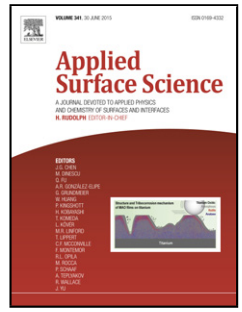
Accepted Manuscript



Title: Microwave plasma-assisted chemical vapor deposition of porous carbon film as supercapacitive electrodes

Authors: Ai-Min Wu, Chen-Chen Feng, Hao Huang, Ramon Alberto Paredes Camacho, Song Gao, Ming-Kai Lei, Guo-Zhong Cao

PII: S0169-4332(17)30668-2
DOI: http://dx.doi.org/doi:10.1016/j.apsusc.2017.03.017
Reference: APSUSC 35393

To appear in: *APSUSC*

Received date: 17-12-2016
Revised date: 27-2-2017
Accepted date: 1-3-2017

Please cite this article as: {http://dx.doi.org/

<AT>Microwave Plasma-assisted Chemical Vapor Deposition of Porous Carbon Film as Supercapacitive Electrodes

<AU>Ai-Min Wu[*†] ##Email##aimin@dlut.edu.cn##/Email##, Chen-Chen Feng[†], Hao Huang[*†] ##Email##huanghao@dlut.edu.cn##/Email##, Ramon Alberto Paredes Camacho[†], Song Gao[†], Ming-Kai Lei[†], Guo-Zhong Cao[†‡]
<AFF>[†]Key Laboratory of Materials Modification by Laser, Ion and Electron Beams (Ministry of Education), School of Materials Science and Engineering, Dalian University of Technology, Dalian 116024, China
<AFF>[‡]Department of Materials Science and Engineering, University of Washington, Seattle, WA 98195, USA

<ABS-HEAD>Highlights► A highly porous carbon film was coated on nickel foam employing MPCVD. ► A 3D-crosslinked nanoscale network owned high degree of graphitization. ► High stability of 95% of capacitance retention after 10,000 cycles. ► Ideal electric double-layer capacitive and quick charge/discharge behavior. ► Facile synthetic route for large-scale production.
□ <ABS-HEAD>Abstract
<ABS-P>Highly porous carbon film (PCF) coated on nickel foam was prepared successfully by microwave plasma-assisted chemical vapor deposition (MPCVD) with C_2H_2 as carbon source and Ar as discharge gas. The PCF is uniform and dense with 3D-crosslinked nanoscale network structure possessing high degree of graphitization. When used as the electrode material in an electrochemical supercapacitor, the PCF samples verify their advantageous electrical conductivity, ion contact and electrochemical stability. The test results show that the sample prepared under 1000 W microwave power has good electrochemical performance. It displays the specific capacitance of 62.75 F/g at the current density of 2.0 A/g and retains 95% of its capacitance after 10,000 cycles at the current density of 2.0 A/g. Besides, its near-rectangular shape of the cyclic voltammograms (CV) curves exhibits typical character of an electric double-layer capacitor, which owns an enhanced ionic diffusion that can fit the requirements for energy storage applications.

<KWD>Keywords: Porous carbon film;;; Double-layer supercapacitor; Microwave plasma;

Chemical vapor deposition; supercapacitive energy storage

<PA>Corresponding Authors [*](Tel.: +86-411-84706661), (Tel.:+86-411-84706133).

<H1>1. Introduction

With the increasing demand for environment-friendly energy storage technology in recent years, electrochemical supercapacitors have received extensive attention with their attractive features including rapid charge/discharge capability, fast charge transfer, long cyclic life (> 10^6) and high power density (2000 W/kg) to fill the gaps left by batteries [1]. Such advantages make them the most applicable in high power supply for both stationary and portable devices of digital communication, memory storage, electric cars and personal electronics [2].

The electrode materials are one of the key components determining the performance of supercapacitors and can be categorized mainly into three types: carbon-based materials,