Electronic Supplementary Material (ESI) for RSC Advances.


# Supporting Information

## $Mn_3O_4$ hollow microcubes and solid nanospheres derived from a metal formate framework for electrochemical capacitor applications

Zhihe Liu, Li Zhang*, Guancheng Xu, Lu Zhang, Dianzeng Jia* Chuyang Zhang

Key Laboratory of Energy Materials Chemistry (Xinjiang University), Ministry of Education.
Key Laboratory of Advanced Functional Materials, Autonomous Region.
Physics and Chemistry Detecting Center, Xinjiang University, Urumqi, 830046, Xinjiang, P. R. China.

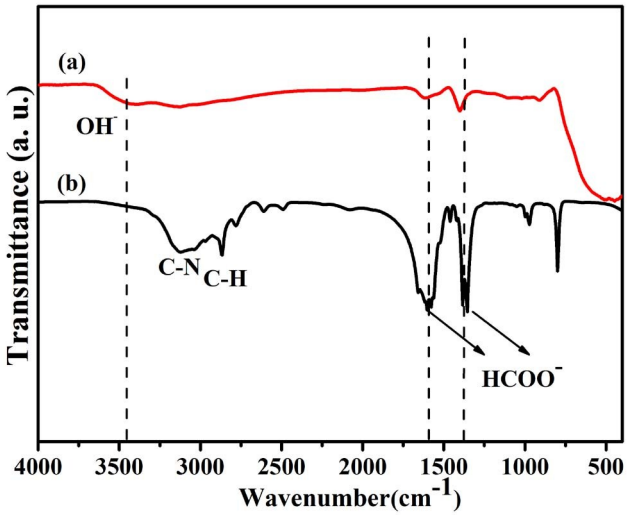


Fig. S1 FT-IR spectra of the precursor (a) and the obtained product by NaOH treatment of precursor (b).

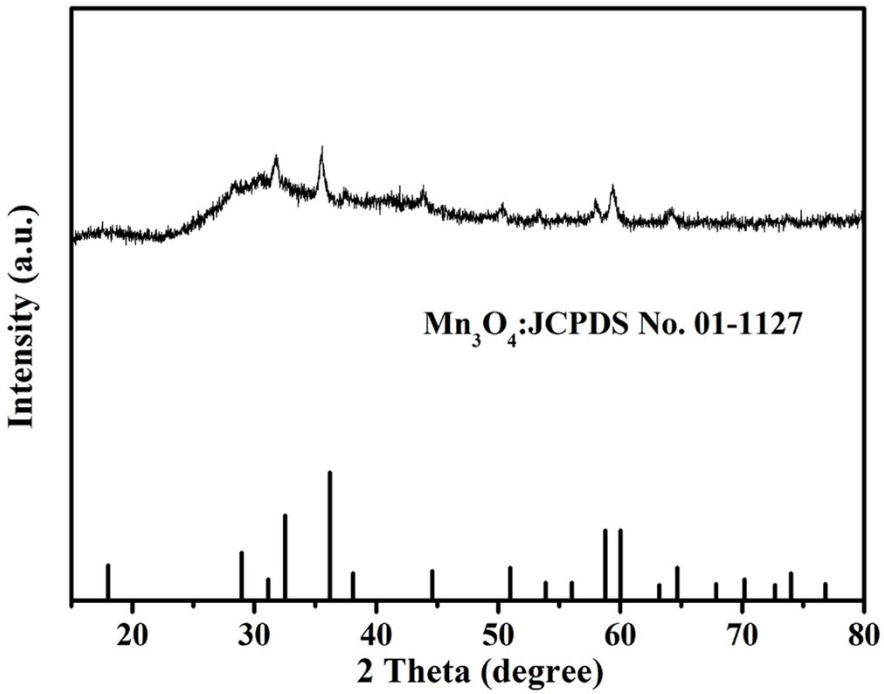


Fig. S2 XRD pattern of $Mn_3O_4$ hollow microcubes synthesized by reaction for 12 h.

