Energy Materials

**Supplementary Material**

# Innovative approaches of porous carbon materials derived from energy waste and their electrochemical properties

**Shuai Ruan[1,2], Xinping He[2,*], Hui Huang[2], Yongping Gan[2], Yang Xia[2], Jun Zhang[2], Wangjun Wan[3], Chen Wang[3], Xinhui Xia[2,4,*], Wenkui Zhang[1,2,*]**

[1]Moganshan Institute ZJUT, Kangqian District, Deqing 313200, Zhejiang, China.
[2]College of Materials Science and Engineering, Zhejiang University of Technology, Hangzhou 310014, Zhejiang, China.
[3]Zhejiang Academy of Science and Technology for Inspection & Quarantine, Hangzhou 311215, Zhejiang, China.
[4]School of Materials Science and Engineering, Zhejiang University, Hangzhou 310027, Zhejiang, China.

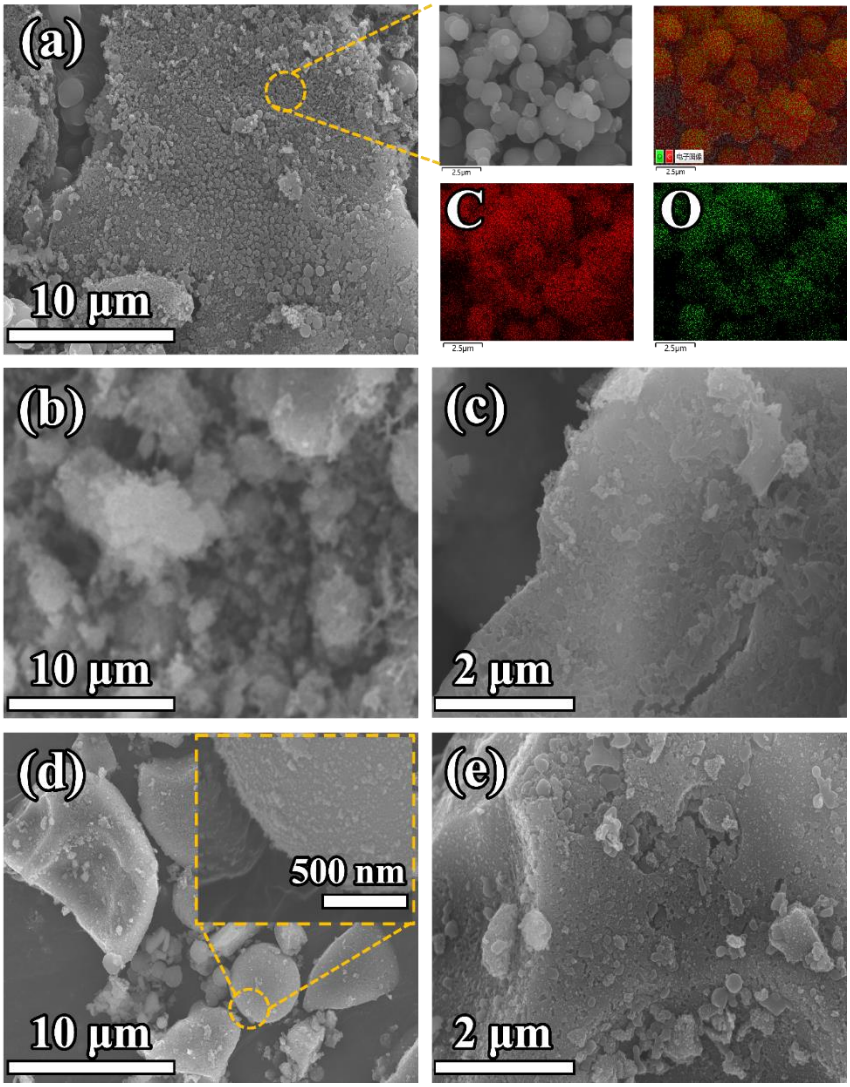
***Correspondence to:** Prof. Xinhui Xia, Science and Engineering, Zhejiang University of Technology, 18 Chaowang Road, Hangzhou 310014, Zhejiang, China. E-mail: cmxwy@zjut.edu.cn; Prof. Xinping He, Science and Engineering, Zhejiang University of Technology, 18 Chaowang Road, Hangzhou 310014, Zhejiang, China. E-mail: xinpinghe@zjut.edu.cn; Prof. Wenkui Zhang, Science and Engineering, Zhejiang University of Technology, 18 Chaowang Road, Hangzhou 310014, Zhejiang, China. E-mail: msechem@zjut.edu.cn

