Supplementary Information for

Multiwall carbon nanotube@mesoporous carbon with core-shell configuration: a well-designed composite-structure toward surpercapacitor electrode

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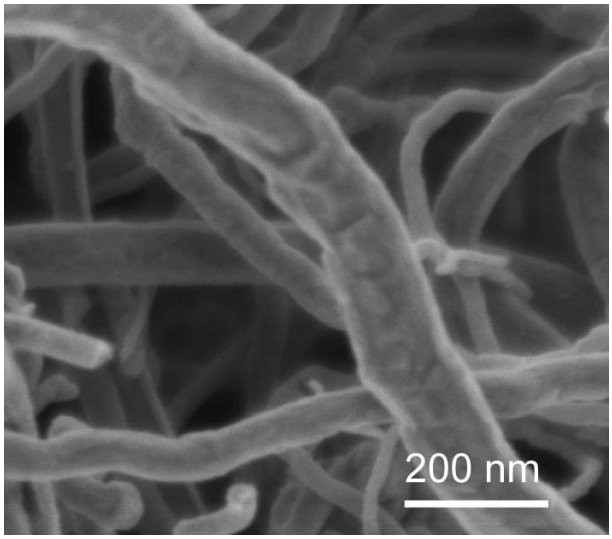

Fig. S1 The SEM image of the pristine MWNTs with outer diameters and lengths in the range of 40 – 100 nm and 5 – 15 μm, respectively, showing smooth surfaces.

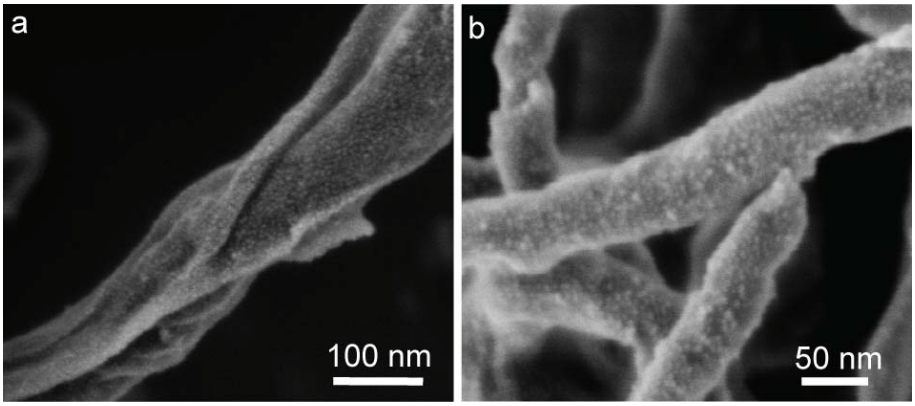

Fig. S2 FESEM images of the uniform core-shell structured MWNT@mesoC composites with crumpled (a) and even (b) mesoC shells. The white dots on the surface of the MWNT@mesoC composite are Au nanoparticles sprayed on prior to introducing into the FESEM measurement.

