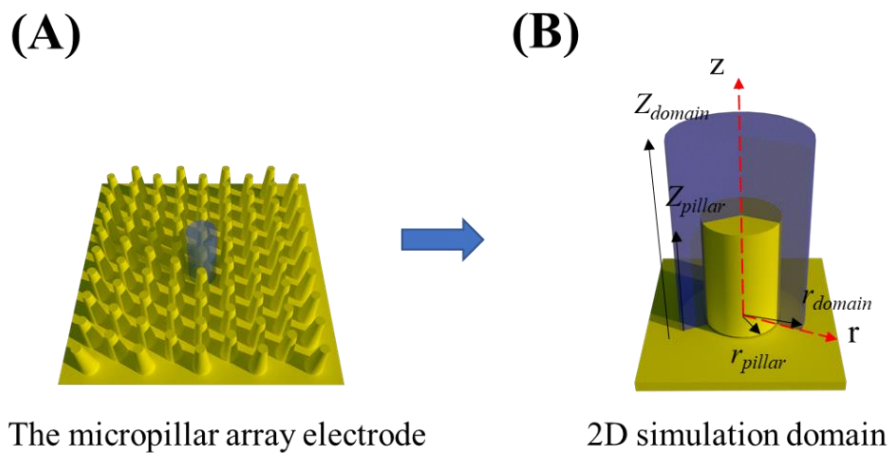


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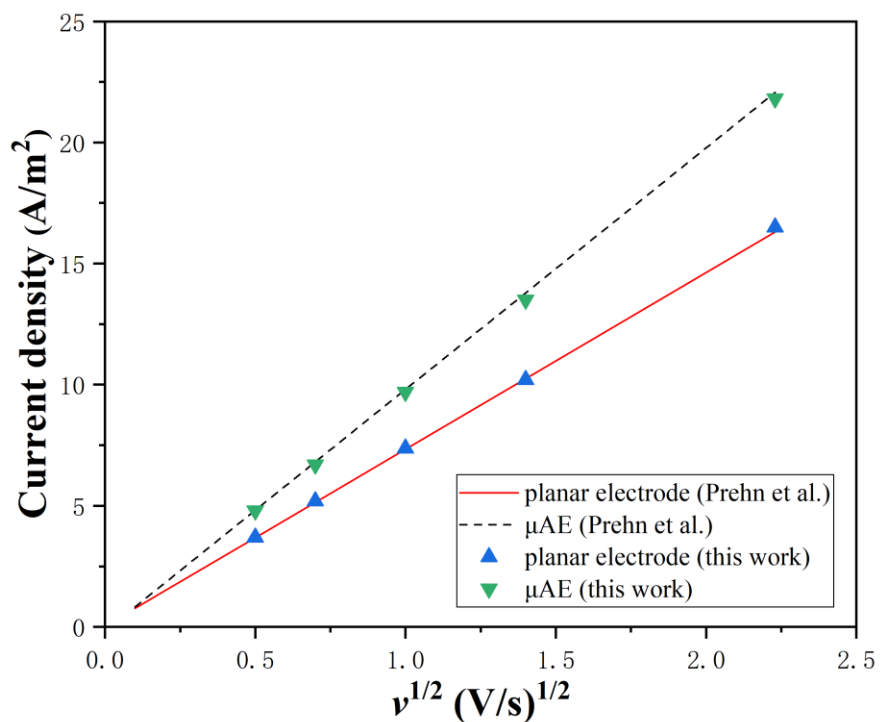
Electronic Supporting Information (ESI)



2

3 **Figure S1. (A) The schematic representation of the μ AE. The blue cylinder represents the**
4 **diffusion domain created for the simulation model. (B) The model with one pillar and a**
5 **cylindrical diffusion domain for the numerical simulation.**