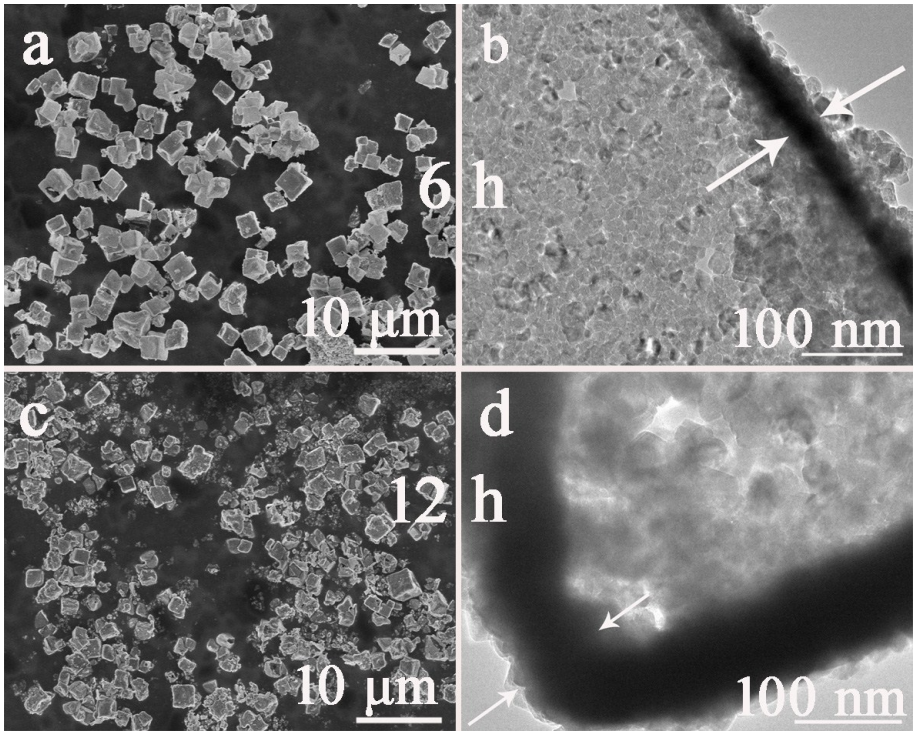


Fig. S3 SEM (a, c) and TEM images (b, d) of $Mn_3O_4$ hollow microcubes synthesized by reaction for 6 h and 12 h.

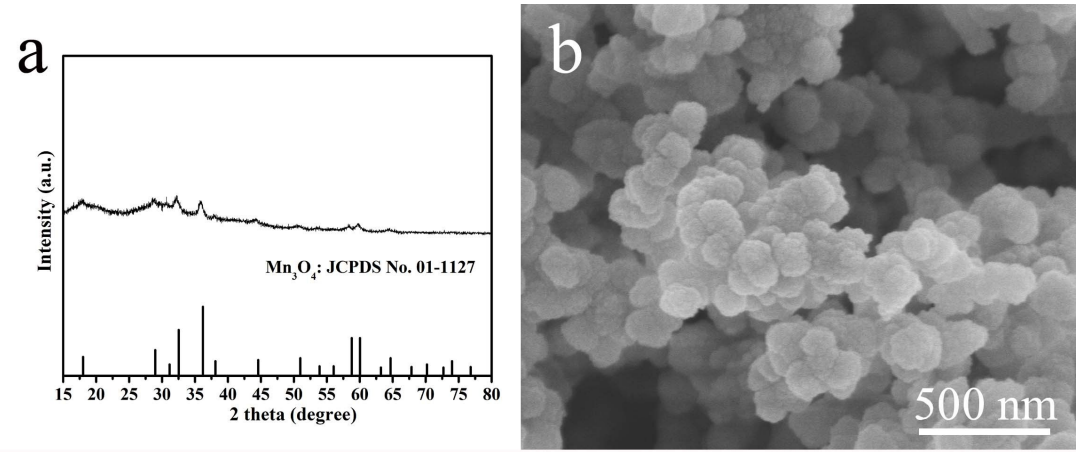


Fig. S4 XRD pattern (a) and SEM image (b) of $Mn_3O_4$ nanoparticles synthesized by reaction of precursor with alkaline solution in a molar ratio of 1:2 for 6 h.

