batteries

# Fabrication of Porous Si@C Composites with Core-Shell Structure and Their Electrochemical Performance for Li-ion Batteries

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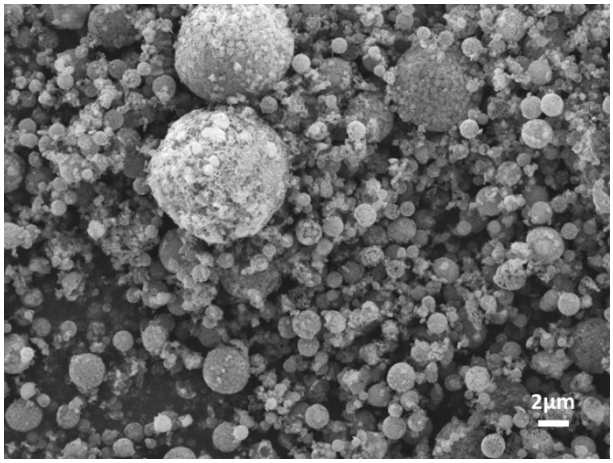
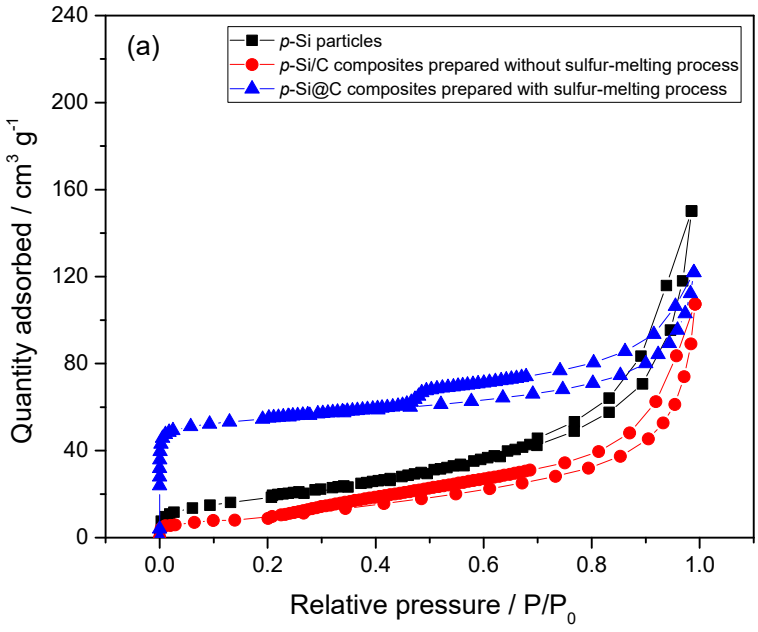



**Figure S1.** SEM image of Al-Si alloy power.



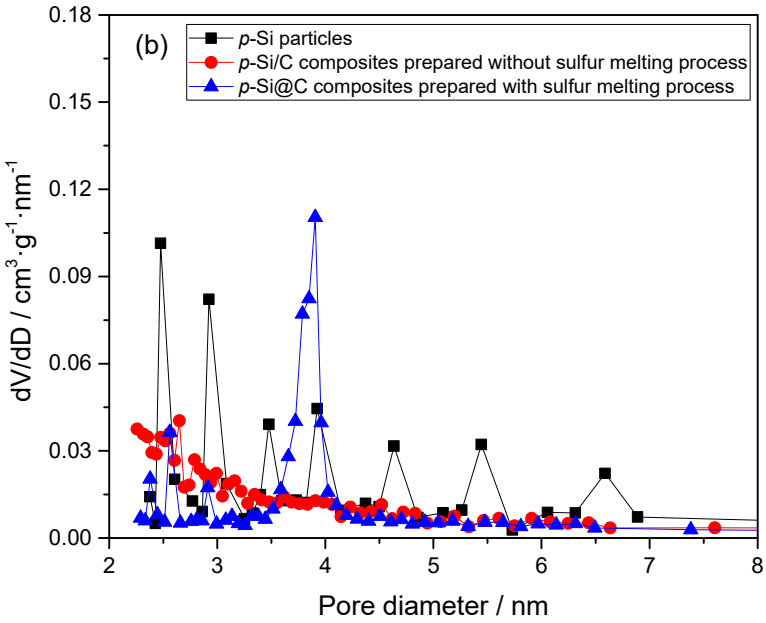



**Figure S2.** (**a**) $N_2$ adsorption-desorption isotherms and (**b**) pore size distribution of *p*-Si particles, *p*-Si/C particles and *p*-Si@C particles.

