CeO$_2$-Co$_3$O$_4$ Nanocomposites with Oxidase-like Activity for Ascorbic Acid Detection

Jin Yang, Shiqi Cheng, Shangying Qin, Li Huang, Yuanjin Xu and Yilin Wang*

School of Chemistry and Chemical Engineering, Guangxi Key Laboratory of Electrochemical Energy Materials, Guangxi University, Nanning 530004, China
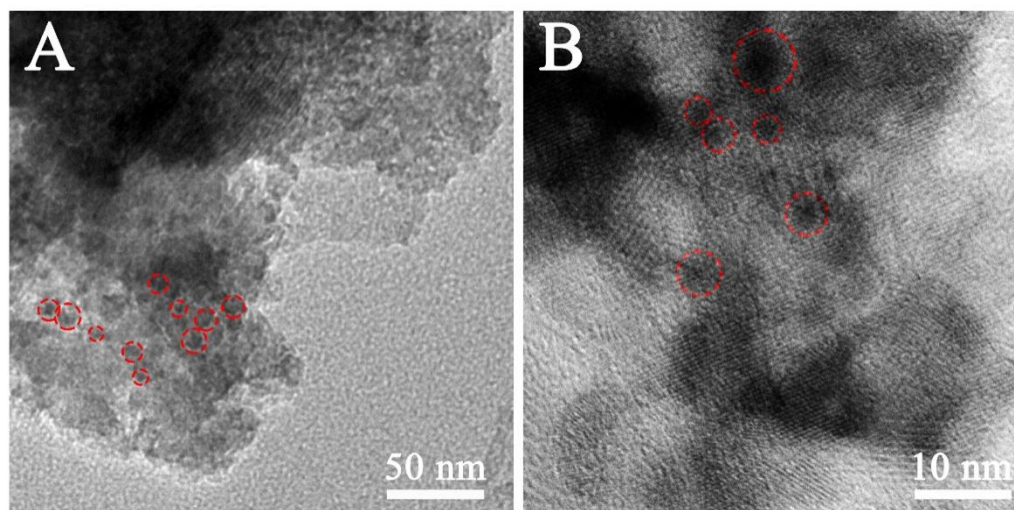
Fig. S1 Typical TEM images of CeO$_2$-Co$_3$O$_4$ NC (A, B).

—

Corresponding author, E-mail address: theanalyst@163.com (Y. Wang)

Table S1. CeO$_2$-Co$_3$O$_4$ NC affinity for substrate TMB (K_m) compared to other nanomaterials.

Nanomaterial	Enzyme	K_m (mM) TMB	V_{max} (10^{-8} M s^{-1}) TMB	References
CeO$_2$ NRs	Oxidases	0.22	48	1
Co$_3$O$_4$ nanoflowers	Oxidases	0.047	4.6	2
CeO$_2$ NPs	Oxidases	0.80	30	3
CeO$_2$ NPs	Oxidases	0.42	10	4
CeO$_2$ NPs	Oxidases	0.14	60	5
Co$_3$O$_4$ NPs	Oxidases	0.051	3.3	6
CeO$_2$ NCs	Oxidases	0.96	6	7
Co$_3$O$_4$ nanosheets	Oxidases	0.35	0.5	8
HPR	*	0.434	10	9
CeO$_2$-Co$_3$O$_4$ NC	Oxidases	0.15	2.7	This work

Table S2. Comparison of analytical performance of AA with different materials.

Material	Analytical method	Linear range (μM)	Detection limit (μM)	References
Fe-Mn nanozymes	Colorimetric	8-56	0.88	10
Ag NPs	Colorimetric	0.4-5	0.13	11
PSS-rGO	Colorimetric	0.8-60	0.15	12
WSCN	Colorimetric	0-14	0.50	13
CuO/Pt nanocomposites	Colorimetric	1-600	0.79	14
Au/Cu NRs	Colorimetric	0-2000	25	15
Pt/ZnCo$_2$O$_4$	Colorimetric	1-15	0.46	16
CuCo$_2$O$_4$ microspheres	Colorimetric	1-10	0.57	17
CDs/Fe$_3$O$_4$ hybrid nanofibers	Colorimetric	1-30	0.28	18
CeO$_2$-Co$_3$O$_4$ NC	Colorimetric	1-500	0.25	This work

References

1. L. Huang, W. Zhang, K. Chen, W. Zhu, X. Liu, R. Wang, X. Zhang, N. Hu, Y. Suo and J. Wang, *Chem. Eng. J.*, 2017, **330**, 746-752.
2. X. Liu, L. Yan, H. Ren, Y. Cai, C. Liu, L. Zeng, J. Guo and A. Liu, *Biosens. Bioelectron.*, 2020, **165**, 112342.
3. W. Qin, L. Su, C. Yang, Y. Ma, H. Zhang and X. Chen, *J Agric. Food Chem.*, 2014, **62**, 5827-5834.

4. A. Asati, S. Santra, C. Kaittanis, S. Nath and J. M. Perez, *Angew. Chem., Int. Ed.*, 2009, **48**, 2308-2312.

5. H. Cheng, S. Lin, F. Muhammad, Y.-W. Lin and H. Wei, *ACS Sens.*, 2016, **1**, 1336-1343.

6. Y. Zhao, Y. Wang, A. Mathur, Y. Wang, V. Maheshwari, H. Su and J. Liu, *Nanoscale*, 2019, **11**, 17841-17850.

7. M. Zhu, Y. Wen, S. Song, A. Zheng, J. Li, W. Sun, Y. Dai, K. Yin and L. Sun, *Nanoscale*, 2020, **12**, 19104-19111.

8. R. D. Isho, N. M. Sher Mohammad and K. M. Omer, *Anal. Biochem.*, 2022, **654**, 114818.

9. C. Yuan, X. Qin, Y. Xu, Q. Jing, R. Shi and Y. Wang, *Microchem. J.*, 2020, **159**, 105365.

10. Y. Han, L. Luo, L. Zhang, Y. Kang, H. Sun, J. Dan, J. Sun, W. Zhang, T. Yue and J. Wang, *LWT*, 2022, **154**, 112821.

11. F. Li, Y. Yu, F. Xiao, H. Liang, C. Liu, P. Fan and S. Yang, *Luminescence*, 2020, **35**, 1084-1091.

12. J. Chen, J. Ge, L. Zhang, Z. Li, J. Li, Y. Sun and L. Qu, *Microchim. Acta*, 2016, **183**, 1847-1853.

13. M. Chen, R. Lu and A. Yu, *Mater. Lett.*, 2020, **263**, 127253.

14. X. Wang, Q. Han, S. Cai, T. Wang, C. Qi, R. Yang and C. Wang, *Analyst.*, 2017, **142**, 2500-2506.

15. S. Xu, X. Dong, S. Chen, Y. Zhao, G. Shan, Y. Sun, Y. Chen and Y. Liu, *Sens. Actua. B.*, 2019, **281**, 375-382.

16. D. Yin, X. Cao, X. Liu, Z. Yang, Z. Liu, D. Wang, Q. Liu, X. Zhang and X. Zhang, *New J. Chem.*, 2020, **44**, 12002-12008.

17. S. Han, X. Chen, Y. Fan, Y. Zhang, Z. Yang, X. Kong, Z. Liu, Q. Liu and X. Zhang, *New J. Chem.*, 2021, **45**, 2030-2037.

18. S. Chen, M. Chi, Z. Yang, M. Gao, C. Wang and X. Lu, *Inorg Chem Front.*, 2017, **4**, 1621-1627.