

Supplementary Information

**Amorphous red phosphorus nanosheets anchored on graphene layers as high
performance anodes for lithium ion batteries**

Li Sun,* Yu Zhang, Deyang Zhang, and Yihe Zhang*

*Beijing Key Laboratory of Materials Utilization of Nonmetallic Minerals and Solid Wastes,
National Laboratory of Mineral Materials, School of Materials Science and Technology,
China University of Geosciences, Beijing, 100083, PR China*

**E-mail: sunli@cugb.edu.cn, zyh@cugb.edu.cn*

Supplementary Figures

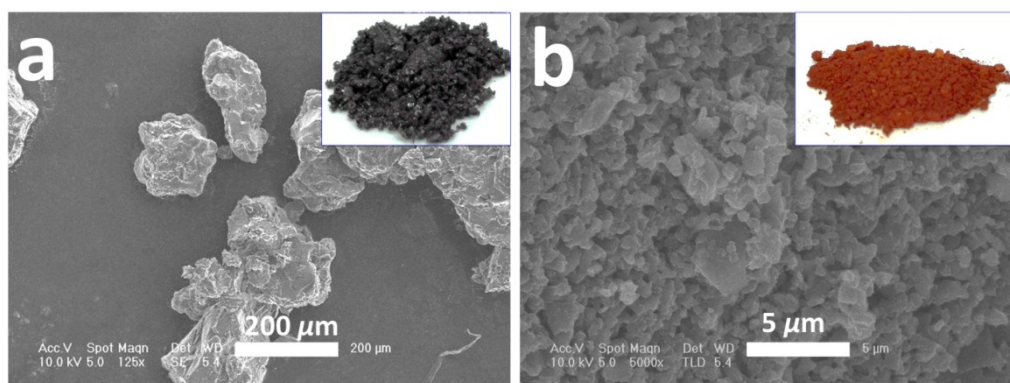


Fig. S1. SEM images of (a) commercial red P and (b) red P after ball-milling and hydrothermal treatment. The inset gives their photos.

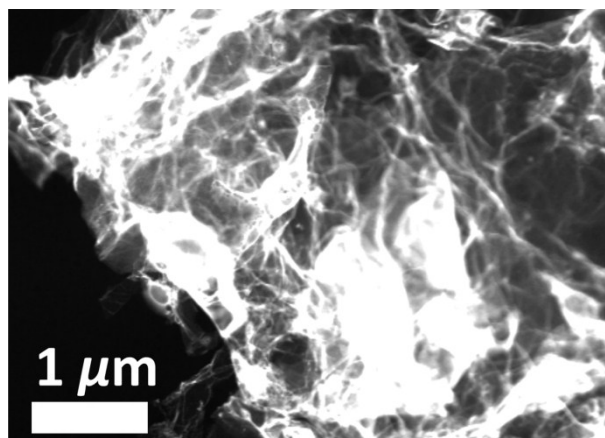


Fig. S2. STEM-HAADF image of the P/graphene composite.

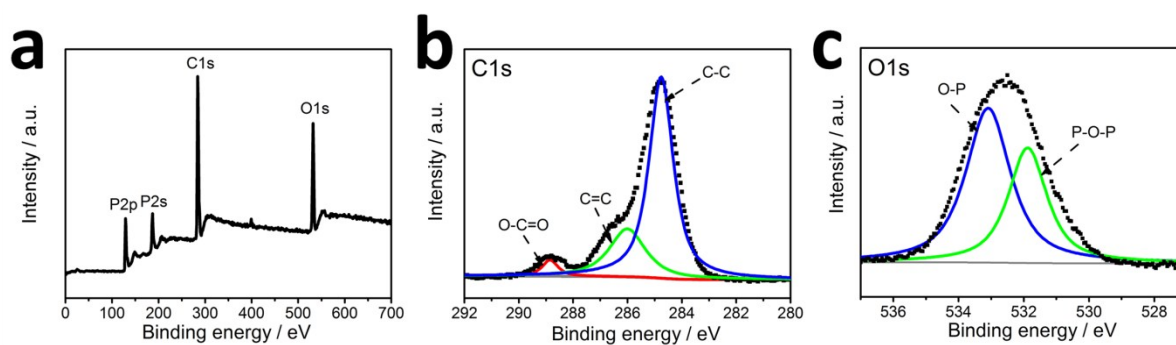


Fig. S3. XPS (a) survey spectra and high-resolution spectra of (b) C 1s, (c) O 1s.