JW-BK200C Apparatus was used to evaluate the surface areas and porous structure of *p*-Si particles, *p*-Si/C composites prepared without sulfur-melting process and *p*-Si@C composites with sulfur-melting process, and the results are shown in Fig. S2. The results indicate that the curves of *p*-Si particles and *p*-Si/C composites both exhibit H3 hysteresis loops which is typical of slit-shaped pores or the space between different parallel Si particles based on the BDDT classification [1]. As shown in Fig. S2b, the proes with size distribution between 3.5 nm and 7 nm in *p*-Si particles disappear, after coated by PANI-based carbon without sulfur-melting process, moreover, no obvious peaks is observed below 3.5nm. The results indicates that some pores in *p*-Si particles are occupied by PANI-based carbon during the preparation of *p*-Si/C composites. Therefore, the surface areas of *p*-Si/C composites (33 $m^2 \cdot g^{-1}$) is smaller than that of *p*-Si particles (62 $m^2 \cdot g^{-1}$). On the other hand, *p*-Si@C composites displays type I isotherm within the range of lower relative pressure ($P/P_0$ = 0~0.01) and type IV isotherm within the range of higher relative pressure ($P/P_0$ > 0.4). Combining the results in Fig. S2, it can be concluded that the pores in *p*-Si particles are retained and the outer carbon layer is porous in *p*-Si@C composites. Therefore, *p*-Si@C composites have high surface areas (207 $m^2 \cdot g^{-1}$).

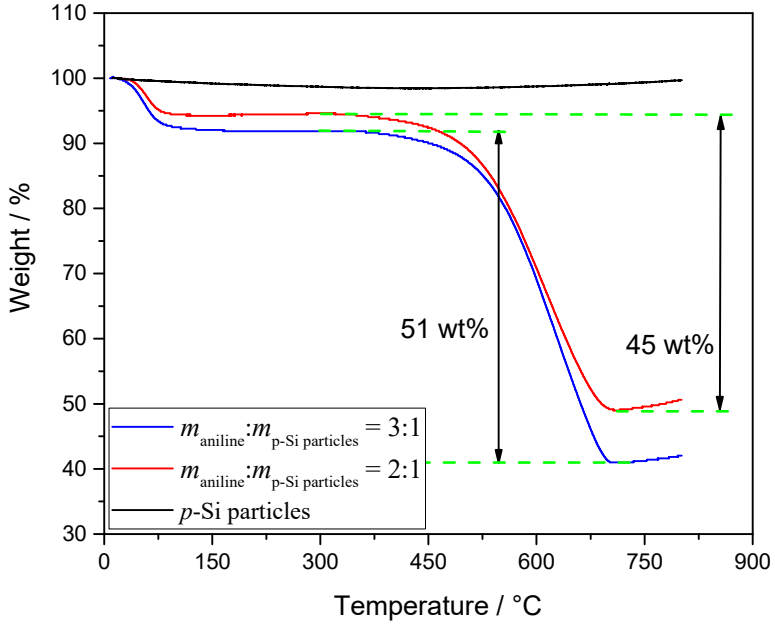
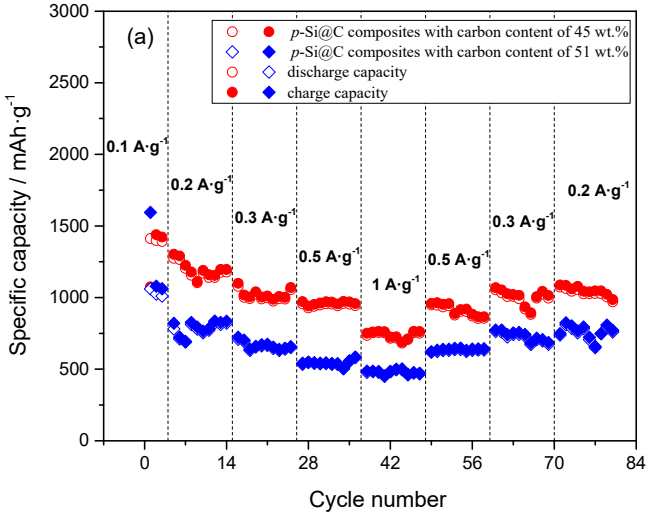



**Figure S3.** TGA curves of *p*-Si particles and *p*-Si@C composites obtained from different mass ratios of aniline and porous silicon particles.

