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Supporting information

An efficient biosensor using functionalized microneedle of Cu_2O-based CoCu-LDH for glucose detection

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Table

Table S1. The performance comparison of CoCu-LDH/Cu_2O/ANE with other published glucose sensors.

Table S2. The influence of different detection methods on the glucose test in human serum samples.

Table S1.

Electrode	substrate	Linear Range (mM)	Sensitivity (μA mM^{-1})	Detection limit (μM)	References
Au@Cu_2O	GCE	0.05~2.0	50.48	18	1
Ag@Ni-MOF	GCE	0.005~0.5	11.31	5	2
CuO/Cu_2O	GCE	0.1~6	137.67	1	3
Cu_xS_y	SPCE	0.2~16	13	0.2	4
$NiCeO_x$/MWCNTs	GCE	0.007~0.466 0.466~3.44	84.27 53.22	1.8	5
CoCu-LDH/Cu_2O	ANE	0.03~0.40 0.40~6.00	116.13 52.08	0.46	This work

The performance comparison of CoCu-LDH/Cu_2O/ANE with other published glucose sensors.

Table S2.

Hospital Detection (mM)	Co-LDH/Cu_2O/ANE Detection (mM)	Sinocare SG-103 Detection (mM)
0.498	0.49	0.48
0.518	0.51	0.55

The influence of different detection methods on the glucose test in human serum samples.

