**Supporting Information**

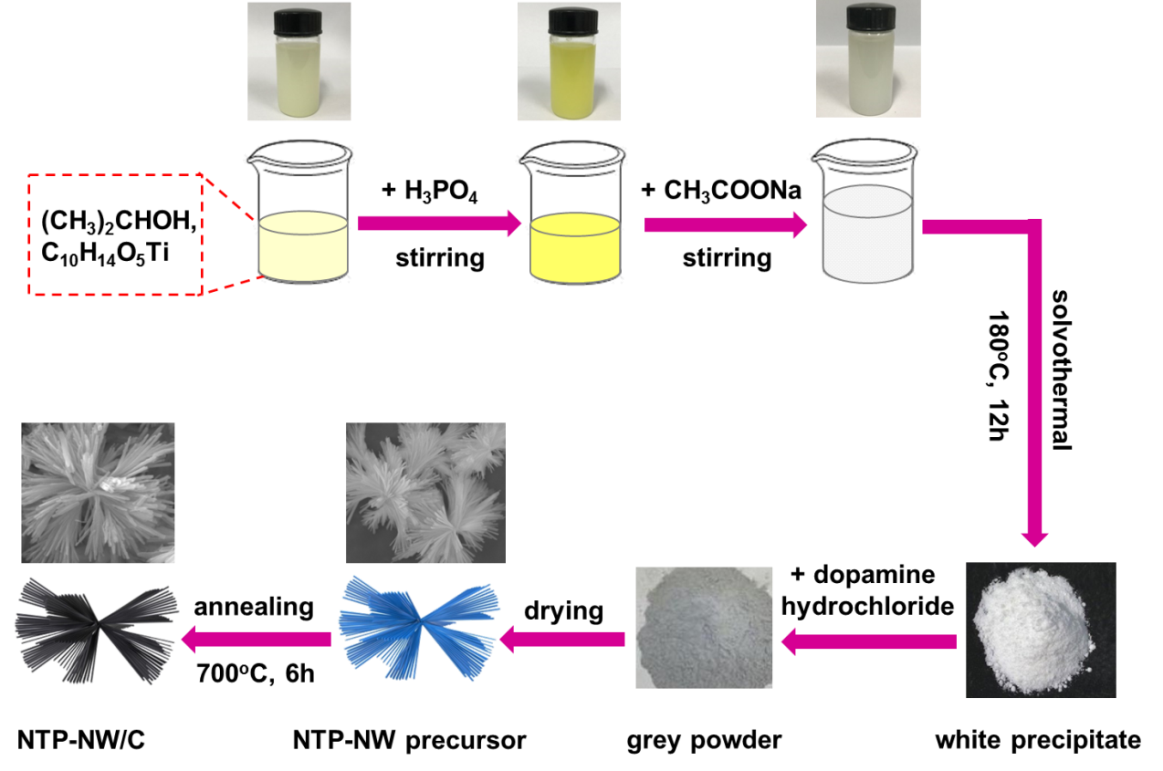
Novel NaTi2(PO4)3 Nanowire Clusters as High Performance Cathodes for Mg-Na Hybrid-ion Batteries

