Flexible and Weaveable Capacitor Wire Based on a Carbon Nanocomposite Fiber

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Supporting Information

Experimental Section

Poly(ethylene glycol)-b-poly(propylene glycol)-b-poly(ethylene glycol) (M_n=5800) and tetraethyl orthosilicate (CP, 97%) were obtained from Sigma-Aldrich. Poly(vinyl alcohol) (M_n=1750±50) was obtained from Sinopharm Chemical Reagent Co., Ltd. Furfuryl alcohol (CP, 97%) was ordered from Aladdin Chemistry Co., Ltd. N,N-Dimethylformamide was provided by Shanghai Qiangshun Chemical Reagent Corp. Anhydrous ethanol (≥99.7%) was ordered from Shanghai Zhenxing Chemical No.1 Factory. Silver paint was ordered from Uninwell International LTD.

The structures were characterized by scanning electron microscopy (Hitachi FE-SEM S-4800 operated at 1 KV) and transmission electron microscopy (JEOL JEM-2100F operated at 200 KV). Cyclic voltammograms were recorded on an electrochemical analyzer system (CHI 660D) at room temperature with increasing scan rates from 0.01 to 0.2 V/s by a three-electrode method. Galvanostatic charge-discharge measurements were made at a current range of 5×10^{-4} to 1×10^{-2} mA by an ARBIN electrochemical workstation (MSTAT-5V/10mA/16Ch).
Figure S1. SEM images of the bare MWCNT fiber and composite fibers. a. Bare fiber. b, c, d, e, and f. Composite fibers with OMC weight percentages of 46%, 70%, 84%, 87%, and 90%, respectively.
Figure S2. a, b, c and d. Sectional SEM images of composite fibers with OMC weight percentages of 0%, 70%, 84% and 90%, respectively.
Figure S3. SEM image of OMC particles.
Figure S4. High resolution transmission electron microscopy image of the individual MWCNT.
Figure S5. a and b. High resolution transmission electron microscopy images of the interface between MWCNTs and OMC particles. c. High resolution transmission electron microscopy image of an OMC particle restricted by MWCNT bundles.
Figure S6. a. Pore size distribution of the OMC. b. Nitrogen sorption isotherms of the OMC.
Figure S7. a. Pore size distribution of the MWCNT/OMC composite material. b. Nitrogen sorption isotherms of the MWCNT/OMC composite. The OMC weight percentage was 87% in the composite material, and a specific surface area of 884 m$^2$/g was obtained.
Figure S8. Schematic illustration to the EDLC wire which is composed of two MWCNT/OMC composite fibers.
Figure S9. Galvanostatic charge-discharge curves of an EDLC wire based on the composite fiber with an OMC weight percentage of 87% at different currents.
Figure S10. Dependence of capacitance ratio on cycle number for EDLC wires based on the composite fibers with different OMC weight percentages. a, b, c, and d. 46%, 70%, 84%, and 90%, respectively.