Supporting Information

In-situ catalytic formation of graphene-like graphitic layer decoration on Na$_3$V$_{2-x}$Ga$_x$(PO$_4$)$_3$ ($0 \leq x \leq 0.6$) for ultrafast and high energy sodium storage

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Fig. S1 Typical SEM image of Na$_3$V$_2$(PO$_4$)$_3$ and corresponding elemental mapping of sodium (yellow), vanadium (blue), gallium (cyan), phosphorous (plum), oxygen (red), and carbon (green) (i).

Fig. S2 The initial charge-discharge curves in the voltage range of 2.3-4.3 V for Na$_3$V$_2$$_x$Ga$_x$(PO$_4$)$_3$ (x= 0, 0.1, 0.2, 0.4 and 0.6) at 0.1 C.
**Fig. S3** Ex-situ XPS of Na$_3$V$_{1.6}$Ga$_{0.4}$(PO$_4$)$_3$ at different charge states.

Table S1 ICP-AES results of Na$_3$V$_2$(PO$_4$)$_3$ and Na$_3$V$_{1.6}$Ga$_{0.4}$(PO$_4$)$_3$ samples.

<table>
<thead>
<tr>
<th>Samples</th>
<th>Na</th>
<th>V</th>
<th>Ga</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na$_3$V$_2$(PO$_4$)$_3$</td>
<td>3.02</td>
<td>2.0</td>
<td>0</td>
<td>3.0</td>
</tr>
<tr>
<td>Na$<em>3$V$</em>{1.6}$Ga$_{0.4}$(PO$_4$)$_3$</td>
<td>3.02</td>
<td>1.6</td>
<td>0.42</td>
<td>3.06</td>
</tr>
</tbody>
</table>
Fig. S4 The rate performances of $\text{Na}_3\text{V}_{1.6}\text{Ga}_{0.4}(\text{PO}_4)_3$ with higher mass loadings in the voltage of 2.3-4.3 V (a). The charge-discharge curves of $\text{Na}_3\text{V}_{1.6}\text{Ga}_{0.4}(\text{PO}_4)_3$ at different current rates (b, c). The comparison of power density (d) with higher mass loadings (4.2 and 6.1 mg cm$^{-2}$) at different current rates.