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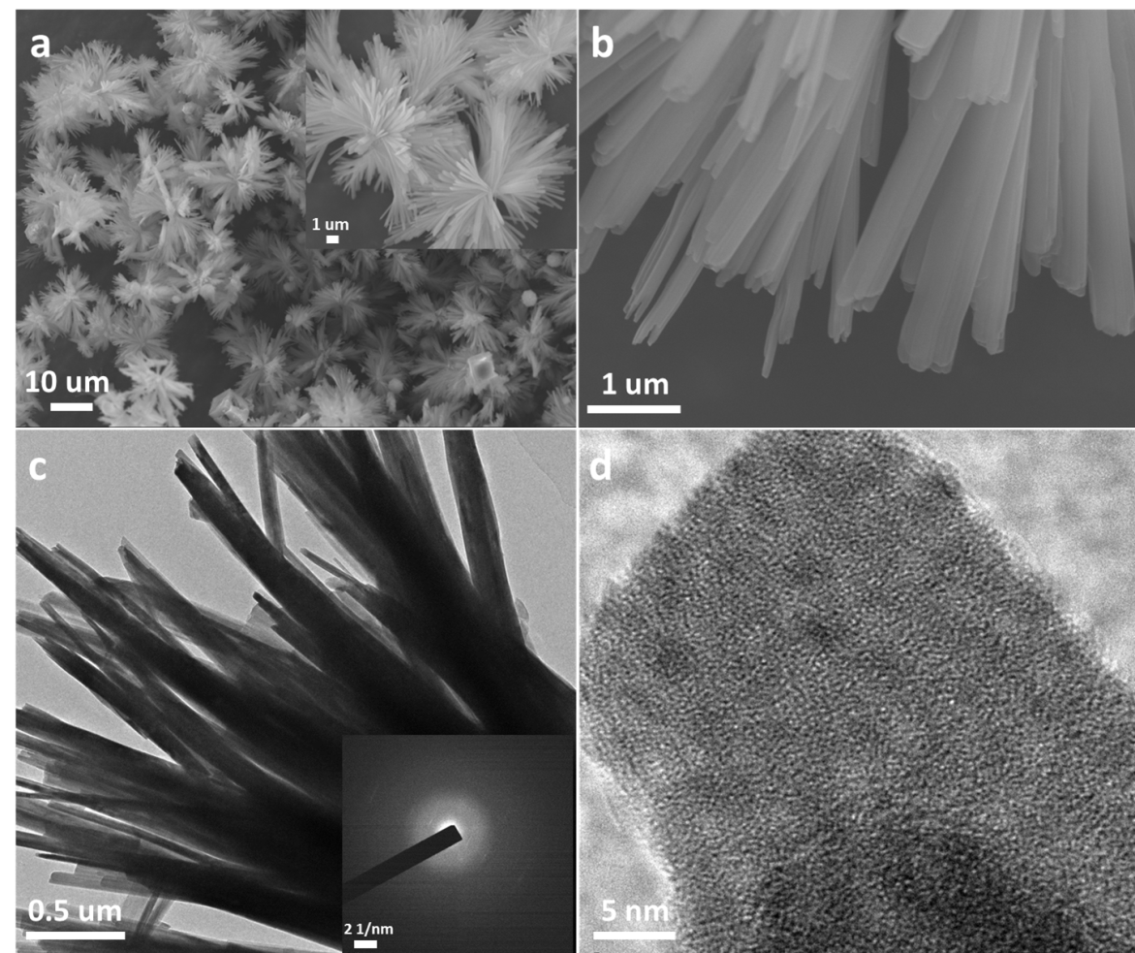
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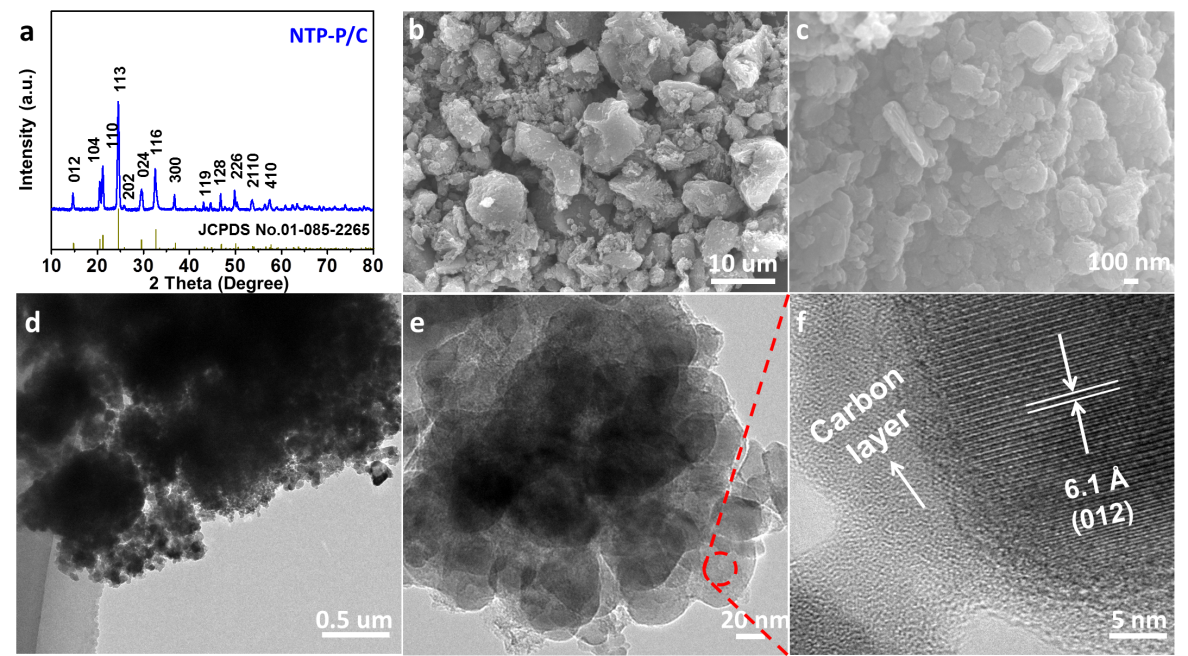
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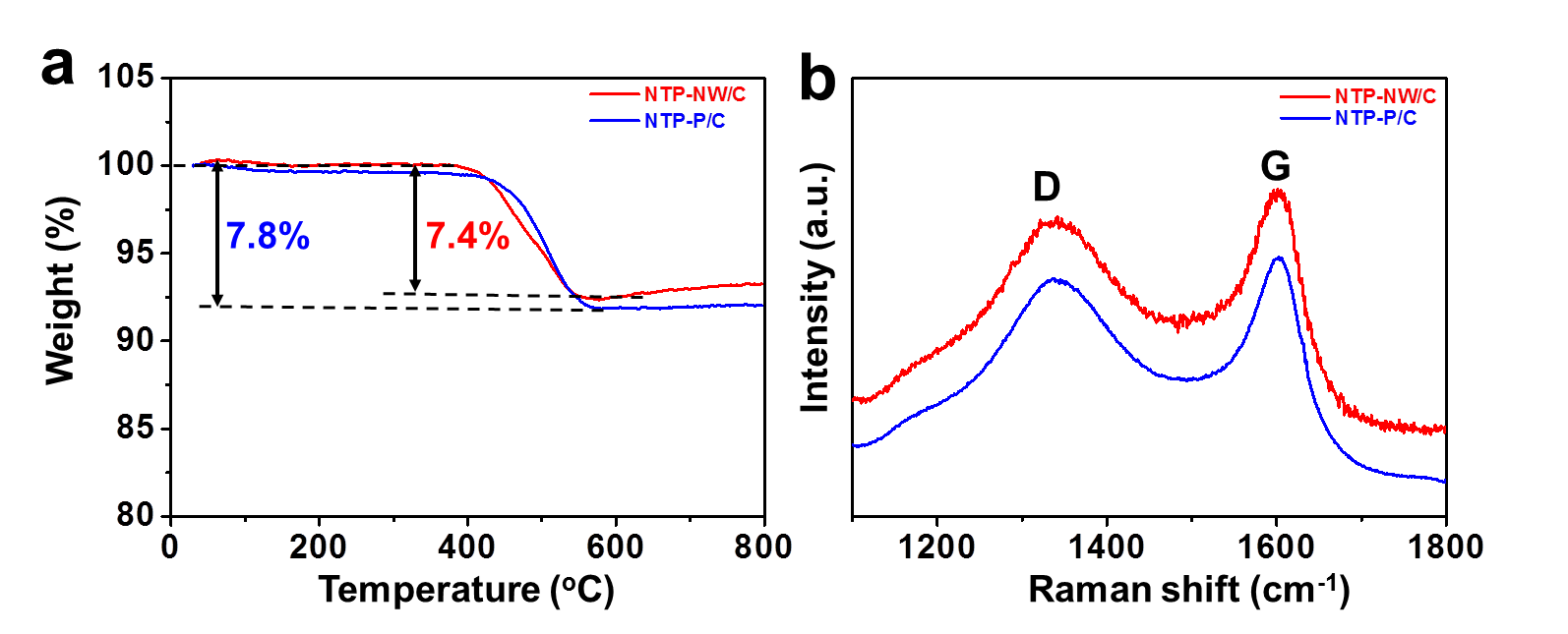
**Figure S1**.Schematic illustration of the fabrication process for the NTP-NW/C nanowire clusters.



