

Supporting Information

Facile synthesis of $\text{Ni}_{11}(\text{HPO}_3)_8(\text{OH})_6/\text{rGO}$ nanorods with enhanced electrochemical performance for aluminum-ion batteries

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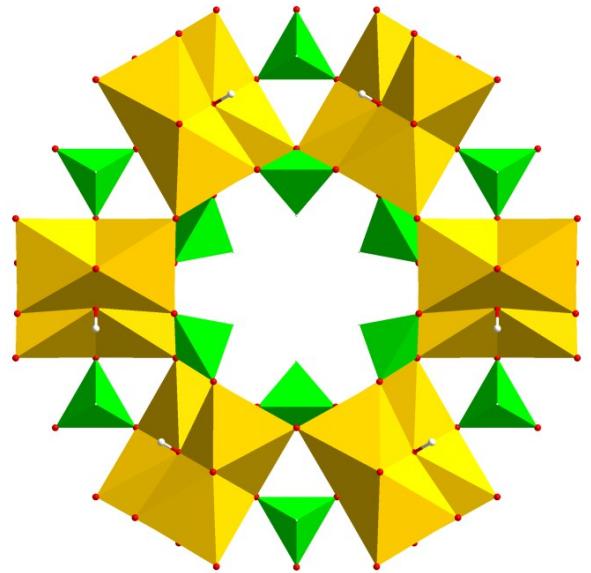


Fig. S1. The crystal structure of $\text{Ni}_{11}(\text{HPO}_3)_8(\text{OH})_6$ in the [001] direction.

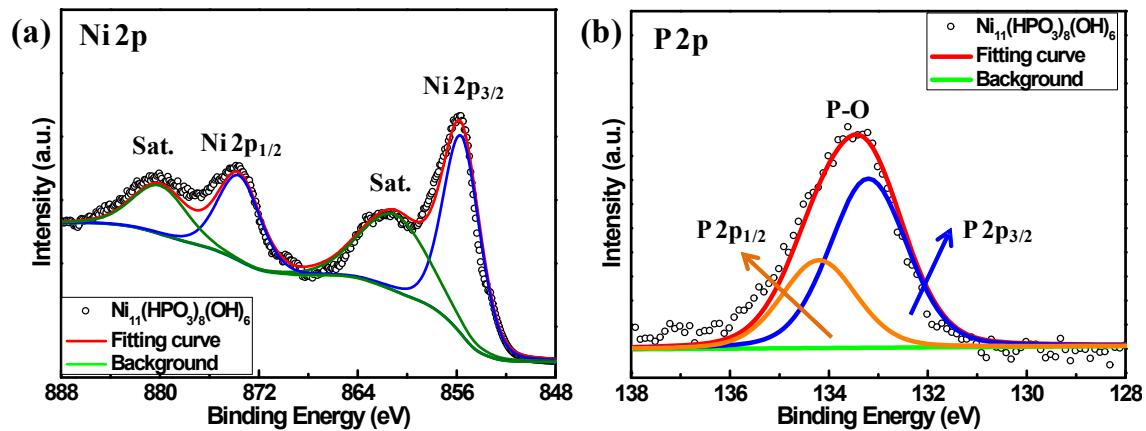


Fig. S2. High-resolution XPS spectra of the Ni 2p (b) and P 2p (b) of the as-prepared $\text{Ni}_{11}(\text{HPO}_3)_8(\text{OH})_6$.

