Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A. This journal is © The Royal Society of Chemistry 2017

## **Supporting Information**

Chelating functional group attached carbon nanotube prepared for performance enhancement of vanadium redox flow battery

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Sample Peak curre (mA cm <sup>-2</sup>		density	Peak Potential (V)		$\Delta E_{p}(V)$	I <sub>pa</sub> /I <sub>pc</sub> (without background
	I <sub>pa</sub>	I <sub>pc</sub>				current)
CNT	0.982	-0.745	0.767	0.693	0.074	0.1677
CA-CNT	4.936	-3.843	0.789	0.672	0.117	0.7929
HAA-CNT	6.506	-4.970	0.788	0.676	0.112	0.8485

Table. S1 The peak current density, peak potential,  $\Delta E_p$  and  $I_{pc}/I_{pc}$  of CNT, CA-CNT and HAA-CNT catalysts. The CVs were measured at 10mV s<sup>-1</sup>



**Figure. S1** (a) CV curves representing  $VO_2^+/VO_2^+$  redox reaction of CNT, CA-CNT and HAA-CNT catalysts that were measured after 10 cycle. (b) CV curves representing  $VO_2^+/VO_2^+$  redox reaction of HAA-CNT catalyst that were measured for maximum 500 cycle by an interval of 100 at scan rate 10mV·s<sup>-1</sup>.



**Figure. S2** CV curves representing  $VO_2^+/VO_2^+$  redox reaction of (a) CNT, (b) CA-CNT and HAA-CNT catalysts that were measured at the potential scan rates of 10~100 mV s<sup>-1</sup>



Figure. S3 Charge/discharge curves of the three VRFB single cells measured after first cycle.



Figure. S4 Relative charge capacity of the three VRFB single cells measured during 50 cycle.