Supporting information

The Effect of Pore Size Distribution of Carbon Matrix On The Performance of Phosphorus@Carbon Material As Anode For Lithium Ion Batteries

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Table. S1 The average particle size of active carbon

Samples	YH-11	Cb	B1-01	YP-50F
Average particle size (μm)	91.16	79.05	36.32	34.41

Table. S2 The pore volume of pores smaller than 1 nm

Samples	YH-11	Cb	B1-01	YP-50F
Pore volume (cm^3 g^{-1})	0.38	0.41	0.50	0.55

Table. S3 The weight analysis of the samples

Carbon	C (g^{-1})	P-C (g^{-1})	P Content (wt%)
Cb	2.0007	3.7764	47.021
YH-11	2.0013	3.7773	47.018
B1-01	2.0008	3.7765	47.020
YP-50F	2.0011	3.7772	47.022

Table S4 Electrochemical performance of phosphorus@carbon composites in lithium battery.

Sample	Initial discharge/charge capacity (mAh g^{-1})	Cyclic performance	Reference
Amorphous phosphorus-carbon composite	2651/2355[b]	Minor decline 90% of capacity is reported to remain after 100 cycles	1
Activated phosphorus-carbon composite	3289/1385[b]	Declining 900 mAh g^{-1} capacity after 20 cycles	2
Nanostructured red phosphorus–carbon composite	1200/840[a]	Relatively stable capacity. Minor decline 745 mAh g^{-1} after 50 cycles	3
Nanoconfined phosphorus in mesoporous carbon	1281/no reported[a]	Remain 850 mAh g^{-1} after 20 cycles	4
Phosphorus @YP-50F	2790/2217[a]	Remain 1370 mAh g^{-1} after100 cycles	This work

[a] Capacity is calculated per total weight of the phosphorus@carbon composite.

[b] All capacity is assigned to the phosphorus component, the capacity of carbon components is neglected as minor contribution.

(1) Qian, J.; Qiao, D.; Ai, X.; Cao, Y.; Yang, H., Reversible 3-Li storage reactions of amorphous phosphorus as high capacity and cycling-stable anodes for Li-ion batteries. *Chem. Commun.* **2012,** *48*, 8931-8933.

(2) Marino, C.; Debenedetti, A.; Fraisse, B.; Favier, F.; Monconduit, L., Activated-phosphorus as new electrode material for Li-ion batteries. *Electrochem. Commun.* **2011,** *13*, 346-349.

(3) Wang, L.; He, X.; Li, J.; Sun, W.; Gao, J.; Guo, J.; Jiang, C., Nano-Structured Phosphorus Composite as High-Capacity Anode Materials for Lithium Batteries. *Angew. Chem. Int. Ed.* . **2012,** *51*, 9034-9037.

(4) Marino, C.; Boulet, L.; Gaveau, P.; Fraisse, B.; Monconduit, L., Nanoconfined phosphorus in mesoporous carbon as an electrode for Li-ion batteries: performance and mechanism. *J. Mater. Chem.* **2012,** *22*, 22713-22720.

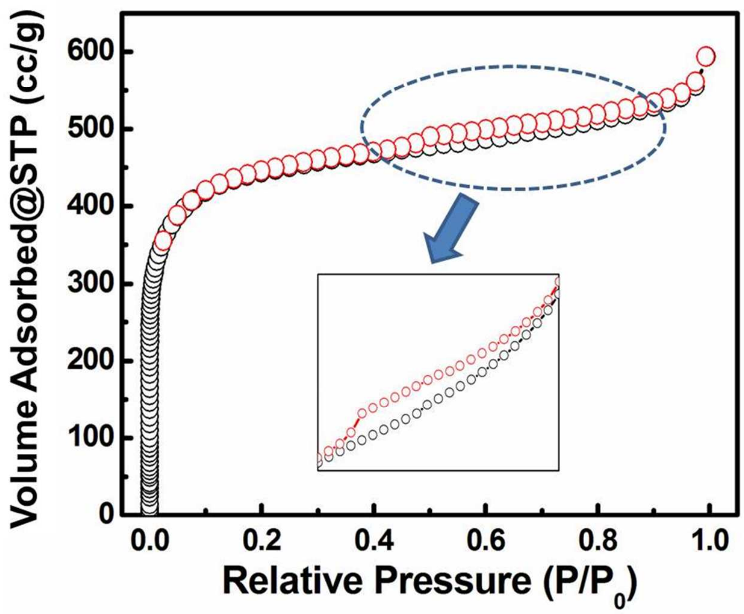

Fig. S1 Nitrogen adsorption and desorption isotherms of active carbon (The four carbons have the similar curve, therefor we only use a sketch to express them).

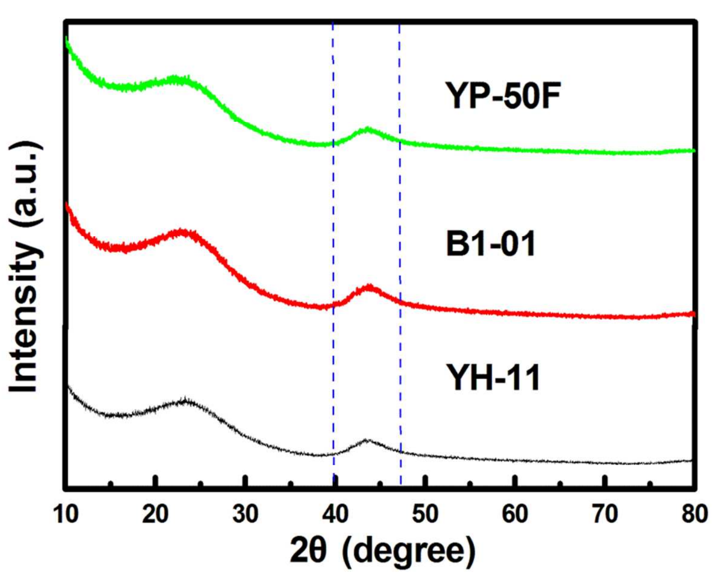

Fig. S2 The XRD patterns of active carbon.

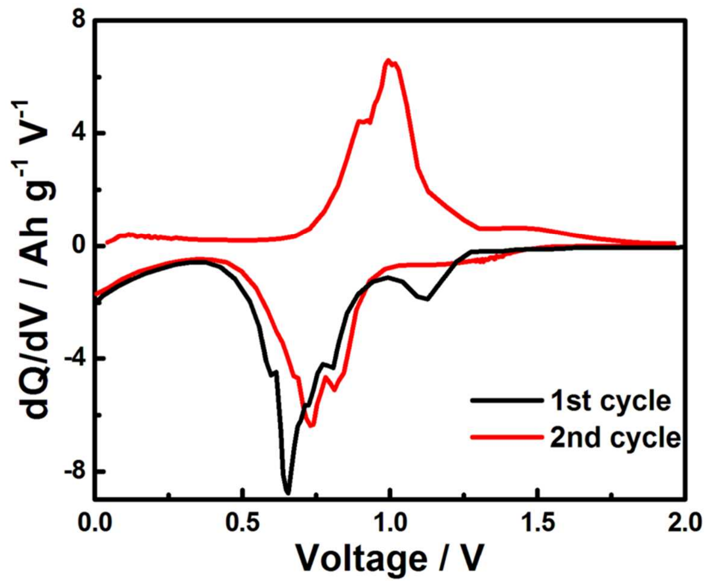

Fig. S3 The differential capacity plots (DCPs) of the phosphorus@YP-50F.