



HAL
open science

Vertically aligned carbon nanotubes based materials for high energy hybrid supercapacitors

Émeline Charon, Baptiste Pibaleau, Ahmed Fakhry, François Tran Van, Fouad Ghamouss, Mai-Phuong Nghiêm, Pierre-Henri Aubert, Philippe Banet, Mathieu Pinault

► To cite this version:

Émeline Charon, Baptiste Pibaleau, Ahmed Fakhry, François Tran Van, Fouad Ghamouss, et al.. Vertically aligned carbon nanotubes based materials for high energy hybrid supercapacitors. NT16, Aug 2016, Vienna, Austria. cea-02351168

HAL Id: cea-02351168

<https://hal-cea.archives-ouvertes.fr/cea-02351168>

Submitted on 6 Nov 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Oral, Congrès NT16, August 7-13, 2016, Vienne, Autriche

Vertically aligned carbon nanotubes based materials for high energy hybrid supercapacitors

Emeline CHARON¹, Baptiste PIBALEAU¹⁻², Ahmed FAKHRY², François TRAN-VAN², Fouad GHAMOUSS², Mai Phuong NGHIEM³, Pierre-Henri AUBERT³, Philippe BANET³, Mathieu PINAULT¹

1 NIMBE, CEA, CNRS, Université Paris-Saclay, CEA Saclay 91191 Gif sur Yvette Cedex, France

2 Laboratoire Physico-Chimie des Matériaux et des Electrolytes pour l'Energie, Université François Rabelais, Parc de Grandmont, 37200 Tours, France

3 Laboratoire de Physicochimie des Polymères et des Interfaces, Université de Cergy-Pontoise, site de Neuville, 5 mail Gay-Lussac, 95031 Cergy-Pontoise Cedex, France

The aim of this project is to develop innovative electrodes materials with high specific capacitance based on vertically aligned carbon nanotubes (VACNT) to be included in supercapacitors with improved specific energy. To achieve this, we will develop new pseudocapacity positive electrode materials based on vertically aligned carbon nanotubes (VACNT) modified by Electronic Conducting Polymers (ECP) and/or manganese oxide electrodeposited in a controlled manner.

In this study, the growth of VACNT by catalytic chemical vapour deposition using mixed aerosol [1] has been adapted for different metal substrates (stainless steel or Al) with controlled and optimized morphologies (length, density, diameter...). VACNT are then used as electrode support material through the development of preparation methodologies of various VACNT/PCE nanocomposite electrodes through electrochemical polymerization with various techniques on VACNT carpets used as templating electrode [2].

VACNT are also used as the 3D matrix hosting the electrodeposition of nanostructured MnO₂ with the objective to optimize the electrochemical parameters in order to deposit the oxide homogeneously throughout the entire depth of the carpet. The electrodeposition is performed in different media and from different MnO₂ precursors [3]. Several pre-treatments of the VACNT with oxygen have been thus performed to act on the hydrophobic character of the pristine forest. Oxide film growth by CVD has also been tested.

The materials and composites have been characterized by scanning and transmission electron microscopies as well as spectroscopies (SEM, TEM, Raman, SEM-EDX and XPS) in order to examine the morphology, the localization and the thickness of the PCE or MnO₂ deposits and their relation to the measured specific capacitance performances.

[1] C. Castro, et al., *Carbon* 48 (2010) 3807-3816.

[2] S. Lagoutte, et al., *Electrochimica Acta* 130 (2014) 754-765.

[3] A. Mery, et al., *Journal of Power Sources* 305 (2016) 37-45.