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VACNT growth on Aluminium: towards innovative supercapacitor nanocomposite electrodes

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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.

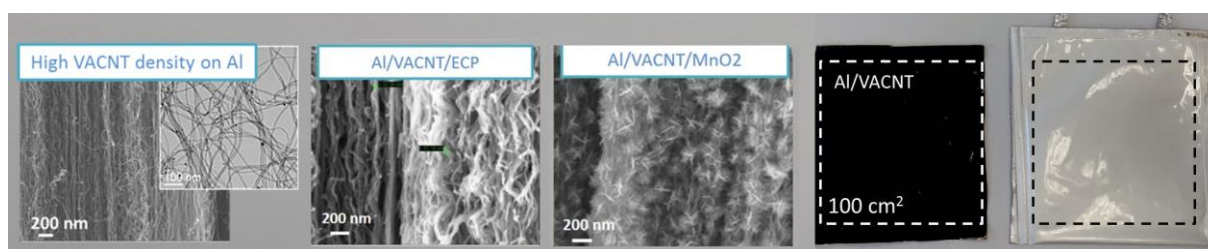


Figure: VACNT grown on Al current collectors, VACNT modified with PCE and metal oxide, upscaled VACNT/Al electrode and a pouch cell

References

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