Electronic Supplementary Information

Mesoporous carbon from biomass: one-pot synthesis and application for Li-S batteries

Jie Li, Furong Qin, Liyuan Zhang, Kai Zhang*, Qiang Li, Yanqing Lai, Zhian Zhang and Jing Fang *

* School of Metallurgy and Environment, Central South University, Changsha 410083, China. E-mail: Chinamcsu@163.com or fangjing526@csu.edu.cn.

Another two carbon samples were synthesized by altering the dosage of colloidal silica. In order to distinguish from the HPBC mentioned in the main text, the carbon samples are named CarSi-10 and CarSi-30, respectively, where the number represents the dosage of colloidal silica (i.e., 10 represents 10 g colloidal silica).

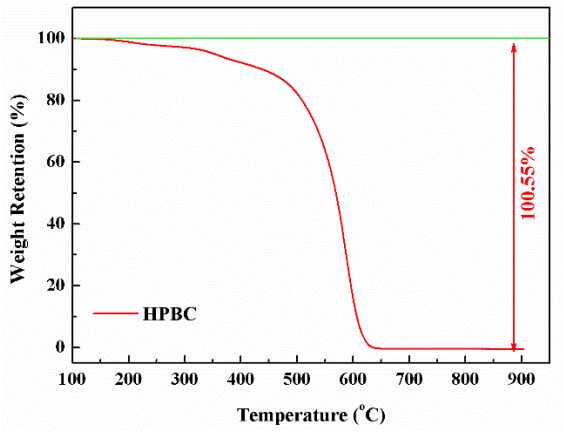

Figure S1. TGA results of HPBC conducted under air atmosphere.

Figure S1 depicts the TGA results of HPBC conducted under air atmosphere, from which it can be observed that the HPBC material totally has no weight retained. The result suggests that the SiO_2 templates were totally removed after treated with dilute hydrofluoric acid.

Figure S2 shows the N_2 adsorption/desorption isotherm and the BJH pore size distribution (inset) derived from desorption branch of HPBC-S. The BET surface area and the pore volume is about 12.6793 $m^2 g^{-1}$ and 0.127678 $cm^3 g^{-1}$, respectively. This result suggests that sulfur has penetrated into the pores during the melting-infusion process.

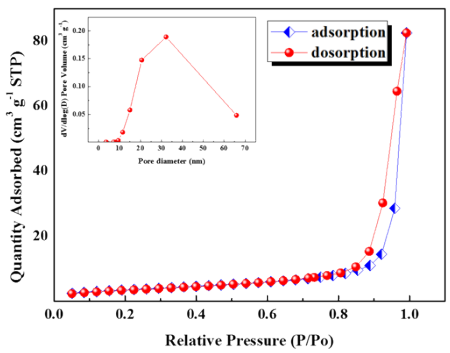

Figure S2. N_2 adsorption/desorption isotherm plot and (inset) BJH pore size distribution of HPBC-S.

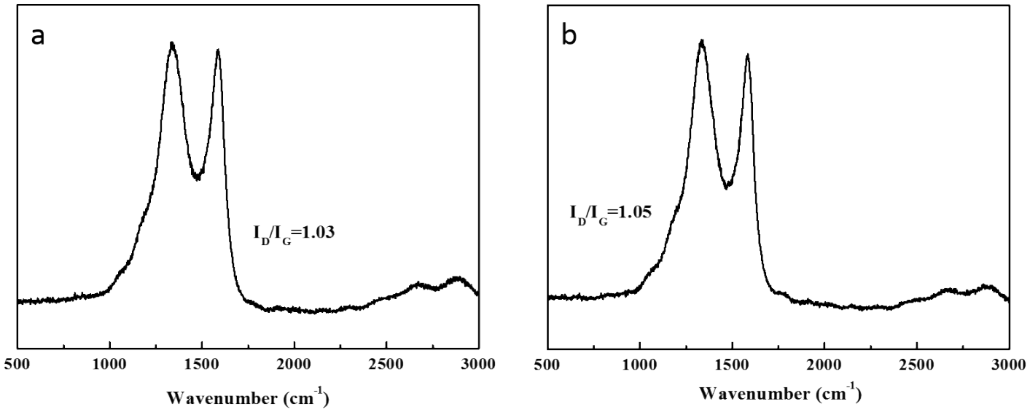

Figure S3. Raman spectra of CarSi-10 (a) and CarSi-30 (b).

Figure S3 shows the Raman spectra of CarSi-10 (a) and CarSi-30 (b). Compared to that of HPBC, these samples possess approximate value of I_D/I_G.

