Electronic Supplementary Information (ESI)

FeP@C Nanoarray Vertically Grown on Graphene Nanosheets: An Ultrastable Li-Ion Battery Anode with Pseudocapacitance-boosted Electrochemical Kinetics

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Calculation process of TGA

$$FeP + 2O_2 \rightarrow \frac{1}{2}Fe_2O_3 + \frac{1}{2}P_2O_5 \qquad M_{FeP} = 87, M_{O_2} = 32$$

For U-FP@C:

$$m_{FeP1} + 2 * \frac{m_{FeP1}}{M_{FeP}} * M_{O_2} = 131\%$$

$$m_{FeP1} = 75\%$$

$$m_{C1} = 1 - m_{FeP1} = 25\%$$

For G⊥FP@C-NA:

$$m_{FeP2} + 2 * \frac{m_{FeP2}}{M_{FeP}} * M_{O_2} = 119\%$$

$$m_{FeP2} = 69\%$$

$$m_{C2} = m_{FeP2}\frac{m_{C1}}{m_{FeP1}} = 23\%$$

$$m_G = 1 - m_{FeP2} - m_{C2} = 8\%$$

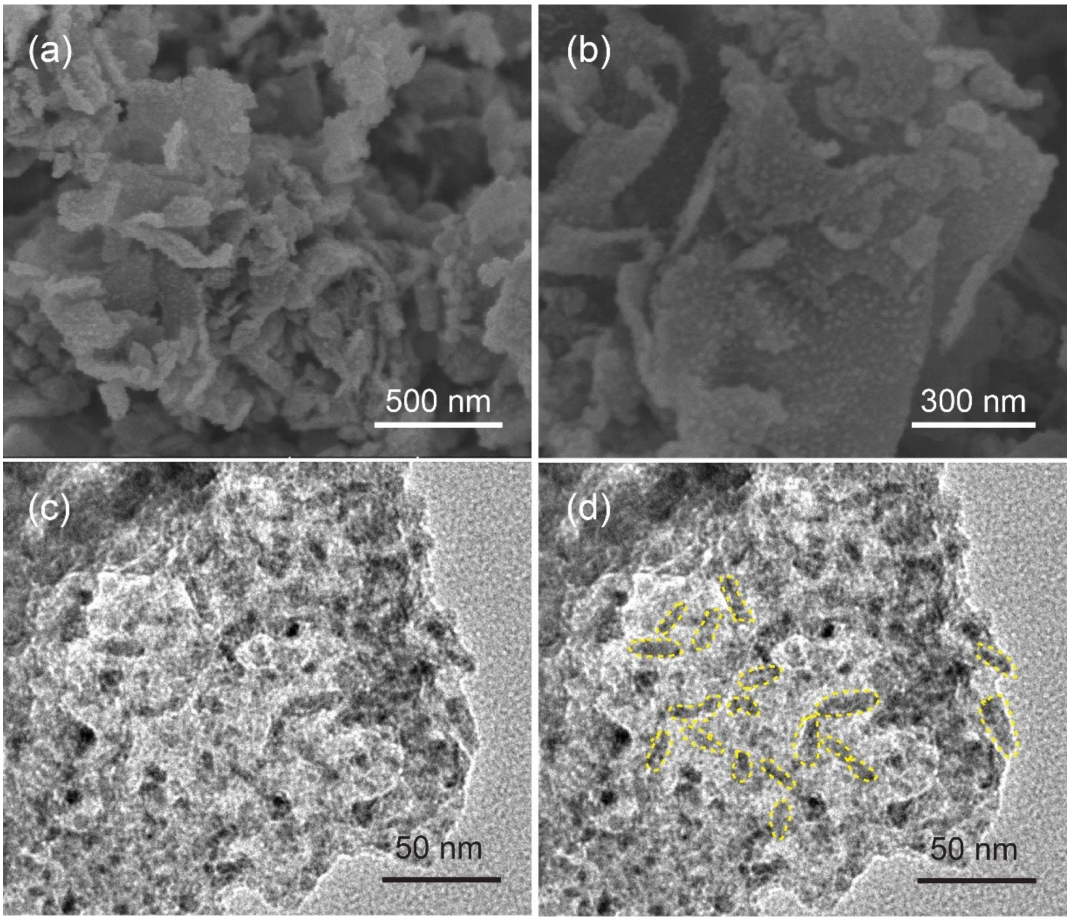

Figure S1. (a, b) The SEM images of G⊥FP@C-NA with different scale. (c, d) The TEM images of G⊥FP@C-NA, and the yellow line marks the FeP nanorods.

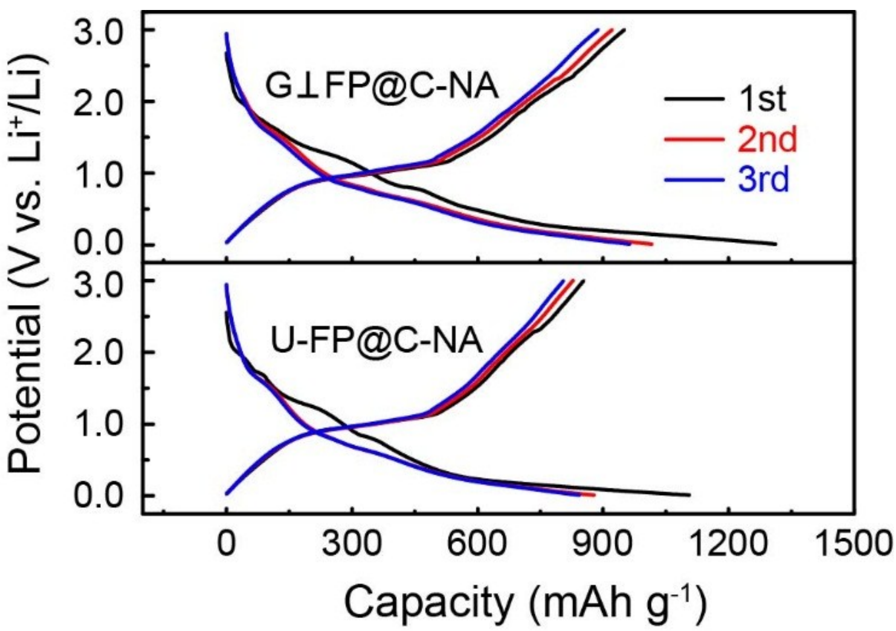

Figure S2. The charge and discharge curves of the initial three cycles at 50 mAh g^{-1} for G⊥FP@C-NA and U-FP@C.