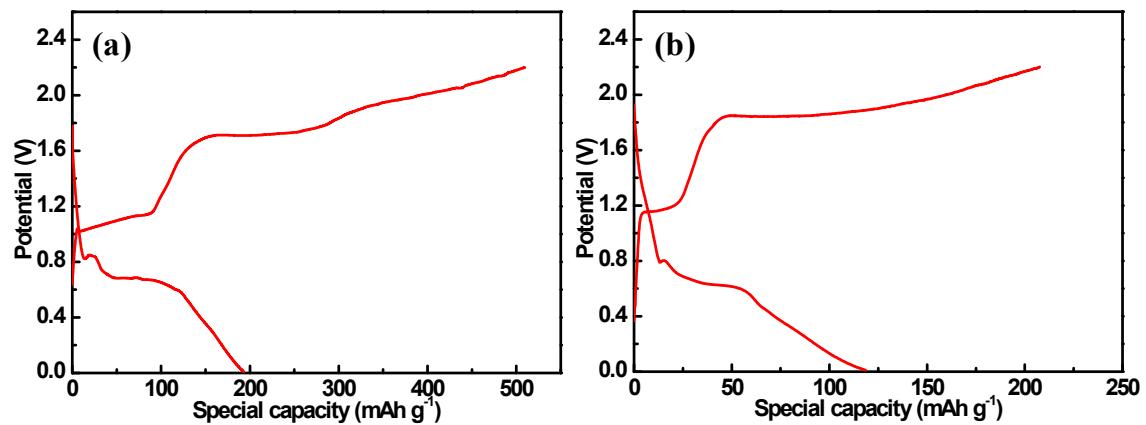


Fig. S3. The first charge-discharge curve of the Ni₁₁(HPO₃)₈(OH)₆ (a) and Ni₁₁(HPO₃)₈(OH)₆/rGO (b) electrodes at a current density of 100 mA g⁻¹ under the potentials ranging from 0.01 to 2.2 V.

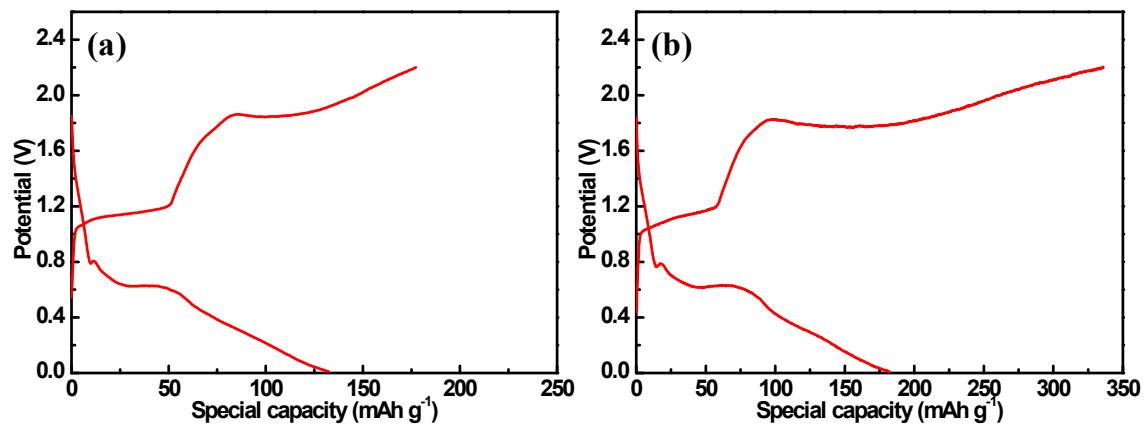


Fig. S4. The first charge-discharge curve of the Ni₁₁(HPO₃)₈(OH)₆ (a) and Ni₁₁(HPO₃)₈(OH)₆/rGO (b) electrodes at a current density of 200 mA g⁻¹ under the potentials ranging from 0.01 to 2.2 V.