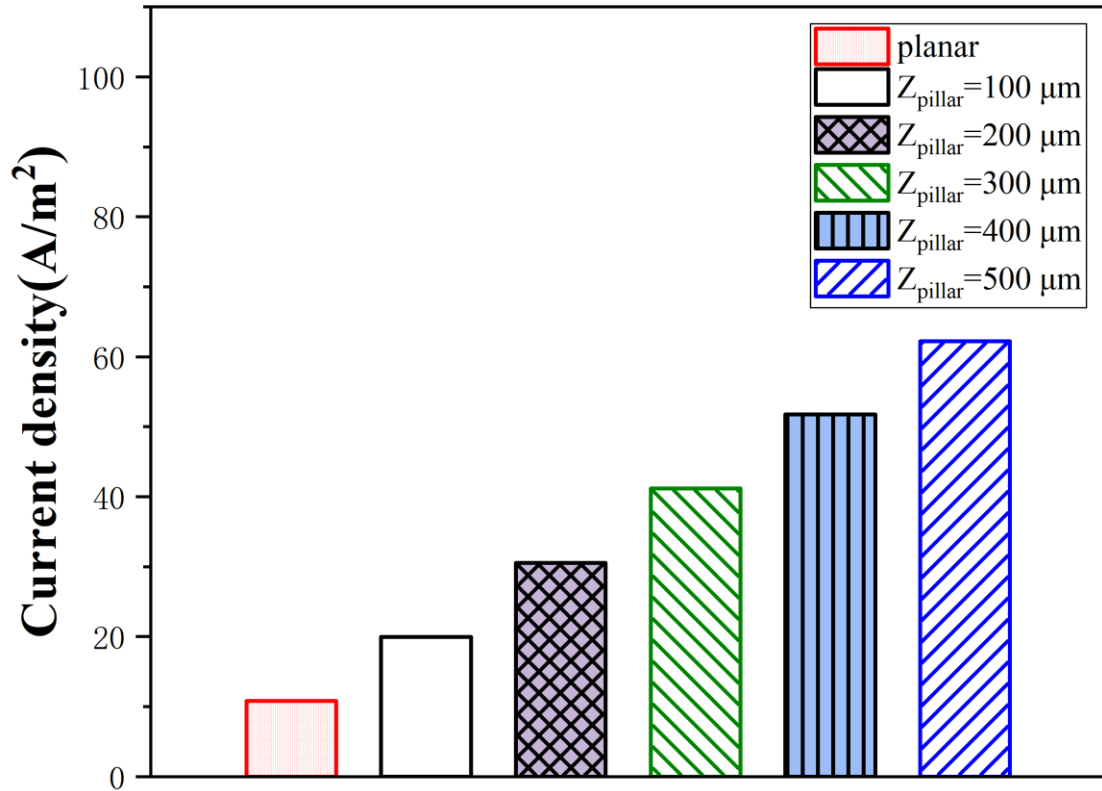
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7
 8 **Figure S2. The current density from the simulation of electrodes with the same geometry**
 9 **and boundary conditions as those in the previous literature. The height, radius, and**
 10 **separation of the μAE were 10 μm, 10 μm and 100 μm, respectively.**

11

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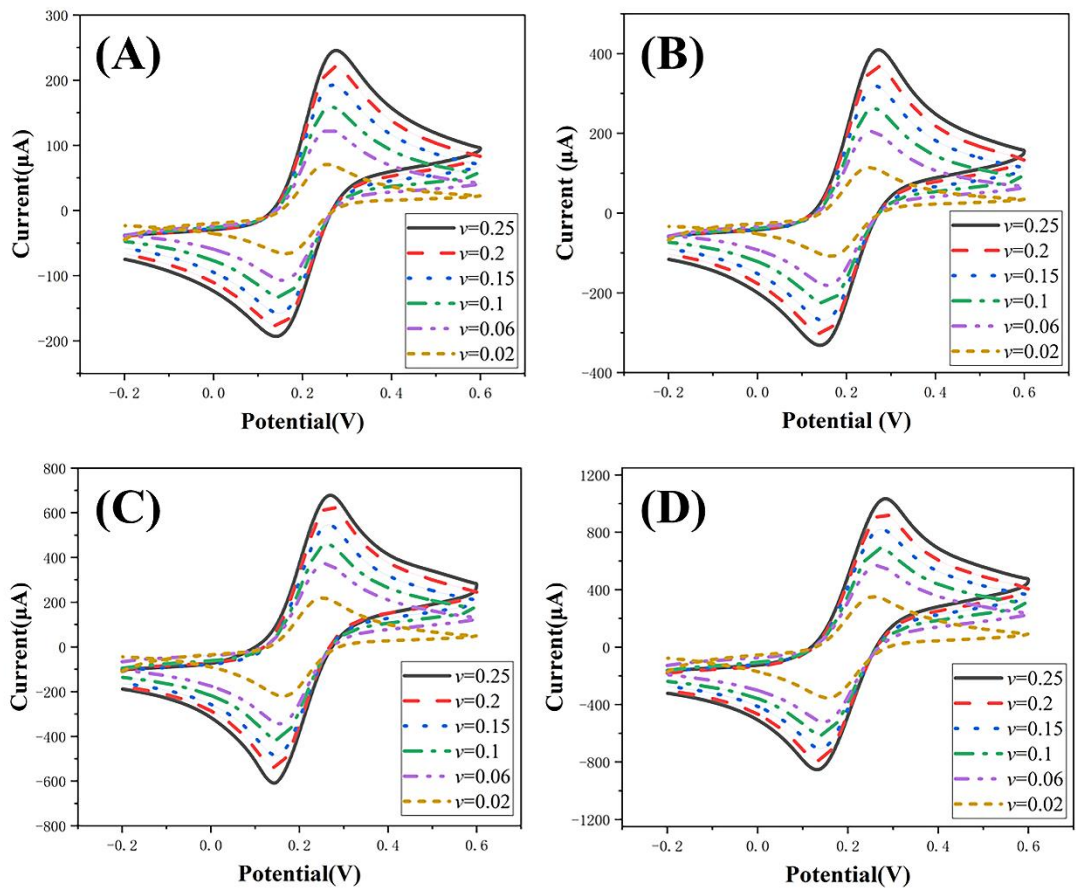


