Electronic Supplementary Material (ESI) for Nanoscale

Supporting Information

Cellulose nanofibers/single-walled carbon nanotubes hybrid non-woven macrofiber mat for novel wearable supercapacitors with excellent stability, tailorability and reliability

Qingyuan Niu, Kezheng Gao and Ziqiang Shao*

Preparation of cellulose nanofibers dispersion

Cellulose fibers (2 g) was suspended in water (400 ml) containing TEMPO (0.033 g) and sodium bromide (0.33 g). The oxidation reaction was started by adding the desired amount of the NaClO solution (15 mmol/g celluose). The pH of the reaction solution was maintained to be 10.00 at 25 ^{o}C by adding 0.5 M NaOH for 6 h. The oxidized cellulose was thoroughly washed with water by filtration. 2 mg/ml oxidized cellulose/water slurries were sonicated for 15 min at power of 300 W in an ice bath. Cellulose nanofibers dispersion was centrifuged at 10000 rpm for 10 min to remove the unfibrilated cellulose. The transparent cellulose nanofibers dispersion was stored at 4 ^{o}C before used.

Preparation of the CNFs/SWCNTs hybrid non-woven macrofiber mat wearable supercapacitors

6 g of H_3PO_4 was added into 60 mL of deionized water, and then 6 g of polyvinyl alcohol (PVA) was added with continuous stirring at 90 ^{o}C until the solution became clear. Two pieces of the CNFs/SWCNTs hybrid non-woven macrofiber mat (with aluminum foil, or without aluminum foil) were soaked in the H_3PO_4-PVA gel electrolyte for 30 s and picked out. After that, two electrode films were left in the fume hood at room temperature for about 4 h to vaporize the excess water, and then the two non-woven macrofiber mat electrode were assembled into non-woven macrofiber mat wearable supercapacitors.

Characterization: The electrochemical performances of the CNFs/SWCNTs hybrid non-woven macrofiber mat wearable supercapacitors were evaluated on a CHI 660E electrochemical workstation. The morphologies of the CNFs/SWCNTs hybrid

non-woven macrofiber mat were characterized by scanning electron microscopy (SEM) (Hitachi S-4800).

