

## Supplementary Information

### **Hierarchical three-dimensional MnO<sub>2</sub>/Carbon@TiO<sub>2</sub> nanotube arrays for high-performance supercapacitors**

Zicheng Wang,<sup>a</sup> Yan Wang,<sup>\*ab</sup> Xia Shu,<sup>a</sup> Cuiping Yu,<sup>a</sup> Jianfang  
Zhang,<sup>a</sup> Jiewu Cui,<sup>a</sup> Yongqiang Qin,<sup>a</sup> Hongmei Zheng,<sup>a</sup> Yong  
Zhang,<sup>ac</sup> Yucheng Wu<sup>\*ac</sup>

<sup>a</sup>School of Materials Science and Engineering, Hefei University of Technology, Hefei  
230009 (China)

<sup>b</sup>Department of Materials Science and NanoEngineering, Rice University, Houston,  
Texas 77005 (United States)

<sup>c</sup>Key Laboratory of Advanced Functional Materials and Devices of Anhui Province,  
Hefei 230009(China)

\*Corresponding authors:

Dr. Yan Wang, Email: stone@hfut.edu.cn,

Prof. Yucheng Wu, Email: ycwu@hfut.edu.cn

Table S1. The relative elemental analysis of C, O and Ti in CTNAs

Element	Wt%	At%
<b>C</b>	8.58	16.99
<b>O</b>	37.98	56.47
<b>Ti</b>	53.44	26.54
<b>Total</b>	100.0	100.0

Table S2. The relative elemental analysis of C, O, Ti and Mn in

CMTNAs

Element	Wt%	At%
<b>C</b>	3.40	7.79
<b>O</b>	32.78	56.41
<b>Ti</b>	51.81	29.78
<b>Mn</b>	12.01	6.02
<b>Total</b>	100.0	100.0