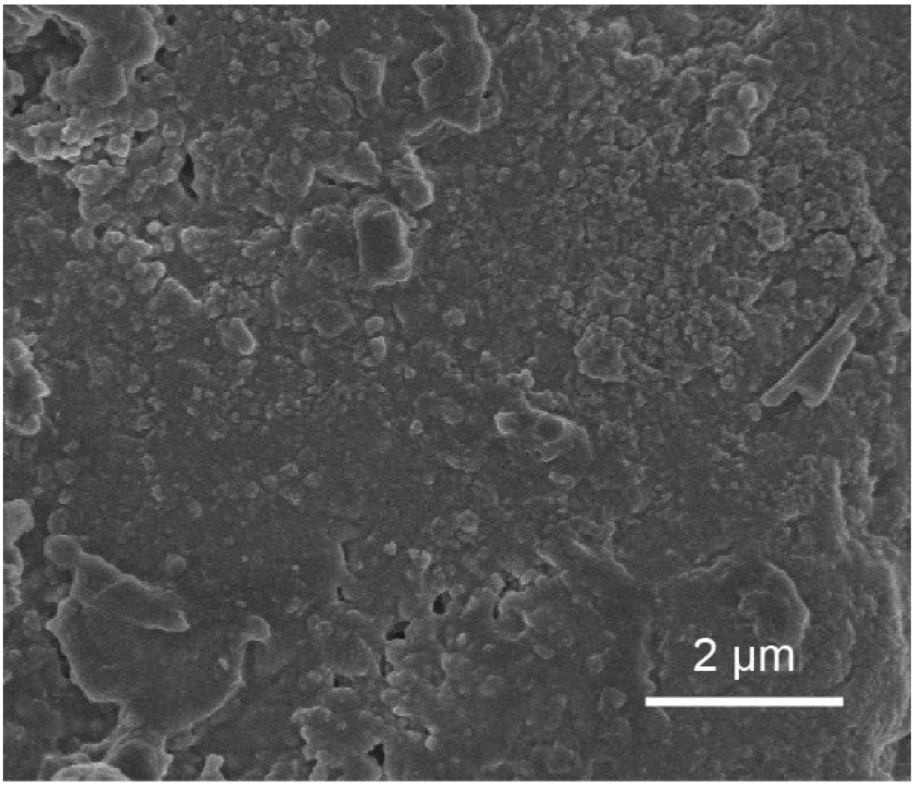

Figure S3. SEM images on the surface of G⊥FP@C-NA electrode after 100 cycles at 500 mA g^{-1}.

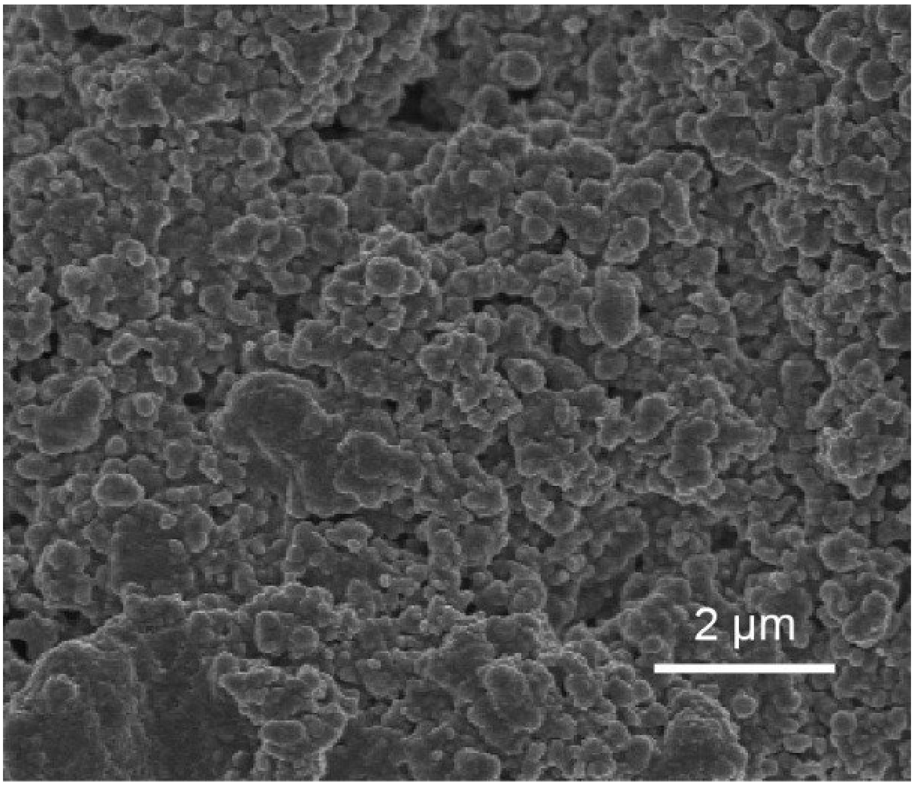

Figure S4. SEM images on the surface of U-FP@C electrode after 100 cycles at 500 mA g^{-1}.