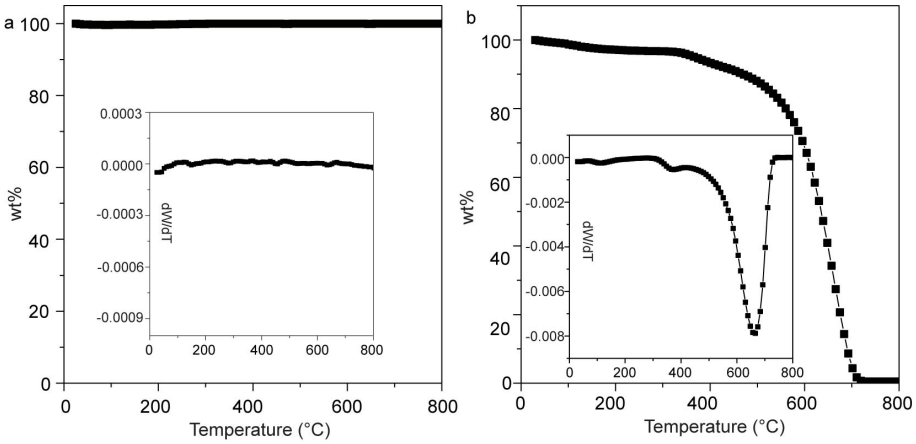

Fig. S3 TG and DTG (inset) curves: (a) the pristine MWNTs conducted in N_2 from 30 to 800 °C without weight loss phenomenon suggesting the high purity; (b) the mechanical mixture comprising of the pristine MWNTs and mesoCs conducted in air from 30 to 800 °C showing a slow weight loss tendency before 500 °C and a dramatically loss step at ~ 600 °C.

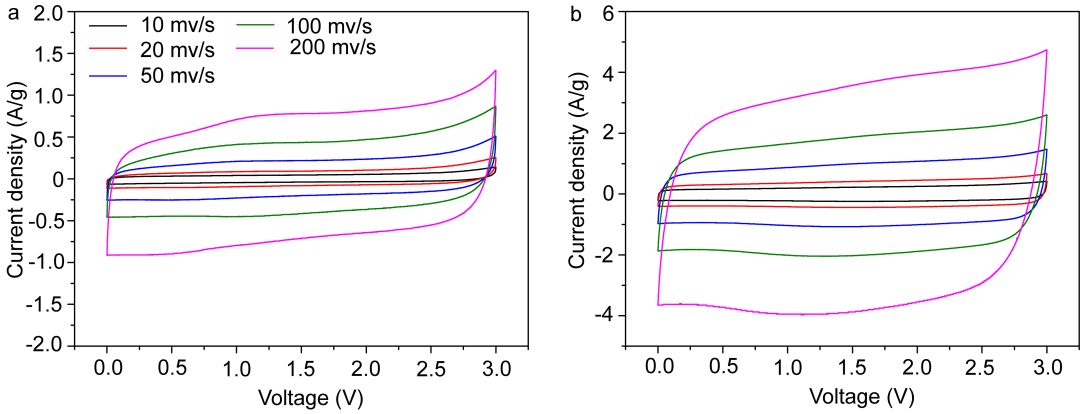

Fig. S4 Cyclic voltammmograms of (a) the pristine MWNTs and (b) core-shell structured MWNT@mesoC composites at different scan rates in 1.0 M $(C_2H_5)_4NBF_4$/PC electrolyte by using the two-electrode quasi-capacitor. The capacitance can be estimated by using an equation $C = 2i/v$, where C is the differential capacitance, i is the current density (its value at 1.5 V is used here for calculations), v is the scan rate multiplied by a factor of two because two carbon electrodes of the capacitor are connected in series.

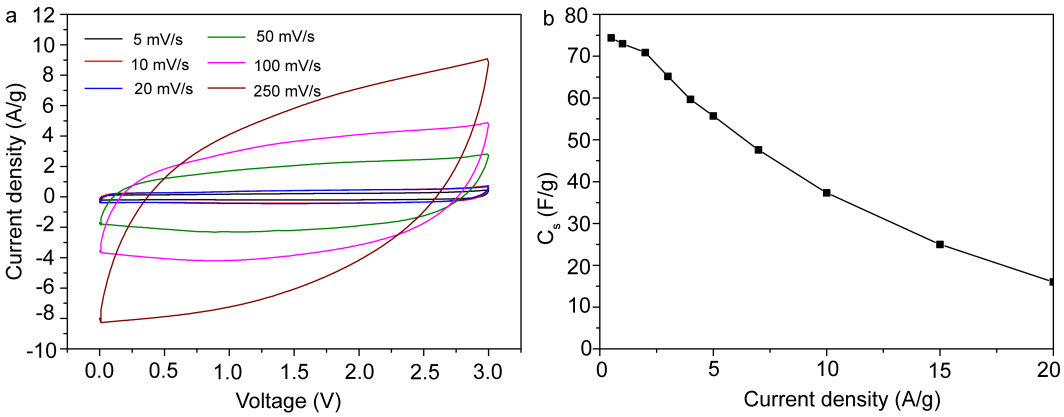

Fig. S5 Cyclic voltammmograms (a), Specific capacitance as a function of current density (b) in 1.0 M $(C_2H_5)_4NBF_4$/PC electrolyte by using the two-electrode quasi-capacitor of the mesoC electrode material.