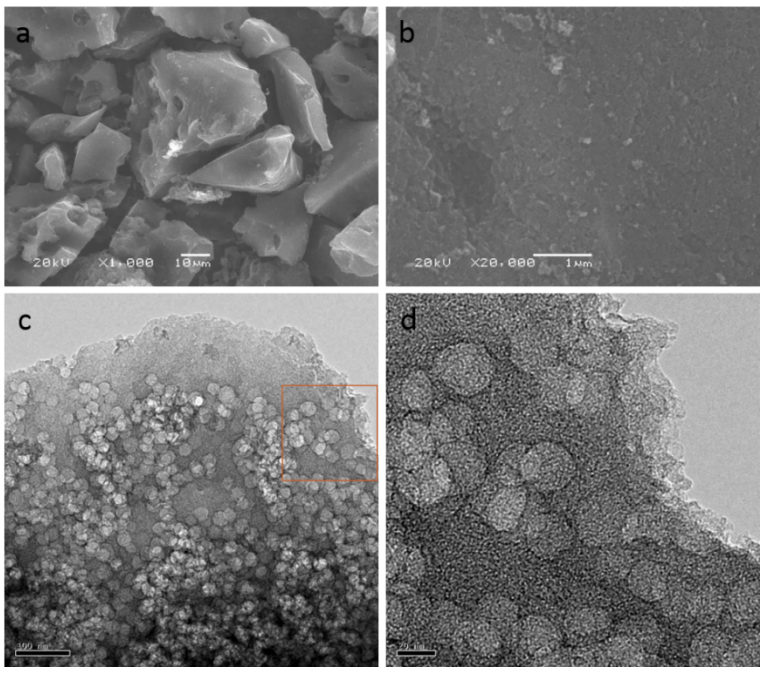

Figure S4. SEM (a and b) and TEM (c and d) images at different magnitude of CarSi-10.

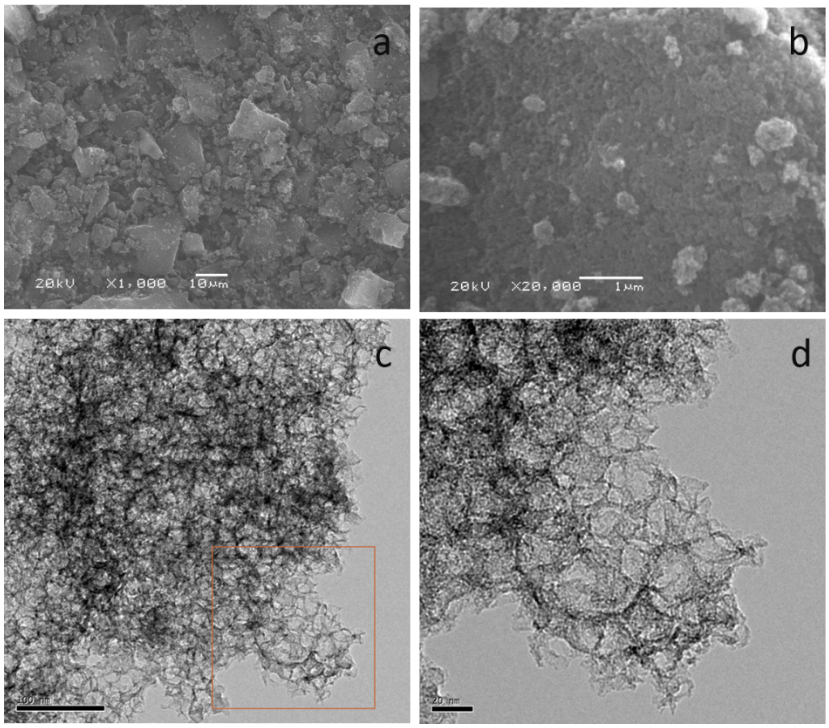

Figure S5. SEM (a and b) and TEM (c and d) images at different magnitude of CarSi-30.

Figure S4a and b present the SEM images of CarSi-10. It can be seen that the micro morphology at high resolution is different from HPBC. The surface of CarSi-10 particles is denser than HPBC and a relatively small amount of pores can be observed from the TEM images of CarSi-10 (Figure S4c and d) compared to the TEM images of HPBC (Figure 1c and d). However, CarSi-30 shares the similar micro morphology with HPBC at high resolution which can be found from the SEM images (Figure S5a and b), as well as the microstructure confirmed by TEM result (Figure S5c and d).

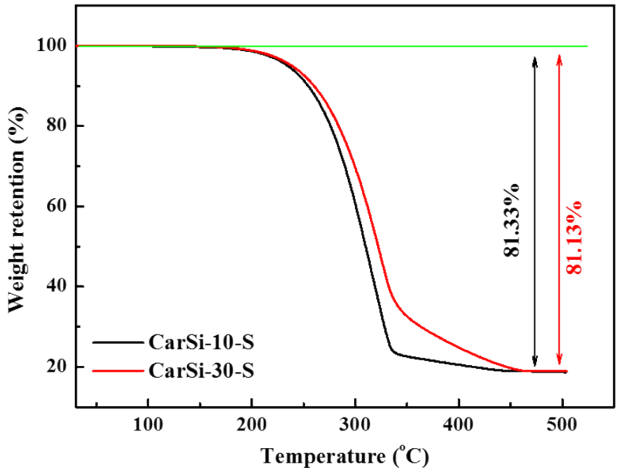

Figure S6 TGA results of CarSi-10-S and CarSi-30-S composites.