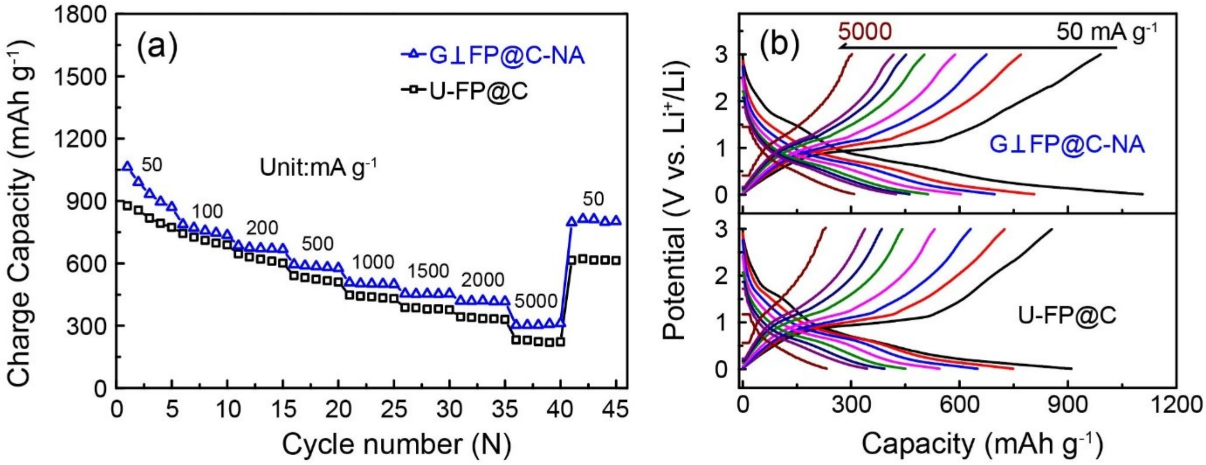

Figure S5. (a) Rate performance and (b) charge and discharge curves at different current densities of G⊥FP@C-NA and U-FP@C without the active process.