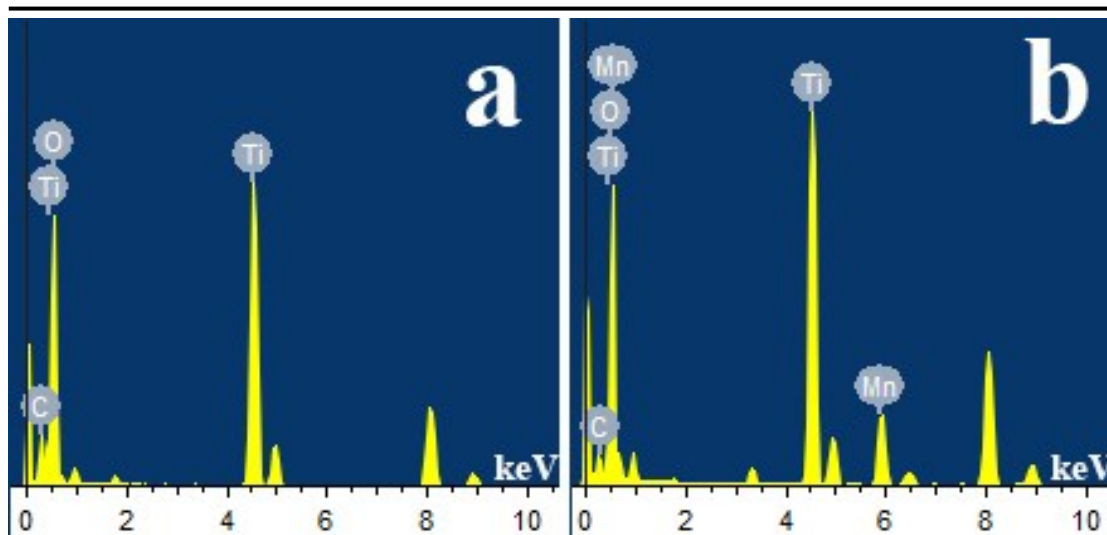


Figure S1. EDX analysis of (a) CTNAs and (b) CMTNAs

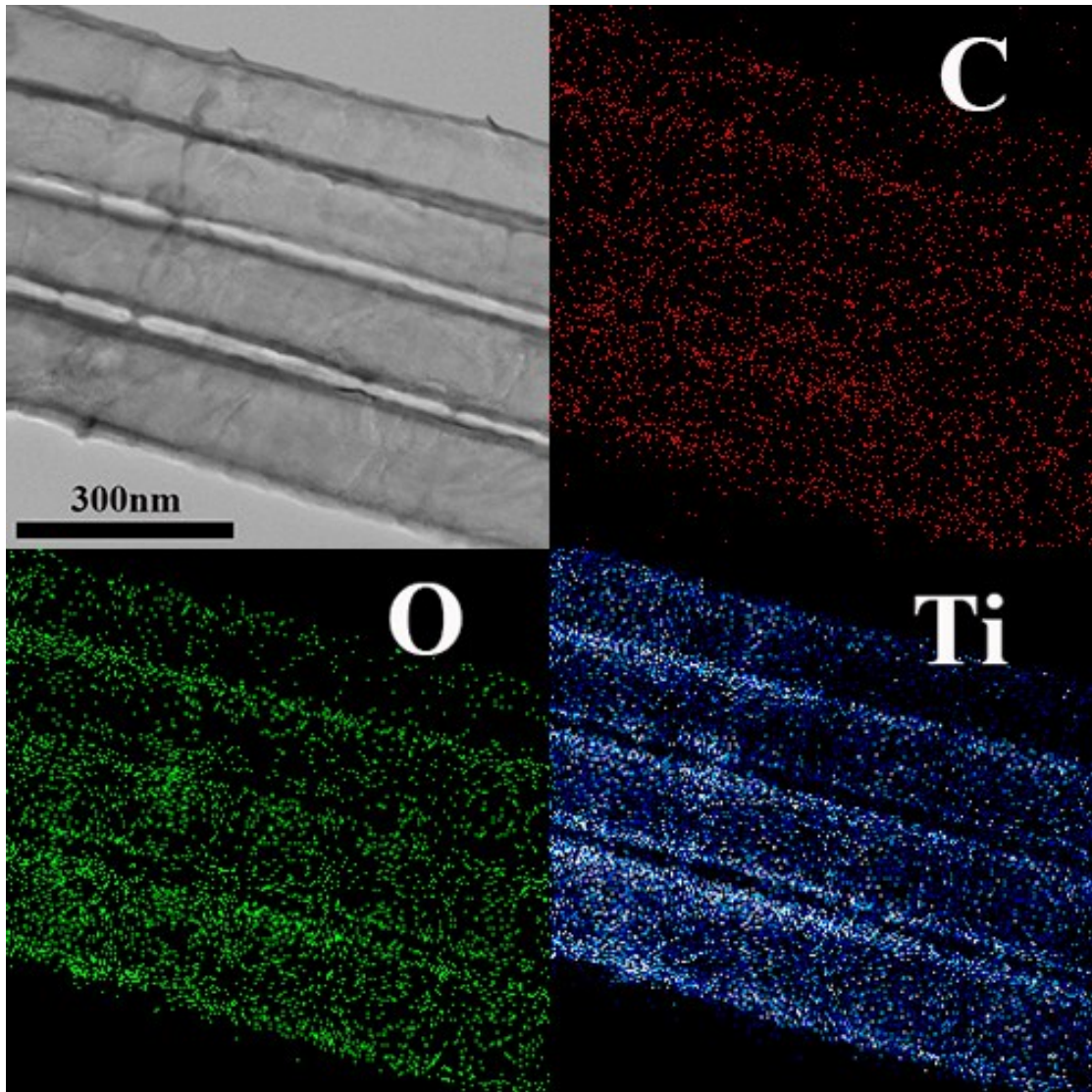


Figure S2. EDS mapping of nanotubes of CTNAs

Table S3. The loading mass of MnO<sub>2</sub> on different samples

Sample	Width (cm)	Height (cm)	Area (cm <sup>2</sup> )	Loading mass of MnO <sub>2</sub> (mg)
ATNAs	2	3.2	6.4	0
CTNAs	2	3.2	6.4	0
CMTNAs (Sample-I)	2	3.2	6.4	1.41
CMTNAs (Sample-II)	2	3.2	6.4	2.75
CMTNAs (Sample-III)	2	3.2	6.4	3.6
CMTNAs (Sample-IV)	2	3.2	6.4	3.9
CMTNAs (Sample-V)	2	3.2	6.4	4.0