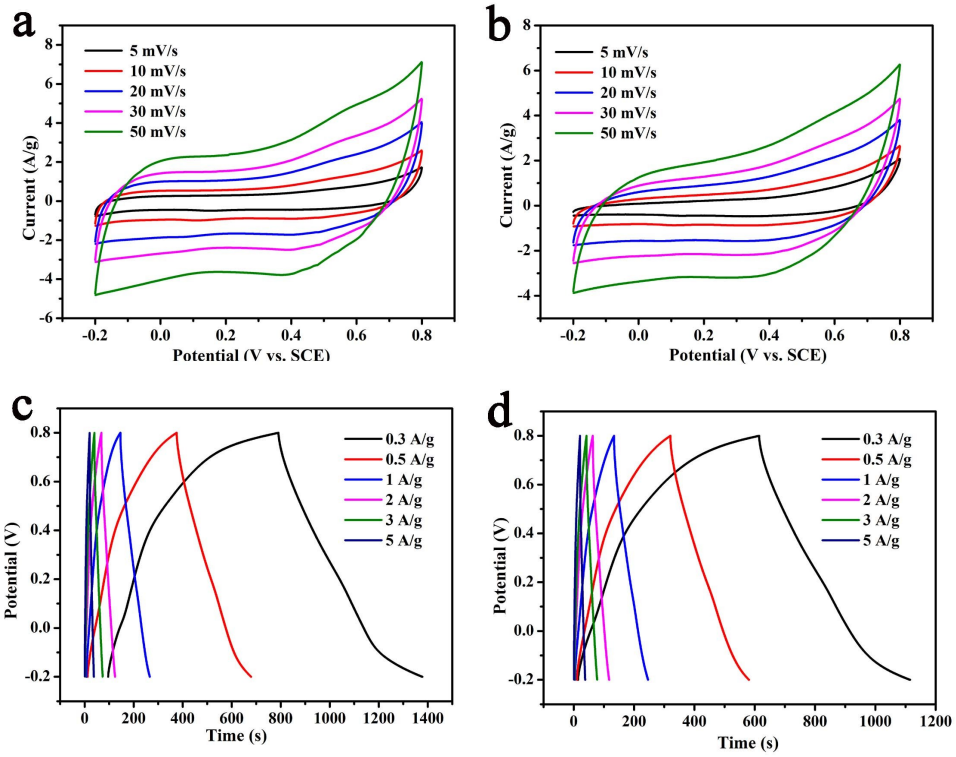


Fig. S5 CV (a, b) and GCD (c, d) curves of $Mn_3O_4$ hollow microcubes (a,c) and solid nanospheres (b,d).

**Table S1.** Comparison of the electrochemical performances of $Mn_3O_4$ electrode materials prepared in the present work with other reported $Mn_3O_4$ based electrode materials.

| Materials | Electrolyte | Test condition | *Cs*(F/g) | Specific capacitance retention after cycle | Ref |
|---|---|---|---|---|---|
| $Mn_3O_4$ hollow-tetrakaidecahedrons | 1 M $Na_2SO_4$ | 5 mV/s | 148 | 100% after 400 cycles | 1 |
| $Mn_3O_4$ hexagonal plate | 1 M $Na_2SO_4$ | 0.5 A/g | 82 | 100% after 1000 cycles | 2 |
| $Mn_3O_4$ nanorod/graphene | 1 M $Na_2SO_4$ | 0.5 A/g | 121` | 100% after 1000 cycles | 3 |
| nitrogen-doped carbon/$Mn_3O_4$ | 1 M $Na_2SO_4$ | 0.5 A/g | 73 | 94% after 1000 cycles | 4 |
| graphene/ $Mn_3O_4$ | 1 M $Na_2SO_4$ | 0.5 A/g | 142 | 92% after 800 cycles | 5 |
| $Mn_3O_4$ solid nanospheres | 1 M $Na_2SO_4$ | 0.5 A/g | 131 | 86% after 8000 cycles | This work |
| $Mn_3O_4$ hollow microcubes | 1 M $Na_2SO_4$ | 0.5 A/g | 152 | 95% after 8000 cycles | This work |

**Supplementary references**


1. M. Fang, X. L. Tan, M. Liu, S. H. Kang, X. Y. Hu and L. D. Zhang, *CrystEngComm*, 2011, **13**, 4915-4920.
2. Z. X. Liu, Y. Xing, S. M. Fang, X. W. Qu, D. P. Wu, A. Q. Zhang and B. Xu, *RSC Adv.*, 2015, **5**, 54867-54872.
3. Lee. J. W, Hall. A. S, Kim. J. D, Mallouk. T. E, *Chem. Mater.*, 2012, **24**, 1158-1164.
4. K. B. Wang, X. B. Shi, A. M. Lu, X. Y. Ma, Z. Y. Zhang, Y. N. Lu and H. J. Wang, *Dalton Trans.*, 2014, **44**, 151-157.

5. J. Y. Qu, F. Gao, Q. Zhou, Z. Y. Wang, H. Han, B. B. Li, W. B. Wan, X. Z. Wang and J. S. Qiu, *Nanoscale*, 2013, **5**, 2999-3005.