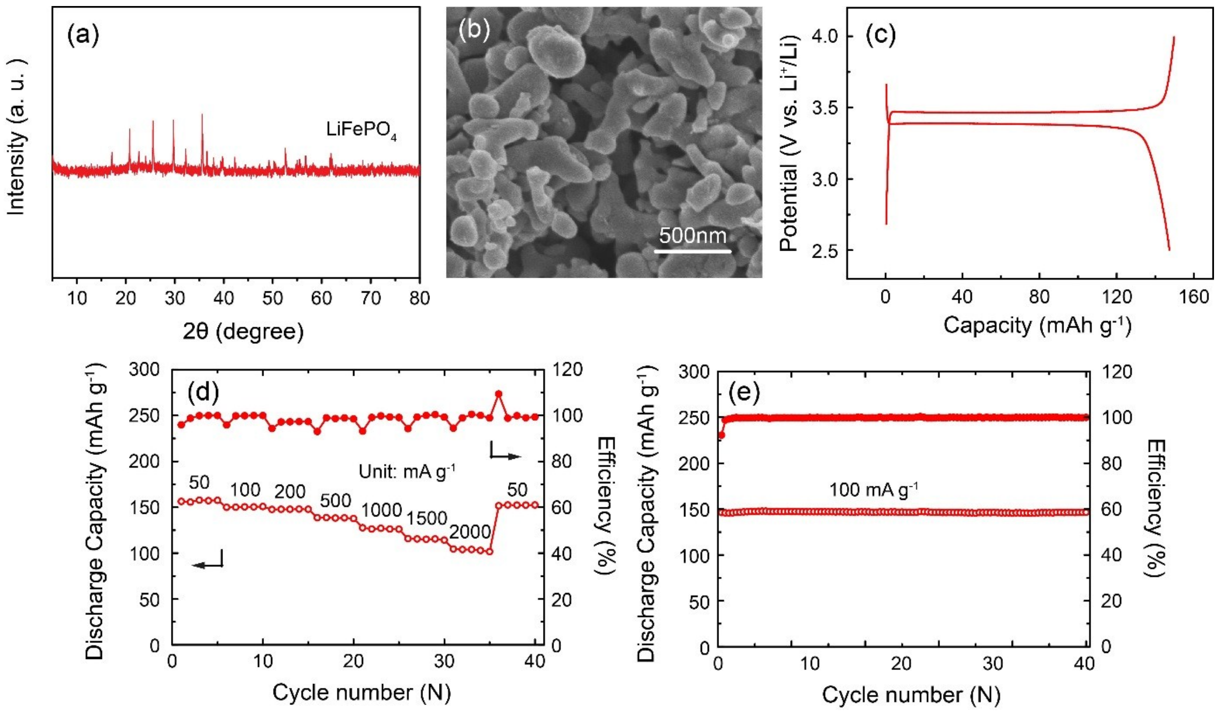

Figure S6. (a) XRD pattern, (b) SEM image, (c) GCD curves, rate performance and cycling stability of $LiFePO_4$.

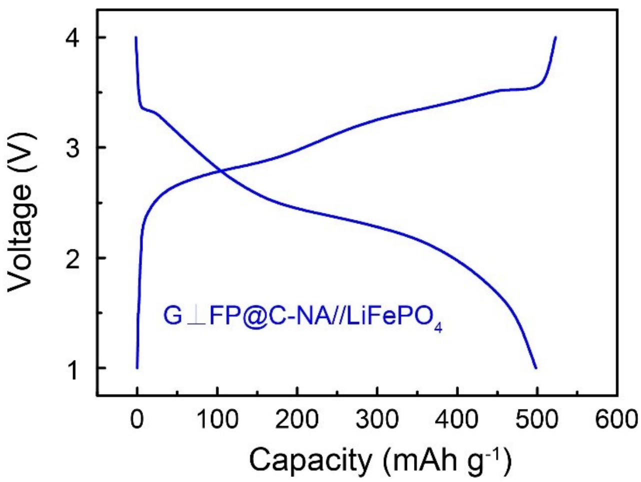

Figure S7. GCD curves of G⊥FP@C-NA//$LiFePO_4$ full cell.

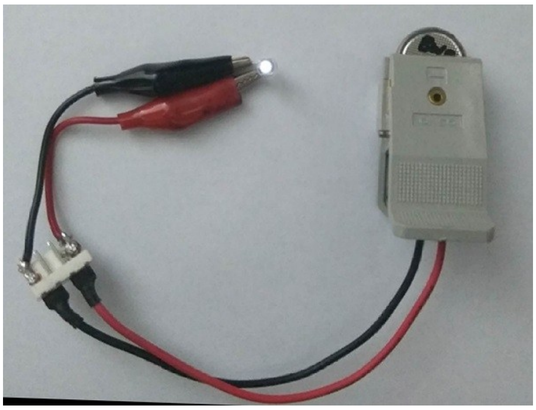

Figure S8. A photograph shows that the full battery can light up a LED bulb.