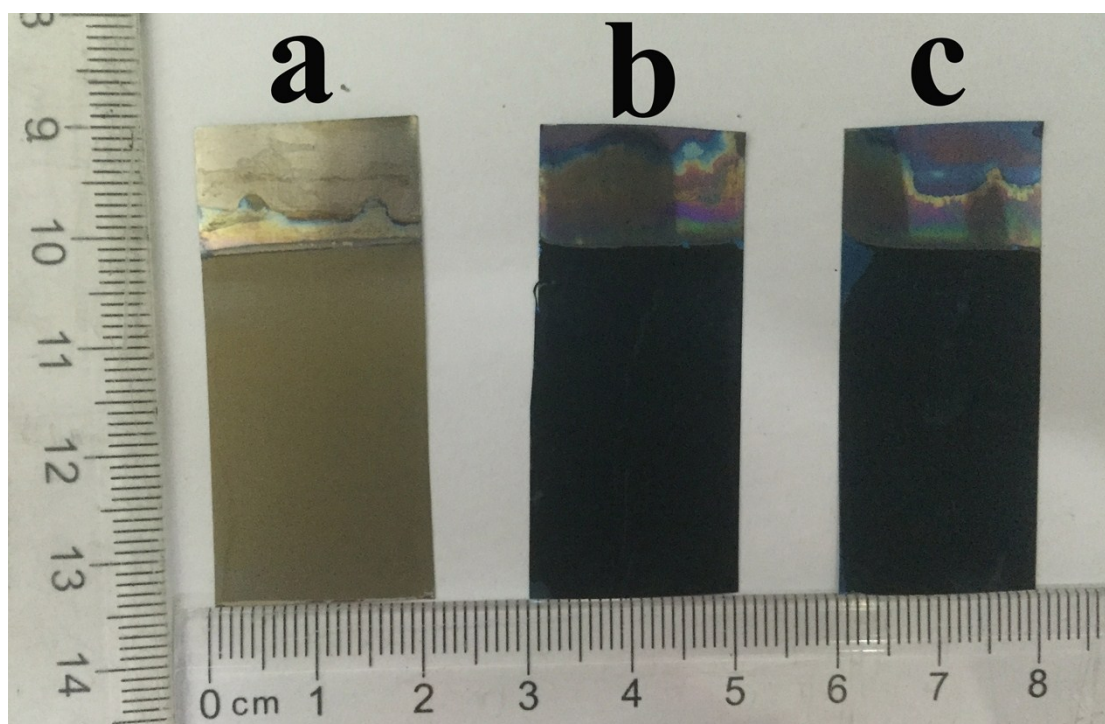


Figure S3. The digital photographs of (a) ATNAs, (b) CTNAs and (c) CMTNAs

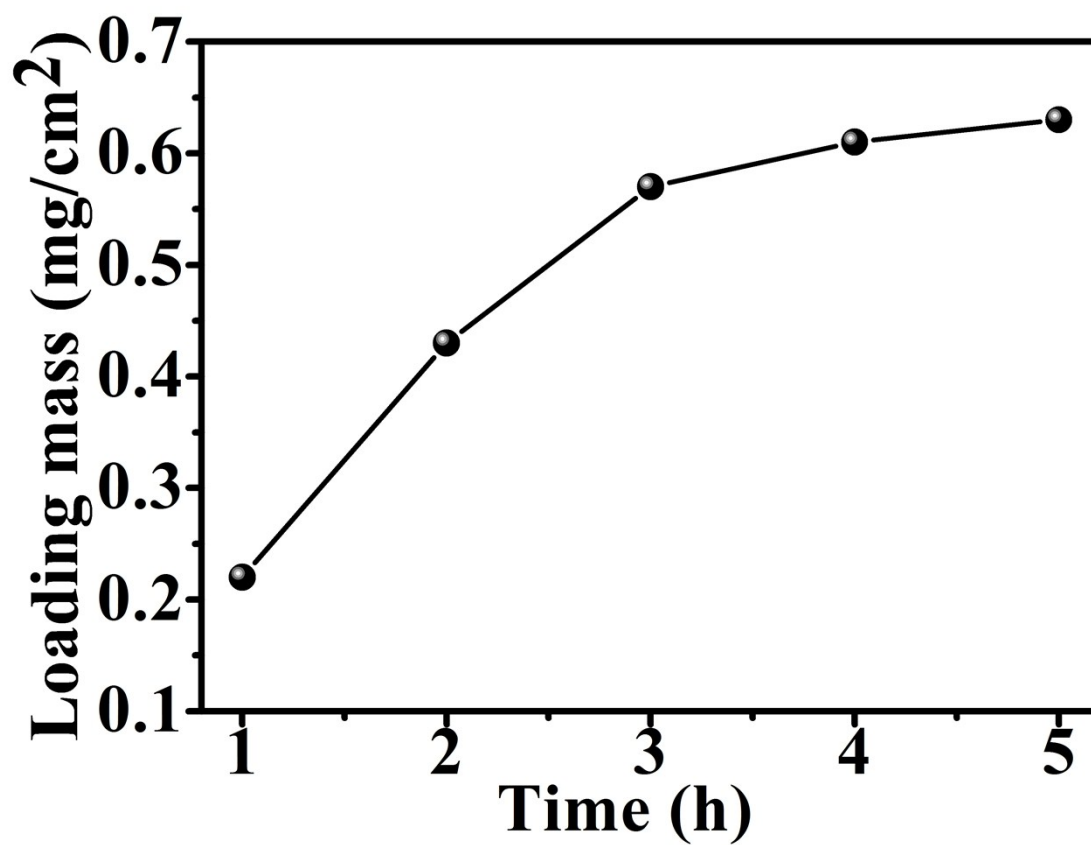


Figure S4. The loading mass of MnO<sub>2</sub> as a function of the time of hydrothermal treatment



