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Solid-state carbon-based textile supercapacitors for energy storage applications

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In this work, carbon-based conducting electrodes based on two different types of carbon nanofibers (CNF) have been produced by the dip and dry coating method onto cotton substrates. Furthermore, activated carbon (Norit A Supra Eur) and manganese oxide (MnO_2) have been subsequenlty added to the CNF-based dip-coated cotton fabrics electrodes and asymmetric supercapacitors have been constructed and tested with the focus of obtaining devices with increased capacitive performance. In particular, the carbon-based active layer was prepared by spreading on the CNF-based electrodes a slurry containing the activated carbon (AC) material, graphite fibres, polyvinylidene difluoride (PVDF) as binder and N,N dimethylacetamide (DMA) solvent, whereas the MnO_2 based active layer was prepared by spreading on the CNF-based textile electrodes a slurry formed by MnO_2, carbon black, graphite fibers, PVDF and DMA. A solution of 1M Na_2SO_4 impregnated in porous paper separator (Nippon Kodoshi Corportion, Japan) was employed as neutral aqueous electrolyte. The supercapacitors were electrochemical investigated by cyclic voltammetry (CV), galvanostatic charge/discharge (GCD) and electrochemical impedance spectroscopy (EIS).

The results indicated that with this particular combination of carbon and manganese oxide active layers on CNF-based cotton fabrics it was possible to obtain specific capacitance of 100 F/g and a high specific energy density of 10 Wh/kg.

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