Electronic Supporting Information

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Polymer Indicator Displacement Assay: Electrochemical Glucose Monitoring Based on Boronic Acid Receptors and Graphene Foam Competitively Binding with Poly-Nordihydroguaiaretic Acid

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Content

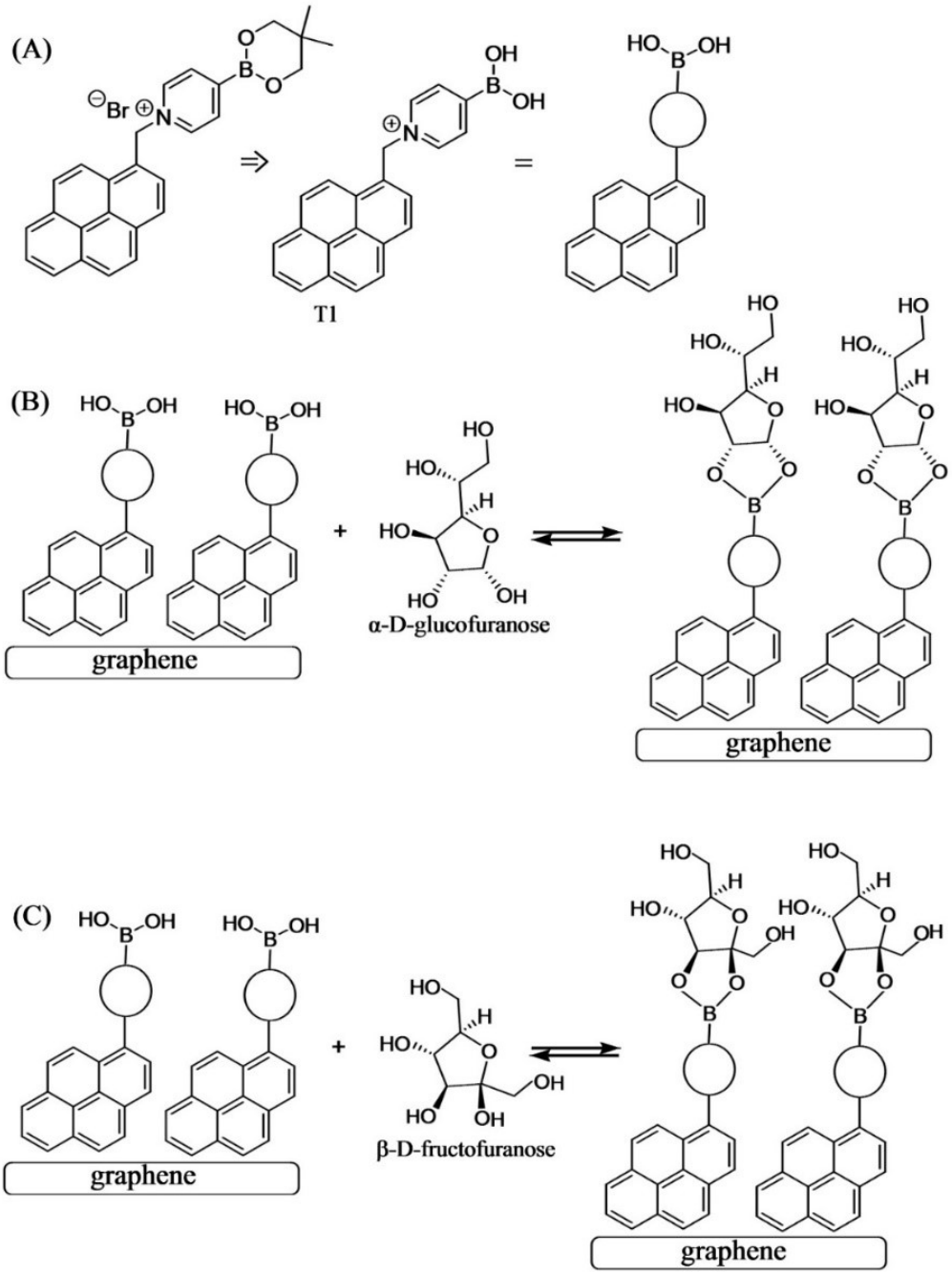

Fig. S1. (A) Molecular structure of the pyrene-boronic acid 4-borono-1-(pyren-2-ylmethyl)pyridin-1-ium bromide (T1) with molecular weight 485.7 g mol^{-1} (for the bromide salt protected by 2,2-dimethyl-propane-1,3-diol). (B,C) Schematic of graphene-immobilised boronic acid reacting with α-D-glucofuranose (the active form of glucose, present in ~0.14 %) or β-D-fructofuranose (the active form of fructose, present in ~25 %).

