Supporting Infomation

Highly sensitive fluorescent explosives detection via SERS: based on fluorescence quenching of graphene oxide @ Ag composite aerogels

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Supplementary Data

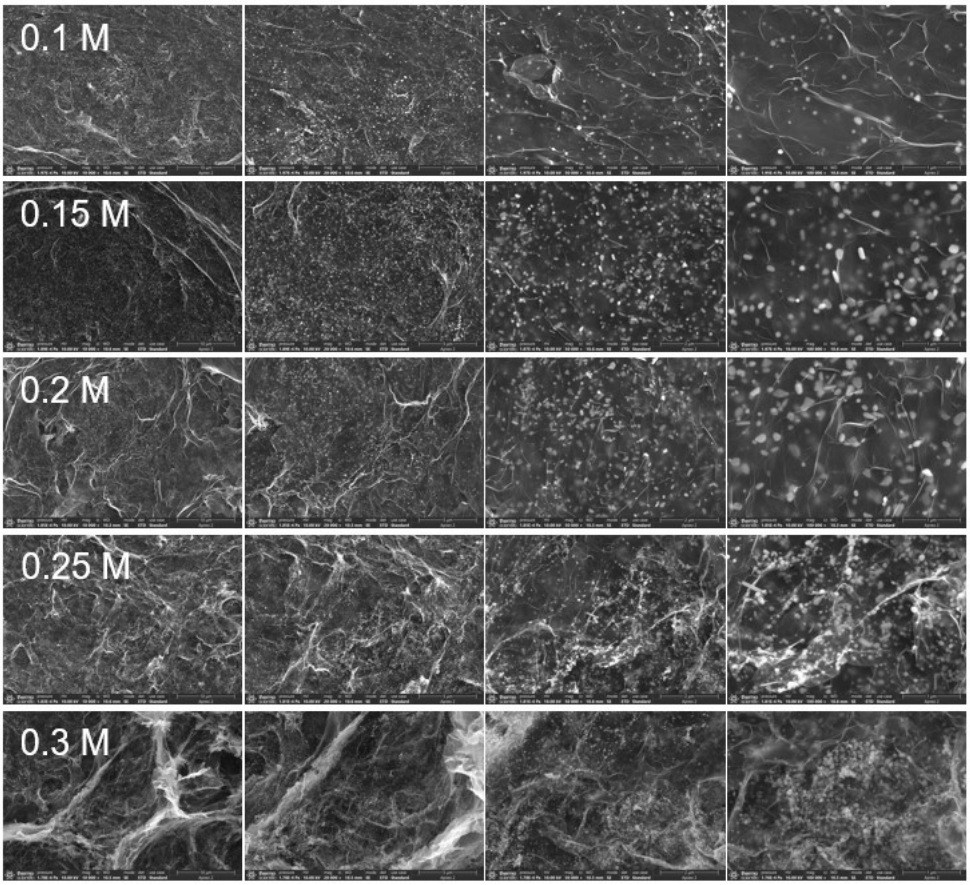

Figure S1. SEM images of GO-Ag ANM with different $AgNO_3$ concentration (0.1 M, 0.15 M, 0.2 M, 0.25 M, 0.3 M).

