Electronic Supplementary Material (ESI) for Journal of Materials Chemistry B.

Electronic Supporting Information (ESI)

Superhydrophilic edge-rich graphene for the simultaneous and disposable sensing of dopamine, ascorbic acid, and uric acid

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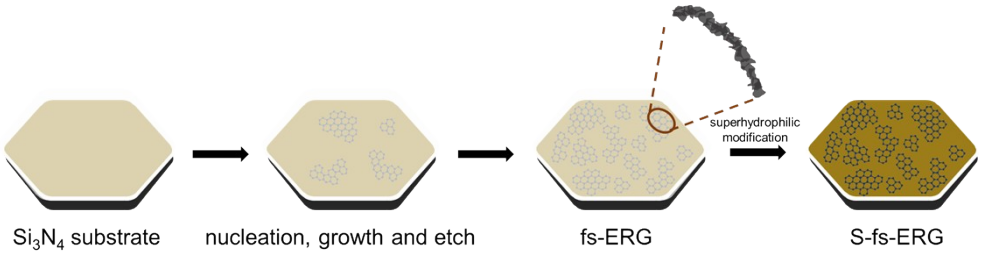

Scheme S1. Schematic diagram for preparation of the S-fs-ERG.

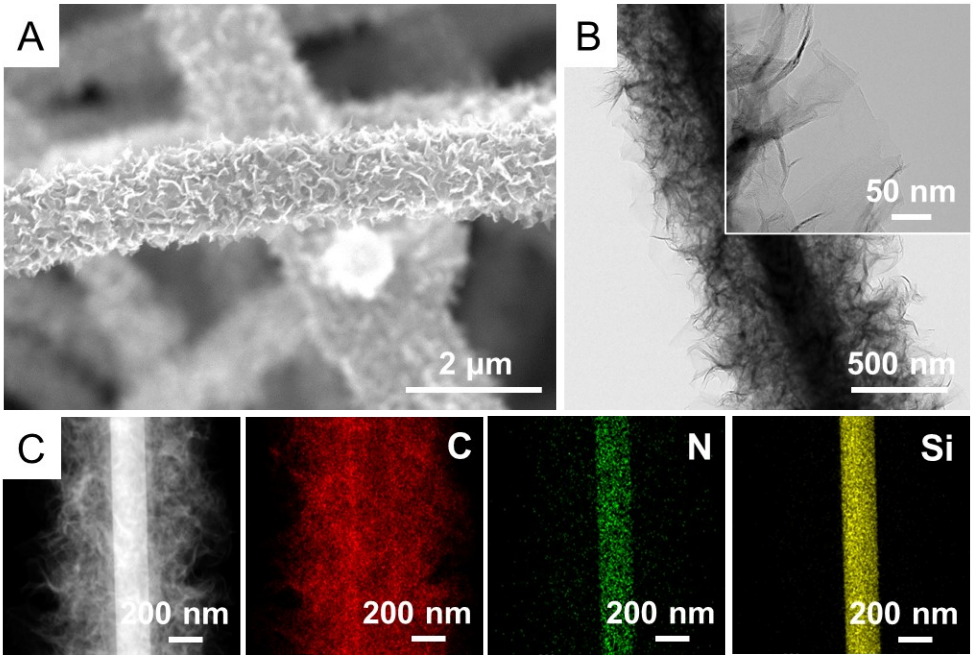

Fig. S1 SEM (A), TEM (B) and corresponding TEM-EDS (C) images of the fs-ERG.

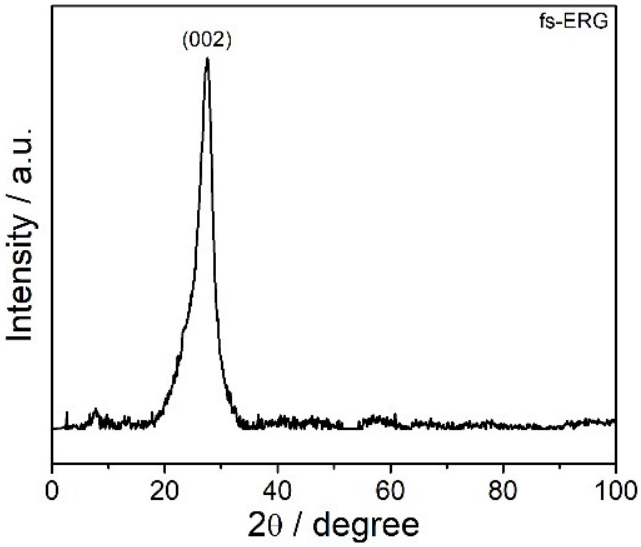

Fig. S2 XRD pattern of the fs-ERG.

