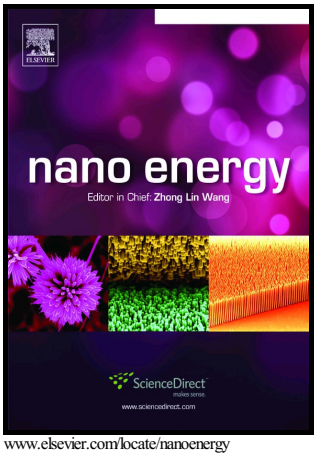
Self-Assembly-Template Engineering Nitrogen-Doped Carbon Aerogels for High-Rate Supercapacitors

Xianjun Wei, Suige Wan, Shuyan Gao



www.elsevier.com/locate/nanoenergy

PII: S2211-2855(16)30311-1
DOI: http://dx.doi.org/10.1016/j.nanoen.2016.08.023
Reference: NANOEN1436

To appear in: *Nano Energy*

Received date: 13 June 2016
Revised date: 31 July 2016
Accepted date: 9 August 2016

Cite this article as: Xianjun Wei, Suige Wan and Shuyan Gao, Self-Assembly-Template Engineering Nitrogen-Doped Carbon Aerogels for High-Rate Supercapacitors, *Nano Energy,* http://dx.doi.org/10.1016/j.nanoen.2016.08.023

Self-Assembly-Template Engineering Nitrogen-Doped Carbon Aerogels for High-Rate Supercapacitors

Xianjun Wei*, Suige Wan, Shuyan Gao*

School of Chemistry and Chemical Engineering, Henan Normal University, Xinxiang Henan 453007, P. R. China; Email: xj_wei@163.com; shuyangao@htu.cn.

Abstract

Three-dimensional (3D) interconnected porous nitrogen-doped carbon aerogels (CAs) have been successfully prepared with polyvinyl alcohol and nitrogen-containing N-phenylethanolamine as carbon and in-situ nitrogen sources, and boric acid as both crosslinking agent and 3D self-template. After drying, carbonization and KOH-activation treatment, the as-obtained CAs exhibit large specific surface area, hierarchically porous structure, heteroatom doping and superhydrophilicity. The optimal sample shows a high surface area up to 2016 m^2 g^{-1} with a total pore volume of 1.179 cm^3 g^{-1}. The synergistic effect of the reasonably hierarchical porosity, high effective surface area utilization, superhydrophilicity, and heteroatom pseudocapacitance are in favor of high specific capacitance of 467 F g^{-1} in three-electrode system and considerable cycle performance of 85.7 %, 90.9 % retention over 10,000 cycles at 20 A g^{-1} and 30 A g^{-1}. Moreover, the symmetric supercapacitor configuration delivers an energy density of 22.75 Wh kg^{-1} at power density of 262.5 W kg^{-1} and 7.6 Wh kg^{-1} at power density of 9572 W kg^{-1}. Here, we pioneer an in-situ self-template approach for fabricating hierarchically porous aerogels with a potential application in supplying a peak power for hybrid electric vehicles, memory backup systems, cold-starting assistants and especially electrochromic devices as demonstrated in our case.

Keywords: Carbon Aerogel; Self-assembly Template; Nitrogen Doping; Supercapacitor

1. Introduction

Carbon aerogels (CAs), a unique class of nanoporous and amorphous carbon material, inherit the network structure and lightweight characteristics of organic aerogels **and display**