**Supplementary Table 1. Composition analysis of fly ash (1)**

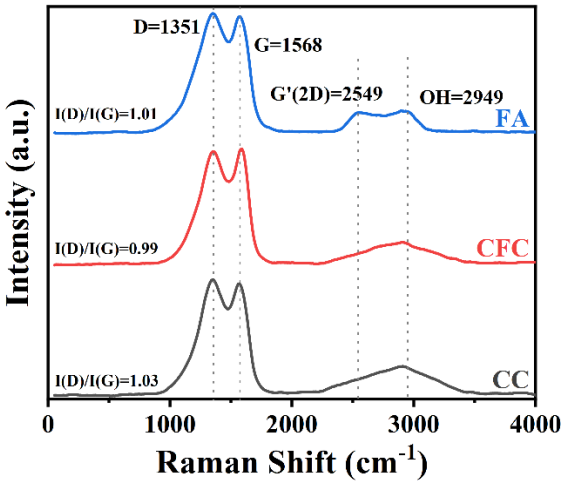
| Element (%) | $SiO_2$ | $Al_2O_3$ | $Fe_2O$ | CaO | $K_2O$ |
|---|---|---|---|---|---|
| Untreated | 44.26 | 39.84 | 5.45 | 2.8 5 | 2.15 |
| Hydrothermal treatment | 47.82 | 40.38 | 3.62 | 1.24 | 2.51 |
| Carbonization | 80.34 | 12.08 | 0.29 | 0.13 | 0.85 |

**Supplementary Table 2. Composition analysis of fly ash (2)**

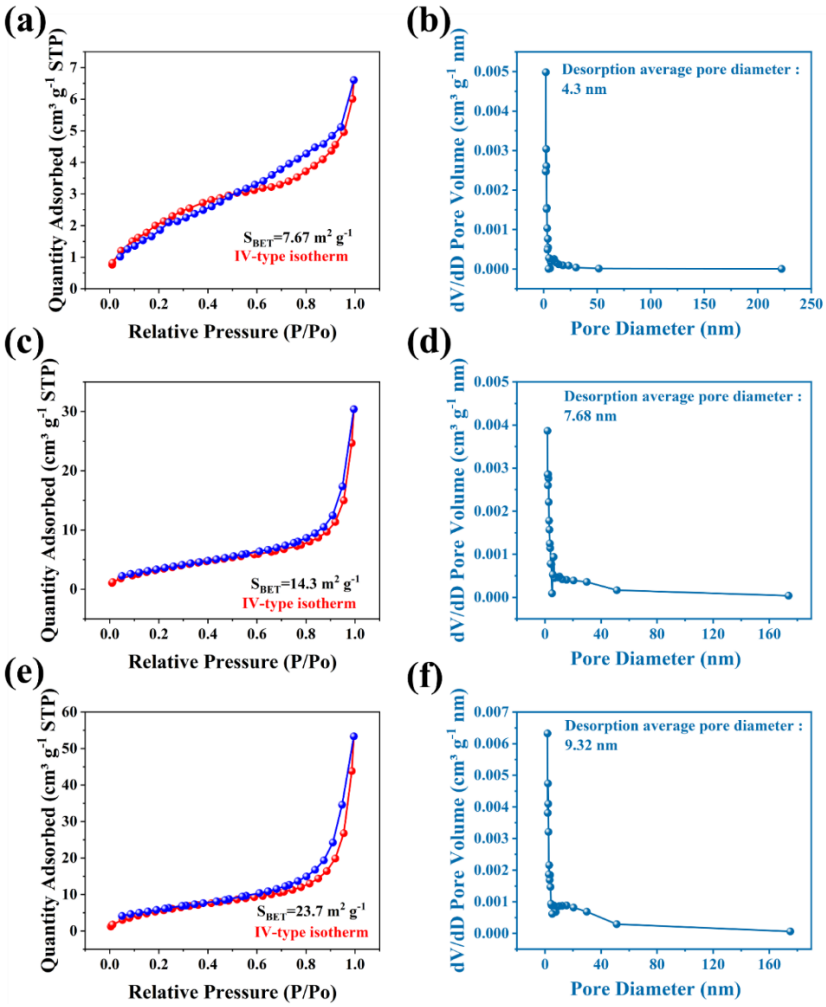
| Element (%) | $TiO_{22}$ | MgO | $SO_3$ | $NaO_2$ | Others |
|---|---|---|---|---|---|
| Untreated | 2.05 | 0.88 | 0.87 | 0.78 | 0.87 |
| Hydrothermal treatment | 2.21 | 0.84 | 0.09 | 0.63 | 0.66 |
| Carbonization | 3.266 | 0 | 0.25 | 1.06 | 1.73 |