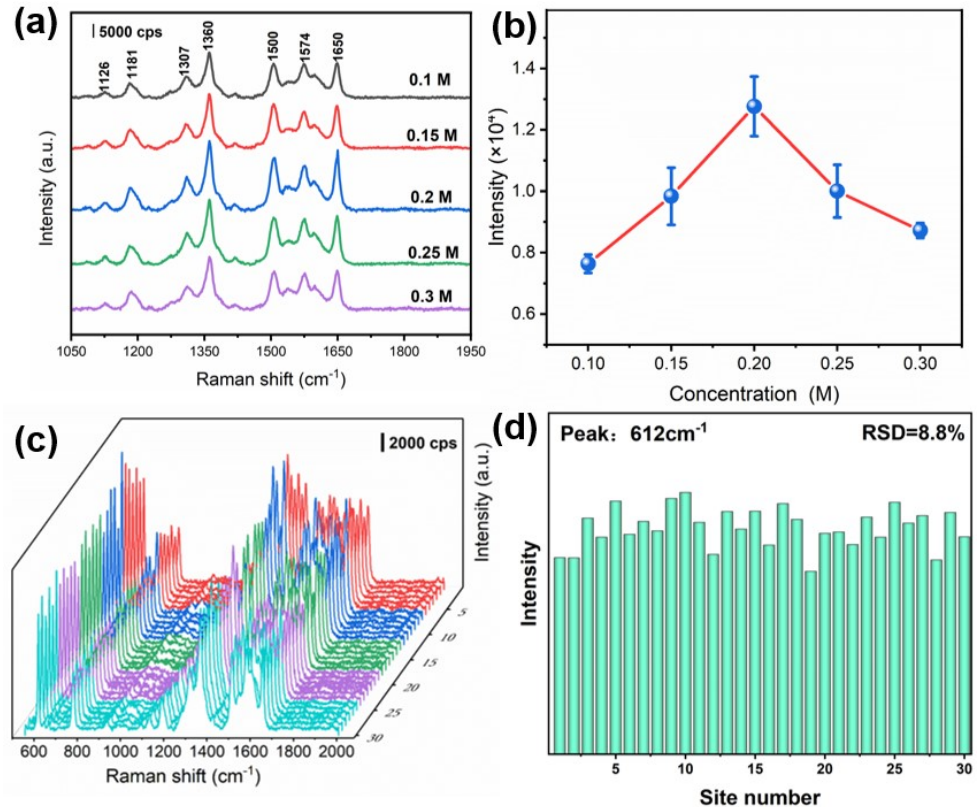

Figure S2. SERS enhanced effect of different concentrations of silver loaded GO-Ag ANM on R6G (a), SERS trend diagram under different concentrations of $AgNO_3$ (b), A series of SERS spectra of R6G ethanol solution (1×10^{-5} M) collected on randomly selected 30 dots of the GO-Ag ANM substrates (c), The SERS intensity distribution of the 1650 cm^{-1} (d).

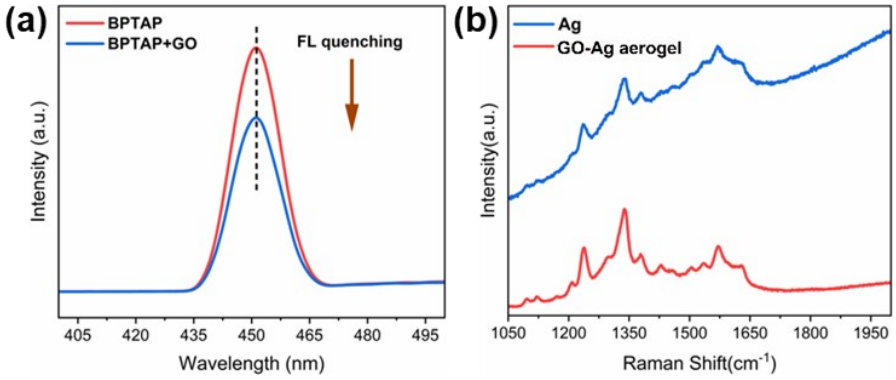

Figure S3. Comparison of fluorescence quenching effects of GO-Ag ANM on fluorescent explosive BPTAP. (a) fluorescence contrast diagram. (b) 10^{-4} M BPTAP Raman performance comparison diagram.

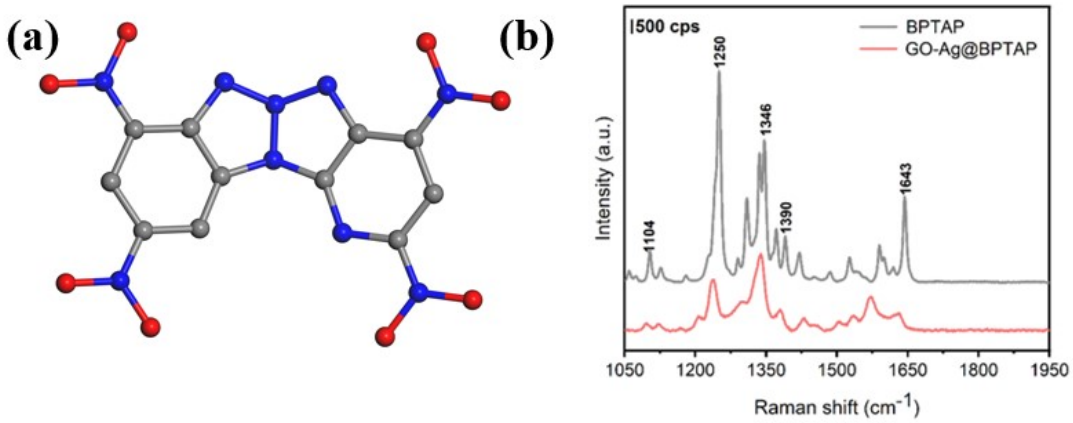

Figure S4. The molecular structure of explosive BPTAP(a), the SERS spectra of explosive BPTAP and GO-Ag@BPTA.