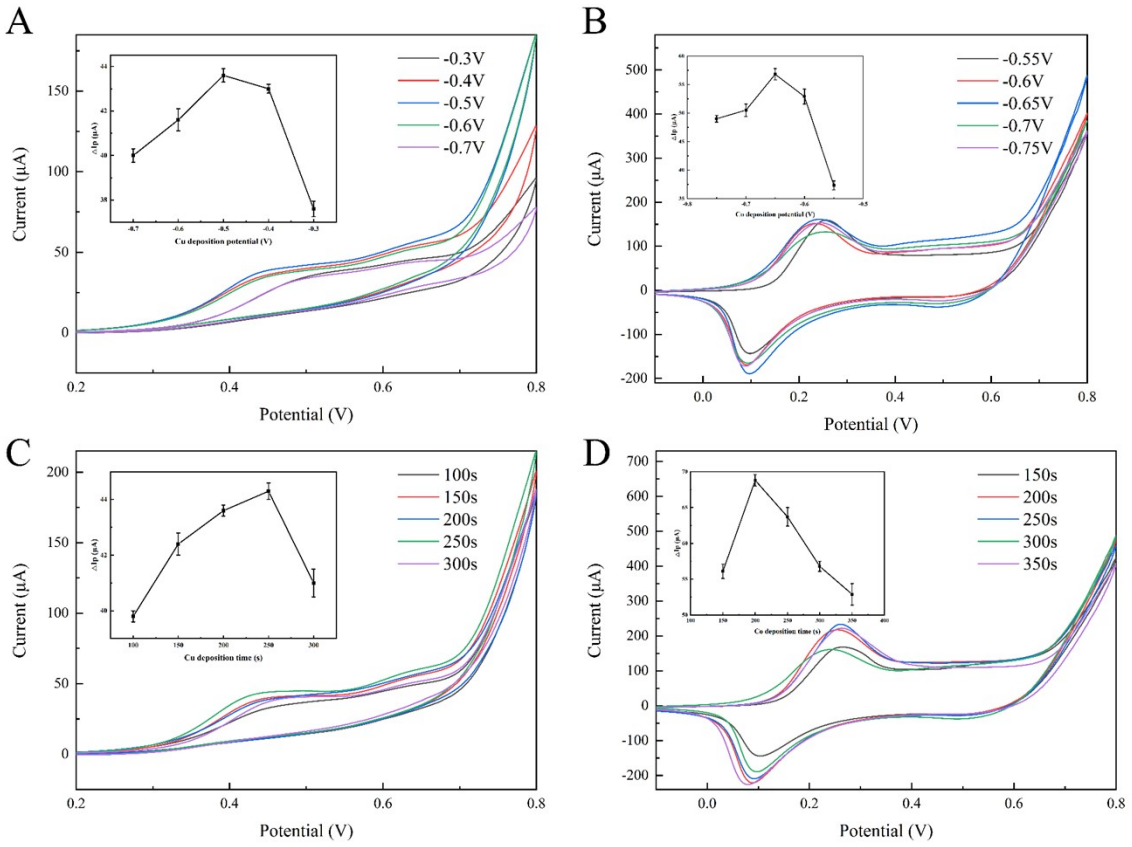
Figure captions

Fig. S1. Effects of electrodeposition conditions on CoCu-LDH/Cu_2O/ANE in the presence of 4 mM glucose (A) different electrodeposition potentials for Cu_2O NPs, (B) different electrodeposition potentials for CoCu-LDH, (C) different electrodeposition time for Cu_2O NPs, and (D) different electrodeposition time for CoCu-LDH. Inset: the effect of different preparation conditions on ΔIp.

Fig. S2. (A) FE-SEM images of CoCu-LDH/Cu_2O/ANE preparation with the optimum electrodeposition parameters. (B) FE-SEM images of CoCu-LDH/Cu_2O/ANE electrode prepared by CoCu-LDH with electrodeposition potential of -0.65 V and deposition time of 350 s.

Fig. S3. Optimizing the conditions of (A) the electrodeposition concentration of $CuSO_4$ in the presence of 4 mM glucose, (B) the electrodeposition molar ratio of $Co(NO_3)_2/CuSO_4$ in the presence of 4 mM glucose, (C) the applied potential of CoCu-LDH/Cu_2O/ANE sensor with the continuous addition of 0.2 mM glucose. Inset: the effect of different preparation conditions on ΔIp. All optimal conditions were obtained in the 0.1 M NaOH solution.

Fig. S4. (A) Amperogram of the CoCu-LDH/Cu_2O/ANE sensor during successive addition of 0.5 mM glucose, 0.05 mM DA, 0.05 mM AA, 0.05 mM UA, 0.05 mM NaCl into 0.1 M NaOH solution at the applied potential of 0.55 V. (B) The ΔIp of five independent CoCu-LDH/Cu_2O/ANE (E1, E2, E3, E4, E5) towards 4 mM glucose in 0.1 M NaOH. (C) The electrocatalytic efficiency of the CoCu-LDH/Cu_2O/ANE sensor toward 1 mM glucose in 15 days. (D) FE-SEM images of CoCu-LDH/Cu_2O/ANE after repeated usage.



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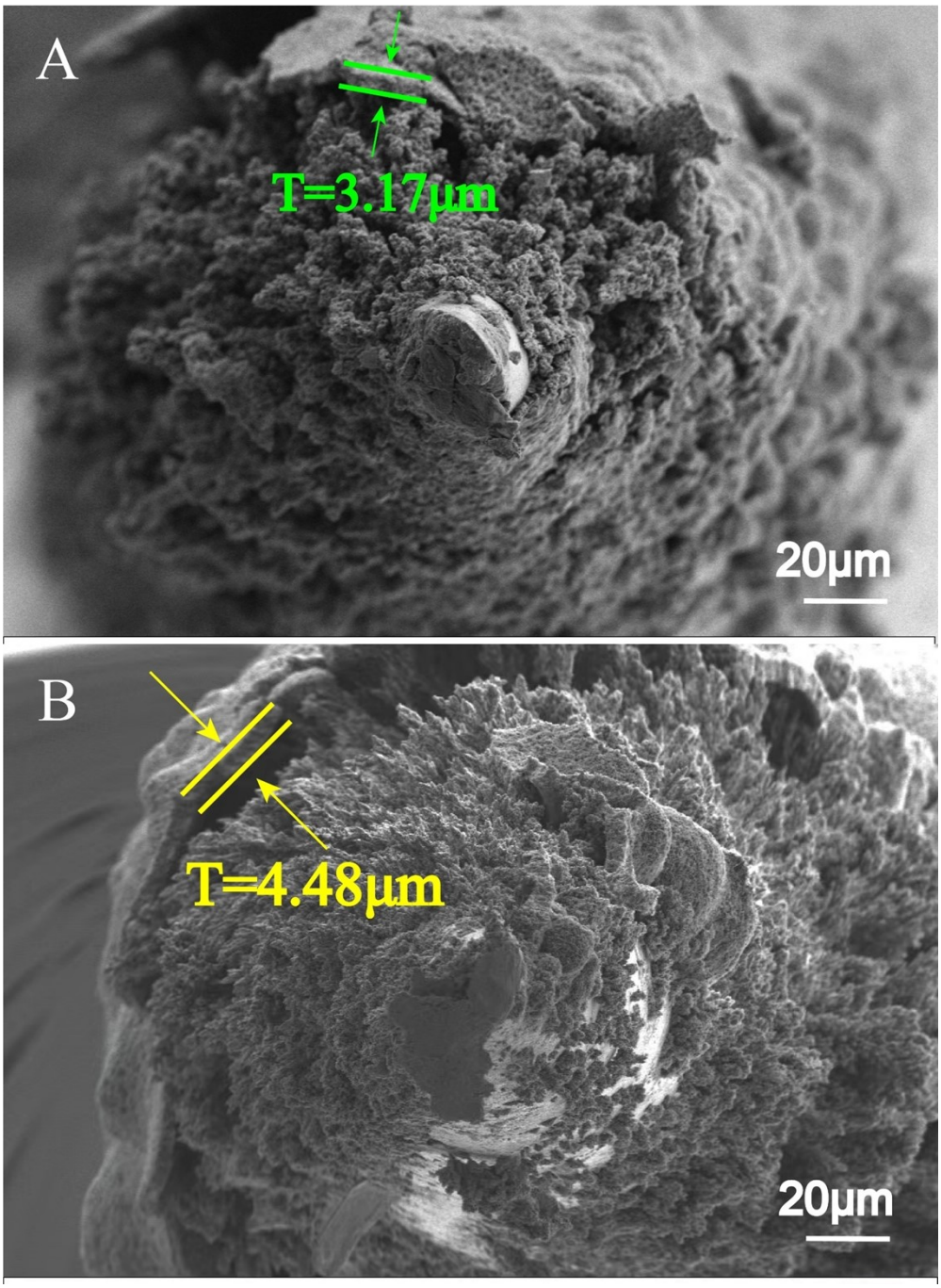