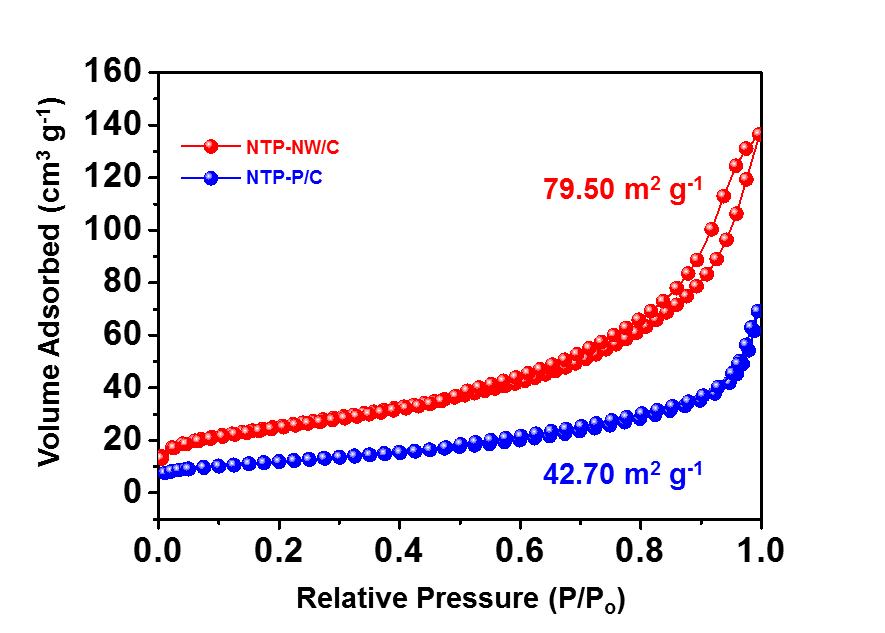
**Figure S2**.(a, b) FESEM images, (c) TEM image with selected area electron diffraction pattern and (d) HRTEM image of NTP nanowire cluster precursors.