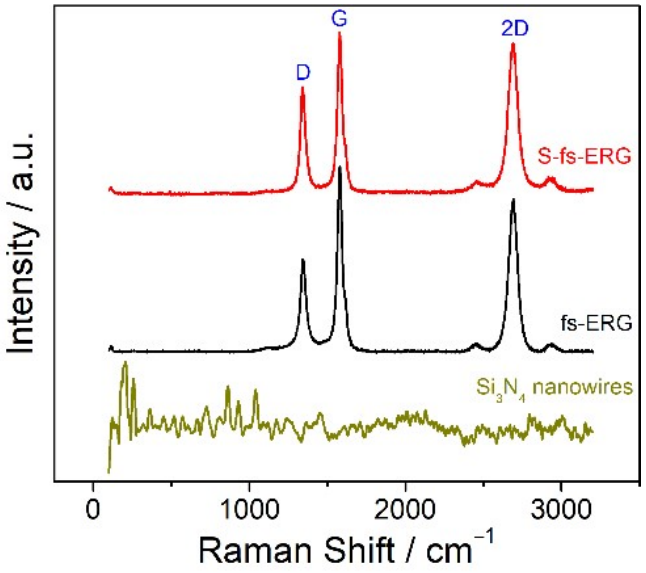

Fig. S3 Raman spectra of the Si_3N_4 nanowires, fs-ERG, and S-fs-ERG.

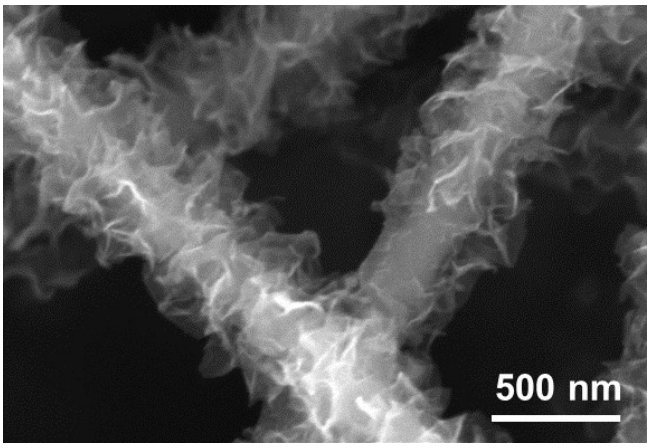

Fig. S4 SEM image of the S-fs-ERG. A small number of fs-ERG nanoplanes were falling-off from the Si_3N_4 nanowires after KOH thermal treatment.