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14 **Figure S3. The current density on the planar electrode and μ AEs with distinct pillar**

15 **heights. Z_{pillar} is the pillar height.**

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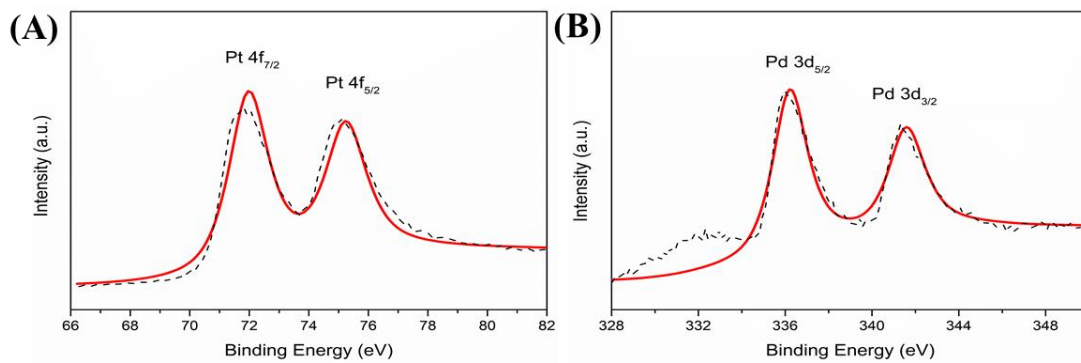


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18 **Figure S4. Cyclic voltammetry of the planar (A), $\mu\text{AE}100$ (B), $\mu\text{AE}300$ (C), and $\mu\text{AE}500$**

19 **(D) in the $\text{K}_3[\text{Fe}(\text{CN})_6]/\text{K}_4[\text{Fe}(\text{CN})_6]$ solution with different scan rate ν .**