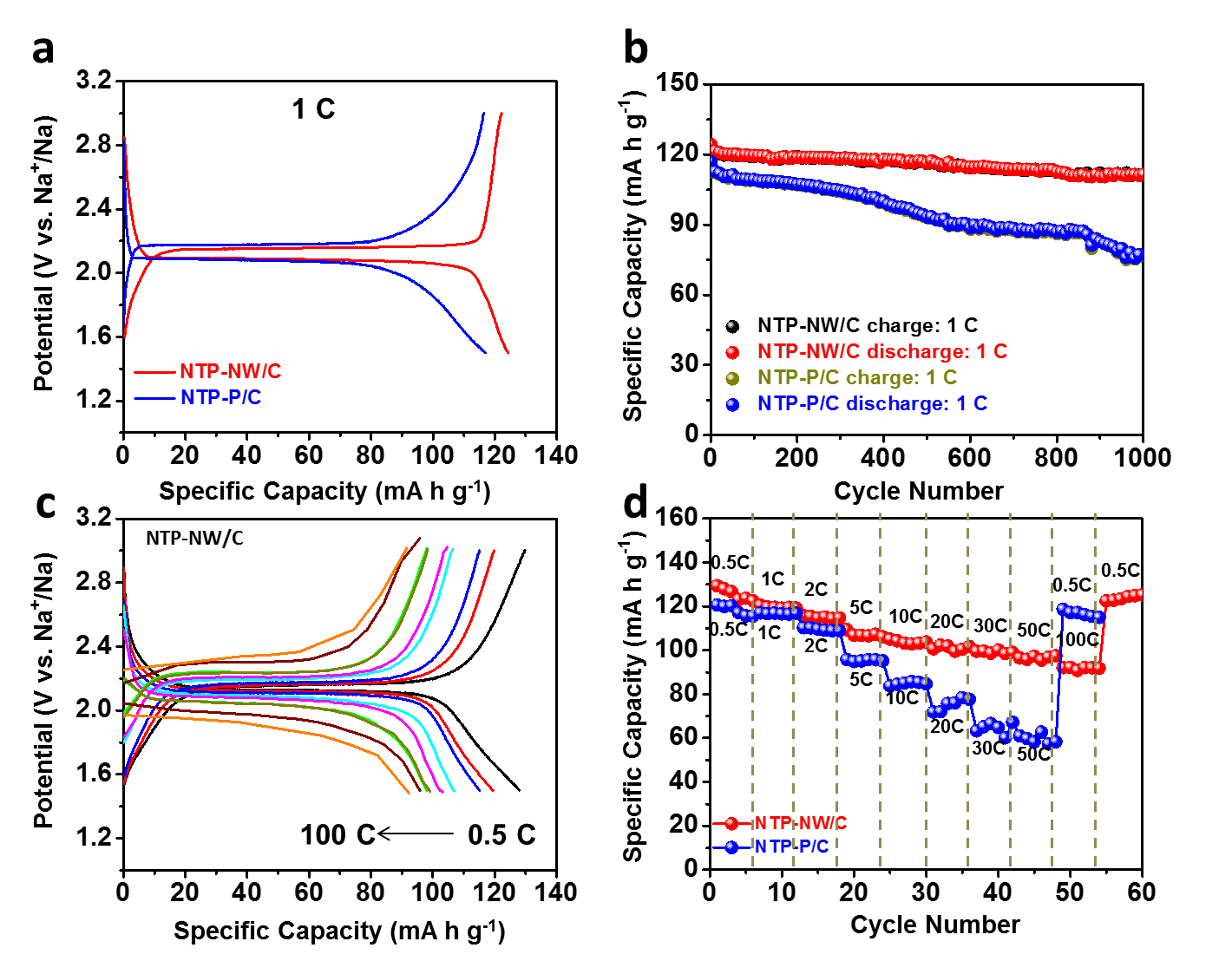
**Figure S3**.(a) The XRD diffraction pattern, (b,c) FESEM images, (d,e) TEM images, and (f) HRTEM image of NTP-P/C.