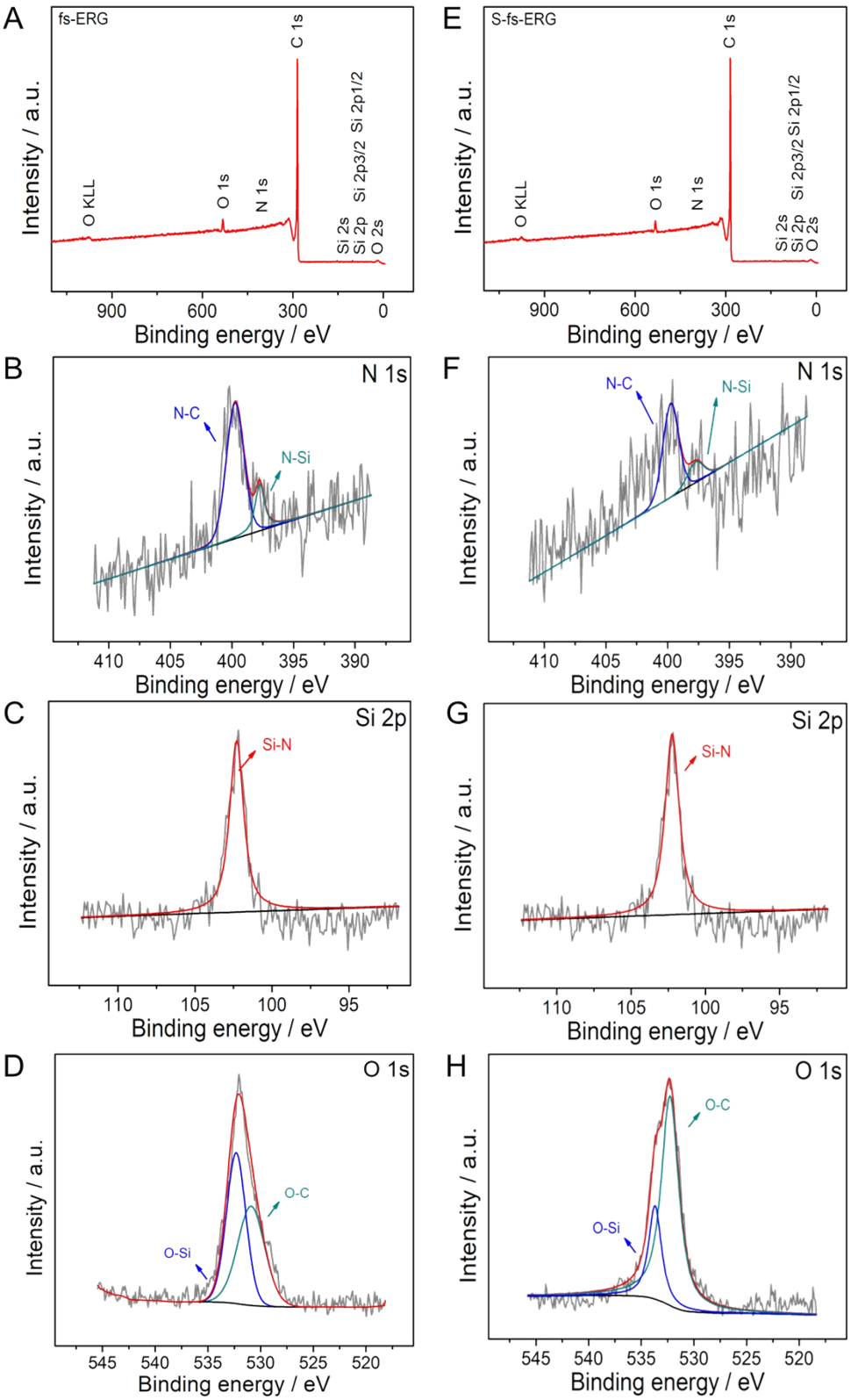

Fig. S5 XPS wide scan (A, E) and high-resolution N 1s (B, F), Si 2p (C, G), and O 1s (D, H) spectra of the fs-ERG (A, B, C, D) and S-fs-ERG (E, F, G, H), respectively.

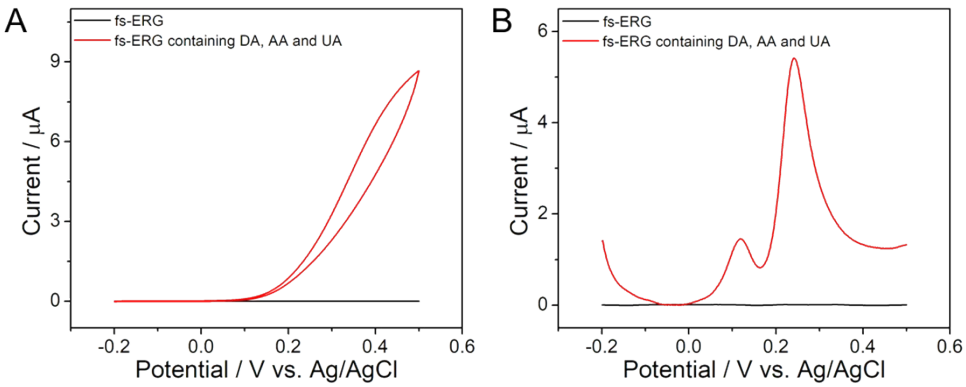

Fig. S6 CV (A) and DPV (B) curves of the fs-ERG electrode in the absence and presence of 0.02 mM DA, 1 mM AA and 0.05 mM UA in 0.1 M PBS (pH 7.4). The scan rate for CV is 50 mV s^{-1}. The pulse amplitude for DPV is 50 mV.

