Electronic Supplementary Material (ESI) for Biomaterials Science.

Supporting Informations

Red phosphorus Decorating Graphene oxide Nanosheets: Label-Free DNA Detection

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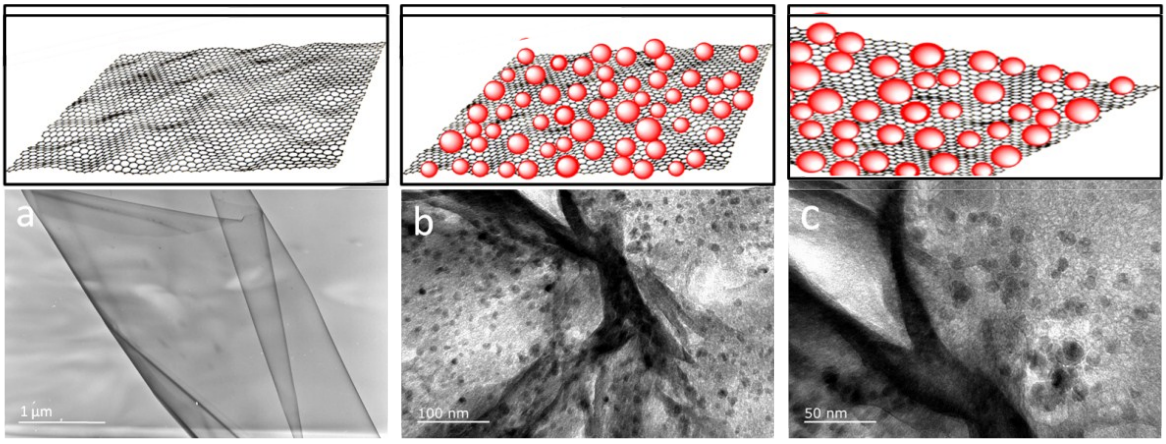


Figure S1.TEM images of a) N-rGO only. (b-c) f-RP@N-rGO, (After red phosphorous (RP)is embedded on N-rGO NSs in different scales). The respective schematic diagrams are shown at the top.