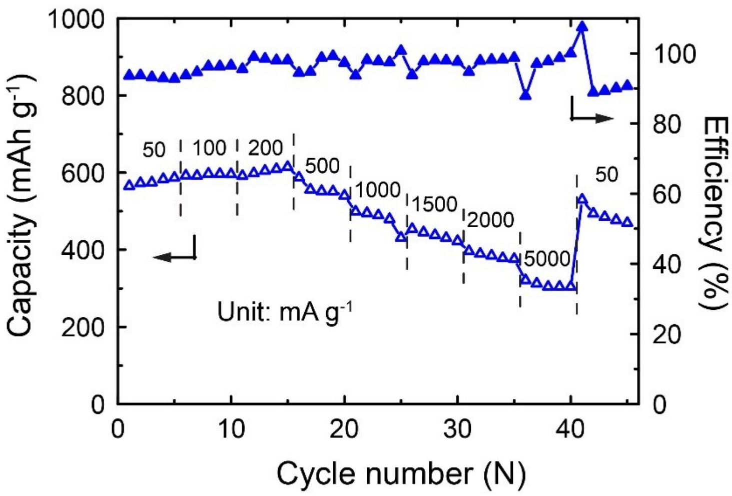

Figure S9. Rate performance of G⊥FP@C-NA//$LiFePO_4$ full cell.

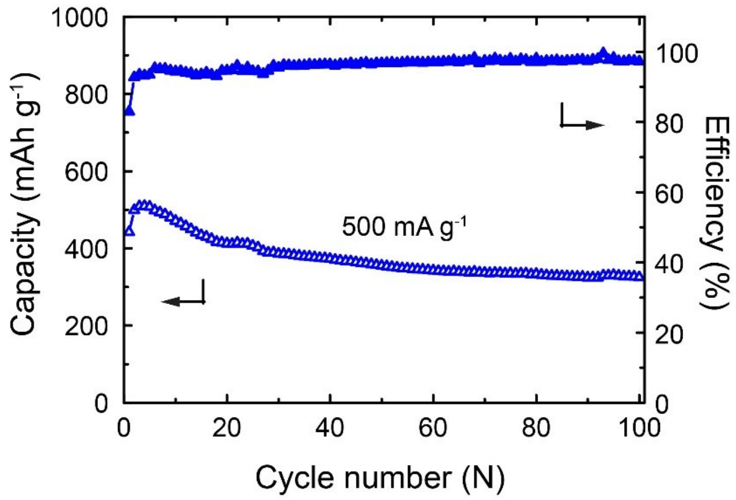

Figure S10. Cycling stability of G⊥FP@C-NA//$LiFePO_4$ full cell.