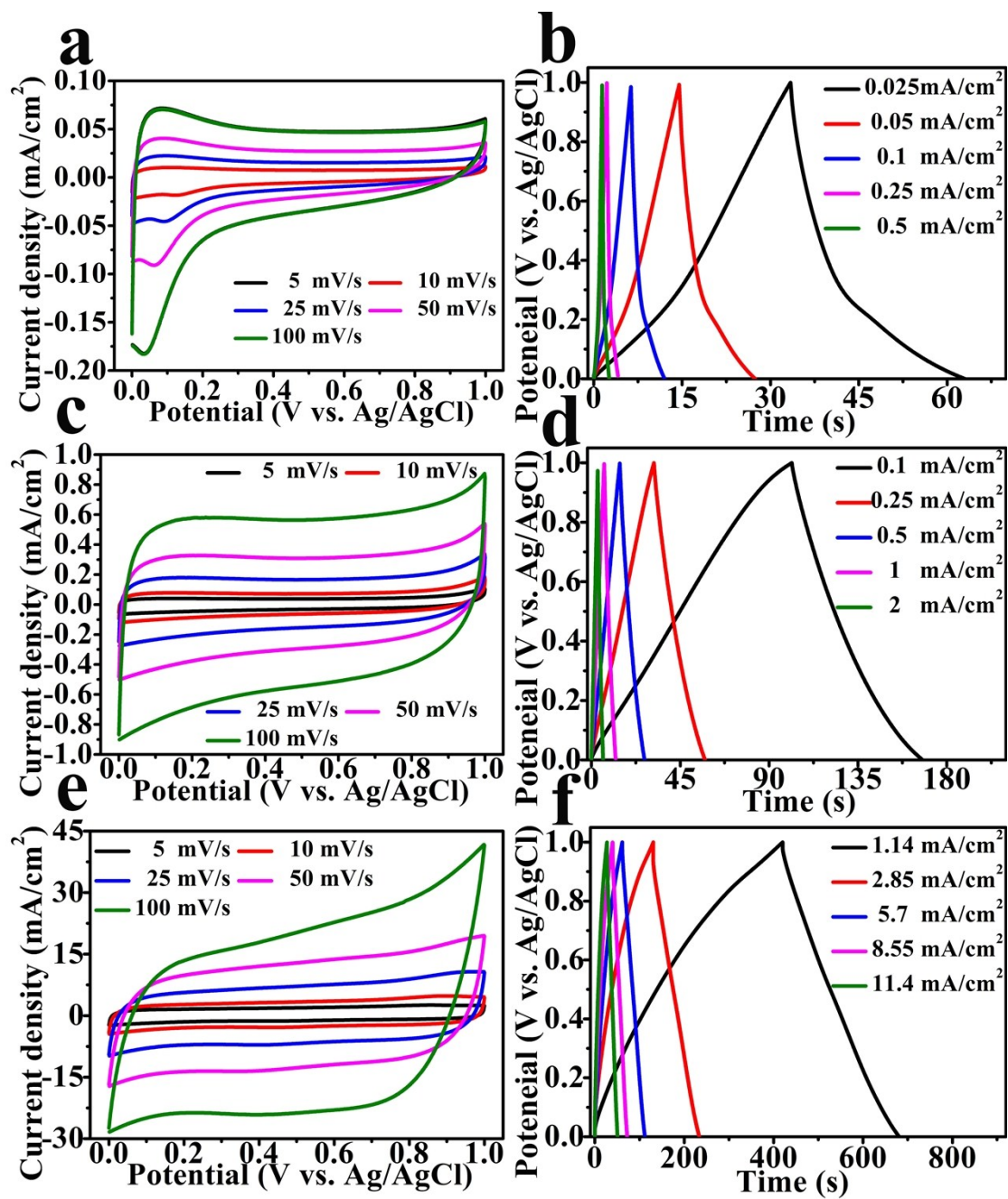


Figure S5. CV curves of (a) ACTNAs, (c) CTNAs and (e) Sample-III at different scan rates; GCD curves of (b) ATNAs, (d) CTNAs and (f) Sample-III measured at different current densities