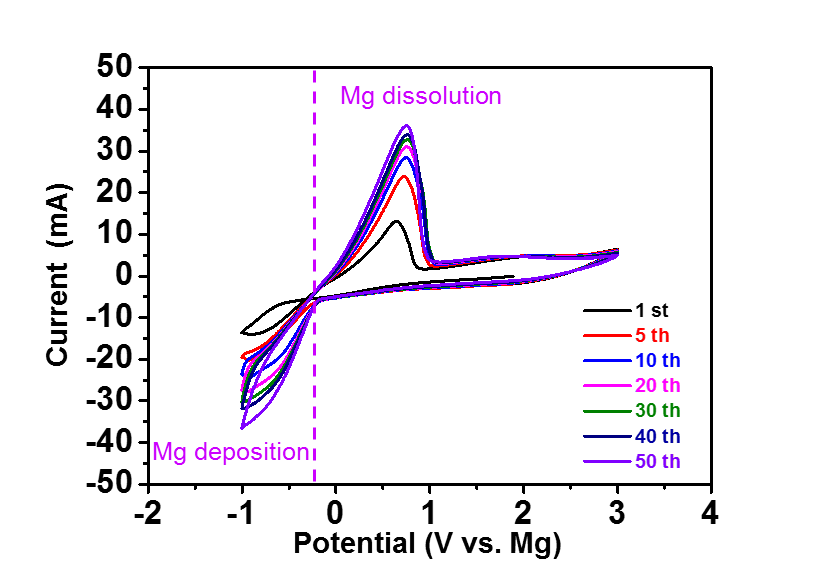
**Figure S4**.(a) TGA curves and (b) Raman spectra of NTP-NW/C and NTP-P/C.



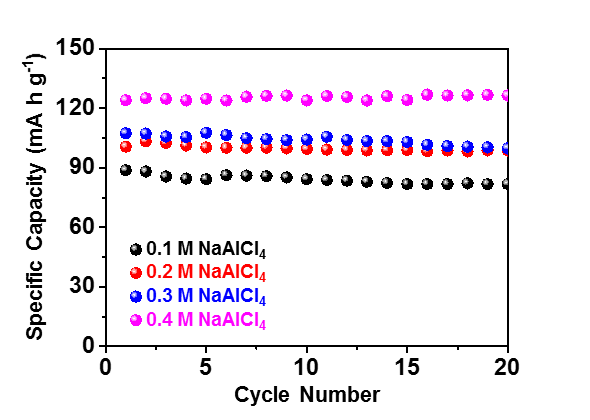
**Figure S5**.Nitrogen adsorption-desorption isotherms of NTP-NW/C and NTP-P/C.



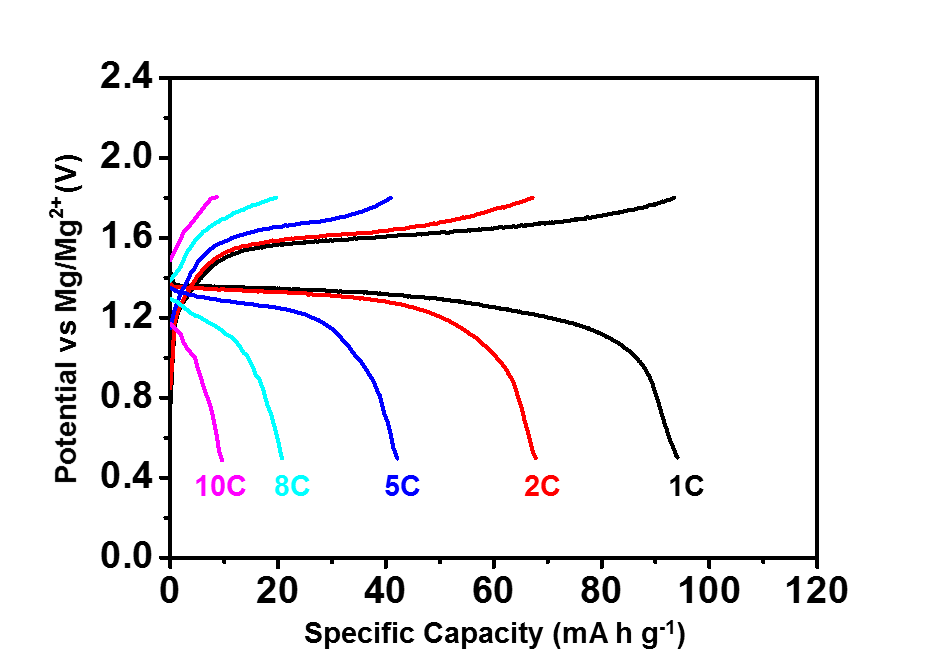
**Figure S6**. Sodium storage properties of the two samples by assembling Na-ion half cells. (a) The discharge-charge curves and (b) cycling performances of NTP-NW/C and NTP-P/C at 1 C. (c) Discharge-charge curves of the NTP-NW/C at different rates. (d) The rate performances of NTP-NW/C and NTP-P/C.