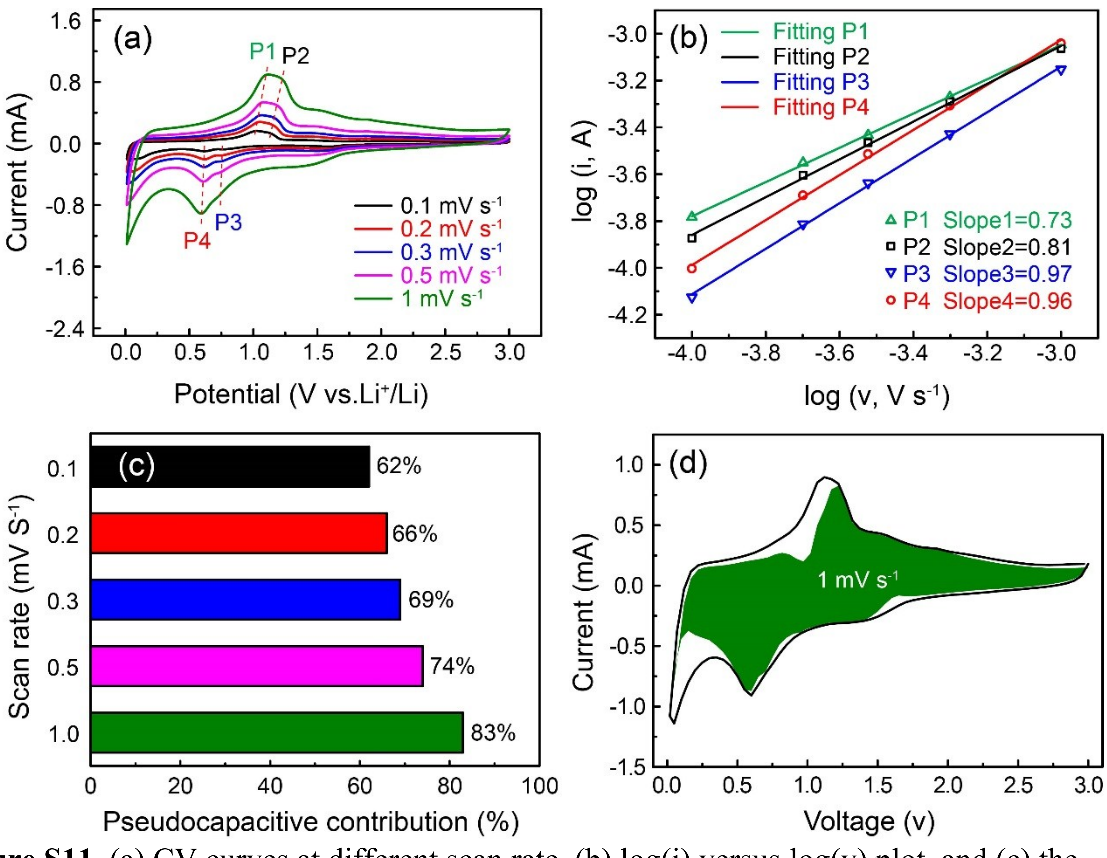

Figure S11. (a) CV curves at different scan rate, (b) log(i) versus log(v) plot, and (c) the pseudocapacitive contribution at different scan rates and (d) CV curve with the pseudocapacitive fraction at a scan rate of 1 mV s^{-1} of U-FP@C.

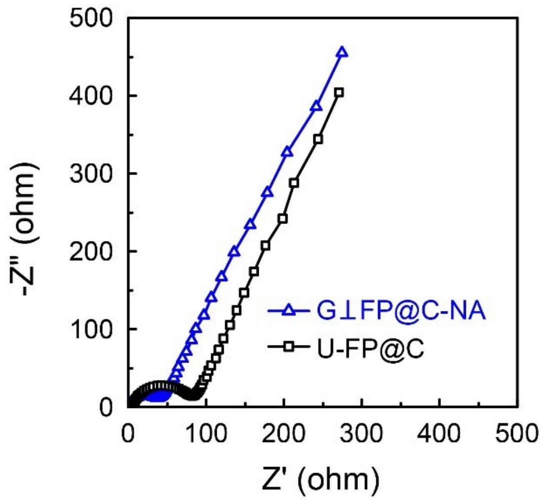

Figure S12. Nyquist plots of G⊥FP@C-NA and U-FP@C from 1 MHz to 0.1 Hz.

Table S1. The comparison of the cycling stability between the present G⊥FP@C-NA and other FeP-based anode materials previously reported in recent years.

Numbers	Samples	Coulombic Efficiency (1st cycle)	Current density (mA g^{-1})	Capacity (1st cycle) (mAh g^{-1})	Cycle numbers (n)	Capacity after cycle (mAh g^{-1})	Capacity decay rate per cycle
1	G/FeP	71.60%	500	768.2	500	1009	-0.06%
			2000	506.5	1300	355.9	0.02%
2[1]	H-FeP@C@GR	74%	200	1154	100	771	0.33%
			500	885	300	542	0.13%
3[2]	FeP@rGO	73%	100	1180	100	997	0.16%
			1000	475	400	470	0.00%
4[3]	FeP	58.1%	100	575	50	334	0.84%
5[4]	FeP@C	70%	200	720	100	720	0.00%
			500	610	400	610	0.00%
6[5]	Mesoporous FeP	49%	144	390	30	355	0.30%
7[6]	Nanorod-FeP@C	28.10%	30	277	200	480	-0.37%
8[7]	Nanoscaled FeP_y	75%	20	1486	10	1089	2.67%
			60	908	10	581	3.60%
9[8]	FeP_2-amorphous	61%	0.1C	766	10	882	-1.51%
			0.2C	310	100	300	0.03%

Reference

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