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C. Querne[a,b*], P.Banet[b], M. Mayne-L'Hermite[a], P.-H. Aubert[b], M. Pinault[a]

[a]NIMBE, CEA, CNRS, Université Paris-Saclay, CEA Saclay 91191 Gif-sur-Yvette France
[b]LPPI (EA 2528), Université de Cergy-Pontoise, 95000 Cergy-Pontoise France
([*]email : corentin.querne@cea.fr)

Owing to their surface area, anisotropy and good electrical conductivity, Vertically Aligned Carbon Nanotubes carpets (VACNT) and their combination to electronic conducting polymer (ECP) are promising materials for ultracapacitor electrodes. To fabricate low cost, highly conducting and light electrodes, we have adjusted a single-step process, namely the Aerosol Assisted Catalytic Chemical Vapor Deposition operated at low temperatures (580 to 615°C), to synthesize VACNT on aluminium current collectors, which is compatible with industrial requirements [1], [2]. This method provides quite long, dense and clean VACNT. In addition, we have also developed an easy method based on electrodeposition of ECP (poly(3-methylthiophene) on VACNT, to improve the capacitance [3]. Homogenous deposition of ECP was achieved all along the thickness of the carpet by pulsed chronoamperometric method. The energy was increased up to 52Wh/kg owing to the nanostructuration of the ECP. To improve supercapacitor's performances, one route consist in enhancing the potential window of the devices and the capacitance of the electrodes. Hence, one approach is to dope with heteroatoms carbon nanotubes in the VACNT. Nitrogen doping should provide potentialities to increase the capacitance owing to the oxidation of the nitrogen sites inserted in the graphitic walls but also by increasing the specific surface because of the bamboo shape of N@VACNT [4]. The growth of nitrogen doped VACNT was achieved at 850°C on Si substrates by using ethylenediamine as nitrogen and carbon source. Such carpets exhibit a low density of 4.10^{10} NTC/cm² of few walled "bamboo" shaped nanotubes, and the nitrogen content is 4.5%at. First electrochemical characterizations, using an ordinary electrolyte ($TEABF_4$ in acetonitrile), show a capacitive storage with a capacitance of 12.6 F/g.

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