Supporting Information

Aqueous $Zn//Zn(CF_3SO_3)_2//Na_3V_2(PO_4)_3$ Batteries with Simultaneous Zn^{2+}/Na^+ Intercalation/De-intercalation

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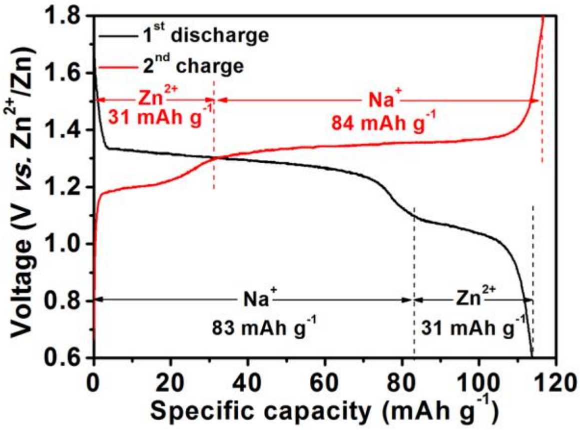

Fig. S1. The capacity contributions from Zn^{2+}/Na^{+} intercalation/de-intercalation at 50 mA g^{-1}.

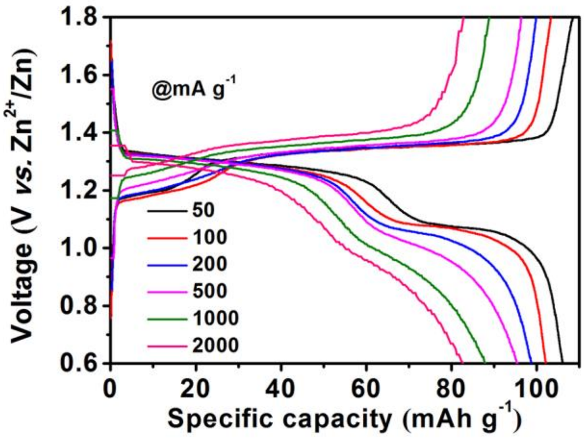

Fig. S2. Charge/discharge curves of NVP@rGO at different current densities.

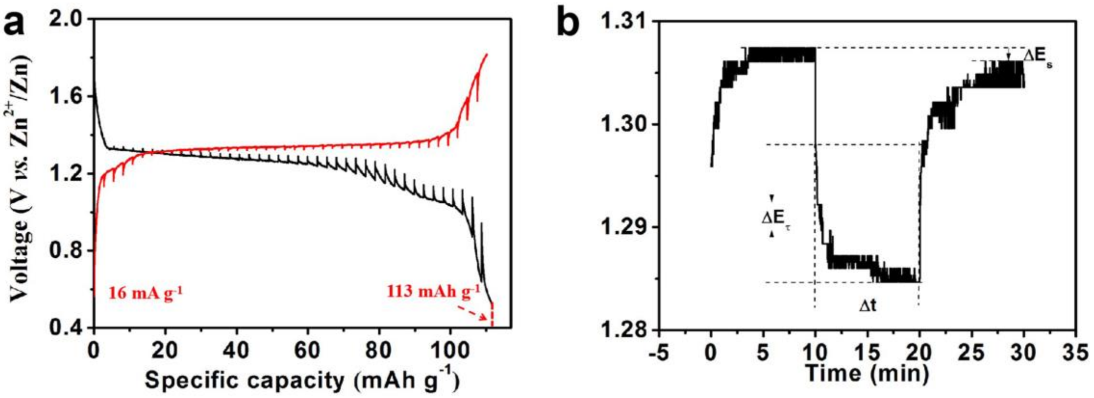

Fig. S3. The GITT test for NVP@rGO microspheres at a current density of 16 mA g^{-1} in a charge/discharge process.

On the basis of Fick's second law, the diffusion coefficient of Na^+ and Zn^{2+} could be calculated using the equation below

$$D = \frac{4}{\pi}\left(\frac{m_a V_M}{M_a S}\right)^2 \left(\frac{\Delta E_s}{\tau\left(\frac{dE_\tau}{d\sqrt{\tau}}\right)}\right)^2$$

where m_a and M_a are the mass and the molecular weight. V_M is the molar volume of the compound. S represents the active surface area. τ is the time period of the current pulse. $dE_\tau/d(\tau^{1/2})$ is the derivative of the voltage change during the current pulse with respect to the charge or discharge time τ. ΔE_τ is the total change of cell voltage during a constant current pulse, and ΔE_s is the change of the steady-state voltage at the end of the relaxation period over a single galvanic static titration.

