Accepted Manuscript

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PII: S0925-8388(17)34324-4

DOI: 10.1016/j.jallcom.2017.12.131

Reference: JALCOM 44217

To appear in: *Journal of Alloys and Compounds*

Received Date: 10 October 2017

Revised Date: 11 December 2017

Accepted Date: 13 December 2017

Please cite this article as: P. Liu, D. Wu, Y. Gao, T. Wang, Y. Tan, D. Jia, Reduced graphene oxide-coated mulberry-shaped α-Fe_2O_3 nanoparticles composite as high performance electrode material for supercapacitors, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2017.12.131.

Reduced graphene oxide-coated mulberry-shaped α-Fe_2O_3 nanoparticles composite as high performance electrode material for supercapacitors

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Highlights

- Fe_2O_3/rGO composites was prepared by a one-pot hydrothermal process.
- Fe_2O_3/rGO_1609 shows high specific capacitance (1051 F g^{-1} at 1 A g^{-1}).
- Fe_2O_3/rGO_1609 exhibits good rate capability (548 F g^{-1} at 30 A g^{-1}).
- 85.4% of the capacitance of Fe_2O_3/rGO_1609 can be remained after 1000 cycles.

Abstract

We report a facile method to synthesize nanocomposites with Fe_2O_3 nanoparticles (NPs) loaded on the surface of the reduced graphene oxide nanosheets (rGO) or wrapped into rGO sheets by simply regulating the temperatures and times of the hydrothermal reaction, which combines the growth of Fe_2O_3 NPs and the reduction of graphene oxide simultaneously. The morphology and microstructure of these samples were examined by X-ray diffraction, scanning electron microscopy, transmission electron microscopy, Raman spectra, X-ray photoelectron spectroscopy, Fourier transform infrared spectrometer and nitrogen isothermal adsorption-desorption. The effects of different temperatures and times of hydrothermal reaction on the microstructure and capacitive performance of these prepared composites were investigated in detail. The as-synthesized mulberry-shaped α-Fe_2O_3 NPs/graphene nanocomposite shows remarkable pseudocapacitive activity containing high specific capacitance (1051 F g^{-1} at 1 A g^{-1}) and excellent rate capability (548 F g^{-1} at 30 A g^{-1}).

Keywords: Fe_2O_3; mulberry-shaped; graphene composite; supercapacitor

1. Introduction