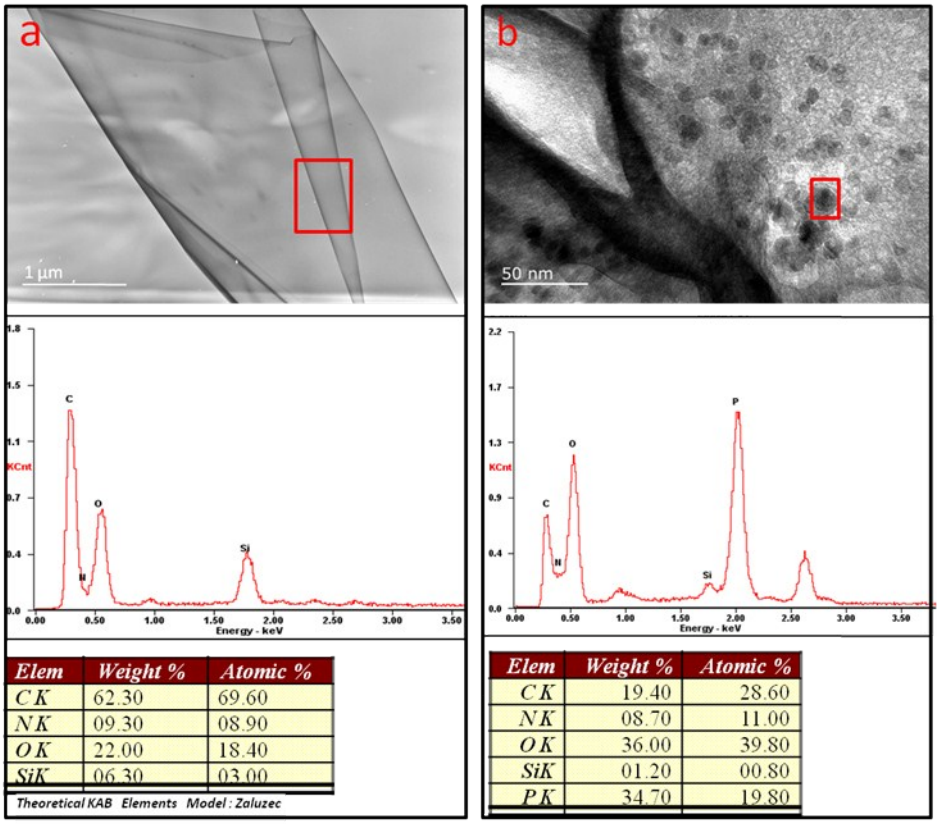


Figure S2. The corresponding EDS profile for phosphorus element in the area marked with red rectangles in (a) the GO sheets and (b) the f-RP@N-rGO NSs.

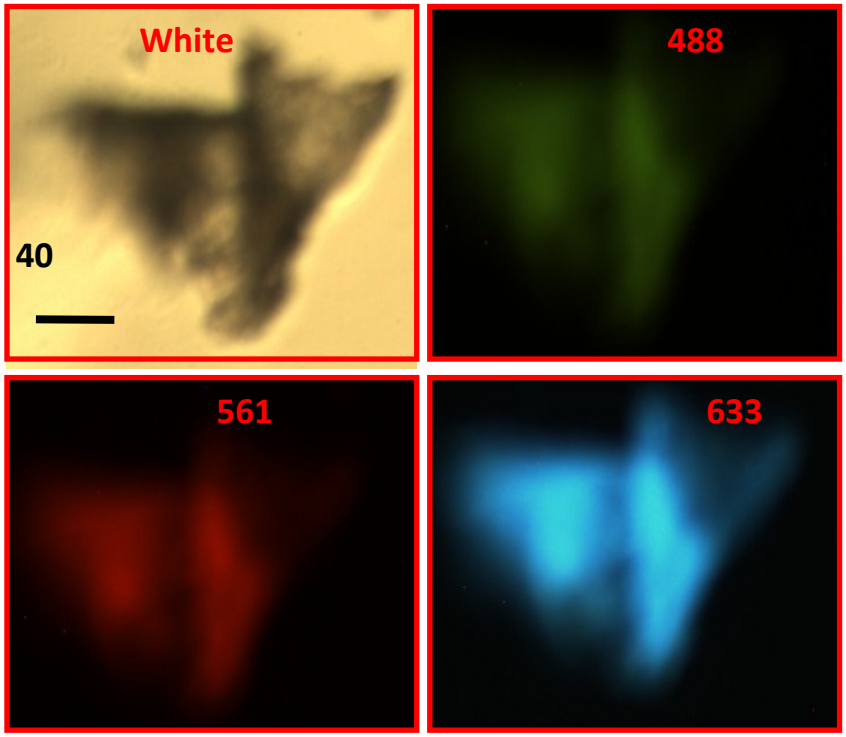


Figure S3. Fluorescence images of f-RP@N-rGO NSs under white light and different band pass filters.

