## **Electronic Supplementary Information (ESI)**

## Synthesis of Nanorod-FeP@C Composites with Hysteresis

## Lithiation in Lithium-ion Battery

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Figure S1. (a) Low-, and (b) high-magnified SEM images of the as-prepared nanorod-FeP@C composites.



**Figure S2.** (a) GITT curve of the FeP@C composites in the first lithiation, and (b) XRD patterns for the FeP@C composites and the ones after first lithiation from GITT

test. For the GITT measurements, the cells were discharged at a current density of 10 mA  $g^{-1}$  for 30 min, followed by open circuit relaxation for 2 h. The procedure was continued until the voltage of the cells reached 0.01 V.



**Figure S3.** XRD patterns for the FeP@C composites after 10 cycles at a current density of 10 mA g<sup>-1</sup> under state of fully discharge/charge.



**Figure S4.** XPS spectra for the FeP@C composites electrode after 10 cycles with a current density of 10 mA  $g^{-1}$ : (a) survery spectra, (b) Fe, and (c) P signal for the

electrode after fully discharged, and (d) survery spectra, (e) Fe, and (f) P signal for the electrode after fully charged.



**Figure S5.** (a) Cyclic voltammogram (CV) for the FeP@C composites after 200 cycles at a current density of 30 mA  $g^{-1}$  in the cell with a scan rate of 0.02 mV s<sup>-1</sup>, and (b) GITT for the FeP@C composites after 200 cycles at a current density of 30 mA  $g^{-1}$  in the cell.



Figure S6. XRD pattern of the acetylene black added in the cell.



**Figure S7.** (a) Cycling performance of the FeP@C composites at a current density of 10 mA  $g^{-1}$ , (b) the corresponding charge-discharge voltage profiles of the composites at the current density of 10 mA  $g^{-1}$  for the 1st, 2nd and 3rd cycles, (c) cycling performance of the FeP@C composites at a current density of 60 mA  $g^{-1}$ , and (d) the corresponding charge-discharge voltage profiles of the composites at the current density of 60 mA  $g^{-1}$  for the 1st, 2nd, 50th, 100th, 150th and 200th cycles.



**Figure S8.** (a) Cyclic voltammograms from 0.02 to 1 mV s<sup>-1</sup> of the FeP@C composites electrode after 200 cycles. (b) b-value determination of the peak anodic current as a function of scan rate.



Figure S9. (a) XRD pattern, (b) Raman spectrum, (c) SEM, and (d) TEM images of

the FeP@C nanocables.



**Figure S10.** (a) Cyclic voltammetries of the FeP@C nanocables between 0.01 and 3 V at a scan rate of 0.1 mV s<sup>-1</sup> for the 1st, 2nd, and 3rd cycles, (b) charge-discharge voltage profiles of the FeP@C nanocables at a current density of 30 mA g<sup>-1</sup> for the 1st, 10th, 40th, 50th, 60th, and 100th cycles, (c) cycling performances of the FeP@C

nanocables at a current density of 30 mA  $g^{-1}$ , and (d) rate capability of the FeP@C nanocables after 100 cycles at a current density of 30 mA  $g^{-1}$ .



**Figure S11.** (a) XRD pattern, (b) low-, (c) high-magnified SEM images, and (d) TEM image of the FeP@C nanocables after 100 cycles in the cell.