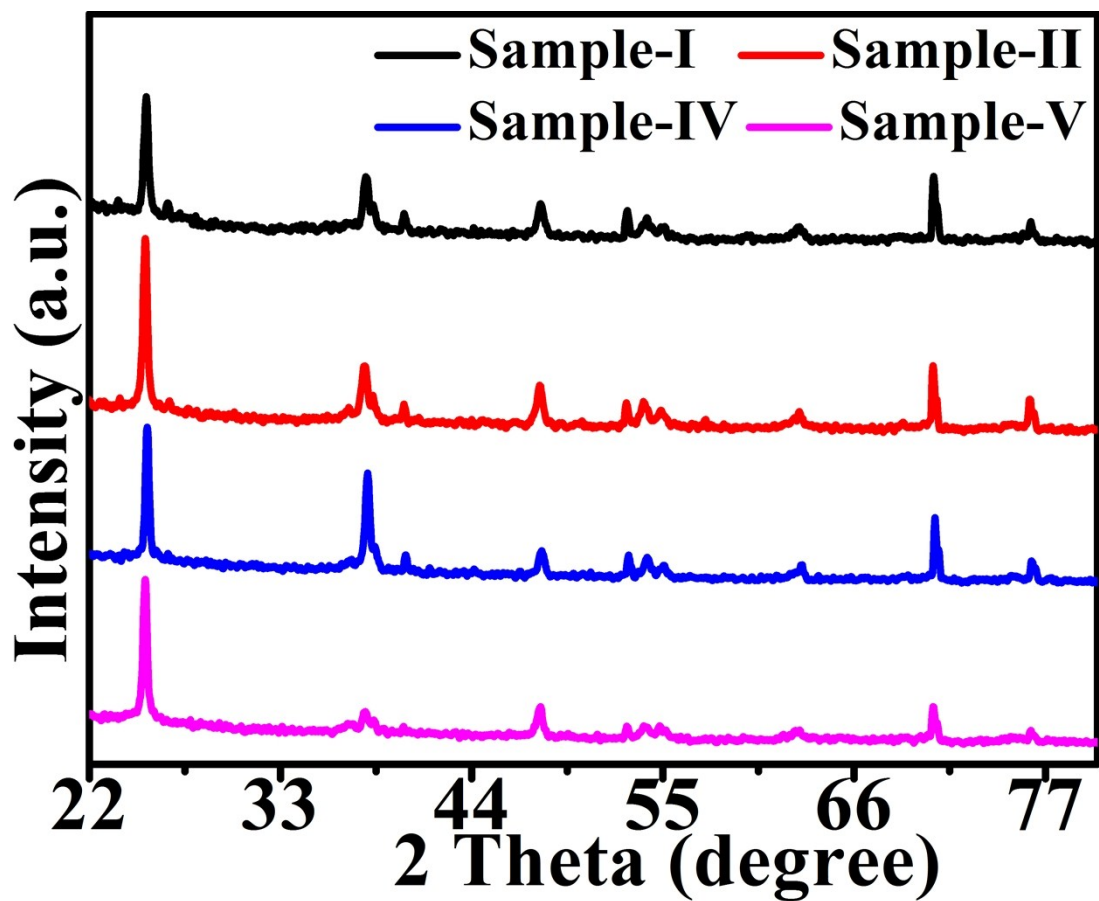


Figure S6. XRD patterns of Sample-I, II, IV and V

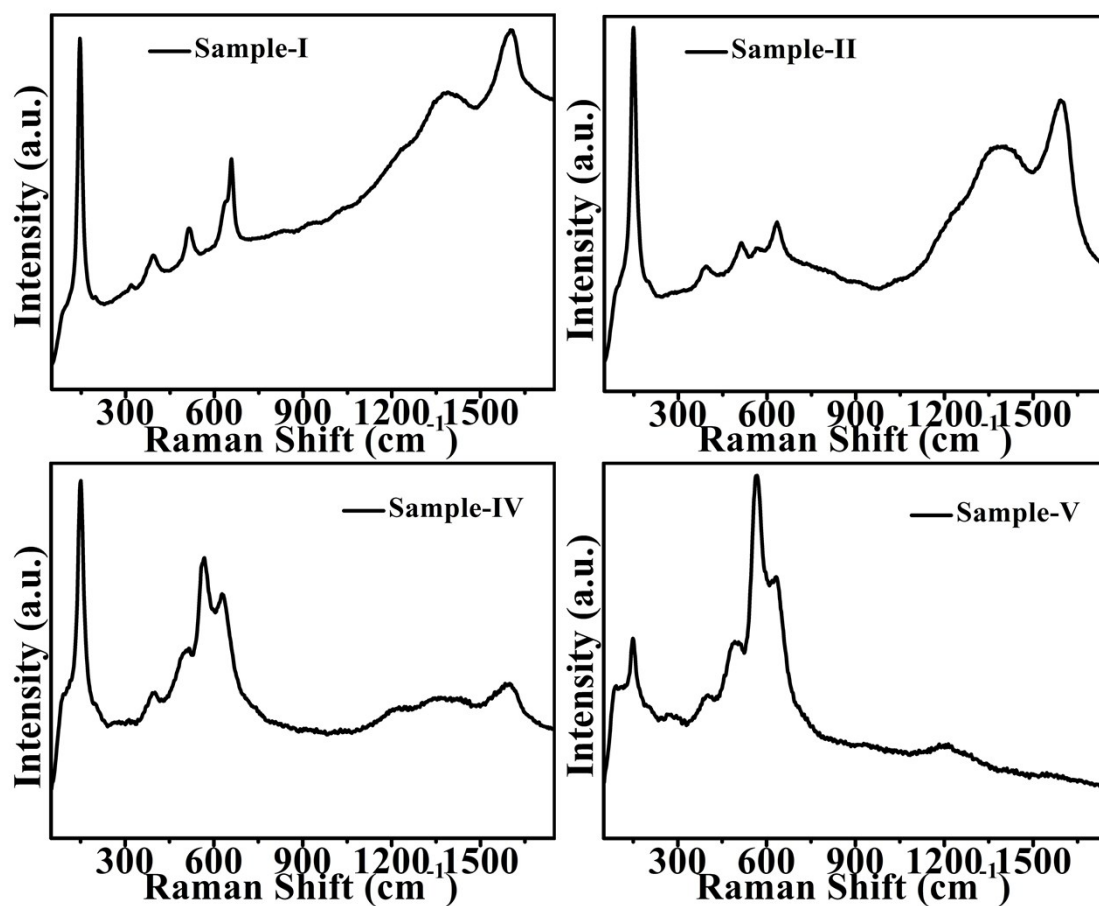


Figure S7. Raman spectra of Sample-I, II, IV and V



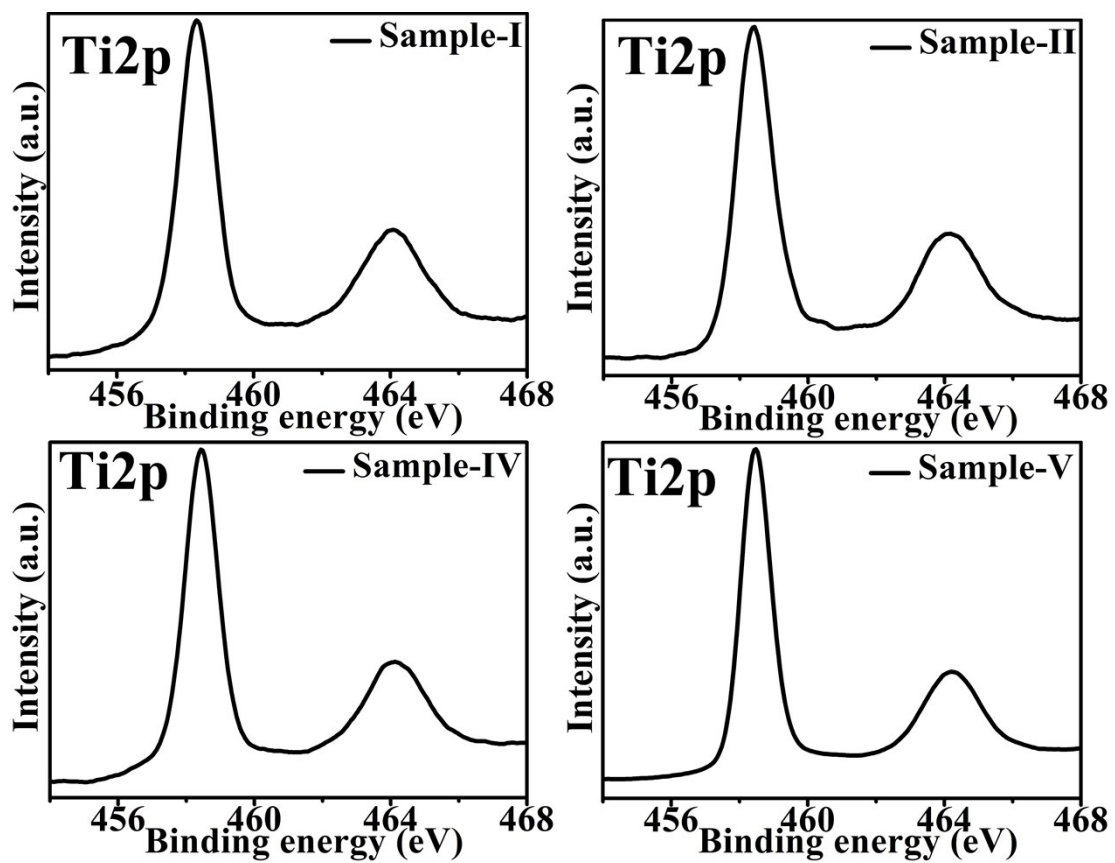