The as-prepared CarSi-10 and CarSi-30 carbon materials also were used as the carbon matrix for Li-S cells, and the content of sulfur in the CarSi-10-S and CarSi-30-S composites is similar to HPBC confirmed by TGA results.

To investigate the electrochemical performance of CarSi-10-S and CarSi-30-S composites, Galvanostatic charge/discharge test has been performed. Figure S7 shows the cycle performance (a) at the current density of 0.5 C and rate performance (b) of CarSi-10-S. After 100 cycles, the Car-10-S cell maintains a reversible capacity up to 400 mAh g^{-1}. It is much lower than that of HPBC-S cell and the rate performance is very poor. The poor electrochemical performance probably attributes to that the CarSi-10 has less pores to accommodate sulfur. However, the CarSi-30-S cell exhibits superior electrochemical performance. After 100 cycles, the reversible capacity retains 708 mAh g^{-1}, which is similar to that of HPBC-S cell (683 mAh g^{-1}).

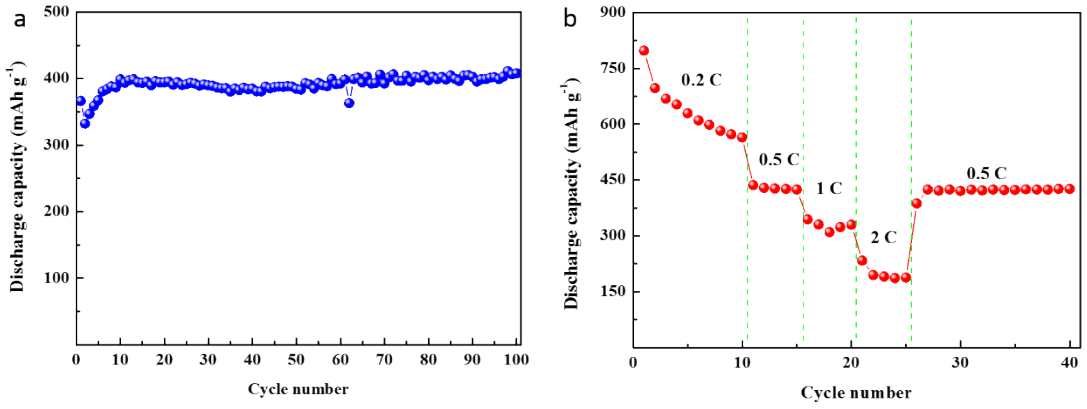

Figure S7. Cycle performance tested at 0.5 C (a) and rate performance (b) of CarSi-10-S cell.

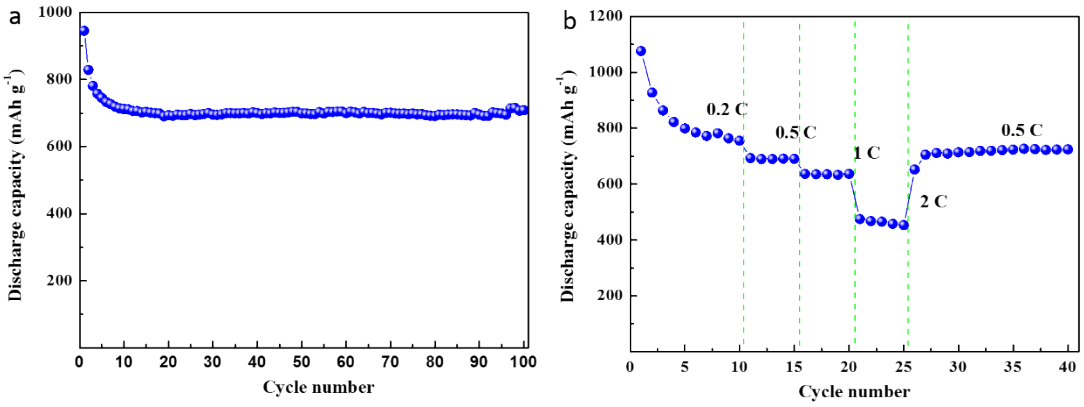

Figure S8. Cycle performance tested at 0.5 C (a) and rate performance (b) of CarSi-30-S cell.

Table S1 C, H and O content obtained from quantitative elemental analysis.

HPBC	Element	C	H	O
	Content (%)	93.34	1.18	4.35
HPBC-S	Element	C	H	O
	Content (%)	20.13	0.048	6.23