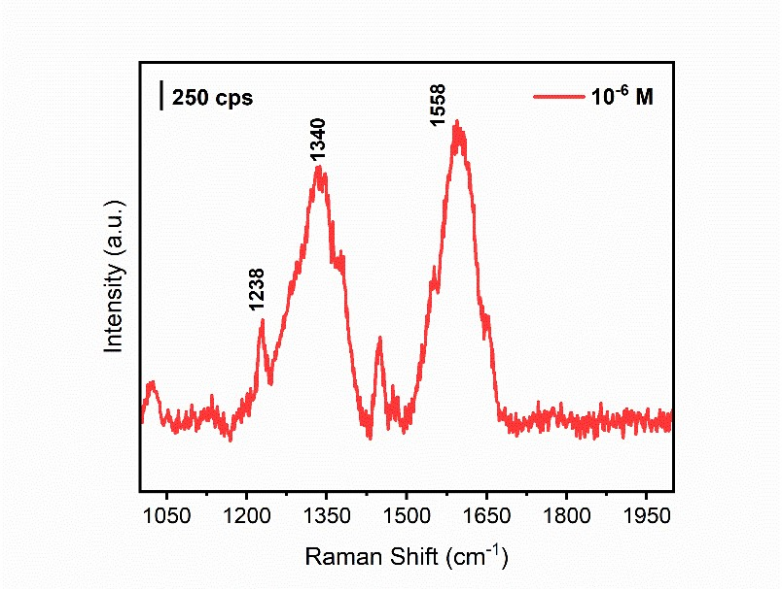

Figure S5. SERS responses of GO-Ag ANM in the presence of BPTAP at 10^{-6} M.

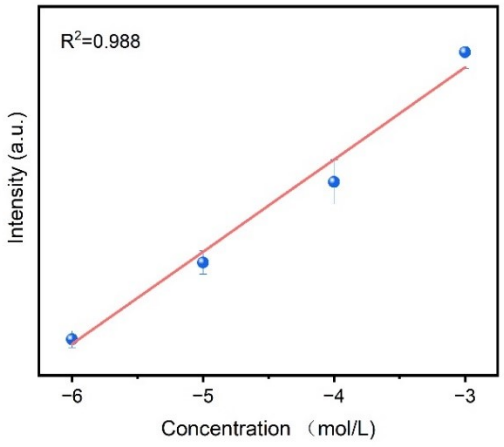

Figure S6. Linear diagram of BPTAP.

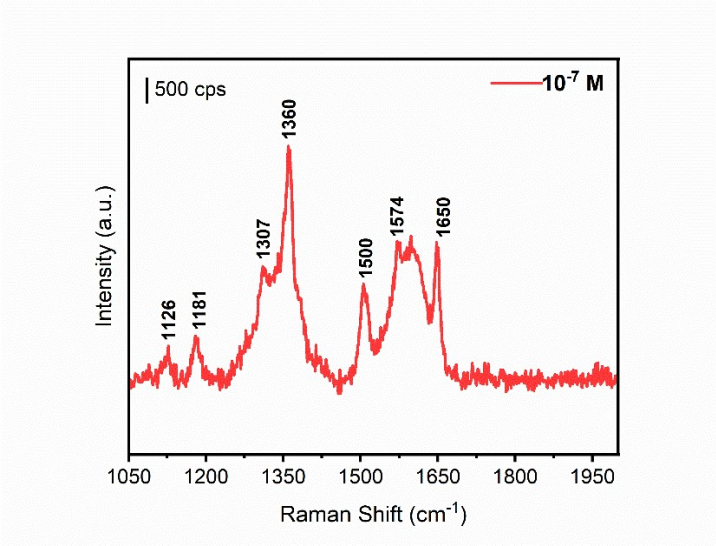

Figure S7. SERS responses of GO-Ag ANM in the presence of R6G at 10^{-7} M.