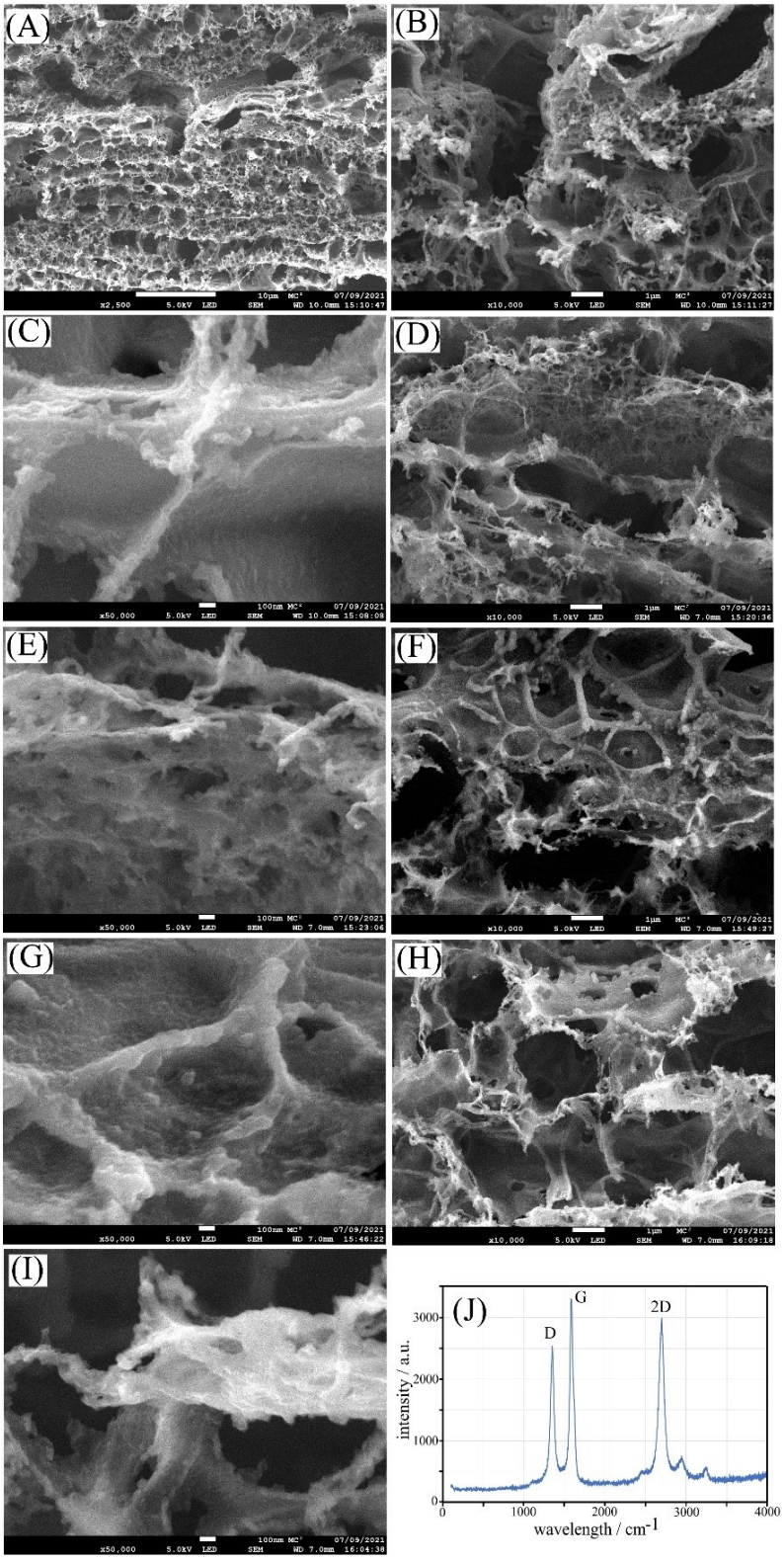

Fig. S2. (A-C) Electron micrographs for graphene foam electrodes with typically 40 μm thickness. (D,E) Graphene foam with boronic acid T1 coating (6 μg on a 4 mm diameter disk). (F,G) Graphene foam with poly-NHG coating (from 50 μM solution; approx. 1 μg on a 4 mm diameter disk). (H,I) Graphene foam with both boronic acid and poly-NHG deposits applied sequentially. (J) Raman data with D (1350 cm^{-1}), G (1587 cm^{-1}), and 2D (2701 cm^{-1}) bands indicated.

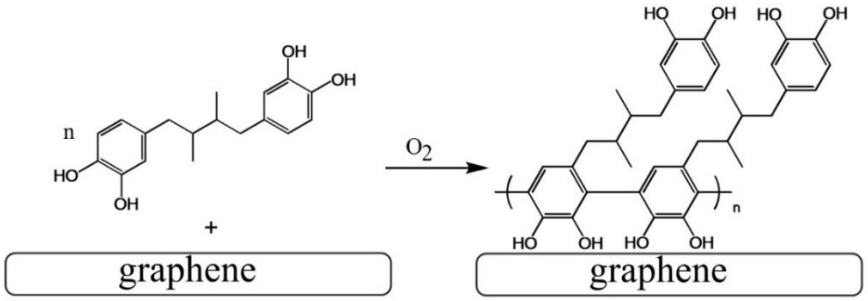

Fig. S3. Illustration of spontaneous poly-NHG formation by oxygen-driven polymerisation.

Table S1. Peak charges (scan rate 50 mV s^{-1}, for the second potential cycle) for a poly-NHG coated graphene foam electrode (4 mm diameter; 6 µg T1; 30 min in 0.05 mM NHG to form poly-NHG) immersed in 0.1 M phosphate buffer pH 7 containing different concentrations of glucose.