Characterization of cellulose nanofiers

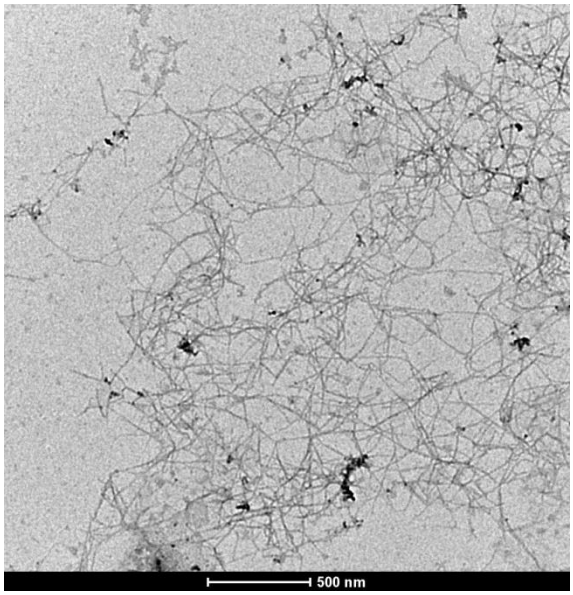

Fig. S1 TEM image of cellulose nanofiber samples

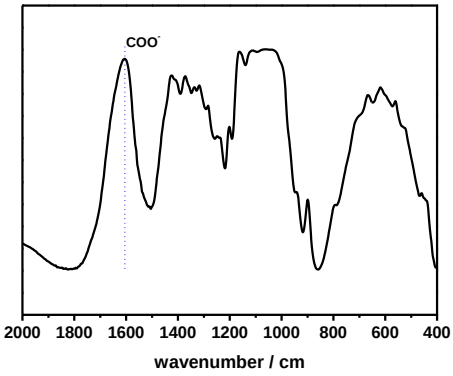

Fig. S2 FT-IR spectra of cellulose nanofiber samples

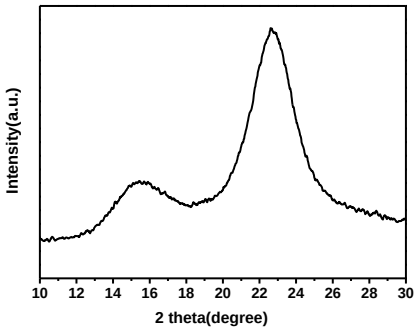

Fig. S3 XRD spectra of cellulose nanofiber samples

Fig. S4 Photograph of the cellulose nanofibers/single-walled carbon nanotubes suspension

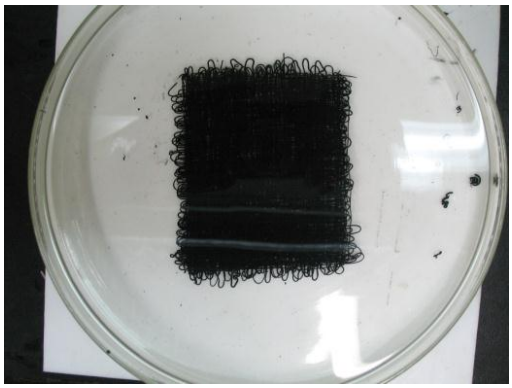

Fig. S5 Photograph of the cellulose nanofibers/single-walled carbon nanotubes hybrid non-woven macrofiber mat in ethanol coagulation bath

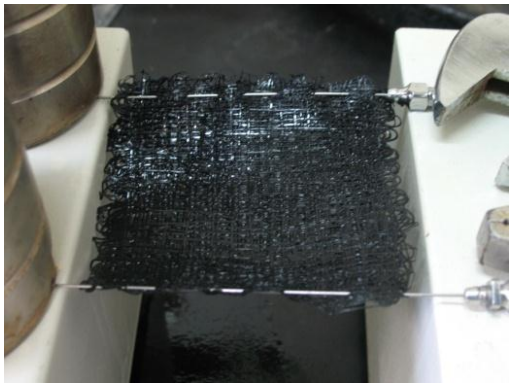

Fig. S6 Cellulose nanofibers/single-walled carbon nanotubes hybrid non-woven macrofiber mat is dried in air under the restricted conditions

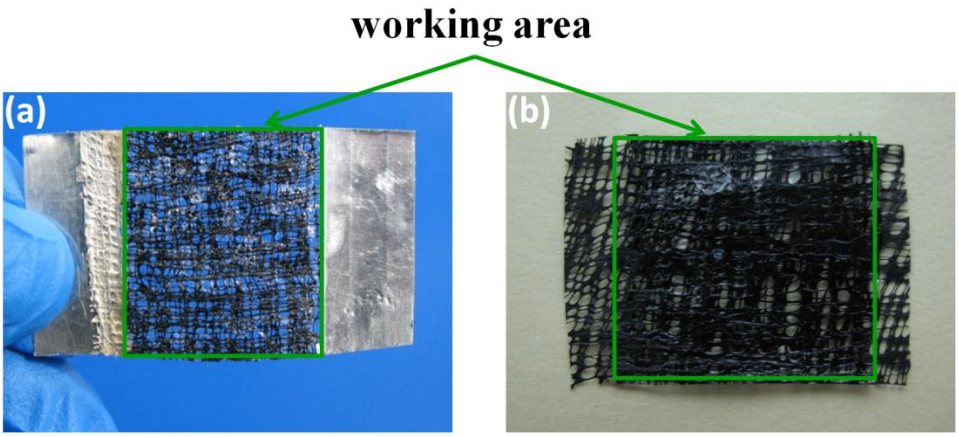

Fig. S7 Photograph of the non-woven macrofiber mat wearable supercapacitors with aluminum foil (a), and without aluminum foil (b).

