

## Supporting Information

Exploration on the modification of carbon-based substrate surface in aqueous  
rechargeable zinc ion batteries

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## 1. Experimental Section

### Materials

$\beta$ -MnO<sub>2</sub> (98%), N-methyl pyrrolidone (NMP, AR), nitric acid (AR) and sulphuric acid (AR) were purchased from Alfa aesar and used without any modification or purification. Acetylene black(battery grade) and polyvinylidene fluoride(PVDF, battery grade) were purchased from Shandong Hairong Power Supply Materials Co., Ltd. The CPs were purchased from HESEN(Toray 060), soaked in the solvent of nitric and sulphuric acid(3:1, v:v) for 6 hours at different temperatures, washed by deionized water and dried for electrode preparation.

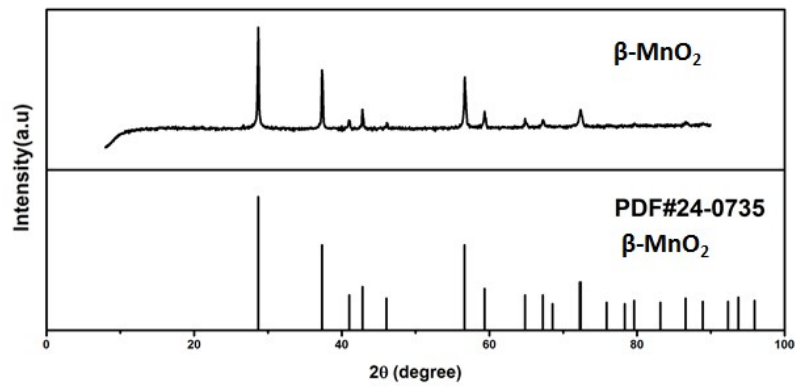
### Battery Assembly

$\beta$ -MnO<sub>2</sub>, acetylene black and PVDF were mixed at a weight ratio of 7:2:1 in NMP, then the slurry was pushed into different CPs and dried at 80 °C under vacuum for 12 hours to prepare the cathodes. Electrochemical measurements were carried out with a CR2032 coin cell using a zinc foil as the anode, glass fiber as the separator and  $\beta$ -MnO<sub>2</sub> electrode as the cathode. The 2 mol·L<sup>-1</sup> ZnSO<sub>4</sub> and 0.2 mol·L<sup>-1</sup> MnSO<sub>4</sub> hybrid aqueous solution was used as electrolyte.

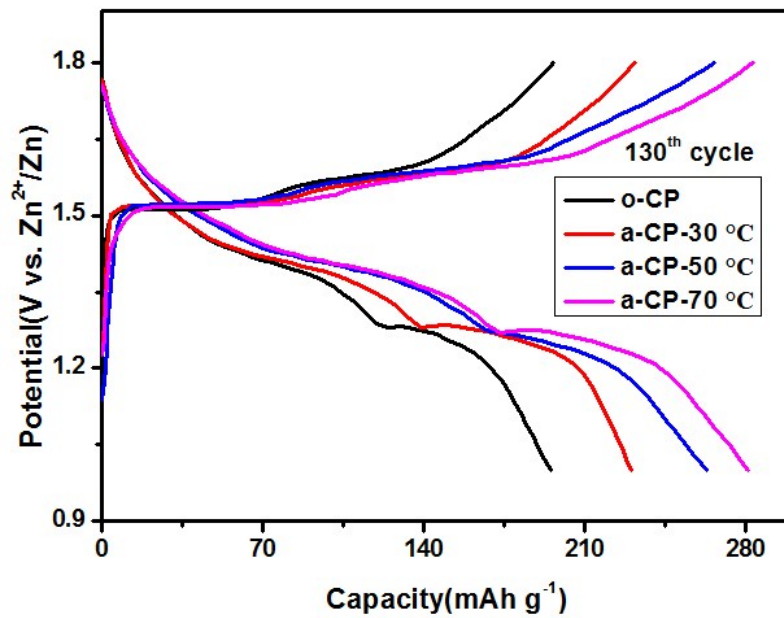
### Characterization

The samples were examined by a field emission scanning electron microscope(FE-SEM, HITACH S4800), measured by X-ray Photoelectron Spectroscopy (XPS, PHI 3056) and analyzed with GASA. The different kinds of carbon papaer were pressed to pellets with KBr and tested on the Fourier-transform infrared spectroscopy (FTIR, Nicolet 6700) with a resolution of 0.02 cm<sup>-1</sup>. The contact angle meter(XG-CAMC3) was used in measuring the contact angle between the CP and deionized water. Electrochemical impedance spectroscopy(EIS) and cyclic voltammogram(CV) were measured on an electrochemical workstation (Solartron, FRA 1455A). The cells with different substrates were cycled on a Land cell tester (CT2001A, Wuhan Jinnuo Company) between 1.0-1.8 V vs. Zn<sup>2+</sup>/Zn.

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3. Figure S2 The charge-discharge curves of MnO<sub>2</sub> cathodes with different substrates at the 130<sup>th</sup> cycle.



4. Figure S3 The charge-discharge curves of MnO<sub>2</sub> cathodes with different substrates at 5 C.

