Fabrication of 3D vertically aligned silver nanoplates on nickel foam-graphene substrate by a novel electrodeposition with sonication for efficient supercapacitors

Muhammad Usman, Lujun Pan, Amjad Sohail, Zafar Mahmood, Ruixue Cui

PII: S1385-8947(16)31667-9
DOI: http://dx.doi.org/10.1016/j.cej.2016.11.105
Reference: CEJ 16106

To appear in: *Chemical Engineering Journal*

Received Date: 29 August 2016
Revised Date: 28 October 2016
Accepted Date: 15 November 2016

Please cite this article as: M. Usman, L. Pan, A. Sohail, Z. Mahmood, R. Cui, Fabrication of 3D vertically aligned silver nanoplates on nickel foam-graphene substrate by a novel electrodeposition with sonication for efficient supercapacitors, *Chemical Engineering Journal* (2016), doi: http://dx.doi.org/10.1016/j.cej.2016.11.105

Fabrication of 3D vertically aligned silver nanoplates on nickel foam-graphene substrate by a novel electrodeposition with sonication for efficient supercapacitors

Muhammad Usman[a*], Lujun Pan[a*, 1], Amjad Sohail[a], Zafar Mahmood[c], Ruixue Cui[a]

[a] School of Physics and Optoelectronic Technology, Dalian University of Technology, Dalian 116024, PR of China

[c] State Key Laboratory of Fine Chemicals, School of Chemical Engineering, Dalian University of Technology, Dalian 116024, PR China

ABSTRACT

We have developed a facile, low-cost and novel method to fabricate three-dimensional (3D) vertically aligned Ag nanoplates (NPs) on Nickel foam-graphene (NFG) substrate using Electrodeposition with sonication (S-Electrodeposition) growth in a AgNO3 solution. The vertically deposited Ag NPs with irregular polyhedron shapes standing on the surface of NFG attributes to enhance the surface area, and sequentially be beneficial for supercapacitor. The novel architecture of composite Ag/Nickel-foam graphene with sonication ((Ag@NFG)S1) exhibits a specific capacitance (SC) of 900 Fg^{-1} at an applied current density of 0.5 Ag^{-1}, a value 3.5 fold higher than that of the composite (Ag@NFG)S0 without sonication and six-fold higher than NFG. Moreover, the composite (Ag@NFG)S1 shows good long-term cyclic stability after 5000 cycles and columbic efficiency was almost 99% with the initial value. This study provides a new strategy to enhance the capacitive properties of NFG based composites, which is a promising candidate for the application of energy storage devices.

Keywords: CVD, Sonication, Electrodeposition, 3D Vertically Aligned Silver NPs, Supercapacitor

*Corresponding Author: Tel: 86-411-84707863-334; Fax: 86-411-84709304

Email: lpan@dlut.edu.cn (Lujun Pan), zakrian2003@gmail.com (Muhammad Usman)