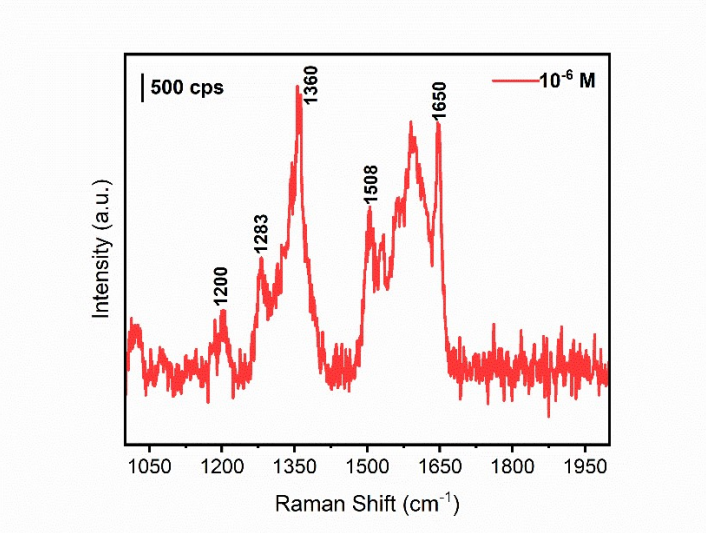

Figure S8. SERS responses of GO-Ag ANM in the presence of RhB at 10^{-6} M.

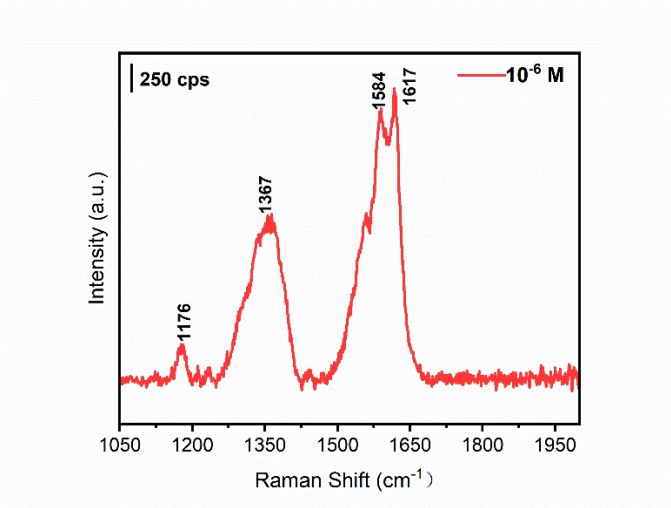

Figure S9. SERS responses of GO-Ag ANM in the presence of CV at 10^{-6} M.

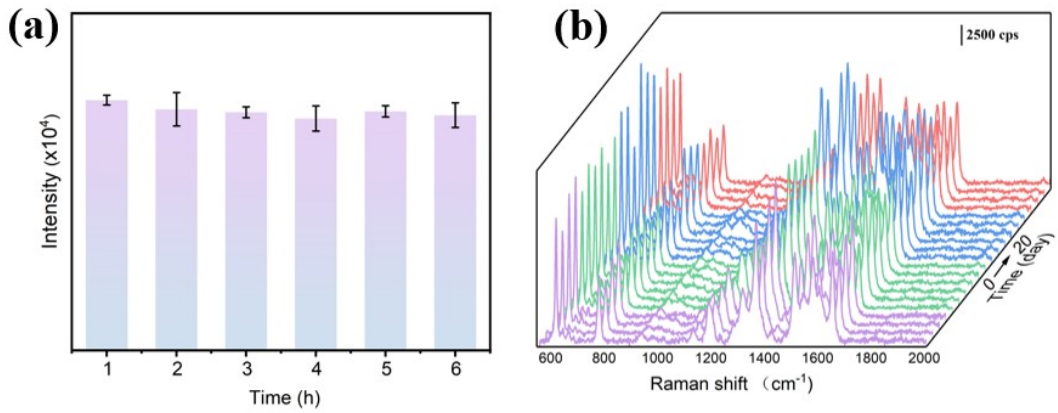

Figure S10. The trend chart illustrates the change in SERS intensity of the GO-Ag ANM substrate, detected with R6G ($1x10^{-5}$ M), at hourly intervals(a). SERS performance diagram of GO-Ag ANM against R6G ($1x10^{-5}$ M) in 1-20 days(b)

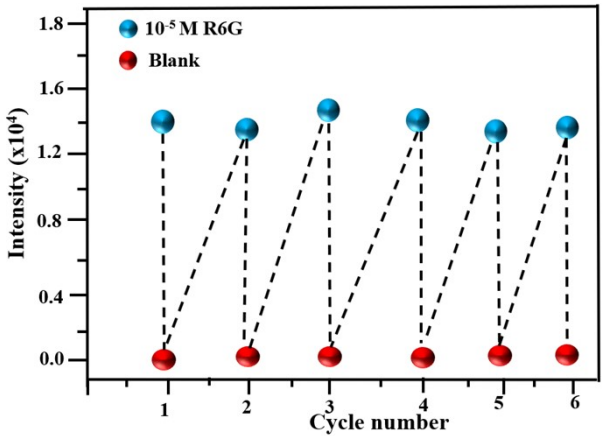

Figure S11. Sensor recovery performance of GO-Ag in 6 cycles cleaned with ethanol

Table S1. GO-Ag ANM for each element Wt% and At%.