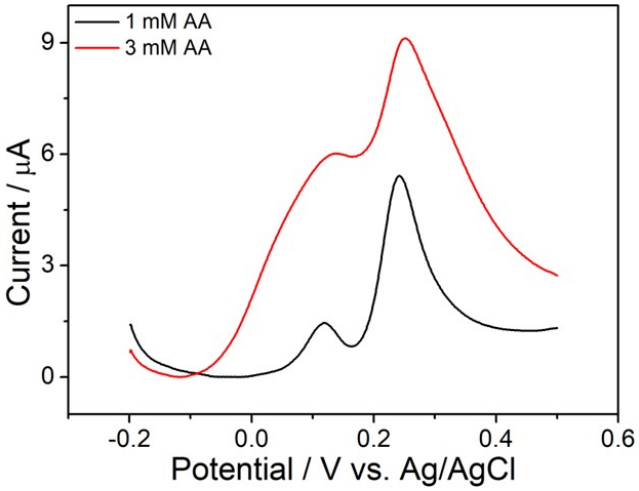

Fig. S7 DPV curves of the fs-ERG electrode containing 0.02 mM DA and 0.05 mM UA with different concentrations of AA in 0.1 M PBS (pH 7.4).

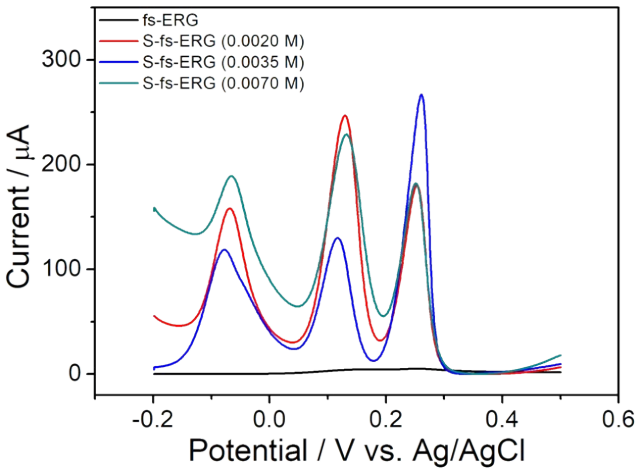

Fig. S8 DPV curves of the fs-ERG and S-fs-ERG electrodes after different concentrations of KOH thermal treatment containing 0.02 mM DA, 1 mM AA and 0.05 mM UA in 0.1 M PBS (pH 7.4).

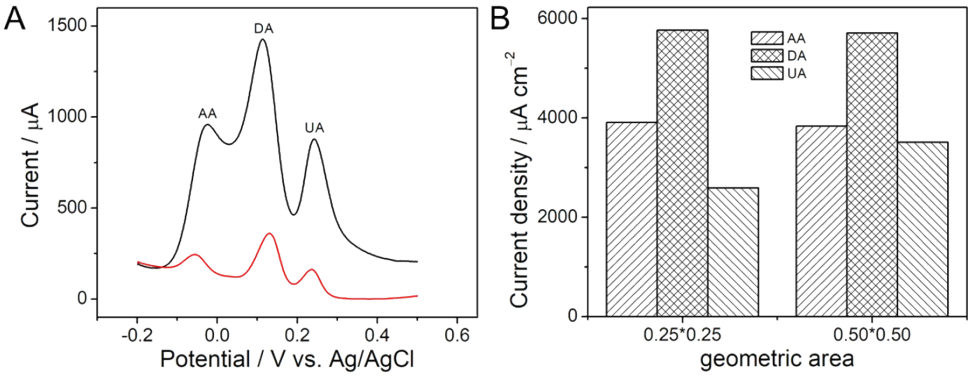

Fig. S9 DPV curves of the S-fs-ERG electrodes with different dimensions of 0.25×0.25 cm (red line) and 0.50×0.50 cm (black line) (A) and the corresponding histograms of the current density responses (B) containing 0.02 mM DA, 1 mM AA and 0.05 mM UA in 0.1 M PBS (pH 7.4).

