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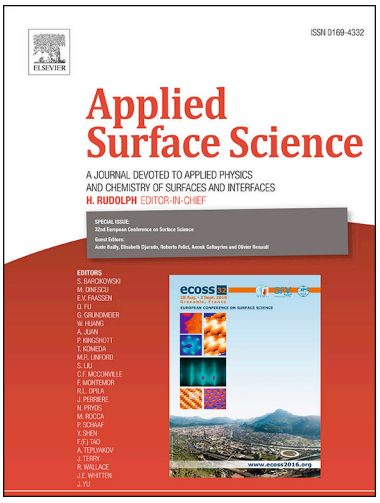

Full Length Article

Facile synthesis of functionalized graphene hydrogel for high performance supercapacitor with high volumetric capacitance and ultralong cycling stability

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PII: S0169-4332(18)31475-2
DOI: https://doi.org/10.1016/j.apsusc.2018.05.161
Reference: APSUSC 39437

To appear in: *Applied Surface Science*

Received Date: 8 February 2018
Revised Date: 19 May 2018
Accepted Date: 21 May 2018

Please cite this article as: Y. Tan, D. Wu, T. Wang, P. Liu, J. Guo, D. Jia, Facile synthesis of functionalized graphene hydrogel for high performance supercapacitor with high volumetric capacitance and ultralong cycling stability, *Applied Surface Science* (2018), doi: https://doi.org/10.1016/j.apsusc.2018.05.161

Facile synthesis of functionalized graphene hydrogel for high performance supercapacitor with high volumetric capacitance and ultralong cycling stability

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Abstract: Graphene gels have attracted intense research due to their excellent gravimetric performances in supercapacitors. However, their low volumetric capacitance and cycling stability limit their practical application. In this work, three-dimensional (3D) reduced graphene aerogel (RGAs) with hierarchical porous and high electrical conductivity were synthesized via simple low temperature chemical reduction method using graphene oxide as precursor and L-cysteine as reducing and functional agent. The sample RGAs-8 that prepared after reduction for 8 hour displayed the highest mass density, higher electrical conductivity and cross-linked porous structure. Electrochemical measurements showed that the gravimetric capacitance and the volumetric capacitance of RGAs-8 reached as high as 203.9 F g^{-1} and 293.6 F cm^{-3} at 0.5 A g^{-1} in 6 M KOH aqueous electrolyte, respectively. In particular, the capacitance of RGAs-8 showed no capacitance loss even after 300000 charge/discharge cycles, clearly demonstrating a robust long-term stability.

Keywords: L-Cysteine, graphene, supercapacitor, long cycle life, high volumetric capacitance

1. Introduction

Graphene has been an attractive material in the past few years due to its high specific surface area, excellent electrical conductivity, extraordinary chemical stability and mechanical flexibility[1-3]. However, because of the strong π-π interaction between graphene sheet, it is easy make the obtained two-dimensional (2D) graphene flakes tend to form irreversible aggregates or overlapping to graphitic structure, and thus the inherent structures and