Supporting Information

Rocking-chair Na-ion hybrid capacitor: a high energy/power system based on Na$_3$V$_2$O$_2$(PO$_4$)$_2$F@PEDOT core-shell nanorods

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**Fig. S1** Comparison of the XRD patterns of Na$_3$V$_2$O$_2$(PO$_4$)$_2$F before calcination, Na$_3$V$_2$O$_2$(PO$_4$)$_2$F and Na$_3$V$_2$O$_2$(PO$_4$)$_2$F@PEDOT.

**Fig. S2** XPS (a) C 1s (b) S 2p spectra of Na$_3$V$_2$O$_2$(PO$_4$)$_2$F@PEDOT.
**Fig. S3** TG curves of NVOPF and NVOPF@PEDOT.

**Fig. S4** (a) GCD curves of NVOPF and (b) PEDOT in 1 M NaClO₄ in EC/PC (1:1 in v/v) with 5 vol % FEC as the additive.
Fig. S5 XPS V 2p$_{3/2}$ spectra of NVOPF@PEDOT at different SOCs.

Fig. S6 GCD curves of NVOPF@PEDOT in 1 M NaClO$_4$ in EC/PC (1:1 in v/v).

J. M. Tarascon et al. reported that two major effects regarding the addition of FEC in Na half-cells emerge. One regards the enhanced efficiency of the cathode’s first cycle by lowering the irreversible capacity and the other one deals with increase polarization.
penalty generated in two-electrode configuration. Some resistive layer grows at OCV on a half-cell with Na counter electrode before testing starts which limits the mass transfer from the counter electrode to the electrolyte.

**Fig. S7** CV curves of NVOPF@PEDOT.

**Fig. S8** The 44\textsuperscript{th} cycle of GCD curves of NVOPF@PEDOT in rate test.
**Fig. S9** EIS of NVOPF and NVOPF@PEDOT electrodes.

**Fig. S10** Different magnification SEM images of the NVOPF@PEDOT electrode after 20 cycle at 1C.
Fig. S11 SEM images of peanut shell derived carbon.

Fig. S12  (a) Nitrogen adsorption–desorption isotherm of peanut shell derived carbon.  
(b) Pore size distribution of peanut shell derived carbon.

Fig. S13 (a-c) Electrochemical properties of AC (peanut shell derived carbon) in half cells:  (a) CV curves at various scan rates from 1.0 to 5.0 mV s$^{-1}$.  (b) GCD curves of the AC at 0.1 A g$^{-1}$.  (c) Rate capabilities of AC at various current rates from 0.1 A g$^{-1}$ to 5 A g$^{-1}$.
Fig. S14 CV curves at various scan rates from 1.0 to 5.0 mV s$^{-1}$ of NVOPF@PEDOT//AC.

Fig. S15 Specific capacity of NVOPF@PEDOT//AC at different current density.
Table S1: The sodium storage properties for reported NVOPF half cells.

<table>
<thead>
<tr>
<th>Electrolyte</th>
<th>Rate capability (mA h g⁻¹)</th>
<th>Cycle life (corresponded capacity retention)</th>
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<tbody>
<tr>
<td>Na₃V₂O₂(PO₄)₂F@PEDOT</td>
<td>1M NaClO₄ in EC:PC+5%FEC</td>
<td>73 at 10C</td>
</tr>
<tr>
<td>Na₃V₂O₂(PO₄)₂F@carbon/graphene²</td>
<td>1M NaClO₄ in EC:DMC</td>
<td>78.5 at 10C</td>
</tr>
<tr>
<td>Na₃V₂O₂(PO₄)₂F/C³</td>
<td>1 M NaPF₆ in EC:PC</td>
<td>30 at 5C</td>
</tr>
<tr>
<td>Na₃V₂O₂(PO₄)₂F-nano-tetraprisms⁴</td>
<td>1M NaClO₄ in PC+5%FEC in the P(VDF-HFP)</td>
<td>81 at 10C</td>
</tr>
<tr>
<td>Na₃V₂O₂(PO₄)₂F/graphene⁵</td>
<td>1 M NaPF₆ in EC:DEC</td>
<td>40 at 10C</td>
</tr>
<tr>
<td>Na₃(VO₁₋ₓPO₄)₂F₁+₂ₓ (0≤x≤1) nanoparticles⁶</td>
<td>1M NaClO₄ in EC:DEC+2%FEC</td>
<td>73 at 10C</td>
</tr>
</tbody>
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Reference: