Supporting Information

Hybrid Supercapacitor Based on Coaxially Coated Manganese Oxide on Vertically Aligned Carbon Nanofiber Arrays

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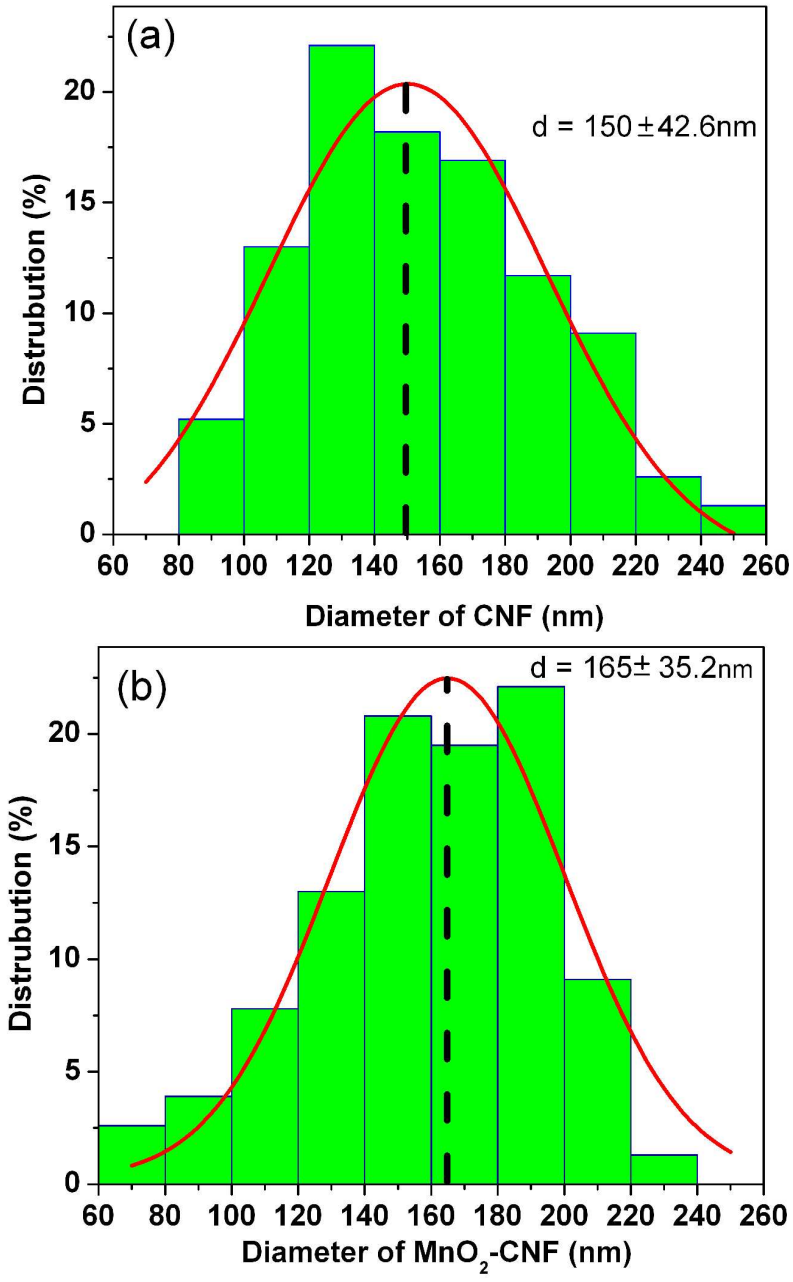

Figure S1. Histograms of the distribution of the outer diameter of carbon nanofibers in a bare acid-treated VACNF array (a) and the same sample after 20 minutes of Manganese Oxide deposition (b). Both histograms are fit with a gaussian distribution with the mean diameter and standard deviation shown in the figure.

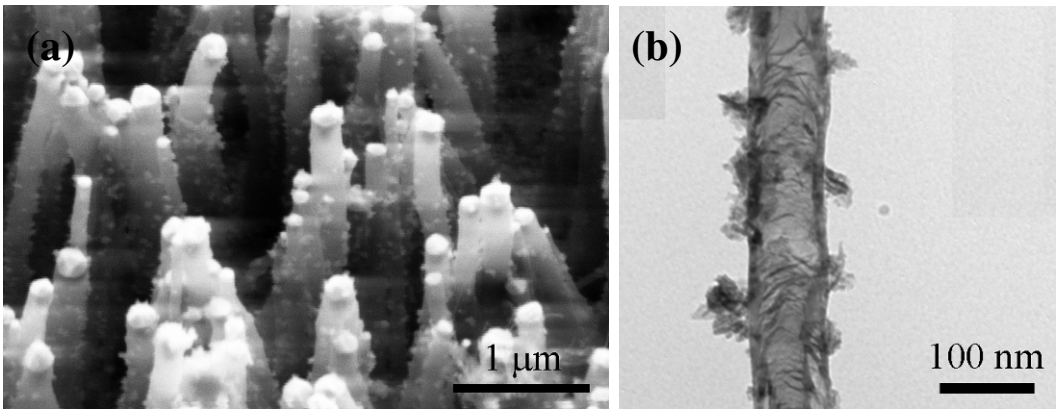

Figure S2. SEM and TEM images of an as-grown VACNF array directly coated with MnO_2 with 26 minutes of electrodeposition time without going through the acid treatment.

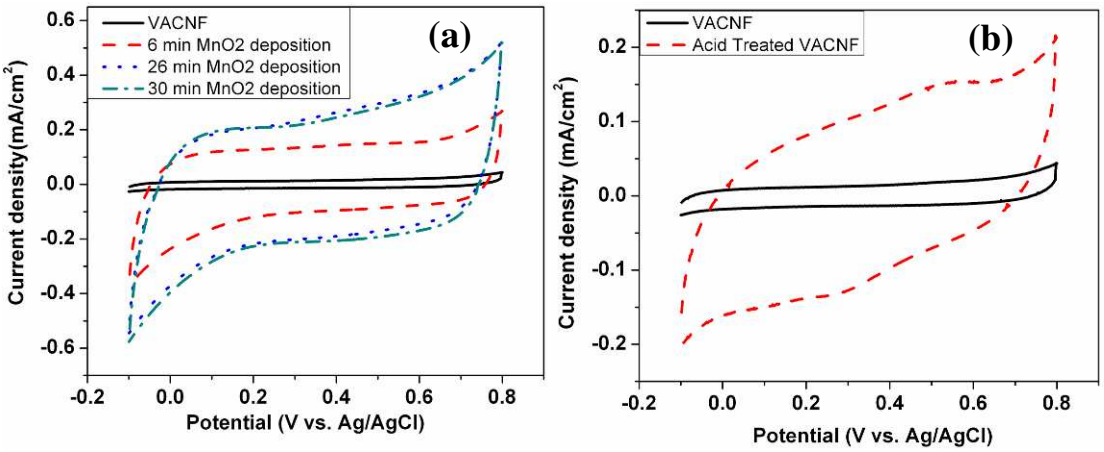

Figure S3. (a) Cyclic voltammograms of an as-grown VACNF arrays without subjecting to acid treatment and this sample after deposited with MnO_2 at various deposition time. (b) Cyclic voltammograms of bare VACNF arrays with and without acid treatment.

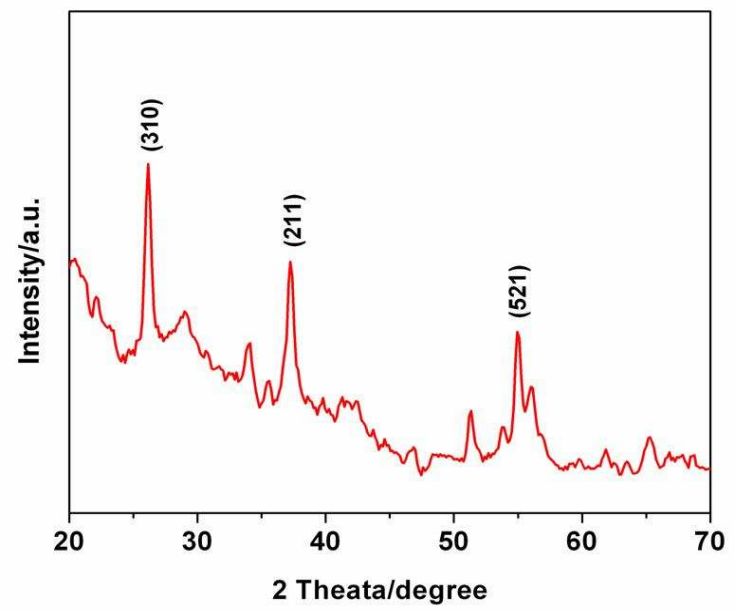

Figure S4. X-ray diffraction of the electrochemically deposited manganese oxide after annealing in the air at 200 ^{o}C. All reflections can be indexed as a pure tetragonal phase of α-MnO_2 with lattice constants a = 0.9784 nm and c = 0.2863 nm (JCPDS 44-0141).

