PLE spectrum of MQDs with the detection wavelength of 407 nm; (c) PL spectrum of GQDs excited at 395 nm; (d) PLE spectrum of GQDs with the detection wavelength of 468 nm

S5 the calculation of the limits of detection.

The limits of detection (LOD) of G/MQDs devices are calculated based on a signal (*S*)-to-noise (*N*) ratio ($S/N > 3$). The details are represented as shown below.

Step I: Take 10 data points at the baseline before gas exposure;

Step II: Plot the data ($\Delta R/R_0$ (*Yi*) Vs Time) ;

Step III: A fifth order polynomial fit *Y* is executed within the data point range.

Step IV:

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

Where, *Yi* is the measured data point and *Y* is the corresponding value calculated fromcurve-fitting equation

Step V:

$$\mathrm{rms}_{\mathrm{noise}} = \sqrt{(V_{x^2} / N)}$$

Where, *N* = 10

$$\mathrm{LOD(ppb)} = 3 * \left(\frac{\mathrm{rms}_{\mathrm{noise}}}{\mathrm{slope}} \right) * 1000$$

Where, Slope is value obtained from $\Delta R/R_0$ vs. concentration plot, Fig.4 (c, d), inset.

The related data are shown below:

G/M 3:1 exposed to NO_2

Time	*Yi*
10	0.000688707
20	0.000688707
30	0.000688707
40	0.000688707
50	-0.000787094
60	-0.000787094
70	-0.00029516
80	-0.000787094
90	-0.000787094
100	0.000688707

rms_{noise} = 0.03424052

slope = 2.47939

LOD (NO_2) = 41.4 ppb

G/M 3:1 exposed to NH_3

Time	*Yi*
10	0.002209452
20	0.002618623
30	-0.001882469
40	-0.002923352
50	0.000255818
60	0.002337584
70	0.001971922
80	-0.000841585
90	0.001354366
100	-0.002923352

rms_{noise} = 0.0473904

slope = 2.403

LOD (NO_2) = 35.5 ppb