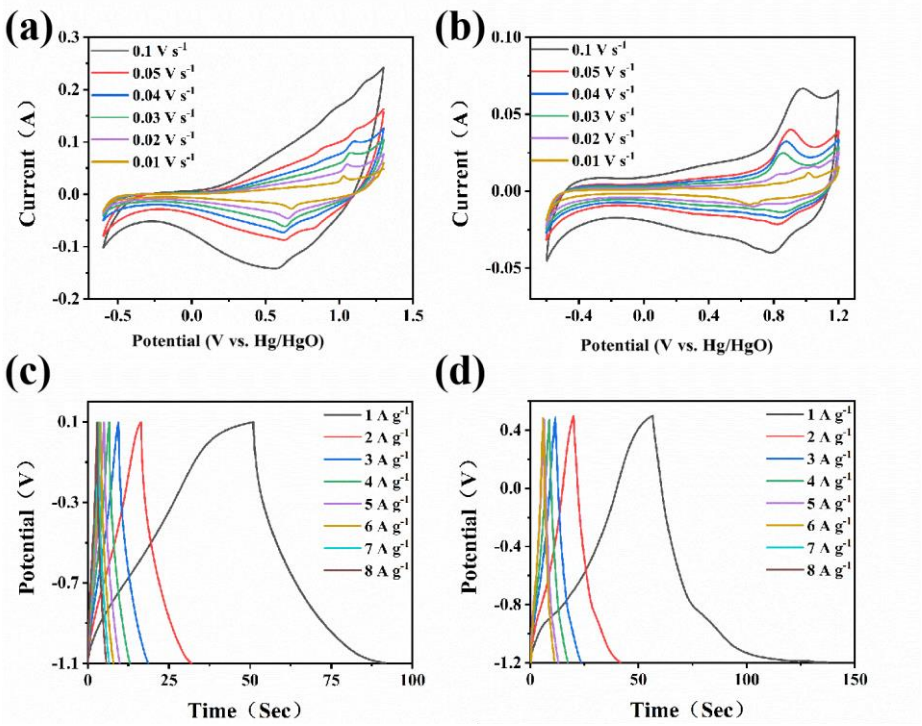

**Supplementary Figure 1.** SEM images of (a) Corn cob after hydrothermal treatment, the illustration shows the photo and EDS spectrum at high magnification rates; (b-c) Fly ash after hydrothermal treatment; (d-e) CFC precursors after hydrothermal treatment at different magnification




**Supplementary Figure 2.** The Raman spectra of CC, FA and CFC




**Supplementary Figure 3.** (a-f) Nitrogen adsorption/desorption isotherm and pore size distribution diagram of corn cob, fly ash, corn cob and fly ash mixture diagram after hydrothermal treatment




**Supplementary Figure 4.** (a-b) CV curves of CC, and FAC at different scanning speeds; (c-d) constant current charge and discharge curves of CC, and FAC at different current densities