Vertically aligned carbon nanotube based materials: towards superpacitor devices with tunable performances

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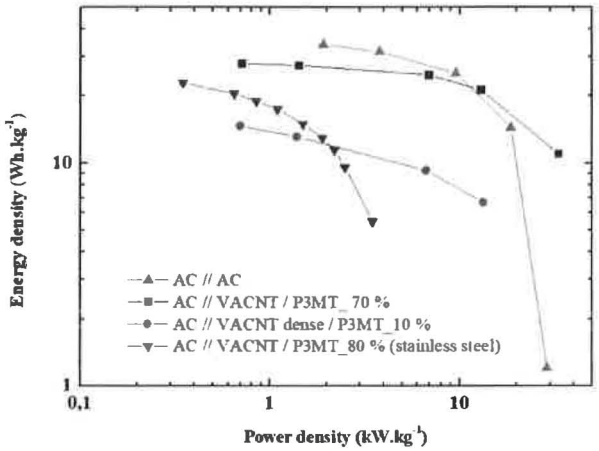
Vertically aligned carbon nanotubes (VACNT) based materials are efficient candidates to build supercapacitor electrodes. Our approach enables to get versatile materials able to tune the supercapacitor performances, which is very promising as compared to activated carbon. VACNT with different thickness and density, while possibly incorporating disordered carbon, are successfully obtained through a one-step CCVD thermal process operated on aluminum collector and up-scaled for commercial applications. The specific capacitance is increasing when the VACNT density and/or thickness increases. Electrode performances reach 20 to 450 mF/cm^2, and the supercapacitor volumetric energy is more than 10 times higher when disordered carbon is incorporated between VACNT. It is also possible to homogeneously incorporate electronically conducting polymer (ECP) inside VACNT, enabling to increase even further the specific capacitance (more than 700 mF/cm^2). Supercapacitors made of VACNT/ECP electrodes can reach 28 Wh/kg and 40 kW/kg (weight of active materials in the 2 electrodes), which is promising as compared to activated carbon (see fig.). Prototype devices prepared from VACNT synthesized at laboratory scale or on an industrial production line (Roll to Roll process) exhibit similar performances.



***Dispositif A** : VACNT sans Cdes + 70%PMeT*
***Dispositif B** : VACNT avec Cdes (70%) + 10%PMeT*

Performances massiques optimales (dispo A) : 28 Wh/kg – 40 kW/kg