Supporting Information

Engineering Graphene with Red Phosphorus Quantum Dots for Superior Hybrid Anodes of Sodium-ion Batteries

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Figure S1. (a) Photo image, (b) SEM image and (c) XRD pattern of the commercial red phosphorus.
Figure S2. TEM images of red phosphorus after hydrothermal treatment at 200 °C for different time. (a) 2 h, (b) 6 h, (c) 12 h, (d) 18 h, and (e, f) 24 h. The insets are the SEAD patterns related to the red phosphorus after hydrothermal treatment at 200 °C for 2 h and 24 h, respectively.
**Figure S3.** Optical images showing the separation process of RPQDs from RPNWs. (a) Digital camera image of ultracentrifuge tubes containing RPQDs and RPNWs solution; (b) Digital camera image of ultracentrifuge tubes containing RPQDs solution and RPNWs sedimentation after centrifugation at 8000 rpm for 30 min. After centrifugation, the 2/3 supernatant containing RPQDs was decanted.

**Table S1.** Zeta potential of GO and RPQDs after PAH modification.

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<tr>
<th>Materials</th>
<th>GO</th>
<th>RPQDs</th>
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<tr>
<td>Zeta potential (mV)</td>
<td>-33.51</td>
<td>32.56</td>
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Figure S4. UV/Vis adsorption spectrum of RPQDs in water.
**Figure S5.** P2p XPS spectrum of commercial red phosphorus.

**Figure S6.** FT-IR spectra of GO and RPQDs/rGO hybrid.
Figure S7. (a) SEM images of RPNWs/rGO hybrid; (b), (c) TEM images of RPNWs/rGO hybrid; (d) High angle annular dark-field STEM (HAADF-STEM) image and corresponding carbon (e) and phosphorus (f) elemental mappings of RPNWs/rGO hybrid.
Figure S8. (a) Cycling performances of RPQDs/rGO electrodes with different GO addition during preparation process at a current density of 200 mA g\(^{-1}\) cycled between 0.005 and 2.0 V vs. Na\(^+\)/Na; (b) Coulombic efficiency of RPQDs/rGO hybrid, RPNWs/rGO hybrid, RPQDs and RPNWs electrodes at a current density of 200 mA g\(^{-1}\).
Figure S9. (a) Discharge-charge profiles of RPQDs at a current density of 125 mA g⁻¹ for LIBs cycled between 0.005 and 2.0 V vs Li⁺/Li; (b) Rate performance of RPQDs electrode for LIBs; (c) Cycling performances of RPQDs with a current density of 125 mA g⁻¹ for LIBs cycled between 0.005 and 2.0 V vs Li