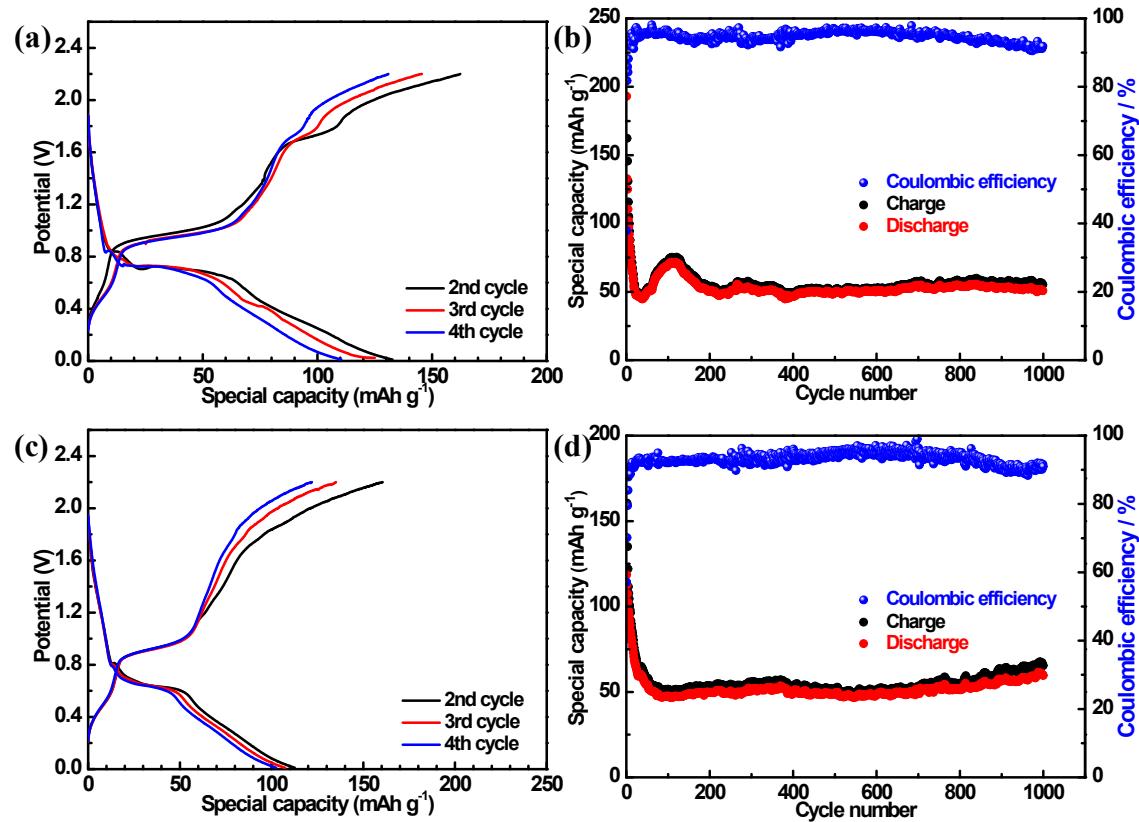


Fig. S5. The charge-discharge curves from 2nd to 4th cycle (a,c) and cycling performance (b,d) of the $\text{Ni}_{11}(\text{HPO}_3)_8(\text{OH})_6$ (a,b) and $\text{Ni}_{11}(\text{HPO}_3)_8(\text{OH})_6/\text{rGO}$ (c,d) electrodes at a current density of 100 mA g^{-1} under the potentials ranging from 0.01 to 2.2 V.

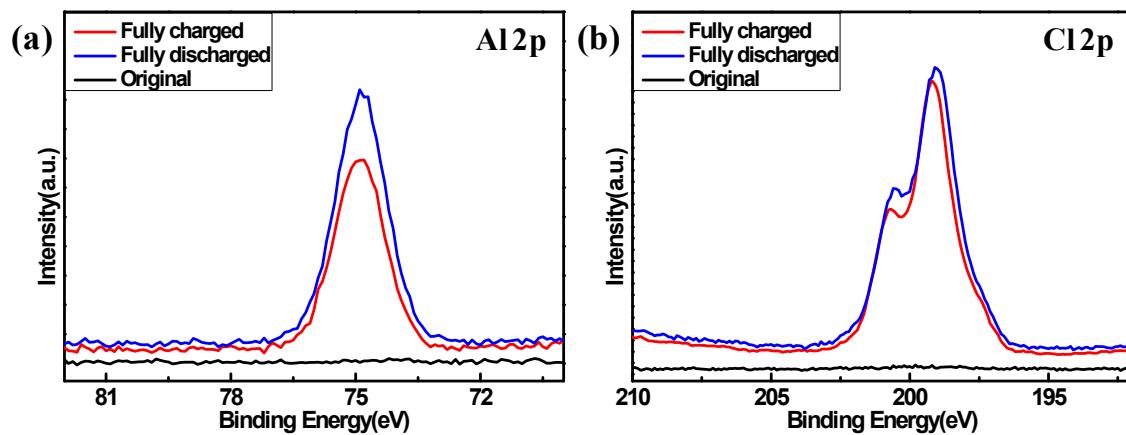


Fig. S6. High-resolution XPS spectra of the Al 2p (a) and Cl 2p (b) of $\text{Ni}_{11}(\text{HPO}_3)_8(\text{OH})_6$ electrode for the different states.

