Supporting Information

Non-enzymatic glucose sensing from nitrogen-enriched detonation soot

Lutfia Isna Ardhayanti,[a,b] Md. Saidul Islam,[a]* Hafijul Islam,[a] Kashfia Nawrin,[a] Cai Ze,[a] Yoshihiro Sekine,[a] and Shinya Hayami *[a,c,d]

Experimental procedure

Preparation of purified nanodiamond (p-ND)

Detonation soot from the Daicel company was purified using a combination of salt-assisted air oxidation (SAAO) and the Fenton reaction, as described in a previous report. In this procedure, detonation soot was mixed with salt at a mass ratio of 1:3, and the resulting sample was heated under air oxidation at 425 °C for 5 hours. The annealed sample was then added to 10 mL of DI water and sonicated for 1 hour. The precipitate was then separated and continuously washed with DI water using centrifugation to remove the remaining salt. Then, the precipitate was vacuum-dried at 70 °C for 24 hours. The dried precipitate undergoes the Fenton reaction by following the procedure: add 50 mg of dried precipitate, 4 g of $FeSO_4.7H_2O$, and 2.5 mL of DI water to the round-bottom flask and sonicate until all the iron is dissolved (keeping the temperature at room temperature). Place the mixture directly in an ice bath and add 1.5 mL of sulfuric acid solution to it slowly, followed by the addition of 1.5 mL of hydrogen peroxide dropwise. These processes were carried out under sonication conditions. The reaction was exothermic, so the proper safety gear was needed and should be performed in a well-ventilated area. Kept the reaction for 1 h before continuing another cycle (1 cycle means addition of sulfuric acid, hydrogen peroxide, and 1h sonication). The cycle repeated 9 times. After the last cycle, the suspension was added with DI water and cooled to room temperature. The precipitate was then separated from the suspension using centrifugation, followed by washing with a 5% hydrochloric acid solution until no color was observed. Washed the precipitate using DI water several times until the pH became neutral and the light grey color of the precipitate appeared. Vacuum-dried precipitate formed at 70 °C for 24 h.

Sample preparation for electrochemical experiments

Mixture 0.5 mg of sample with 145 μL of DI water, 45 μL of ethanol, and 10 μL of Nafion 20%. The mixture then undergoes 1 hour of sonication. Take 5 μL of the mixture and drop cast it into the glass carbon electrode (with a diameter of 0.3 cm), then vacuum dry at 70 °C for 1 h.

Electrochemical procedure

The electrochemical measurements used for glucose sensing were cyclic voltammetry and linear sweep voltammetry. This measurement was recorded using an ALS /CH Instrument 7002E. The measurement was conducted in three-electrode cells with Glassy Carbon Electrode (GCE) as the working electrode, Ag/AgCl as the reference electrode, and platinum wire as the counter electrode. The electrolyte used was 0.1 M NaOH solution. All the working electrode was measured directly under alkaline conditions before glucose addition. The working electrode needs to be stabilized before measurement by CV cycling several times under alkaline conditions until no significant change in current is produced.

Table S1: Elemental compositions of detonation soot and p-ND obtained from XPS analysis.

Sample name	Atomic percentage (%)			
	C	N	O	Cu
Detonation soot	92.29	2.37	5.22	0.12
p-ND (SAAO+Fenton)	85.06	1.9	12.51	-

Table S2: Comparison of glucose oxidation of the current work and some other related work.

Materials	Sensitivity (μA mM^{-1} cm^{-2})	Linear range (mM)	LOD (μM)	Reference

Detonation soot	116.22	5-20	-	This work
Boron-doped diamond (BDD)	7.25	2-10	-	[1]
Boron-doped microcrystalline diamond (BDMD)	101.9	0.25-10	25	[2]
Cu@Ni	420	0.2-12.2	62.5	[3]
PtNi-BDD	110.4	2-12	-	[4]

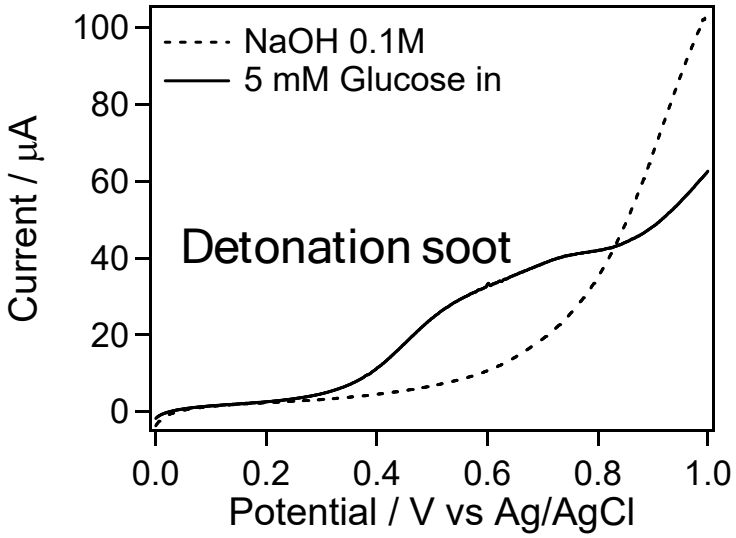

Figure S1: LSV of detonation soot with and without glucose.