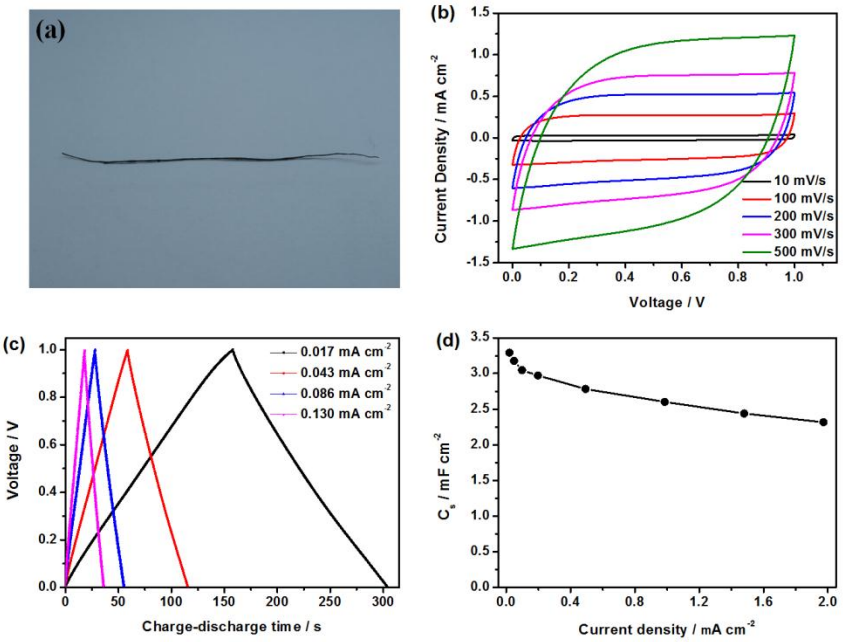

Fig. S8 (a) Photograph of the CNFs/SWCNTs hybrid fiber wearable supercapacitor (The effective length is about 1 cm). (b) Typical CV curves of the CNFs/SWCNTs hybrid fiber wearable supercapacitor at different scan rates. (c) Typical galvanostatic charge–discharge curves of the CNFs/SWCNTs hybrid fiber wearable supercapacitor at different current densities. (d) The area capacitance of the the CNFs/SWCNTs hybrid fiber wearable supercapacitor as a function of the current density.

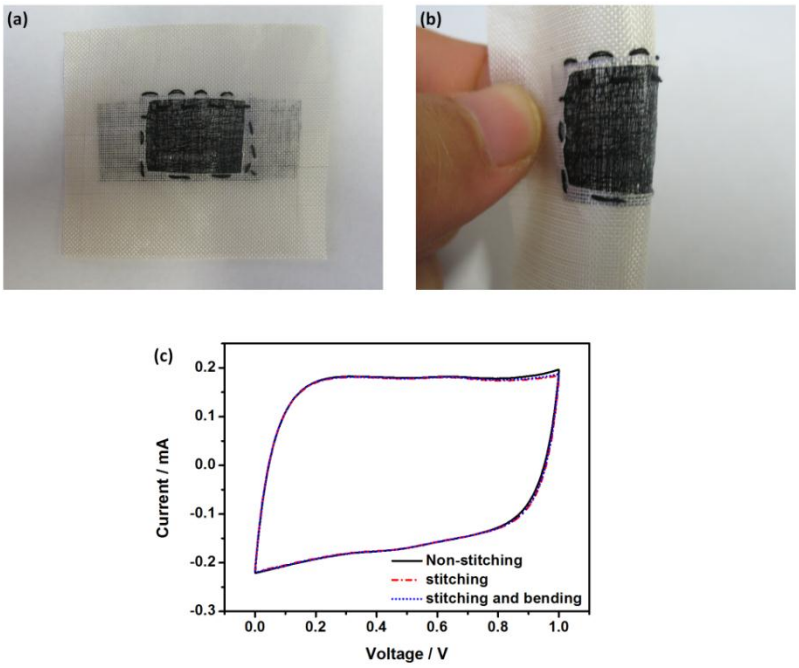

Fig. S9 Photograph of the non-woven macrofiber mat wearable supercapacitors integrated textile in flat (a) and bending (b) state. (c) CV curves of the supercapacitor in Non-stitching, stitching and stitching (bending) state at a scan rate of 10 mV s^{-1}.