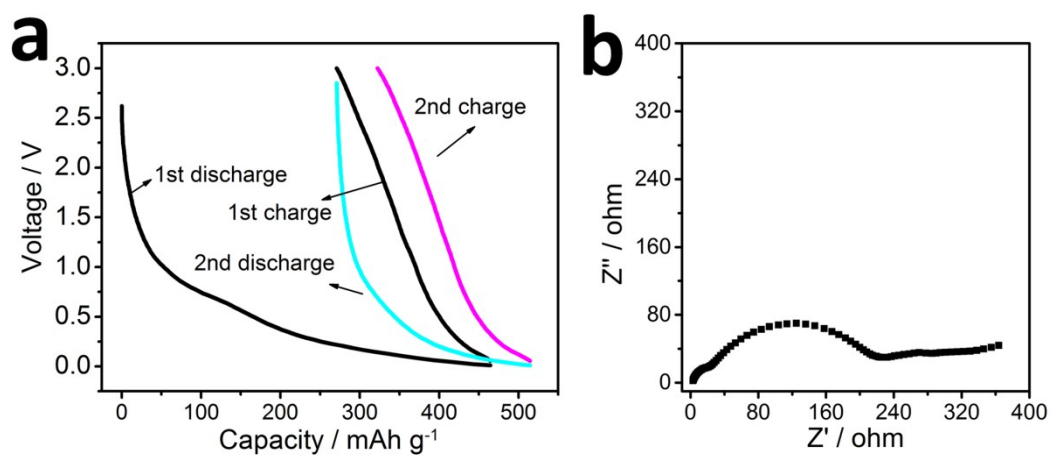


Fig. S4. (a) Voltage profiles of CNT at 200 mA g⁻¹. (b) Electrochemical impedance spectra of red P.

Table S1 Comparison of this work with previously reported P-graphene composites.

Composite	Method	P loading	Capacity based on the composite	Reference
P/graphene for LIBs	solution-based method	80%	~1024 mAh g ⁻¹ (100 th cycle) at 200 mA g ⁻¹	This work
P-graphene for LIBs	ball-milling	70%	~898 mAh g ⁻¹ (300 th cycle) at 130 mA g ⁻¹	Ref. 17
Sandwich-like P/reduced graphene oxide for LIBs	high-pressure assisted spraying	72%	~693 mAh g ⁻¹ (50 th cycle) at 100 mA g ⁻¹	Ref. 26
P/N-doped graphene Paper for SIBs	phase-transformation	66%	~1500 mAh g ⁻¹ (100 th cycle) at 200 mA g ⁻¹	Ref. 25
P/Graphene Aerogel for SIBs	vapor-redistribution	80%	~1270 mAh g ⁻¹ (100 th cycle) at ~200 mA g ⁻¹	Ref. 20
P nano dots on reduced graphene oxide for SIBs	vaporation and condensation	61.4%	~1000 mAh g ⁻¹ (300 th cycle) at 1593 mA g ⁻¹	Ref. 27

Table S2 Comparison of this work with previously reported P composite electrodes for lithium storage.

Composite	Method	P loading	Capacity based on the composite	Reference
P/graphene	solution-based method	80%	~1024 mAh g ⁻¹ (100 th cycle) at 200 mA g ⁻¹	This work
Red P@CMK-3 composite	Vaporization –condensation –conversion	60%	971 mAh g ⁻¹ (85 th cycle) at 200 mA g ⁻¹	Ref. 11
Active carbon/red P composite	Vaporization –condensation	60%	1370 mAh g ⁻¹ (50 th cycle) at 140 mA g ⁻¹	Ref. 16
Amorphous red P/ CNT composite	Ball milling	80%	798 mAh g ⁻¹ (50 th cycle) at 130 mA g ⁻¹	Ref. 28