Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Fe_2O_3--Decorated Millimeter-Long Vertically Aligned Carbon Nanotube Arrays as Advanced Anode Materials for Asymmetric Supercapacitor with High Energy and Power Densities

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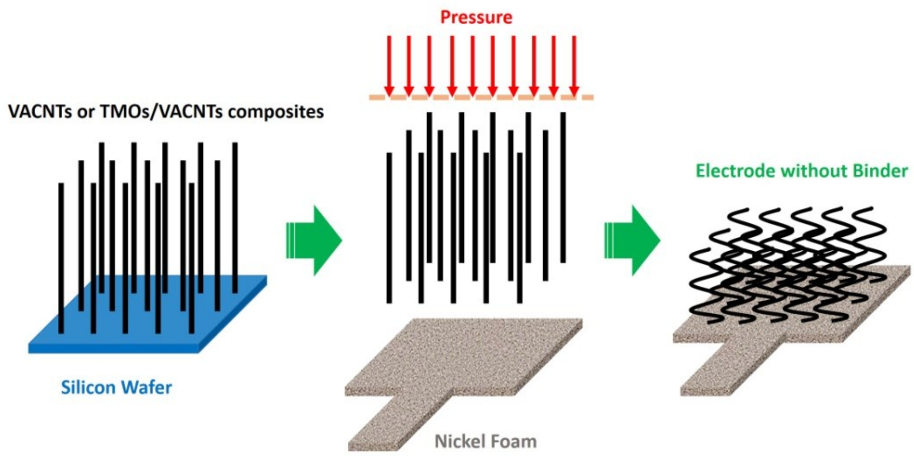


Figure S1. Schematic diagram of the electrode fabrication for electrochemical measurements.

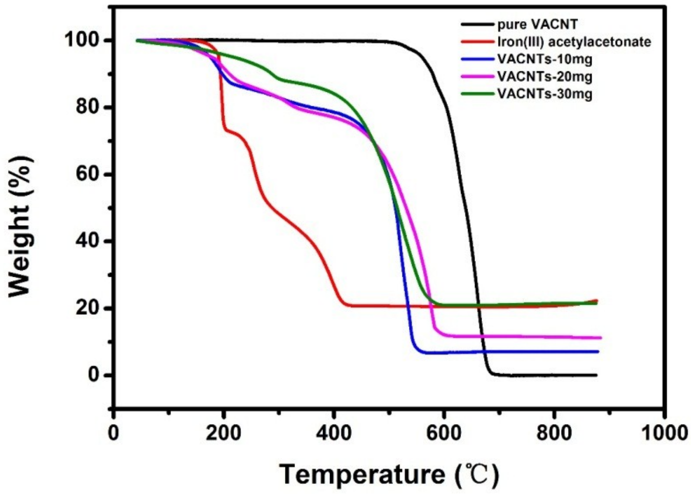


Figure S2. Thermogravimetric analysis of the pristine VACNT (black), the iron precursor (red), VACNTs with 10mg precursor (blue), VACNTs with 20mg precursor (pink), and VACNTs with 30mg precursor (green).

