Yttrium Doping Stabilizes the Structure of Ni$_3$(NO$_3$)$_2$(OH)$_4$

Cathodes for Application in Advanced Ni-Zn Batteries

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The energy density (E, Wh/kg) and power density (P, W/kg) of the devices were calculated using the following formula:

$$E = \int IVdt/m$$

(1)

$$P = E /\Delta t$$

(2)

Where I was the discharging current, V was the discharging voltage, dt was the time differential, m was the total mass of the active electrode materials, $\Delta t$ was the discharging time.

Figure S1. Part of the XRD patterns of Ni$_3$(NO$_3$)$_2$(OH)$_4$ and Y-Ni$_3$(NO$_3$)$_2$(OH)$_4$. 

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Table 1. Determine the atomic ratio of Y to Ni in Y-Ni$_3$(NO$_3$)$_2$(OH)$_4$ by EDS.

<table>
<thead>
<tr>
<th>Materials</th>
<th>Y(at%)</th>
<th>Ni(at%)</th>
<th>Y:Ni</th>
</tr>
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<tbody>
<tr>
<td>Y-Ni$_3$(NO$_3$)$_2$(OH)$_4$</td>
<td>2.41</td>
<td>31.73</td>
<td>7.59%</td>
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</table>
Figure S2. (a) SEM images of Ni$_3$(NO$_3$)$_2$(OH)$_4$, (b)SEM images of Y-Ni$_3$(NO$_3$)$_2$(OH)$_4$. 
Figure S3. (a-b) TEM images of Ni$_3$(NO$_3$)$_2$(OH)$_4$, (c) SAED pattern of Ni$_3$(NO$_3$)$_2$(OH)$_4$, (d) HRTEM of Ni$_3$(NO$_3$)$_2$(OH)$_4$. 
Figure S4. (a) CV curves of the Y-Ni$_3$(NO$_3$)$_2$(OH)$_4$ electrodes at different scan rates, (b) Relationship of Y-Ni$_3$(NO$_3$)$_2$(OH)$_4$ between log (i) and log (v).
Figure S5. Capacitive contributions of $\text{Ni}_3(\text{NO}_3)_2(\text{OH})_4$ at different scan rates.
Figure S6. CV curves of the Ni$_3$(NO$_3$)$_2$(OH)$_4$/Zn battery electrodes at different scan rates.
Figure S7. SEM of Y-Ni$_3$(NO$_3$)$_2$(OH)$_4$ after 100 charge-discharge cycles at 1 A/g.
Figure S8. XPS of Y-Ni$_3$(NO$_3$)$_2$(OH)$_4$ after 100 charge-discharge cycles at 1 A/g.