Accepted Manuscript

Construction of three-dimensional nitrogen-doped graphene coated with uniform nickel oxide/nickel ferrite nanoparticles with enhanced electrochemical properties for supercapacitors

Ying Wang, Denghui Pan, Mingmei Zhang, Tianjiao Ma, Hong Liu, Zaoxue Yan, Jimin Xie

PII: S0925-8388(18)32343-0

DOI: 10.1016/j.jallcom.2018.06.222

Reference: JALCOM 46558

To appear in: *Journal of Alloys and Compounds*

Received Date: 24 April 2018

Revised Date: 18 June 2018

Accepted Date: 19 June 2018

Please cite this article as: Y. Wang, D. Pan, M. Zhang, T. Ma, H. Liu, Z. Yan, J. Xie, Construction of three-dimensional nitrogen-doped graphene coated with uniform nickel oxide/nickel ferrite nanoparticles with enhanced electrochemical properties for supercapacitors, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.06.222.

Construction of three-dimensional nitrogen-doped graphene coated with uniform nickel oxide/nickel ferrite nanoparticles with enhanced electrochemical properties for supercapacitors

Ying Wang, Denghui Pan, Mingmei Zhang*, Tianjiao Ma, Hong Liu, Zaoxue Yan, Jimin Xie

School of Chemistry and Chemical Engineering, Jiangsu University, Zhenjiang 212013, China

 Correspondence author Tel: +86 11 88791708; fax: +86 11 88791800.
E-mail address: zhangmingmei@ujs.edu.cn. (M. M. Zhang)

Abstract

In this paper, nickel oxide (NiO) and nickel ferrate ($NiFe_2O_4$) nanoparticles grown on three-dimensional nitrogen-doped graphene (denoted as NiO/$NiFe_2O_4$/3DNG) are successfully synthesized by combining tube furnace calcination method and microwave synthesis method. The electrochemical characteristics of as-prepared composites have been quantitatively measured by cyclic voltammetry (CV), galvanostatic charge-discharge (GCD) measurements and electrochemical impedance spectroscopy (EIS) in different concentration of potassium hydroxide (KOH) electrolyte. The results show that the 3DNG based ternary hybrids possess an ultrahigh specific capacitance of 1556.5 F g^{-1} at the current density of 1 A g^{-1} in 6 M KOH solution and with a retention of 92.5 % capacitance value over 2000 cycles. Furthermore, the NiO/$NiFe_2O_4$/3DNG hybrids exhibit the maximum energy density of 55.6 Wh kg^{-1} with the power density of 1598.7 W kg^{-1} in the two-electrode system. This high-performance of as-prepared hybrids can be attributed to the synergistic effect between NiO and $NiFe_2O_4$, as well as the satisfied 3DNG conductive network. In addition, this work might develop a new and effective technique for high-activity, good soft and environmentally friendly substrate materials used in a wide range of applications in supercapacitors.

Keywords: nickel ferrite; three dimensional nitrogen-doped graphene (3DNG); supercapacitor; flexible electrode materials.