Elements	C		Ag		O		N	
Samples	**Wt%**	**At%**	**Wt%**	**At%**	**Wt%**	**At%**	**Wt%**	**At%**
0.1	60.91	78.36	21.24	3.04	7.90	7.63	9.94	10.97
0.15	60.20	70.61	9.38	1.22	19.50	17.17	10.93	10.99
0.2	58.20	77.25	23.79	3.52	8.96	8.93	9.05	10.31
0.25	54.84	71.32	20.59	2.98	12.28	11.99	12.29	13.71

0.3	44.62	73.11	40.59	7.41	7.47	9.19	7.32	10.29

Table S2. The SERS intensity of the 612 cm^{-1} bands from thirty dots.

Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Intensity	10946	10932	13155	12083	14100	15246	16964	9443	14249	14575
Number	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Intensity	12918	11134	13519	12542	13540	11648	13956	13076	10187	12299
Number	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Intensity	12374	11683	13209	12086	14037	10874	13289	10817	13464	12104

Table S3: Explosive BATAP Raman signature peak

Raman shift (cm^{-1})	Tentative Assignments
1104	ring respiratory peak
1250	symmetric N=N-N stretching vibration peak
1346	symmetric NO_2 stretching
1390	symmetric NO_2 stretching vibration peak
1643	cyclic stretching vibration peak of benzene derivative

Text S1. The detailed calculation of the enhancement factor.

To quantitatively characterize the enhancement ability of this SERS active substrate, the enhancement factor (EF) value of R6G is calculated according to the following equation:

$$\mathbf{EF = (}\boldsymbol{I}_{\mathbf{SERS}}\mathbf{/}\boldsymbol{I}_{\mathbf{bulk}}\mathbf{)(}\boldsymbol{N}_{\mathbf{bulk}}\mathbf{/}\boldsymbol{N}_{\mathbf{SERS}}\mathbf{)} \qquad \text{Equation. S1}$$

Where I_{SERS} and I_{bulk} were the peak intensities of 1×10^{-6} M R6G on GO-Ag ANM and 1×10^{-3} M R6G on silicon wafer at 1645 cm^{-1}, respectively. N_{SERS} and N_{bulk} were the number of R6G molecules excited by the laser beam on GO-Ag ANM and the silicon

wafer, respectively. Herein, a certain volume (V_{SERS}) and concentration (C_{SERS}) R6G ethanol solution was dispersed to an area of S_{SERS} at GO-Ag ANM. For non-SERS Raman spectra, a certain volume (V_{bulk}) and concentration (C_{bulk}) R6G ethanol solution was dispersed to an area of S_{bulk} at a clean Si substrate. Both the substrates were dried in air. Considering the area of laser spot was the same, the equation thus becomes: $EF=(I_{SERS}/I_{bulk})\ (C_{bulk}V_{bulk}/C_{SERS}V_{SERS})(S_{SERS}/S_{bulk})$. In our experiment, 20 μL of 1×10^{-6} M R6G was dispersed to an area of 12 mm^2 for GO-Ag ANM and 20 μL of 1×10^{-3} M R6G ethanol solution was dispersed to an area of 16 mm^2 for the silicon wafer s. For the band at 1645 cm^{-1}, I_{SERS}/I_{bulk} was [(9882+9654+9947)/3] / [(652+685+671)/3] ≈ 14.7. Therefore, average enhancement factor for the band at 1652 cm^{-1} was calculated to be 1.96×10^4.

Text S2. Detailed calculative process of relative standard deviation (RSD).

$$RSD=(SD/X_{average})\times100\% \qquad \text{Equation S2}$$

SD (standard deviation) was calculated according to the well-known formula:

$$SD=\sqrt{\frac{1}{n-1}\times\sum_{i=1}^{n}(X_i-X_{average})^2} \qquad \text{Equation S3}$$

where, n is the total number of the R6G standard sample. Xi is the "i" sample of the series of measurements. $X_{average}$ is the average value of the SERS signals obtained for the specific series of identical samples repeated n times. SD=1120.664, $X_{average}$ = 1219.4, RSD was calculated to be 8.88%.