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

\[ FeP + 2O_2 \rightarrow \frac{1}{2}Fe_2O_3 + \frac{1}{2}P_2O_5 \]

\[ M_{FeP} = 87, M_{O_2} = 32 \]

For U-FP@C:

\[ m_{FeP1} + 2 \cdot \frac{m_{FeP1}}{M_{FeP}} \cdot M_{O_2} = 131\% \]

\[ m_{FeP1} = 75\% \]

\[ m_{C1} = 1 - m_{FeP1} = 25\% \]

For G-⊥FP@C-NA:

\[ m_{FeP2} + 2 \cdot \frac{m_{FeP2}}{M_{FeP}} \cdot M_{O_2} = 119\% \]

\[ m_{FeP2} = 69\% \]

\[ m_{C2} = m_{FeP2} \cdot \frac{m_{C1}}{m_{FeP1}} = 23\% \]

\[ m_{G} = 1 - m_{FeP2} - m_{C2} = 8\% \]
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\(_{\perp}\)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$_{\perp}$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//LiFePO₄ 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.

<table>
<thead>
<tr>
<th>Numbers</th>
<th>Samples</th>
<th>Coulombic Efficiency (1st cycle)</th>
<th>Current density (mA g⁻¹)</th>
<th>Capacity (1st cycle) (mAh g⁻¹)</th>
<th>Cycle numbers (n)</th>
<th>Capacity after cycle (mAh g⁻¹)</th>
<th>Capacity decay rate per cycle</th>
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<tbody>
<tr>
<td>1</td>
<td>G/FeP</td>
<td>71.60%</td>
<td>500</td>
<td>768.2</td>
<td>500</td>
<td>1009</td>
<td>-0.06%</td>
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<td></td>
<td></td>
<td></td>
<td>2000</td>
<td>506.5</td>
<td>1300</td>
<td>355.9</td>
<td>0.02%</td>
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<td>2[1]</td>
<td>H-FeP@C@GR</td>
<td>74%</td>
<td>200</td>
<td>1154</td>
<td>100</td>
<td>771</td>
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<td></td>
<td></td>
<td></td>
<td>500</td>
<td>885</td>
<td>300</td>
<td>542</td>
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<td>3[2]</td>
<td>FeP@rGO</td>
<td>73%</td>
<td>100</td>
<td>1180</td>
<td>100</td>
<td>997</td>
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<td></td>
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<td>1000</td>
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<td>400</td>
<td>470</td>
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<td>4[3]</td>
<td>FeP</td>
<td>58.1%</td>
<td>100</td>
<td>575</td>
<td>50</td>
<td>334</td>
<td>0.84%</td>
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<td>5[4]</td>
<td>FeP@C</td>
<td>70%</td>
<td>200</td>
<td>720</td>
<td>100</td>
<td>720</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>500</td>
<td>610</td>
<td>400</td>
<td>610</td>
<td>0.00%</td>
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<td>6[5]</td>
<td>Mesoporous FeP</td>
<td>49%</td>
<td>144</td>
<td>390</td>
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<td>355</td>
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<td>7[6]</td>
<td>Nanorod-FeP@C</td>
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<td>30</td>
<td>277</td>
<td>200</td>
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<td>8[7]</td>
<td>Nanoscaled FePy</td>
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<td>20</td>
<td>1486</td>
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<td>60</td>
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<td>9[8]</td>
<td>FeP₂-amorphous</td>
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Reference