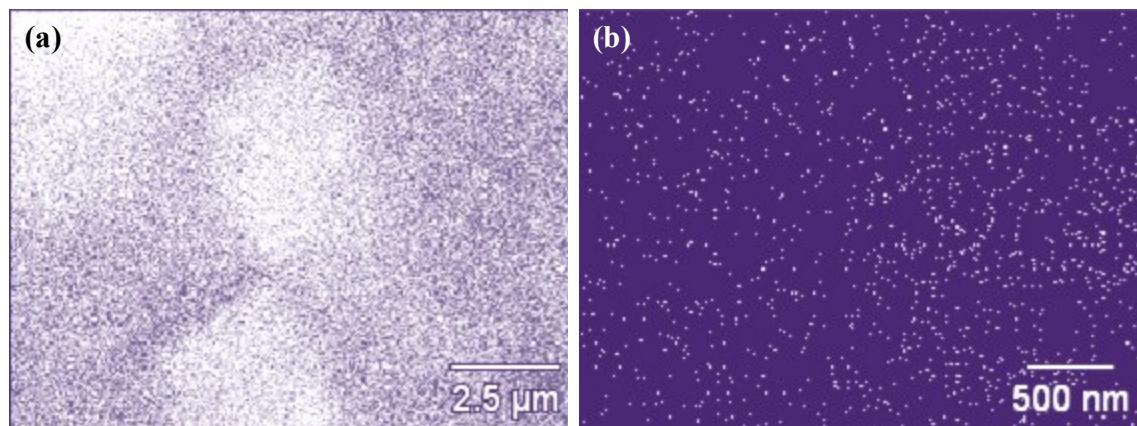


Fig. S7. The mapping images of Cl element for the charged (a) and discharged (b) sample.