Carbon contents in *p*-Si@C composites were estimated under air by thermogravimetric analysis (TGA) on TGA/DSC simultaneous thermal analyzer (Mettler Toledo TGA/DSC/1600LF, Switzerland). The carbon contents of *p*-Si@C composites prepared from $m_{aniline}$ : $m_{p\text{-}Si\ particles}$ = 2:1 and 3:1 are about 45 wt.% and 51 wt.%., respectively.



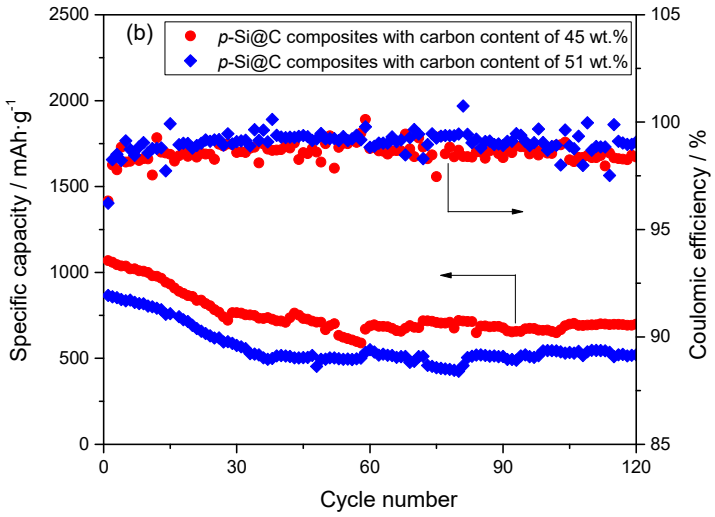



**Figure S4.** performance for *p*-Si@C composites with different carbon contents.

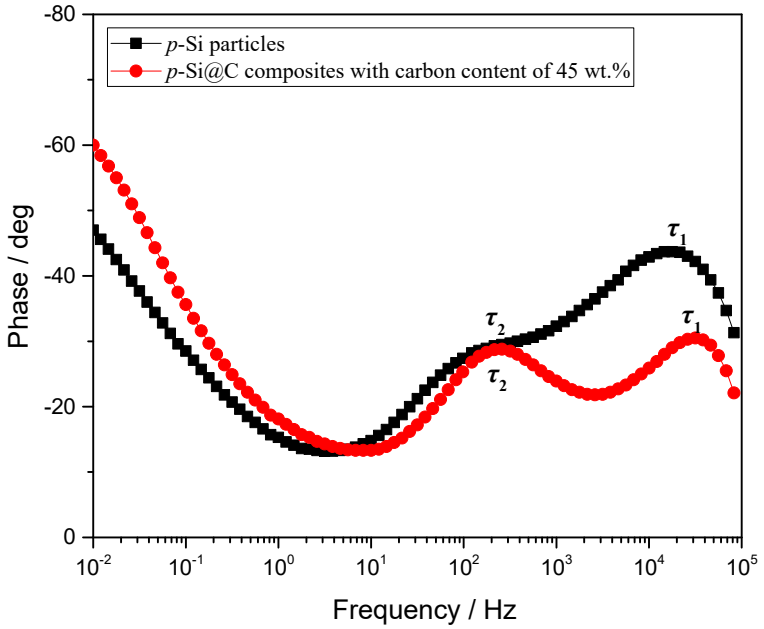



**Figure S5.** Bode plots for *p*-Si particles and *p*-Si@C composites with carbon contents of 45 wt.%.

## Reference

1. Pan, C.; Zhang, D.; Shi, L. CTAB assisted hydrothermal synthesis, controlled conversion and CO oxidation properties of CeO2 nanoplates, nanotubes, and nanorods. *J. Solid State Chem.* **2008**, 181, 1298-1306.