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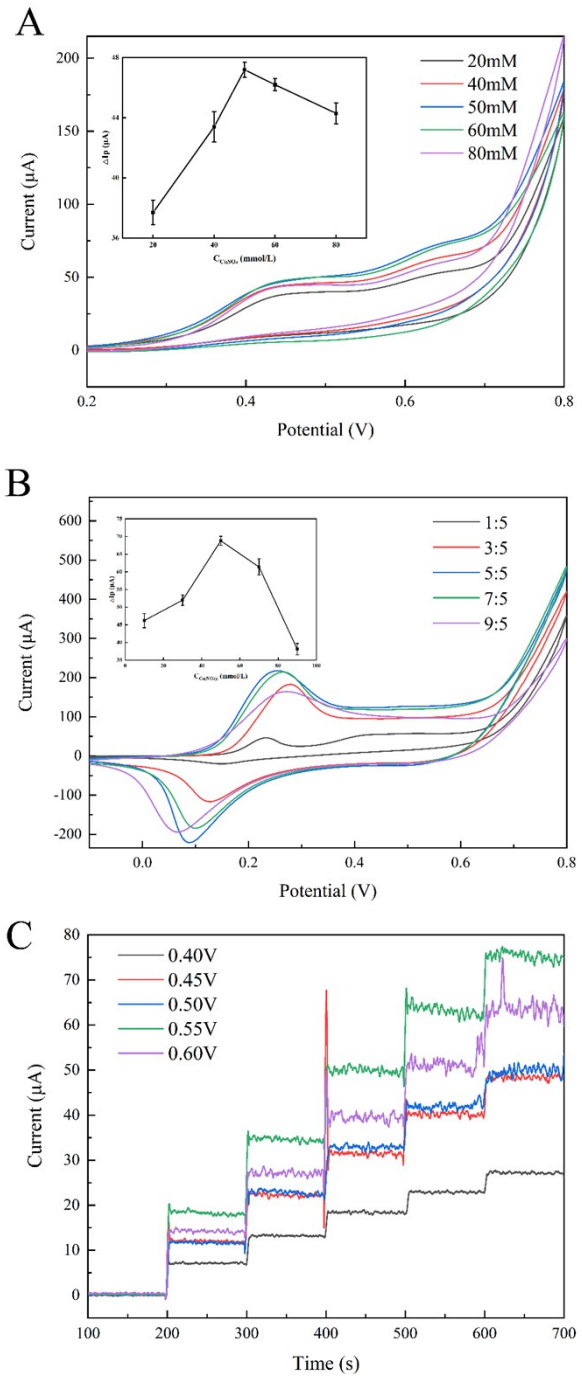