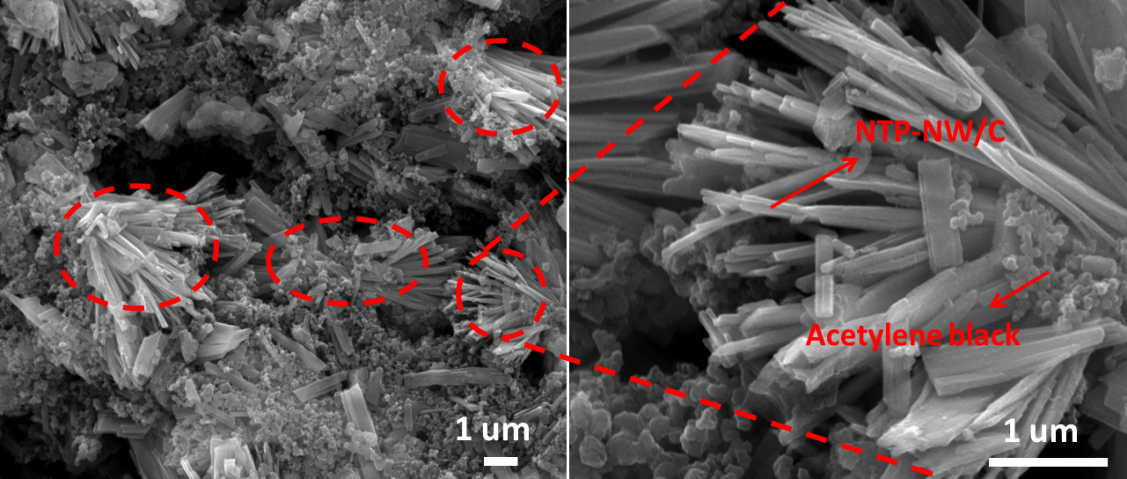
**Figure S7**. Cyclic voltammograms of hybrid Mg-Na electrolyte at a scan rate of 50 mV s−1 in a three-electrode cell.

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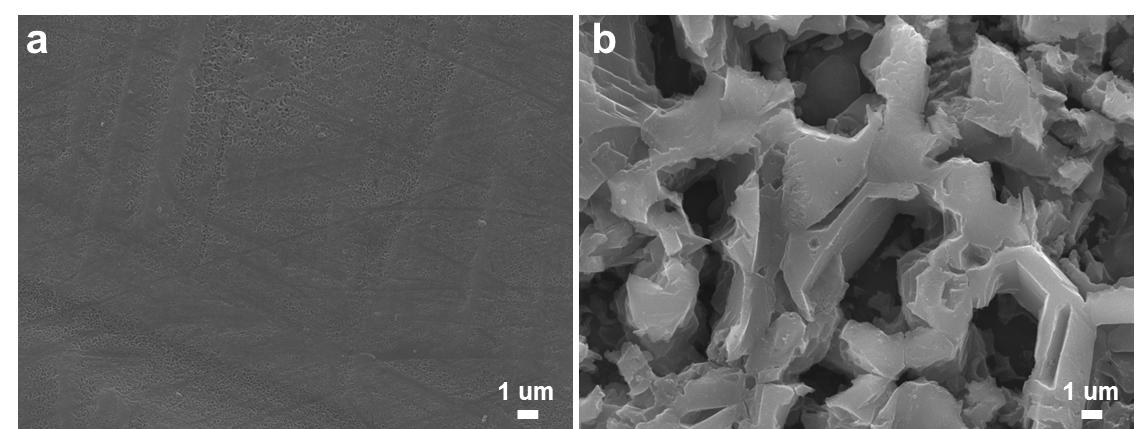
**Figure S8.** The cycling performances of NTP-NW/C at 0.5 C under different concentrations of NaAlCl4.