[glucose]	QP1$_{ox}$ / µC	QP2$_{ox}$ / µC	QP1$_{ox}$/QP2$_{ox}$	QP1$_{red}$ / µC	QP1$_{ox}$/QP1$_{red}$
1 mM	65.6	90.3	0.73	141	0.46
5 mM	69.9	71.1	0.98	144	0.49
10 mM	67.7	62.4	1.08	131	0.52
25 mM	61.5	44.4	1.39	121	0.51
50 mM	87.9	44.8	1.96	131	0.67
100 mM	77.4	31.1	2.49	118	0.65

Table S2. Peak charges (scan rate 50 mV s^{-1}, for the second potential cycle) for a poly-NHG coated graphene foam electrode (4 mm diameter; 6 μg T1; 30 min in 0.05 mM NHG to form poly-NHG) immersed in 0.1 M phosphate buffer pH 7 containing different concentrations of fructose.

[fructose]	QP1$_{ox}$ / μC	QP2$_{ox}$ / μC	QP1$_{ox}$/QP2$_{ox}$	QP1$_{red}$ / μC	QP1$_{ox}$/QP1$_{red}$
0.01 mM	87.6	127.3	0.69	186	0.47
0.1 mM	92.7	102.9	0.90	178	0.52
1 mM	111.1	86.4	1.28	172	0.64
5 mM	115.8	55.9	2.07	170	0.68
10 mM	108.6	46.3	2.35	156	0.69
25 mM	118.3	22.3	5.31	132	0.89
50 mM	125.1	28.5	4.39	138	0.91
100 mM	135.0	17.5	7.72	145	0.93