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Carbon nanotubes branch on cobalt oxide nanowires core as enhanced high-rate cathodes of alkaline batteries

Xinqi Liang, Fan Wang, Minghua Chen, Xinhui Xia



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Xinqi Liang, Fan Wang, Minghua Chen*, Xinhui Xia*

^a Key Laboratory of Engineering Dielectric and Applications (Ministry of Education), Harbin University of Science and Technology, Harbin 150080, P. R. China

^b State Key Laboratory of Silicon Materials, Key Laboratory of Advanced Materials and Applications for Batteries of Zhejiang Province, and Department of Materials Science and Engineering, Zhejiang University, Hangzhou 310027, P. R. China.

* Corresponding author: chenminghuahrb@126.com (M. H. Chen); helloxxh@zju.edu.cn (X. H. Xia)

Abstract

Directional synthesis of carbon/metal oxide core-branch arrays is of great importance for development of advanced high-rate alkaline batteries. In this work, we report a facile hydrothermal-chemical vapor deposition (CVD) method for controllable fabrication of $\text{Co}_3\text{O}_4@\text{CNTs}$ core-branch arrays. Interestingly, free-standing Co_3O_4 core nanowires are intimately decorated by cocoon-like branch CNTs with diameters of 20-30 nm, which act as a highly conductive network and structure stabilizer. The electrochemical performance of the designed $\text{Co}_3\text{O}_4@\text{CNTs}$ core-branch arrays are tested as cathodes of alkaline batteries. Arising from enhanced electrical conductivity, larger surface area and improved structural stability, the $\text{Co}_3\text{O}_4@\text{CNTs}$ arrays show superior high-rate electrochemical performance with a higher capacity (116 mAh g^{-1} at 2.5 A g^{-1}), lower polarization and better cycling stability than the pure Co_3O_4 nanowires arrays (76 mAh g^{-1} at 2.5 A g^{-1}). Our directional composite strategy can be extended to preparation of other carbon-based core-branch arrays for applications in electrochemical batteries and catalysis.

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