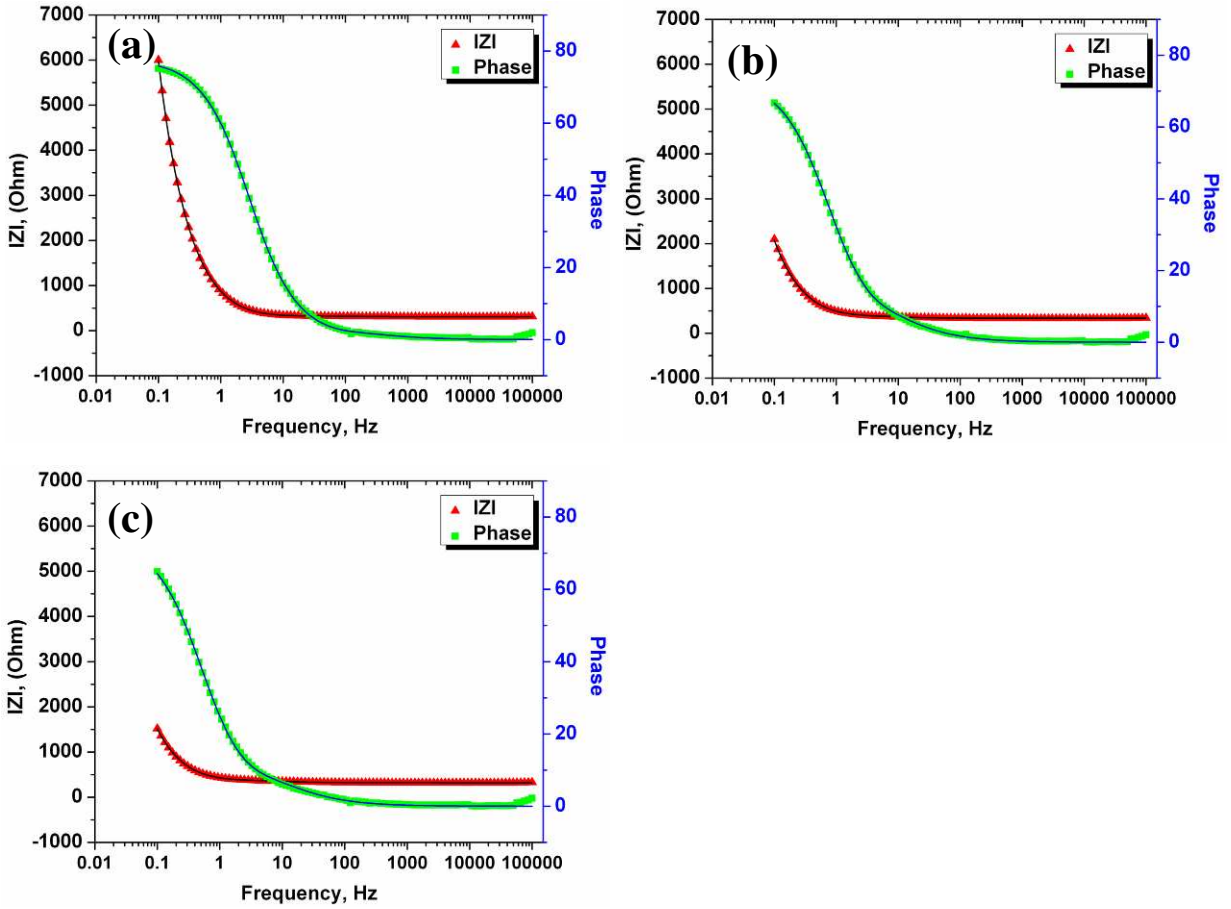

Figure S5. Bode plots of an acid-treated VACNF array (a) and similar samples after 6 minutes of MnO_2 deposition (b) and 20 minutes of MnO_2 deposition (c).

Table SI Fitting parameters of electrochemical impedance spectra for the acid-treated VACNF arrays

Sample conditions	Rs (Ohm)	CPE		R_{ct} (Ohm)	C (F)
		Y (Ohm)	α		
Acid-treated VACNF	306.6	1.649E-4	0.8119	28.78	9.19E-5
After 6 min MnO_2 deposition	333.5	5.501E-4	0.7912	202.6	2.105E-4
After 20 min MnO_2 deposition	319.1	6.591E-4	0.7734	154.6	4.161E-4

Note:
The employed equivalent circuit is shown in Fig. 5.

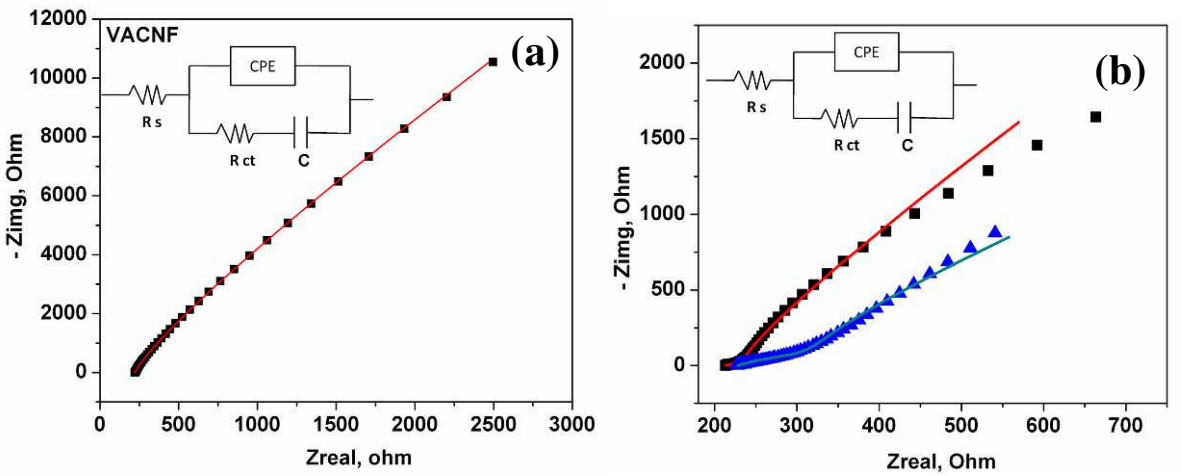

Figure S6. Nyquist plot and fitting of electrochemical impedance spectra of samples without going through acid treatments: (a) an as-grown VACNF array, (b) a VACNF array after 6 minutes of MnO_2 deposition (filled square), and (c) a VACNF array after 26 minutes of MnO_2 deposition (filled triangle).