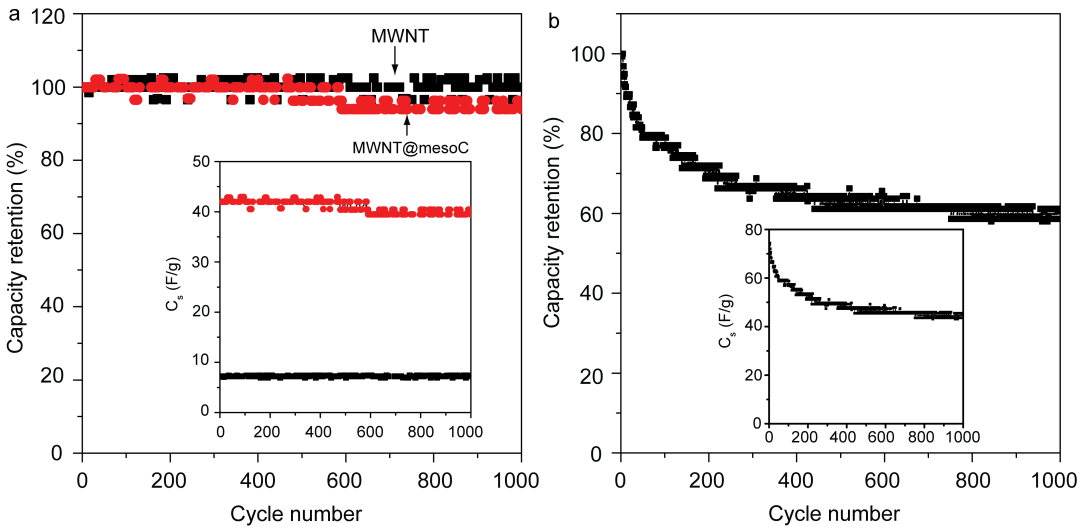

Fig. S6 Cyclability of the pristine MWNTs, MWNT@mesoC composite (a) and mesoC (b) electrode materials under a current density of 1.0 A/g in 1.0 M $(C_2H_5)_4NBF_4$/PC electrolyte.