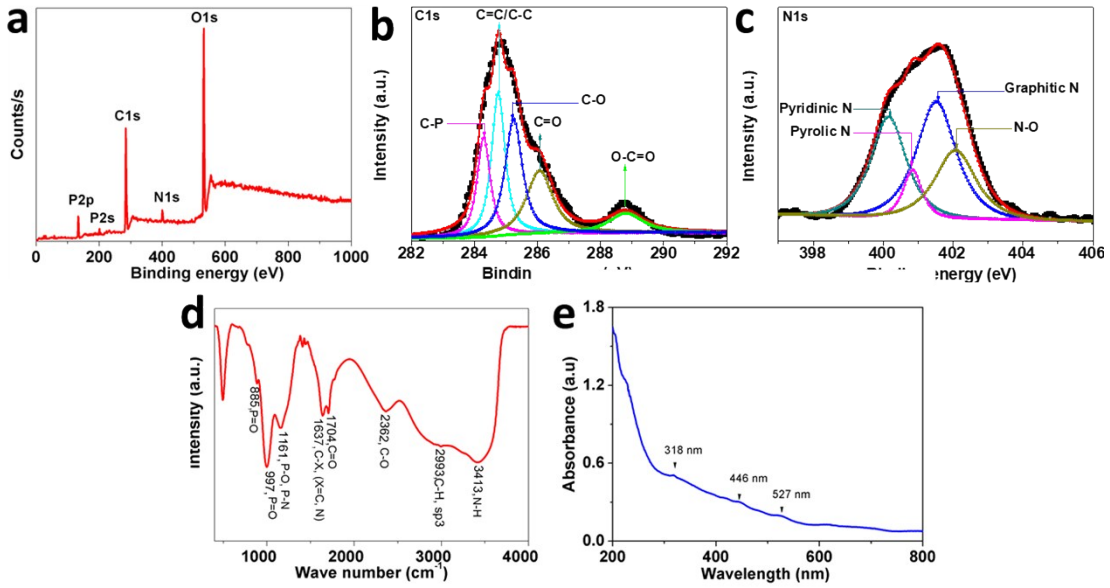


Figure S4. (a) XPS Survey spectrum with all elements peak. High-resolution XPS spectra of (b) C 1s,and (c) N 1s for f-RP@N-rGO NSs. (d) Fourier-transform infrared spectrum of f-RP@N-rGO NSs. (e) Ultraviolet(UV) visible spectrum of f-RP@N-rGO NSs.

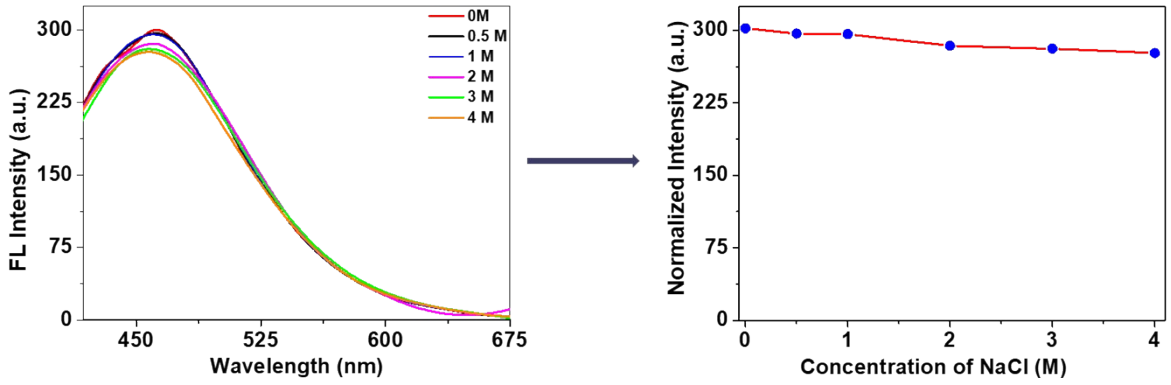


Figure S5. Effect of ionic strength on the fluorescence intensity of f-RP@N-rGO NSs (0.01 mg mL^{-1}) (ionic strengths were controlled by various concentrations of NaCl). The fluorescence spectra were obtained under the constant excitation and emission wavelengths at 420 nm and 458 nm respectively.