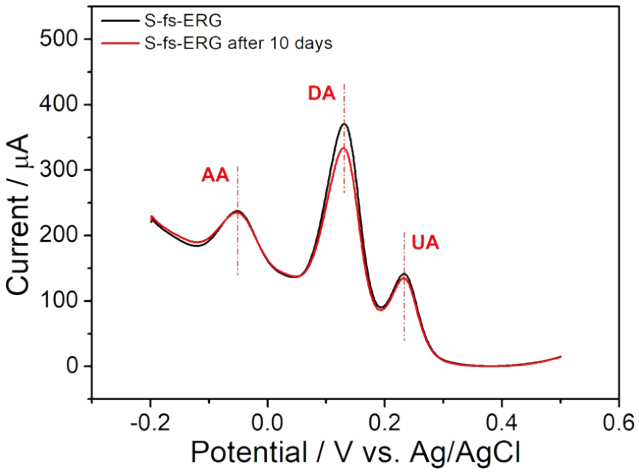

Fig. S10 DPV curves of the S-fs-ERG electrode containing 0.02 mM DA, 1 mM AA and 0.05 mM UA for stability test.

Table S1 The TEM-EDS element analysis of the fs-ERG (A) and S-fs-ERG (B).

(A)

Element (Family)	Atomic Fraction (%)	Mass Fraction (%)
C (K)	92.97	85.67
N (K)	0.00	0.00
Si (K)	7.03	14.33
Total	100.00	100.00

(B)

Element (Family)	Atomic Fraction (%)	Mass Fraction (%)
C (K)	96.00	91.80
N (K)	0.00	0.00
Si (K)	3.68	7.78
O (K)	0.32	0.41
Total	100.00	100.00

Table S2 The atomic content changes about C, N, Si and O elements of the fs-ERG and S-fs-ERG.

Atomic contents (%)	C	N	Si	O
fs-ERG	92.46	0.92	3.59	3.04
S-fs-ERG	94.19	0.82	1.85	3.14

Table S3 Comparison of the differently modified electrodes for electrochemical determination of the DA, AA and UA.

Electrode	Linear range / μM			Limit of detection (LOD) / μM			Refs
	DA	AA	UA	DA	AA	UA	
2D-hBN[a]	3−75	N.A.	N.A.	0.65	N.A.	N.A.	[1]
NOCC[b]	0.3−55	10−1300	N.A.	0.18	3.41	N.A.	[2]
Pt@NP-AuSn/Ni/CFP[c]	1−10	200−2000	25−800	N.A.	N.A.	N.A.	[3]
BG-CNPs[d]	5−2535	10–3570	5−220	0.7	1.1	2.4	[4]
S-fs-ERG	0.1−50	2.5−1000	0.5−50	0.1	2.5	0.5	This work

Note: The low detectable limit as evaluation index in this work.

N.A.: not available.

[a]: 2D hexagonal boron nitride

[b]: nitrogen/oxygen-codoped carbon cloth

[c]: Pt nanoparticles modified nanoporous AuSn(Pt@NP-AuSn) alloy on Ni buffered flexible carbon fiber paper (CFP)

[d]: biomass derived ground cherry husks derived carbon nanoplates

1. A. F. Khan, D. A. C. Brownson, E. P. Randviir, G. C. Smith and C. E. Banks, *Anal. Chem.*, 2016, **88**, 9729−9737.
2. X. Xi, D. Wu, W. Ji, S. Zhang, W. Tang, Y. Su, X. Guo and R. Liu, *Adv. Funct. Mater.*, 2019, **30**, 1905361.
3. H. Yang, J. Zhao, M. Qiu, P. Sun, D. Han, L. Niu and G. Cui, *Biosens. Bioelectron.*, 2019, **124–125**, 191−198.
4. X. Li, H. Li, T. Liu, Y. Hei, M. Hassan, S. Zhang, J. Lin, T. Wang, X. Bo, H.-L. Wang, H. Li and M. Zhou, *Sens. Actuators B Chem.*, 2018, **255**, 3248−3256.