Figure S8. XPS peaks of Ti2p of Sample-I, II, IV and V

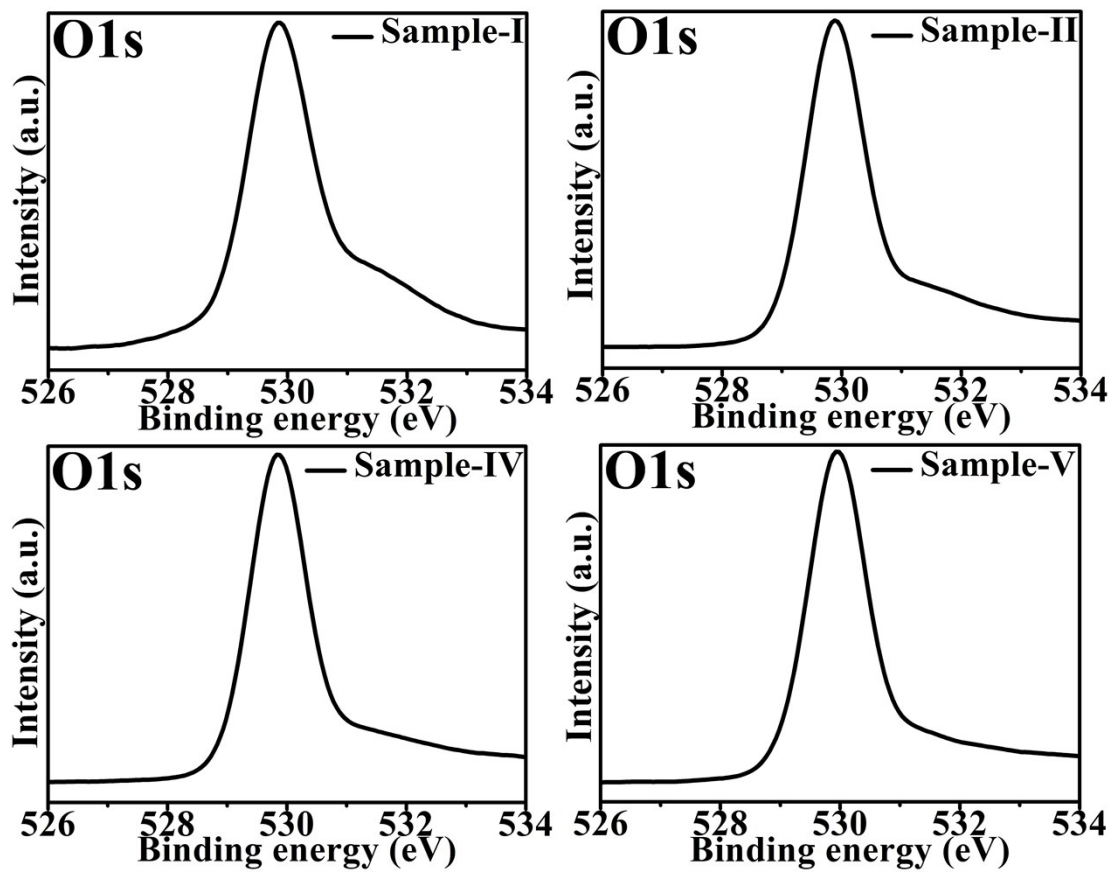


Figure S9. XPS peaks of O1s of Sample-I, II, IV and V

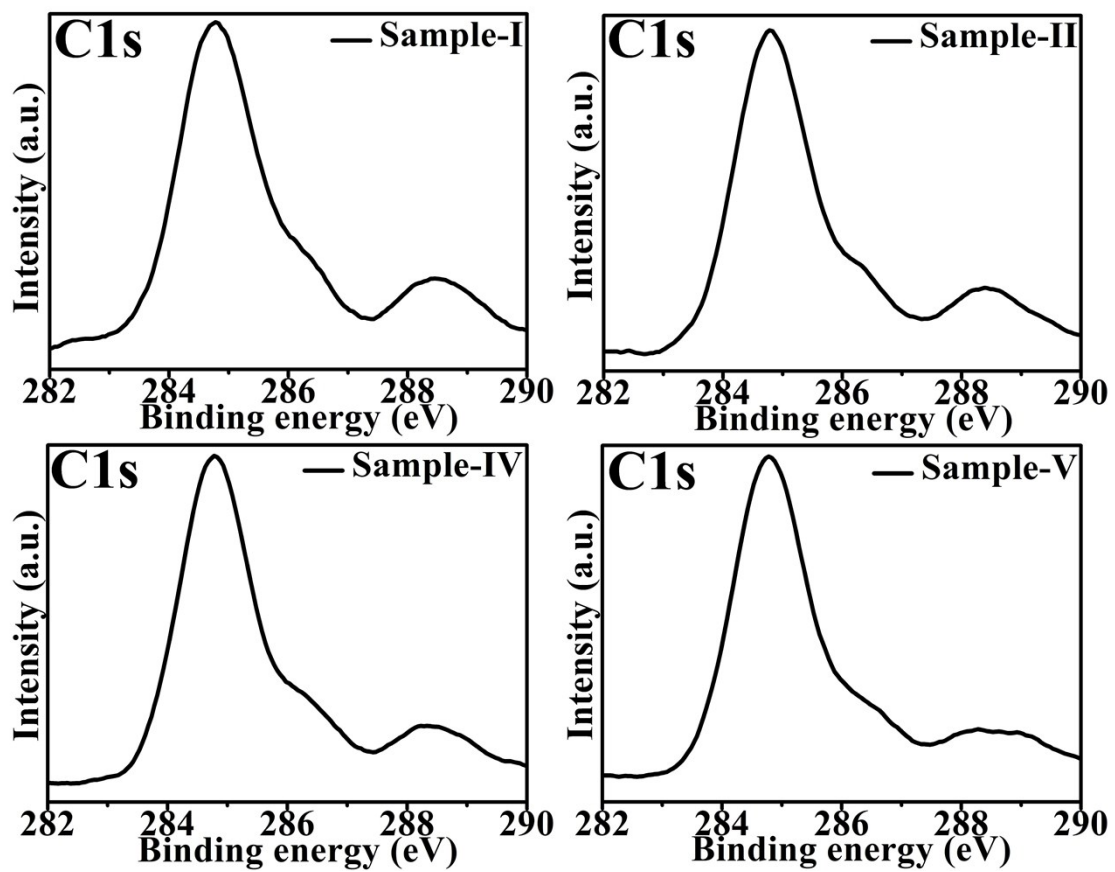


Figure S10. XPS peaks of C1s of Sample-I, II, IV and V