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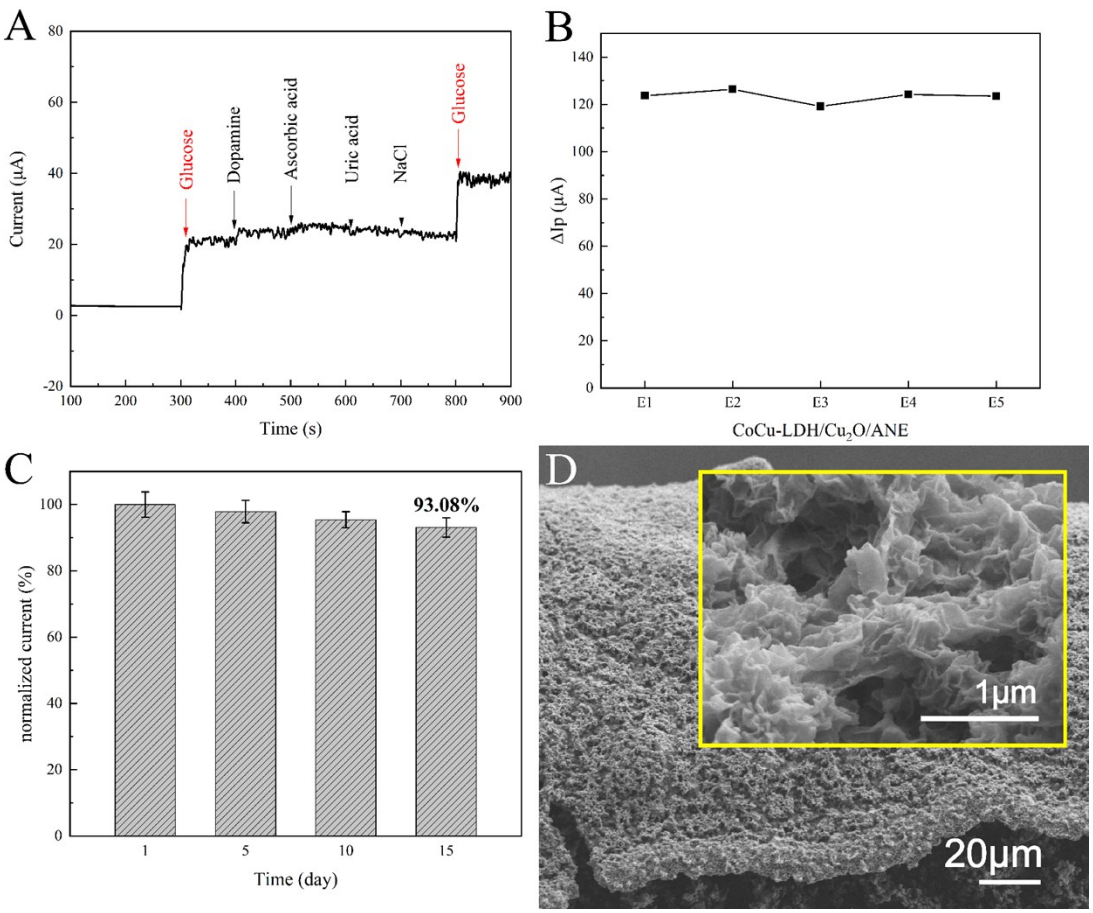

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References

1. Y. Su, H. Guo, Z. Wang, Y. Long, W. Li and Y. Tu, *Sensors and Actuators B-Chemical*, 2018, **255**, 2510-2519.
2. J. Cao, J. Yun, N. Zhang, Y. Wei, H. Yang and Z. Xu, *Synthetic Metals*, 2021, **282**.
3. R. Li, X. Liu, H. Wang, Y. Wu, K. C. Chan and Z. Lu, *Electrochimica Acta*, 2019, **299**, 470-478.
4. P. Tetyana, N. Mphuthi, A. N. Jijana, N. Moloto, P. M. Shumbula, A. Skepu, L. S. Vilakazi and L. Sikhwivhilu, *Journal*, 2023, **13**.
5. M. Waqas, L. Yang, Y. Wei, Y. Sun, F. Yang, Y. Fan and W. Chen, *Electrochimica Acta*, 2023, **440**.