1 SUPPLEMENTAL

Treatment	Element	Weight %	Atomic %
Sonochemical electrodeposition (SED)	СК	5.7	41.0 ± 12.9
	O K	3.4	18.7 ± 12.5
	Pt M	88.1	39.2 ± 2.2
	Pt L	0.4	1.2 ± 0.6
	Pb M	0.2	0.1 ± 5 13.7
Combination of sonochemical and pulsed deposition in phase (SPED)	CK	13.3	61.4 ± 10.6
	O K	4.4	15.3 ± 11.8
	Pt M	81.6	23.1 ± 2.5
	Pt L	0.1	2.1 ± 1.5
	Pb M	0.6	0.2 ± 24.1
Pulsed electrodeposition (PED)	CK	15.9	64.4 ± 10.0
	0 K	1.3	11.1 ± 11.6
	Pt M	74.0	18.2 ± 2.7
	Pt L	2.1	0.9 ± 0.6
	Pb M	0.8	0.8 ± 10.4
Combination of sonochemical and pulsed deposition in phase (pulSED)	CK	18.3	67.0 ± 10.5
	OK	1.3	13.8 ± 11.9
	Pt M	69.0	14.7 ± 3.2
	Pt L	3.2	2.2 ± 1.5
	Pb M	1.9	1.6 ± 11.9

Table S1. EDX data for nanoplatinum deposited using various treatments.



- 10 reduce the diffusion layer. This serves to improve the electrodeposition process of
- 11 nanomaterials onto the working electrode.





15 **Figure S2.** Schematic of the sonoelectrodeposition system. The working electrode was

16 a Pt/Ir electrode with a Pt counter electrode. The cup holding the plating solution is

17 placed in the bath sonicator. Power to the sonicator and power supply are controlled by

18 an Arduino microcontroller.



Figure S3. Schematic representation of four plating treatments used in this work: (A)
sonochemical electrodeposition with no pulsing (SED); both plating potential and
sonicator are active for a fixed duration. (B) Pulsed SED (pulSED); plating potential
duration (T_{ON}) and sonication duration (T_{US}) are alternated a number of cycles (N_{CYCLES}).
(C) No sonication; plating potential is pulsed (PED). (D) Constant sonication and pulsed
plating potential (SPED).



29 Figure S4. Scanning electron micrographs for various treatments (a) SED, (b) SPED,

30 (c) PED, (d) pulSED.

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Figure S7. Trend between ES and sensitivity for various nanoplatinum probes shown in Table 1. The pulSED technique (550 mHz) was higher than all other methods used in this manuscript, and significantly higher than previous publications using nanplatinum only. The graphene-nanoplatinum "sandwich" by Vanegas et al (2014) was similar in terms of sensitivity towards H₂O₂, but had a lower electroactive surface area than the pulSED nanoplatinum.



56 Figure S8. Representative cyclic voltammograms for various pulSED duty cycles. The









Figure S10. Cyclic voltammograms for pulSED nanoplatinum-modified electrodes in the

absence and presence of 5mM β glucose (PBS buffer at pH 7.1) at a scan rate of 50

80 mV sec⁻¹





Figure S11. Effect of concentration on response time for pulSED sensors a)
 Representative step change in oxidative current showing the data and the empirical
 model. Panels b and c: average response time as a function of total concentration for b)
 hydrogen peroxide and c) glucose sensors



Figure S12. Effect of Nafion on reducing interference by electroactive species such as ascorbic acid (AA) at +500 mV operating potential. The DCPA plot clearly shows that the Nafion-modified electrode was sensitive to $1 \text{mM} \text{H}_2\text{O}_2$ addition, but not AA. The red arrows represent total AA concentrations of 2.5 mM and 5.0 mM. Addition of AA did not cause a change in oxidative current (less than 1% change for concentrations between 0.1 mM and 5mM).

95 Calculating metal thickness with Faraday's Law

96 According to Faraday's Law, the mass of plated metal in is:

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$$M = \frac{I^* t^* M W}{z^* F}$$
 (Equation S1)

where: 98 M = Mass of plated metal [g] 99 100 I = Plating current [Coul sec⁻¹] t = Plating time [sec] 101 MW = Atomic weight of metal [g mol⁻¹] 102 103 z = Valence of the dissolved metal [eq mol⁻¹]F = Faraday's constant [96,485 Coul eq⁻¹] 104 105 The thickness of the plated metal can be calculated by: 106 $T = \frac{M}{\rho^* A_s}$ (Equation S2) 107 where: 108 T = Thickness of plated metal [µm] 109 ρ = density of metal [g cm³] 110 A_s = Physical surface area of the electrode [cm²] 111 112