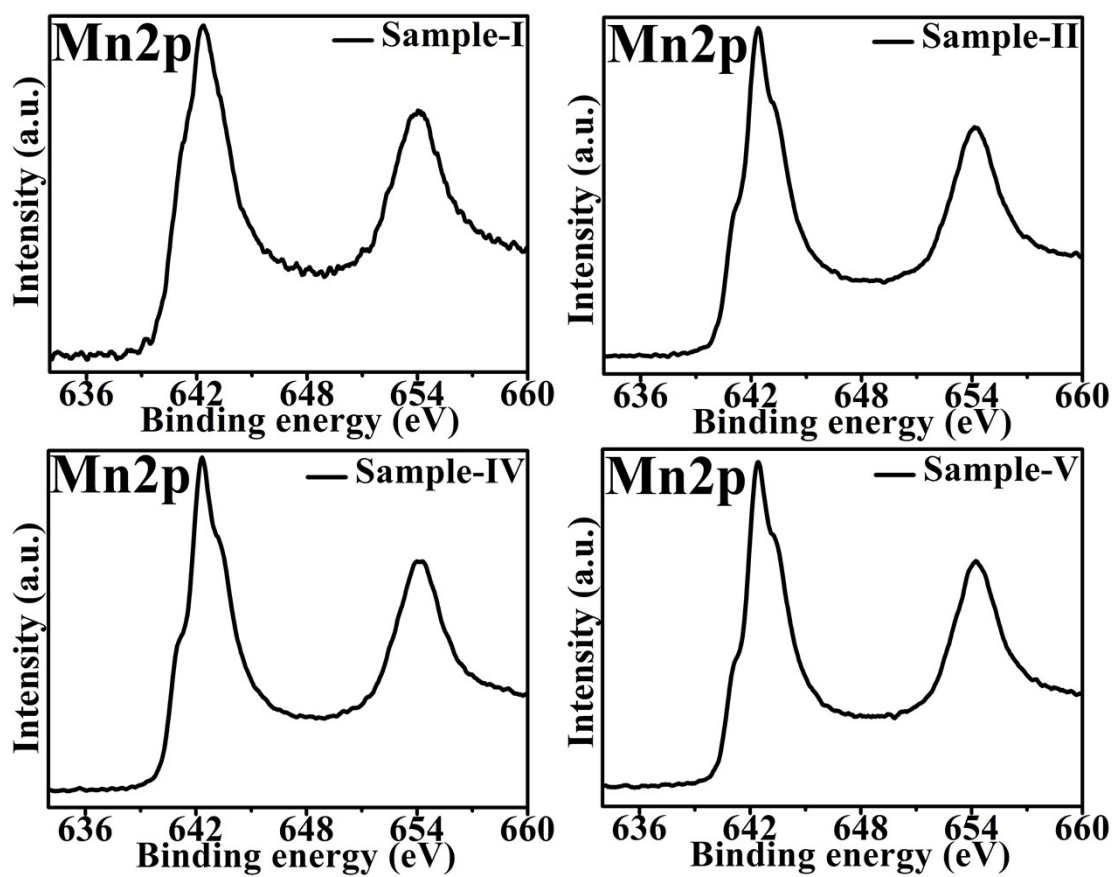


Figure S11. XPS peaks of Mn2p of Sample-I, II, IV and V

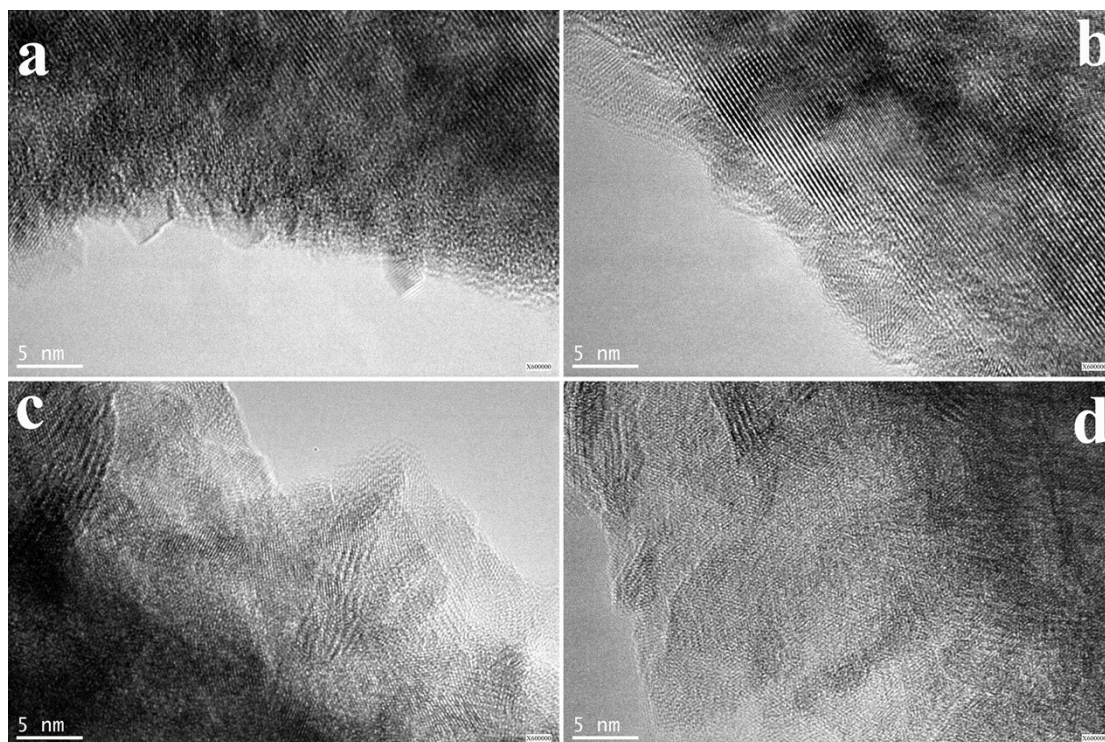


Figure S12. HRTEM images of (a) Sample-I, (b) Sample-II, (c) Sample-