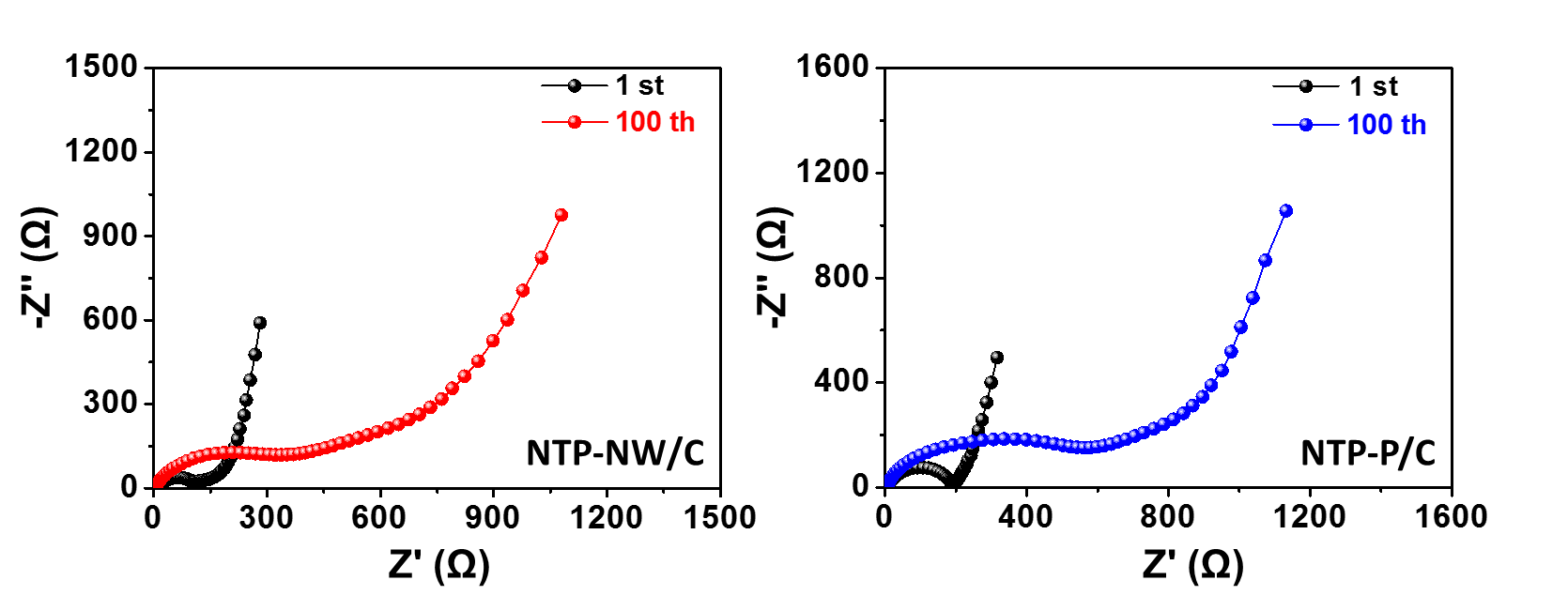
**Figure S9**. Discharge-charge curves of the NTP-P/C at different rates.



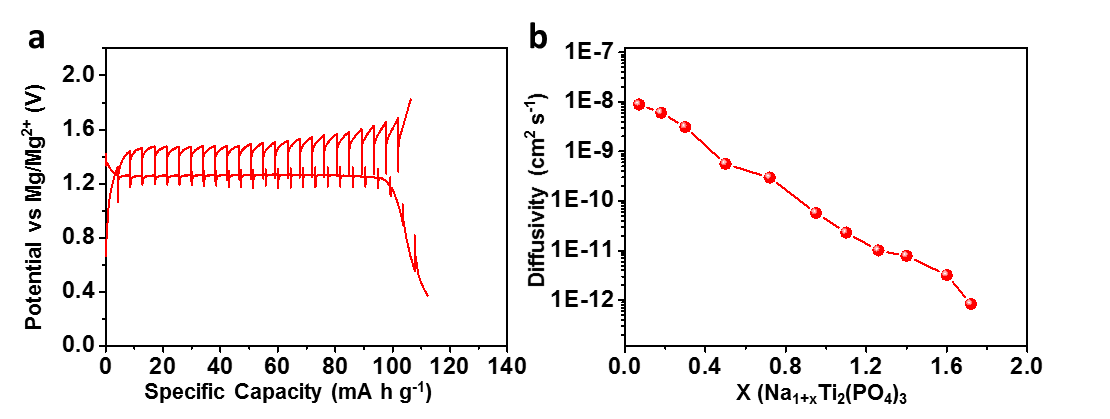
**Figure S10**. SEM images of NTP-NW/C electrode after 100 cycles at 5 C.