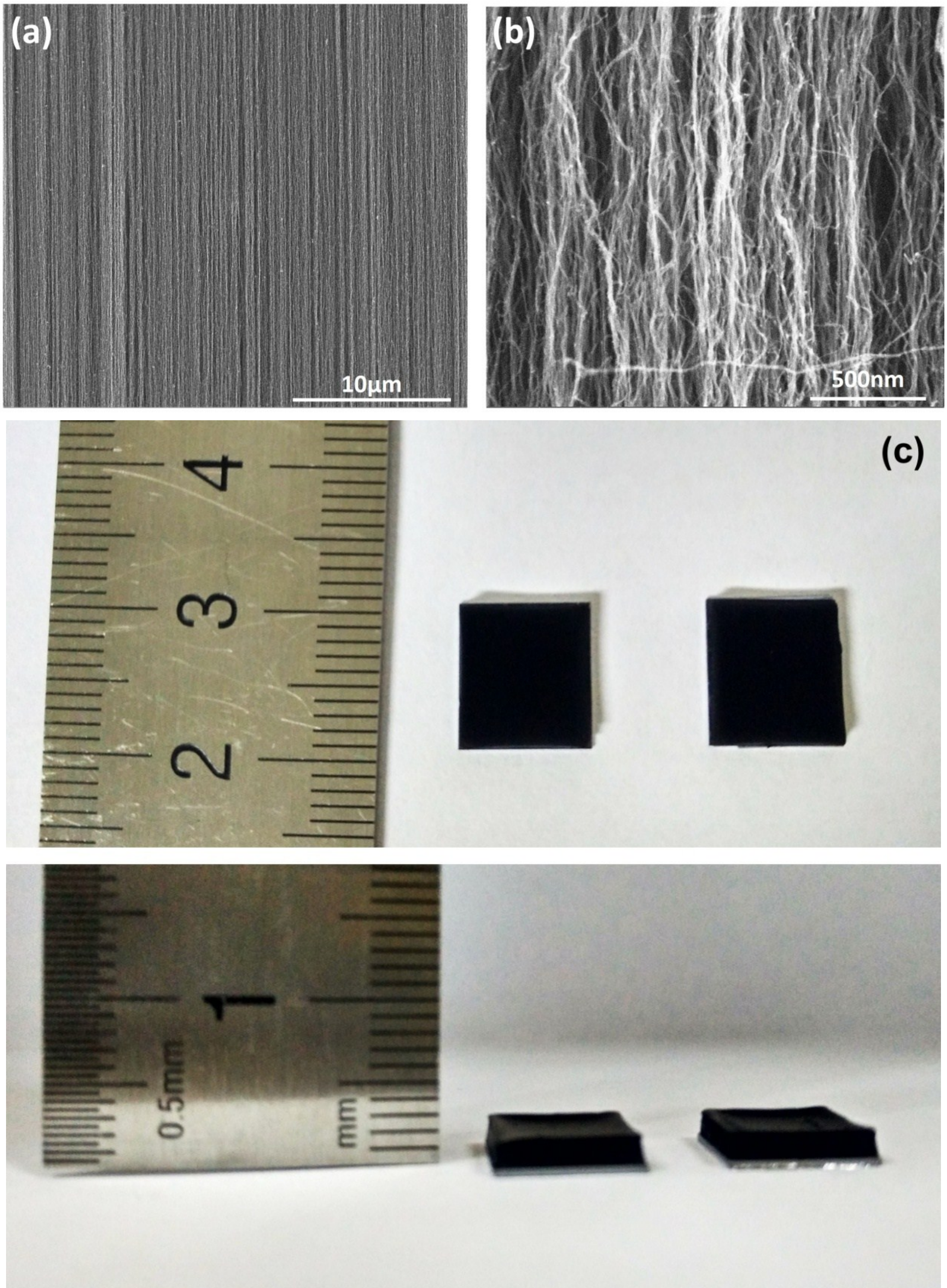
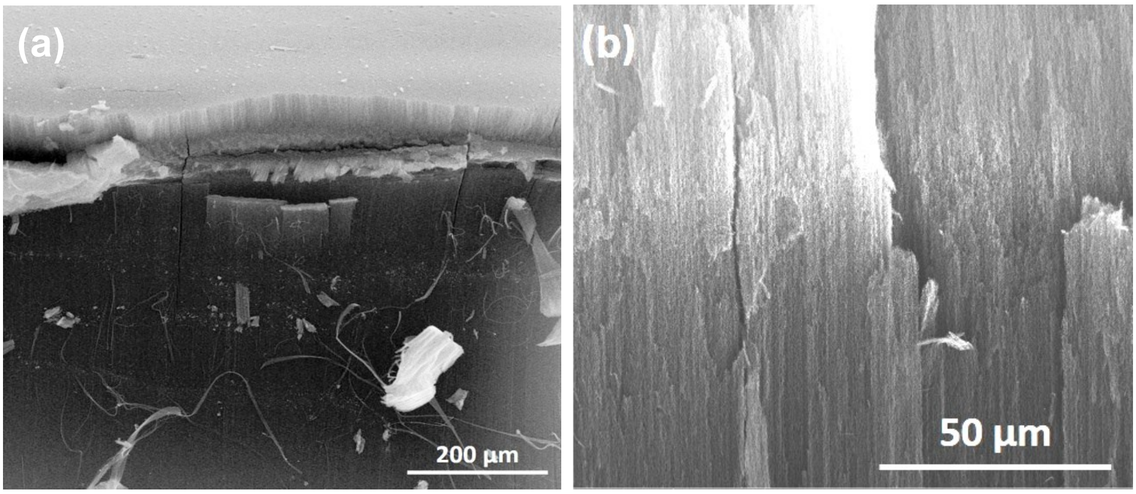


Figure S3. Cross-sectional SEM images (a, b) and digital photograph (c) of the pristine VACNTs. (Thickness of Si substrate: 0.5 mm.)



Firgue S4. Cross-sectional SEM images of the VACNTs-26.06 composite: (a) low-magnification; (b) magnified image for the top surface layer.