IV and (d) Sample-V

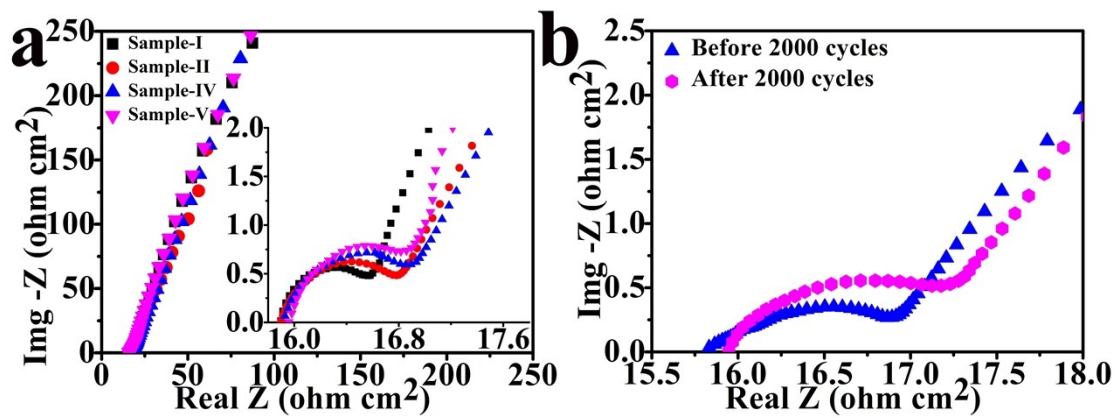


Figure S13. (a) Nyquist plots of Sample-I, II, IV and V; (b)

Electrochemical impedance spectroscopy curves of CMTNAs measured

before and after 2000 charge-discharge cycles