**Figure S11**. SEM images of the Mg anode (a) before cycling and (b) after 100 cycles at 5 C.



**Figure S12**. The Nyquist plots of the NTP-NW/C (a) and NTP-P/C (b) in different states.



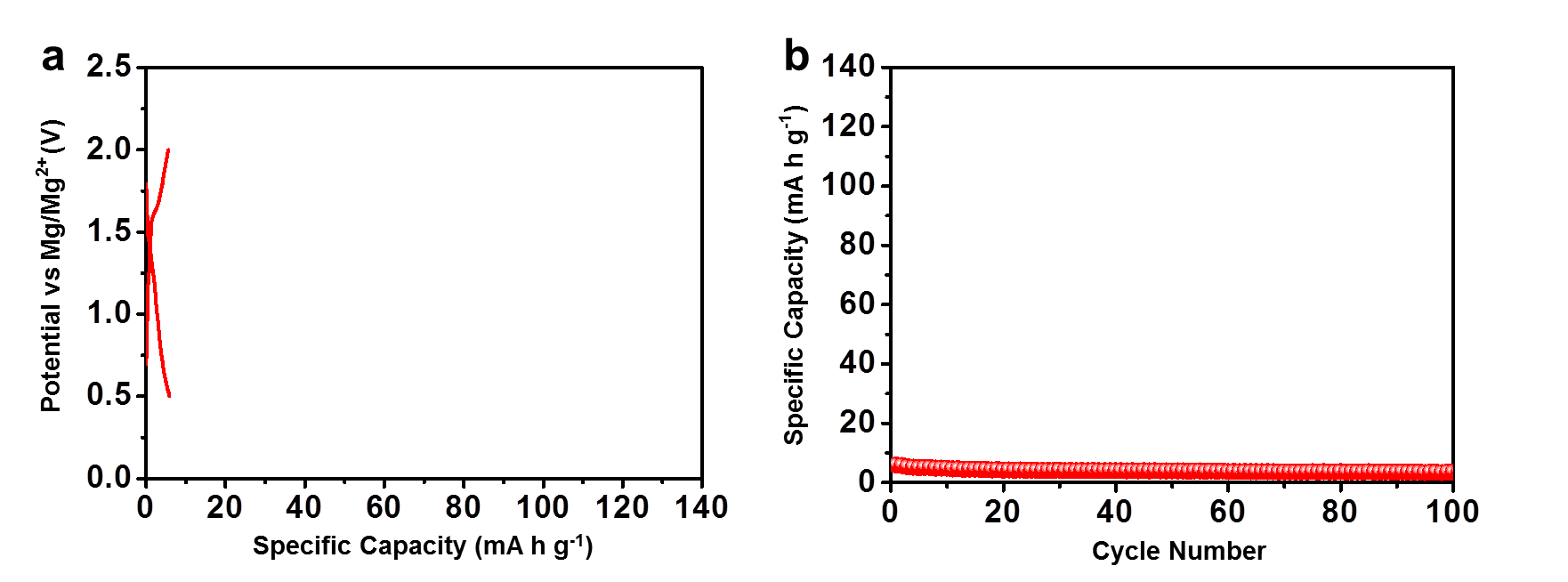
**Figure S13.** (a) GITT curve of NTP-P/C at 0.5-1.8 V. (b) Diffusivity versus state of discharge.

**Table S1.** The calculated diffusion coefficients versus state of discharge of NTP-NW/C.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **X (Na1+xTi2(PO4)3** | 0.07 | 0.20 | 0.36 | 0.58 | 0.8 | 1.02 | 1.22 | 1.38 | 1.54 | 1.65 | 1.77 | 1.86 |
| **D (cm2 s-1)** | 1.2E-8 | 5.8E-9 | 3.7E-9 | 9.7E-10 | 5.8E-10 | 3.6E-10 | 1.5E-10 | 8.2E-11 | 5.9E-11 | 2.9E-11 | 2.3E-11 | 1.4E-11 |

**Table S2.** The calculated diffusion coefficients versus state of discharge of NTP-P/C.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **X (Na1+xTi2(PO4)3** | 0.06 | | 0.18 | 0.30 | 0.50 | 0.72 | 0.95 | 1.10 | 1.26 | 1.40 | 1.61 | 1.68 |
| **D (cm2 s-1)** | | 8.9E-9 | 6.0E-9 | 3.1E-9 | 5.6E-10 | 2.9E-10 | 5.7E-10 | 2.3E-10 | 1.0E-11 | 7.8E-11 | 3.2E-12 | 8.3E-13 |



**Figure S14**. (a) The initial discharge-charge curves and corresponding (b) Cycling performance of NTP-NW/C at 1 C performed in the pure Mg electrolyte without NaAlCl4.