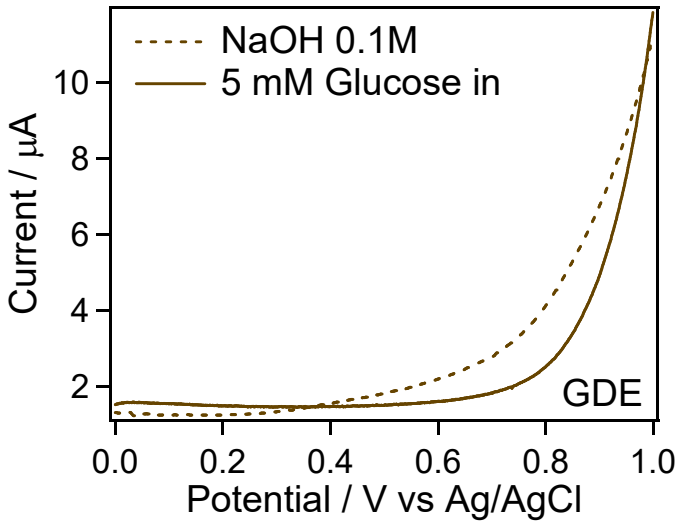

Figure S2: LSV of glassy disk electrode with and without glucose.

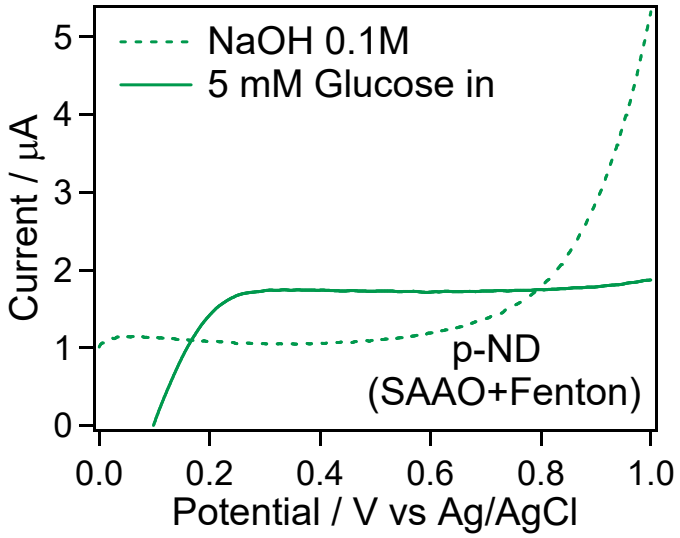

Figure S3: LSV of p-ND with and without glucose.

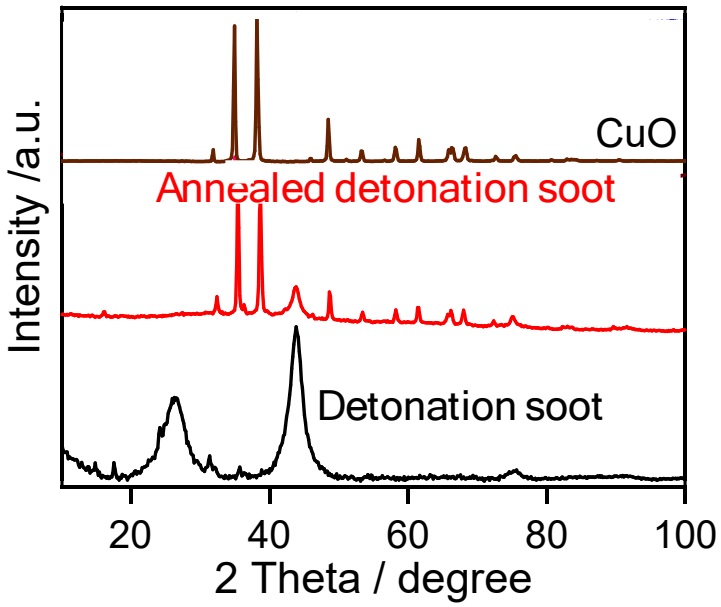

Figure S4: PXRD of detonation soot, annealed detonation soot, and CuO.

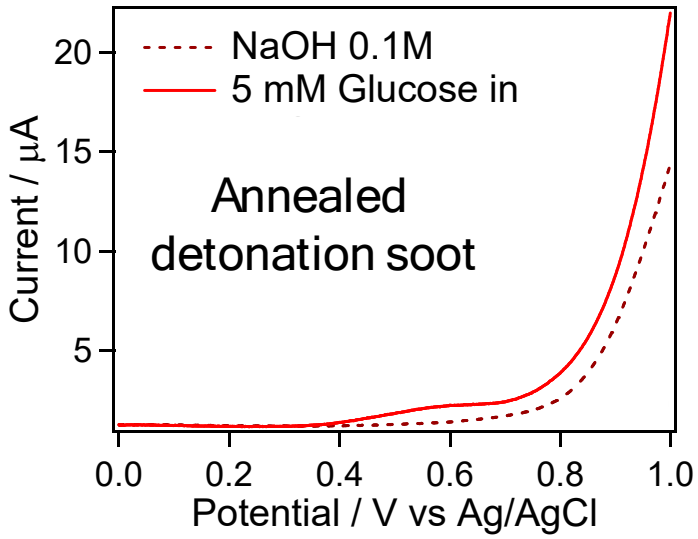

Figure S5: LSV of annealed detonation soot with and without glucose.

Reference :

[1] Z. Liu, A.F. Sartori, J.G. Buijnsters, Electrochemistry Communications, 2021, 130, 107096

[2] J. Zhao, L. Wu, J. Zhi, Analyst, 2009, 134, 794-799

[3] R. Ghosh, X. Li, M.Z. Yates, ACS Applied Materials & Interfaces, 2024, 16, 17-29

[4] R. Zhu, Z. Zhao, J. Cao, H. Li, L. Ma, K. Zhou, Z. Yu, Q. Wei, Journal of Electroanalytical Chemistry, 2022, 907, 116084