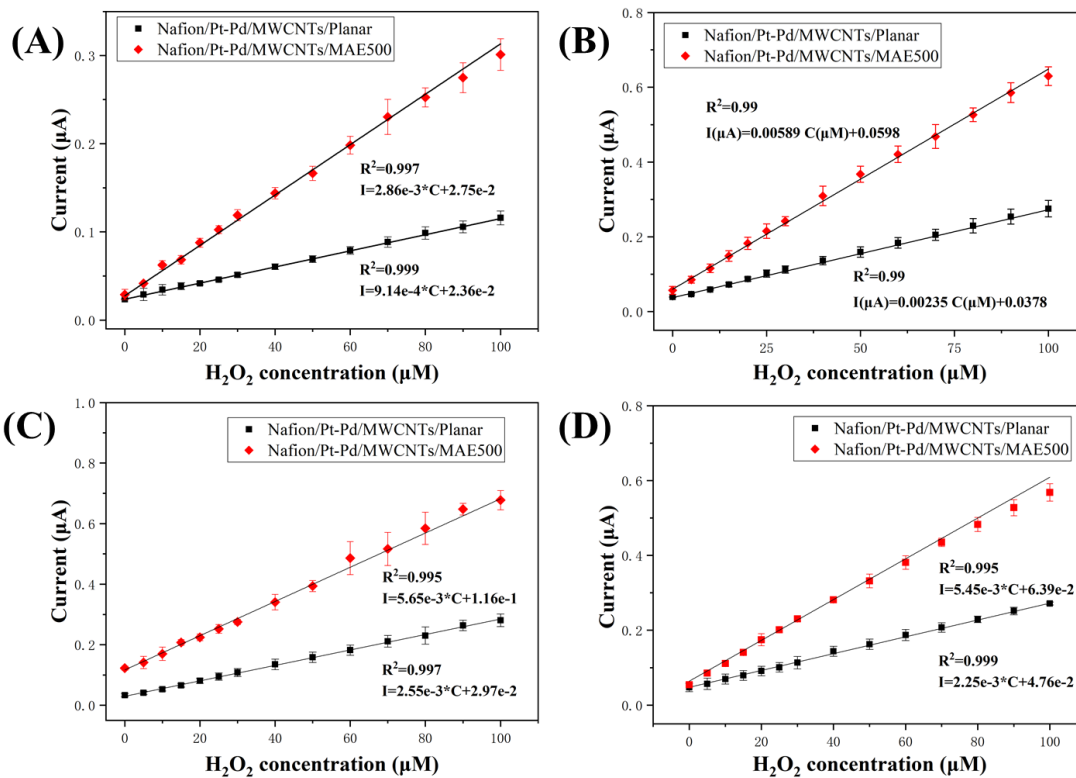
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22 **Figure S5. The XPS spectra of (A) Pt and (B) Pd in the Pt-Pd/MWCNTs nanocomposites.**

23



24

25 **Figure S6. The calibration curve of the μ AE500 and the planar electrodes, when (A) 1 μ g,**
 26 **(B) 2 μ g, (C) 4 μ g, and (D) 8 μ g Pt-Pd/MWCNTs were deposited on to both types of**
 27 **electrodes.**

28

29 **Table S1 Boundary conditions used in the simulations.**

Equations	Boundary
$[A] = [A]_{bulk}$	$0 \leq r \leq r_{domain}, z = z_{domain}$
$[B] = 0$	$0 \leq r \leq r_{domain}, z = z_{domain}$
$\frac{\partial A}{\partial r} = \frac{\partial B}{\partial r} = 0$	$r = 0, z_{pillar} < z < z_{domain}$ $r = r_{domain}, 0 < z < z_{domain}$
$D_A \frac{\partial A}{\partial r} = -D_B \frac{\partial B}{\partial r} = k_f A - k_b B$	$r \leq r_{pillar}, z = z_{pillar}$ $r = r_{pillar}, 0 < z < z_{pillar}$ $r_{pillar} < r < r_{domain}, z = 0$

30

31

32 **Table S2 Parameters of the micropillar working electrode**

	planar	μ AE100	μ AE300	μ AE500
Projection area (mm*mm)	3 × 3			
The top radius of the top surfaces (μ m)	-	50		
Base radius of the base surfaces (μ m)	-	100		
Height (μ m)	-	100	300	500
Pitch (μ m) ^a	-	300		
Number of pillars	-	90		
Surface area (cm ²)	0.09	0.1161	0.1971	0.2817
Normalised area ^b	1.0	1.29	2.19	3.13

33 ^aDistance from pillar to pillar centers.

34 ^bNormalised by the area of the planar electrode.

35

36 **Table S3 Comparison of the electrochemical biosensors and their performances in**
 37 **sarcosine detection.**

Electrode	Modification	Electrode type	Linear range (μM)	Sensitivity ($\mu\text{A}\cdot\text{mM}^{-1}\cdot\text{cm}^{-2}$)	Detection limit (μM)	References
Glassy carbon electrode	Sarcosine oxidase/ platinum - mesoporous nickel phosphonate	planar	5-40	123.51	0.24	[1]
Glassy carbon electrode	Riboflavin/ gold- platinum bimetallic nanoparticles- polypyrrole/graphen e-chitosan	planar	2.5-30	N/A	0.68	[2]
Glassy carbon electrode	Sarcosine oxidase/platinum@ porous zeolitic imidazolate framework-8	planar	5-30	14.3	1.06	[3]
Screen printed electrodes	Sarcosine oxidase	planar	0.01-0.1	N/A	0.016	[4]
graphite rod electrode	Polyvinylalcohol- partially prehydrolyzed tetraethyl orthosilicate	planar	500-7500	40.1	500	[5]
μAE	Nafion/Pt- Pd/MWCNTs	μAE	5-60	17.1	1.28	This work

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41

42 **Reference**

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