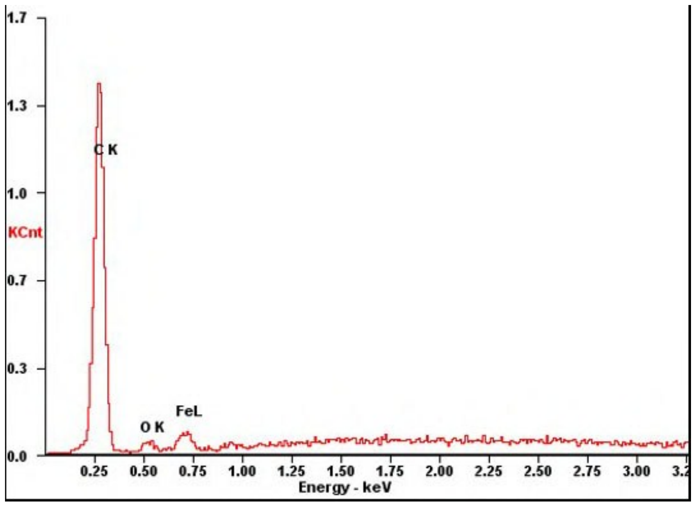


Figure S5. Corresponding EDS spectrum for the selected section in Fig.2e.

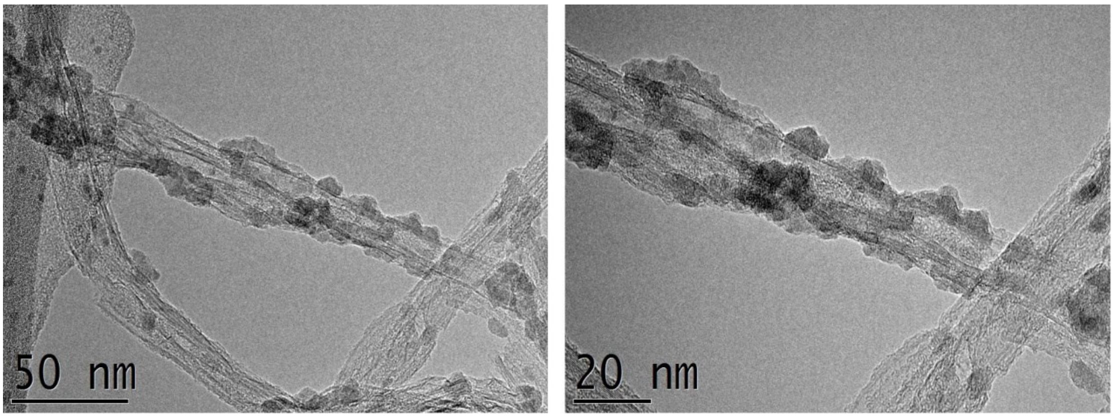


Figure S6. TEM images of the VACNTs-17.10 sample showing the decoration of Fe_2O_3 particles on outer surface of CNTs.

Table S1 . Effect of impregnation time in $SCCO_2$ on the weight gain of VACNTs.

Impregnation time in $SCCO_2$	1h	3h	6h	9h	12h
Weight gain of VACNTs	0.57 mg	1.28 mg	2.37 mg	2.56 mg	2.78 mg

Table S2. Effect of precursor mass on the weight gain of VACNTs after $SCCO_2$ processing and the weight percentage of Fe_2O_3 in the composite.

Mass of Fe precursor	Weight gain of VACNTs after impregnation	Wt.% of Fe_2O_3 in the composite after annealing
10 mg	0.83 mg	5.41
20 mg	1.60 mg	13.95
30 mg	2.37 mg	17.10
40 mg	3.17 mg	26.06

Table S3. Parameters for capacitance calculation in Fig.4b

Sample	Voltage drop (V)	Discharge time (s)
VACNTs	1.2	2.86
Fe_2O_3	1.2	19.20

VACNTs-5.41	1.2	20.34
VACNTs-13.95	1.2	28.67
VACNTs-17.10	1.2	37.20
VACNTs-26.06	1.2	30.15

Table S4. Parameters for capacitance calculation in Fig.5e

Current density (A g^{-1})	Voltage drop (V)	Discharge time (s)
2	0.6	181.76
4	0.6	178.72
6	0.6	174.69
8	0.6	171.76
12	0.6	170.52
16	0.6	169.6
20	0.6	168.6
24	0.6	167.98

Table S5. Parameters for capacitance calculation in Fig.6c

Current density (A g^{-1})	Discharge time (s)	IR Drop (V)
2	64	0.12
4	28	0.2
6	17	0.22
8	12.5	0.22
12	8	0.27
16	5.7	0.31
20	4	0.45
24	2.6	0.7

Table S6. Volume capacitance, volume power density/energy density of the asymmetric supercapacitor

Current density (mA/cm^3)	Volume specific capacitance (F/cm^3)	Volume energy density (mWh/cm^3)	Volume power density (W/cm^3)
90	13.7	6.2	0.1
180	12.6	5.7	0.2
270	11.6	5.2	0.3
360	11.4	5.1	0.4
540	11.3	5.1	0.6
720	11.0	5.0	0.9
900	10.7	4.8	1.2
1080	10.2	4.6	1.8

[*] In the calculation, whole volume of the asymmetric supercapacitor is used, including the active materials, the current collector, the separator and the electrolyte.