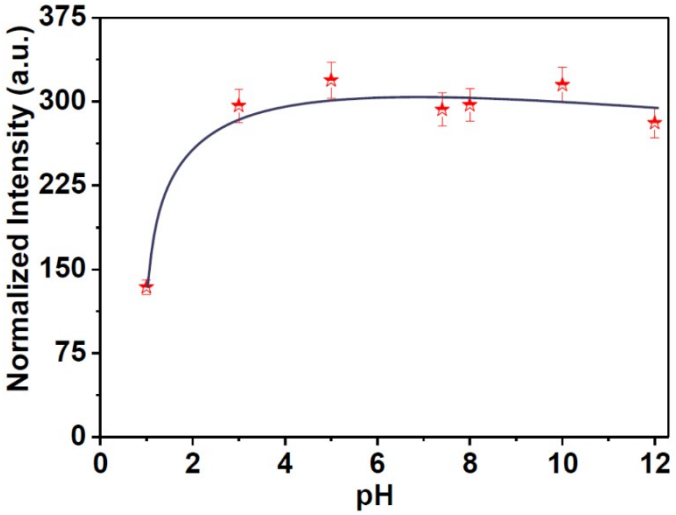
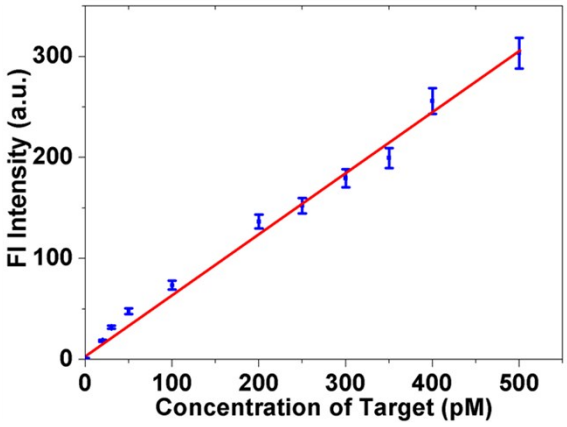


Figure S6. Effect of pH on the emission of f-RP@N-rGO NSs (0.01 mg mL^{-1}).



Equation	y = a + b*x	
Adj. R-Square	0.9922	
	Value	Standard Error
LINEARITYGRAPH Intercept	10.77037	4.23075
LINEARITYGRAPH Slope	0.58256	0.01632

Figure S7. Linearity curve of target DNA detection concentrations with presence of f-RP@N-rGO NSs and ssDNA. The excitation wavelength is 420 nm, and the monitored emission wavelength is458 nm. The detection limit of T (Ebola Virus DNA in this study) using f-RP@N-rGO NSs sensor is determined from the following equation: DL = K × SD/S, where K = 3, SD is the standard deviation of the blank solution, and S is the slope of the calibration curve. DL = K × SD/S=3 ×0.1077/0.582pM = 0.555× 10^{-12}M (therefore, finally limit of detection=0.555 pM).[1]

Table S1. DNA Sequences Used for the fluorescence assay.

Name	Sequence 5' to 3'
ssDNA	GCATTAGCTTCCGTTCTCTC
SudZai Ebola virus DNA-Target DNA (T)	GAGACAACGGAAGCTAATGC
Single base mismatch DNA at the central location (SM1)	GAGACAACGG**G**AGCTAATGC
Single base mismatch DNA at near 5' location (SM2)	G**T**GACAACGGAAGCTAATGC
Single base mismatch DNA at near 3' location (SM3)	GAGACAACGGAAGCTAAT**C**C
Double base mismatch DNA at central locations (DM1)	GAGACAA**A**GG**G**AGCTAATGC
Double base mismatch DNA at near to both ends location (DM2)	G**T**GACAACGGAAGCTA**C**TGC
Random DNA (R)	AAGATACCGGTAGCCAATCC

* The mutation base is indicated by underline and **bold**

Table S2. Comparison of fluorescent DNA sensors using different 2D nanomaterial.

Type	Sensitivity	Detection time	Probe synthesis	Multiplexed detection	Reference
GO-based DNA detection (premixing)	10 nM	Slow (0.5 h)	Convenient (single labeling)	Not reported	2
Graphdiyne-based DNA detection	84 pM	10 min	Convenient (single labeling)	Not reported	3
AuNP-based DNA detection	nM	Fast (minutes)	Difficult (dual labeling)	Yes	4
SWNT-based DNA detection	4 nM	Slow (several hours)	Convenient (single labeling)	Not reported	5
GO-based DNA detection (postmixing)	100 pM	Fast (1 min)	Convenient (single labeling)	Yes	6
TaS 2 -based DNA detection	50 pM	Fast (≈5 min)	Convenient (single labeling)	Yes	7
f-PR@N-rGO	0.5 pM	instant	Very convenient (No need labeling)	yes	This work

Reference:

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