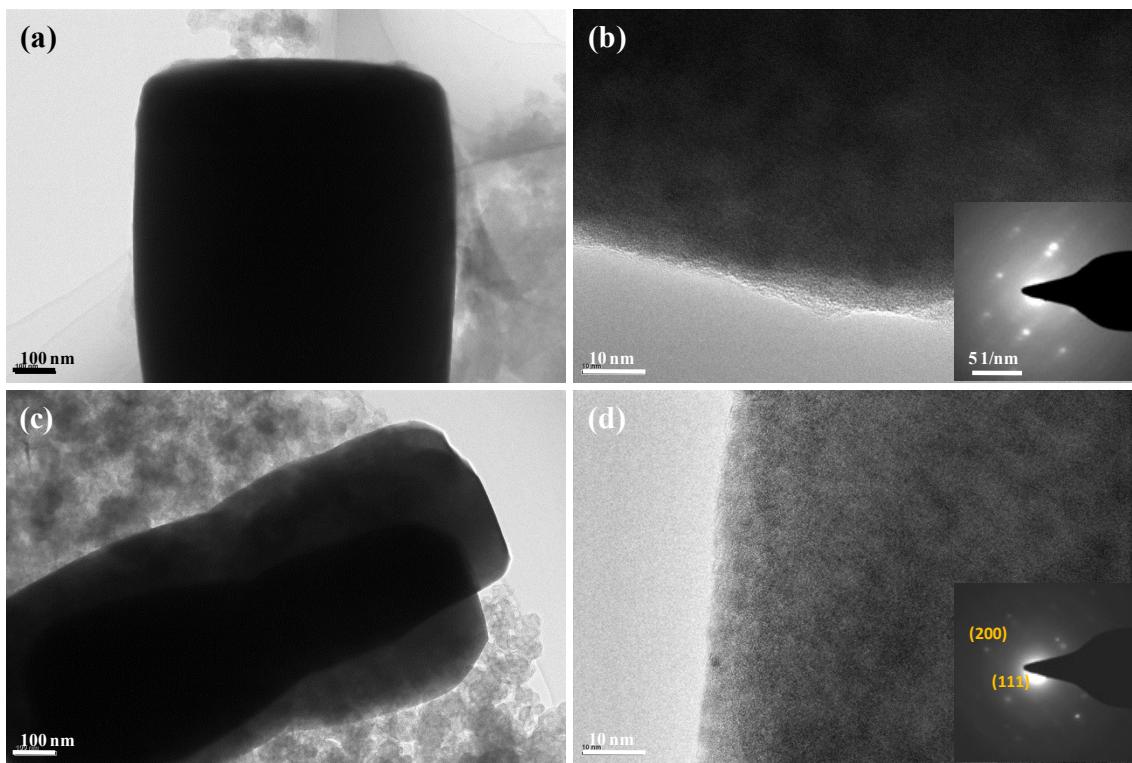


Fig. S8. The TEM images of the charged (a,b) and discharged (c,d) $\text{Ni}_{11}(\text{HPO}_3)_8(\text{OH})_6$ (Inset: SAED pattern).

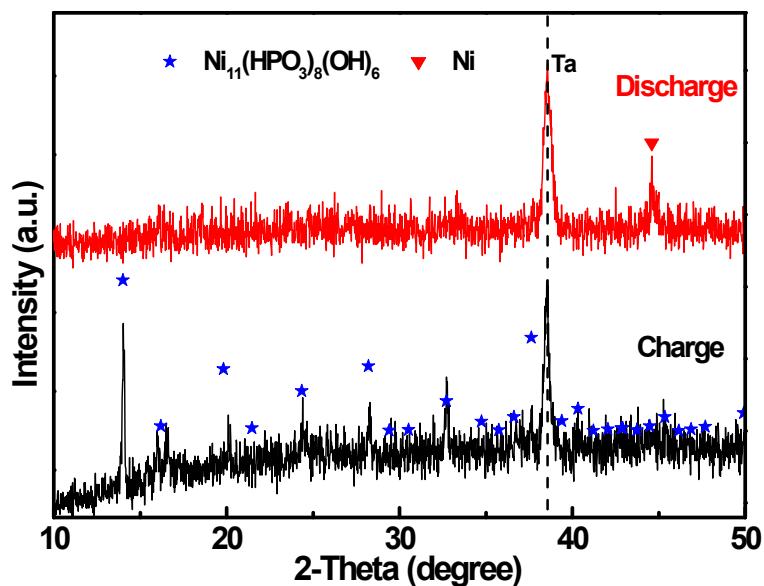


Fig. S9. XRD patterns of the charged and discharged $\text{Ni}_{11}(\text{HPO}_3)_8(\text{OH})_6$ electrodes.

