VACNT growth on Aluminium: towards innovative supercapacitor nanocomposite electrodes

Fabien Nassoy, Baptiste Pibaleau, Thomas Vignal, François Tran-Van, Fouad Ghamouss, Pierre-Henri Aubert, Philippe Banet, Jéremie Descarpentries, Martine Mayne, Mathieu Pinault

VACNT growth on Aluminium: towards innovative supercapacitor nanocomposite electrodes

Fabien Nassoy[1,4], Baptiste Pibaleau[1,2], Thomas Vignal[3], François Tran-Van[2], Fouad Ghamouss[2], Pierre-Henri Aubert[3], Philippe Banet[3], Jéremie Descarpentries[4], Martine Mayne[1], Mathieu Pinault[1]*

[1] *NIMBE, CEA, CNRS, Université Paris-Saclay, CEA Saclay 91191 Gif-sur-Yvette France;*
[2] *PCM2E, Université François Rabelais, Parc de Grandmont, 37200 Tours, France*
[3] *LPPI, Université de Cergy-Pontoise, site de Neuville, 95031 Cergy-Pontoise Cedex, France*
[4] *NawaTechnologies, Chez STMicroelectronics, 13106 Rousset Cedex, France*

Type of Contribution: **_oral__** (please indicate if you prefer oral or poster)

Abstract:
The aim of this work is to develop innovative electrodes materials with high specific capacitance based on vertically aligned carbon nanotubes (VACNT) for supercapacitors. Catalytic chemical vapor deposition (CCVD) is one of the best method for VACNT growth. However considering the aluminium melting temperature (c.a. 660°C), the synthesis of VACNT on such substrates requires a significant reduction in the growth temperature as compared to conventional substrates [1-2]. Our approach was first to identify the most relevant synthesis parameters to achieve VACNT growth at such a low temperature by using precursor mixtures more favourable for a decomposition at low temperature [3]. Our results show that, with a single-step aerosol assisted CCVD process; it is possible to obtain clean, long and dense VACNTs on Al current collectors, with a growth rate at the best level of the state of the art at such low temperature. VACNT are then used to develop new pseudocapacitive electrode materials based on VACNT modified with Electronic Conducting Polymers (ECP) and/or metal oxide electrodeposited in a controlled manner [4]. Nanocomposite electrodes of poly-3-methylthiophene (P3MT) in ionic liquid and manganese oxide in aqueous electrolytes both homogeneously deposited on VACNT have been elaborated and their storage properties determined. Finally, we select best nanocomposite configurations for electrodes upscaling demonstrating the industrial feasibility of the approach.

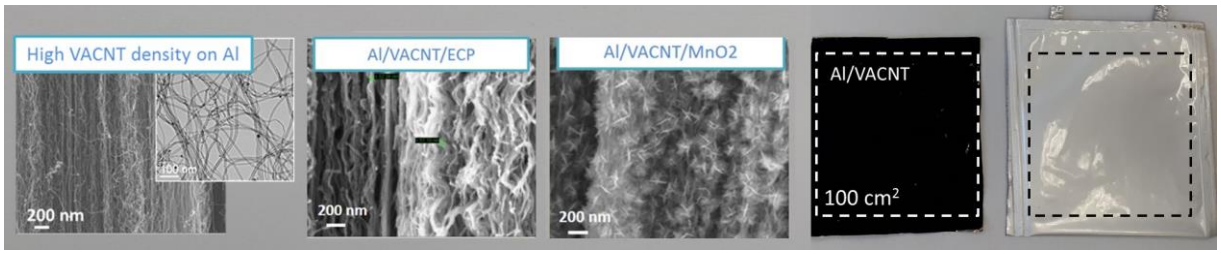

Figure: VACNT grown on Al current collectors, VACNT modified with PCE and metal oxide, upscaled VACNT/Al electrode and a pouch cell

References

[1] C. Castro et al, Carbon, 2013, 61, 585
[2] M. Delmas et al, Nanotechnology, 2012, 23
[3] M. R. Arcila-Velez et al, Nano Energy, 2014, 8, 9–16
[4] S. Lagoutte, et al., Electrochimica Acta 130 (2014) 754-765.

Corresponding author:
Dr. Mathieu PINAULT
CEA Saclay
Nanometric Structures Laboratory
DRF/IRAMIS/NIMBE/LEDNA - UMR 3685
Bât. 522, P. 249A
91191 Gif sur Yvette Cedex, France
Office: (+33)1-69-08-91-87
Lab: (+33)1-69-08-35-16
Fax: (+33)1-69-08-87-07
mathieu.pinault@cea.fr
http://iramis.cea.fr/nimbe/