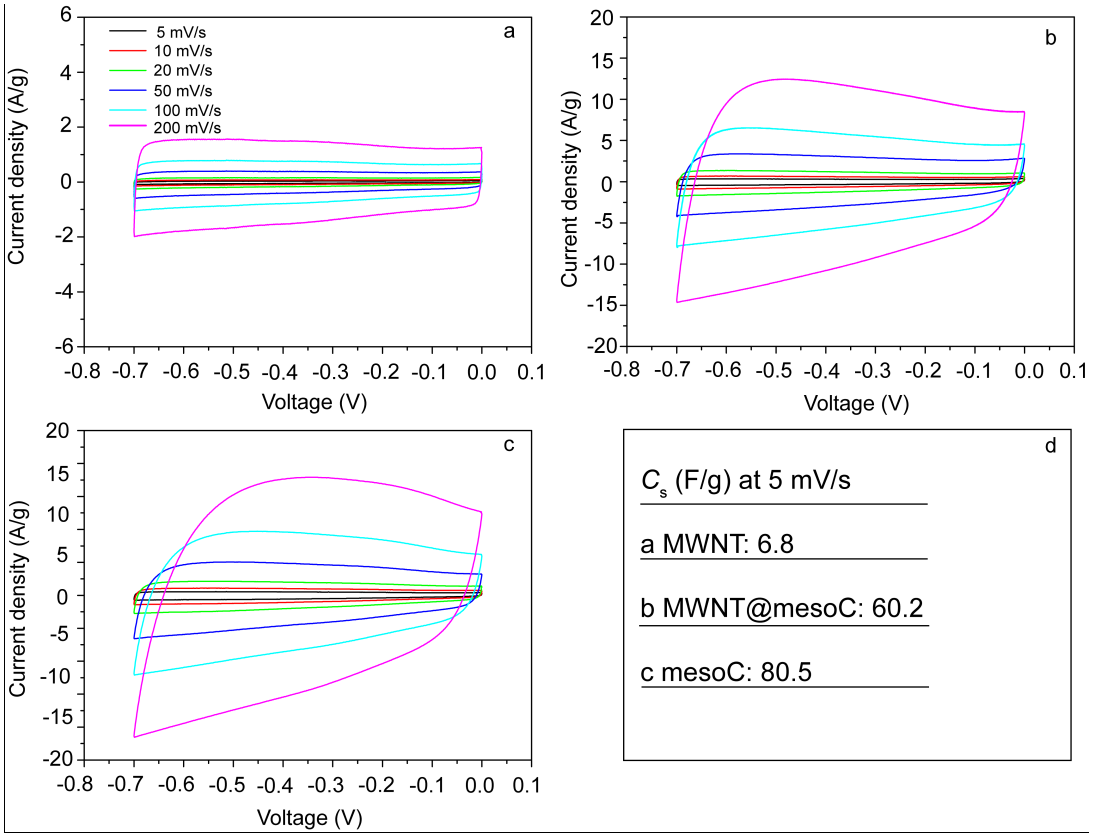

Fig. S7 Cyclic voltammmograms of (a) the pristine MWNTs, (b) MWNT@mesoC composite with core-shell configuration and (c) mesoC at different scan rates in 6 M KOH electrolyte by using the three-electrode system. (d) The calculated specific capacitance (C_s) of three electrode materials, which are estimated using an equation $C = i/v$, where C is the differential capacitance, i is the current density (its value at 0.35 V is used here for calculations), v is the scan rate.

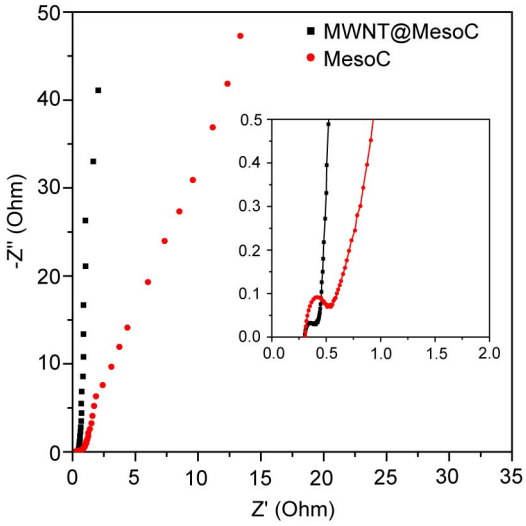

Fig. S8 Nyquist plots of the MWNT@mesoC composite with core-shell configuration and mesoC in 6 M KOH using a Solartron Instrument model 1287 electrochemical interface and 1255B frequency response analyzer controlled by a computer. (Frequency range: 0.001 Hz ~ 100 kHz; ac-amplitude: 5 mV)

Table S1. Physicochemical properties of the pristine MWNTs, mesoC and composite materials with core-shell structure.

Sample	S_{BET} (m^2/g)	S_{micro} (m^2/g)	S_{ex} (m^2/g)	V_{micro} (cm^3/g)	V_T (cm^3/g)	D_{meso} (nm)
MWNT	71	8	63	0.003	0.33	40
mesoC	789	36	753	0.003	0.74	3.7
MWNT@mesoS	562	485	77	0.19	0.29	2.5
MWNT@mesoSC	56	54	5	0.002	0.12	-
MWNT@mesoC	381	0	381	0	0.75	3.9/40