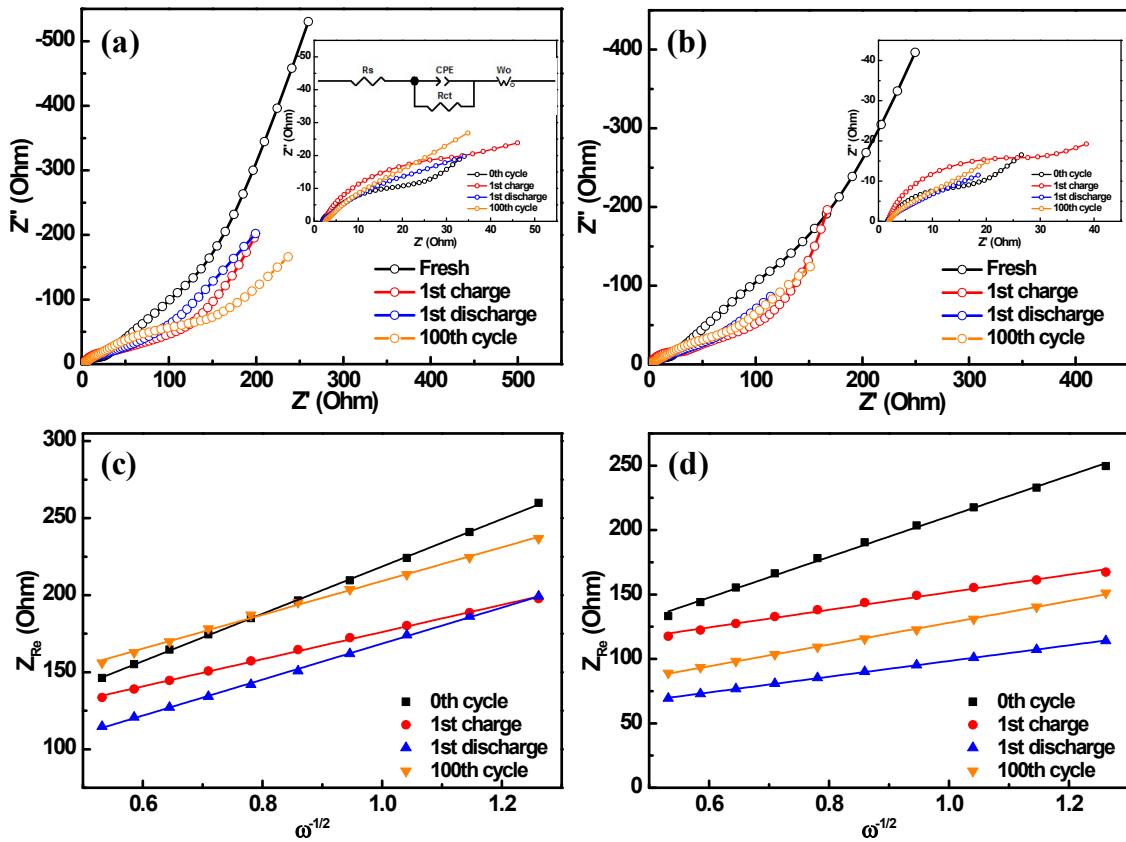


Fig. S10. Nyquist plots (a,b) and the relationship between Z_{Re} and $\omega^{-1/2}$ (c,d) of the Ni₁₁(HPO₃)₈(OH)₆ (a,b) and Ni₁₁(HPO₃)₈(OH)₆/rGO (c,d) electrodes. The equivalent circuit from inset of a can be used analyze the measured impedance.

Table S1. EDX element analysis results of the fully charged Ni₁₁(HPO₃)₈(OH)₆.

<i>Element</i>	<i>Weight %</i>	<i>Atom %</i>
<i>C K</i>	64.38	74.30
<i>O K</i>	26.77	23.19
<i>Al K</i>	0.36	0.18
<i>P K</i>	1.49	0.67
<i>Cl K</i>	0.04	0.01
<i>Ni K</i>	6.97	1.65
<i>Total</i>	100.00	100.00

Table S2. EDX element analysis results of the fully discharged $\text{Ni}_{11}(\text{HPO}_3)_8(\text{OH})_6$.

<i>Element</i>	<i>Weight %</i>	<i>Atom %</i>
<i>C K</i>	15.81	44.84
<i>O K</i>	2.50	5.33
<i>Al K</i>	1.24	1.56
<i>P K</i>	2.93	3.22
<i>Cl K</i>	0.17	0.16
<i>Ni K</i>	77.35	44.88
<i>Total</i>	100.00	100.00

Table S3. The parameters obtained by fitting the impedance spectra of $\text{Ni}_{11}(\text{HPO}_3)_8(\text{OH})_6$ and $\text{Ni}_{11}(\text{HPO}_3)_8(\text{OH})_6/\text{rGO}$ electrodes under different states.

Sample		R_s (Ω)	R_{ct} (Ω)	$CPE-T$ (F)	$CPE-P$
$\text{Ni}_{11}(\text{HPO}_3)_8(\text{OH})_6$	0th cycle	1.841	25.03	0.0002	0.69
	1th charge	2.237	35.93	0.0001	0.80
	1th discharge	1.747	77.14	0.0014	0.52
	100th cycle	2.325	136.5	0.0012	0.55
$\text{Ni}_{11}(\text{HPO}_3)_8(\text{OH})_6/\text{rGO}$	0th cycle	1.742	19.63	0.0001	0.78
	1th charge	1.875	33.04	0.00006	0.88
	1th discharge	1.579	56.66	0.003	0.51
	100th cycle	1.72	76.93	0.002	0.54