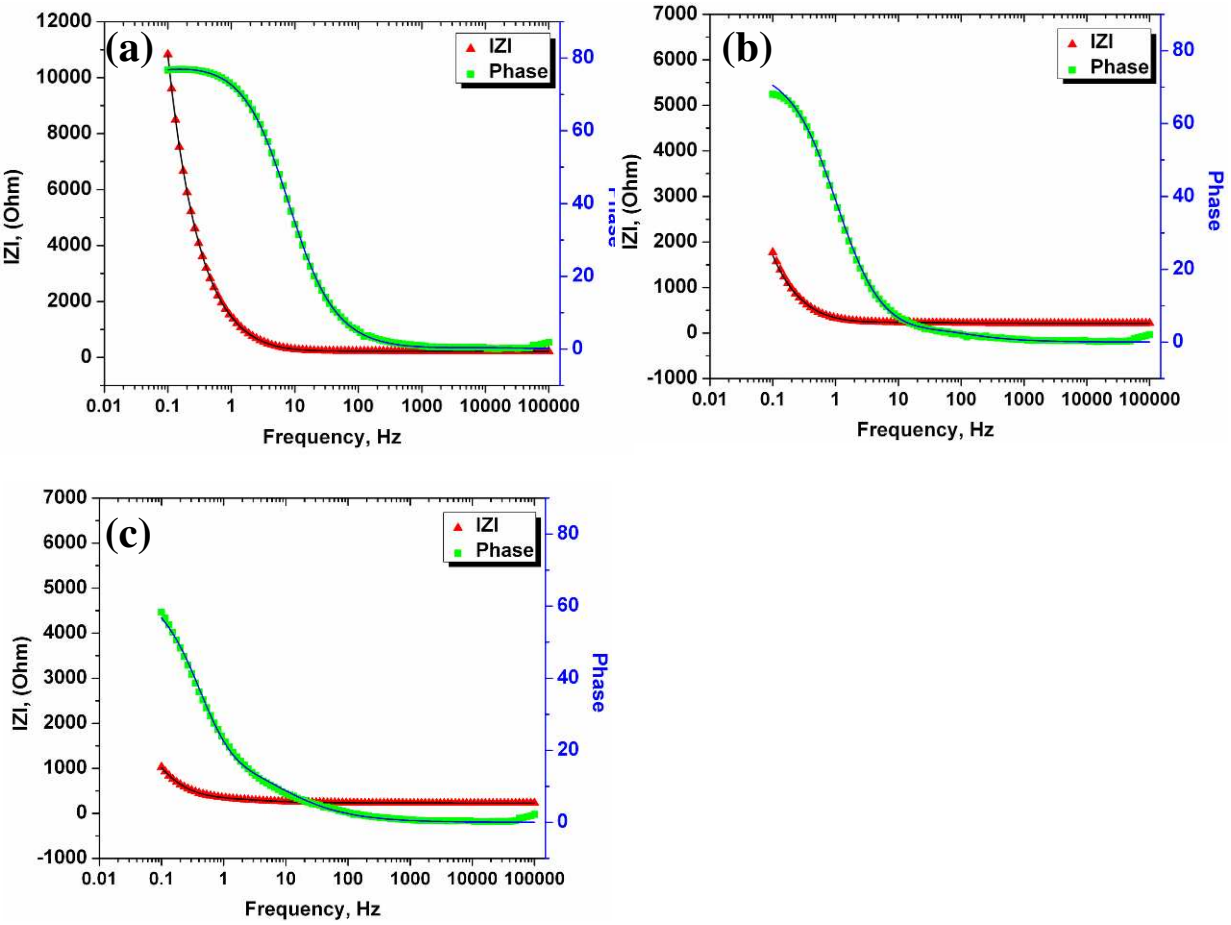

Figure S7. Bode plots of as-grown VACNF array (a), after 6 min MnO_2 depsoition (b), after 26 min MnO_2 deposition (c).

Table SII Fitting parameters of electrochemical impedance spectra for the non-treated VACNF arrays

Sample conditions	Rs (Ohm)	CPE		R_{ct} (Ohm)	C (F)
		Y (Ohm)	α		
Non-treated VACNF	219.8	7.032E-5	0.745	4.427	7.156E-5
After 6 min MnO_2 deposition	213.6	5.101E-4	0.656	38.19	4.13E-4
After 26 min MnO_2 deposition	228	1.047E-3	0.6841	275.7	5.684E-4

Note:
The employed equivalent circuit is shown in Fig. S5.