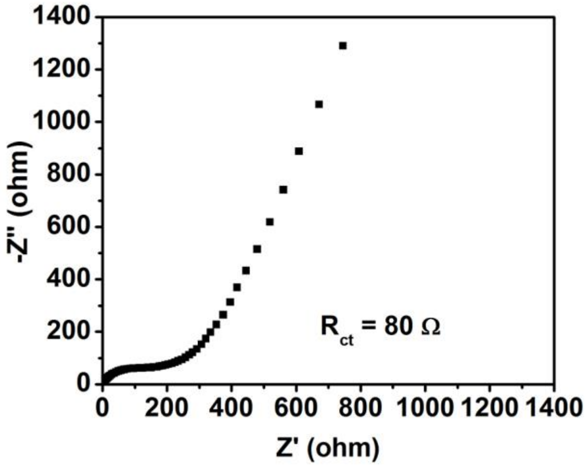

Fig. S4. Nyquist plots of NVP@rGO.

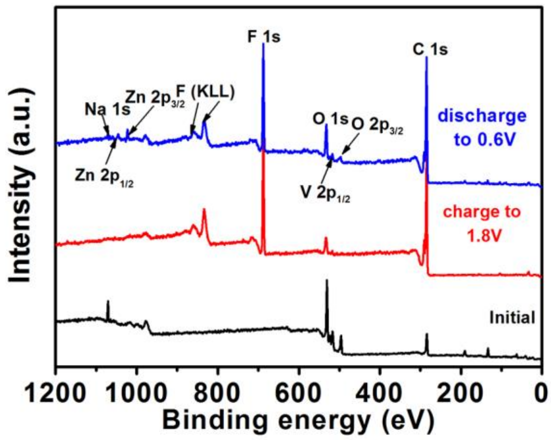

Fig. S5. XPS survey spectra of the electrodes obtained at different states (original, charged, and discharged states). The fluorine comes from the PVDF binder.

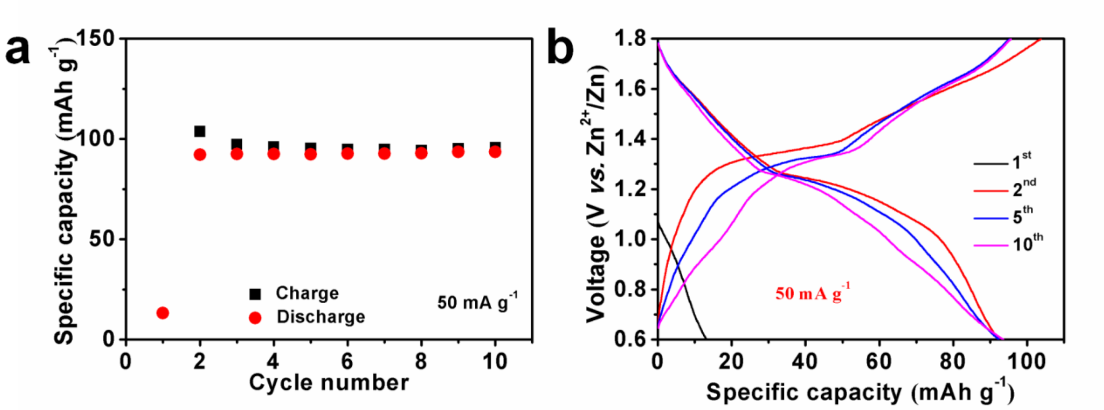

Fig. S6. Cycling performance (a) and charge/discharge curves (b) of $Na_xV_2(PO_4)_3$@rGO (prepared by charging NVP@rGO to 1.8 V and then washed with deionized water).

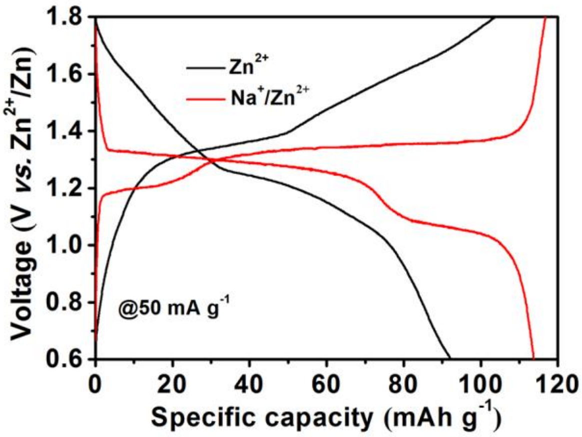

Fig. S7. Charge/discharge curves of NVP@rGO and $Na_xV_2(PO_4)_3$@rGO (prepared by charging NVP@rGO to 1.8 V and then washed with deionized water).

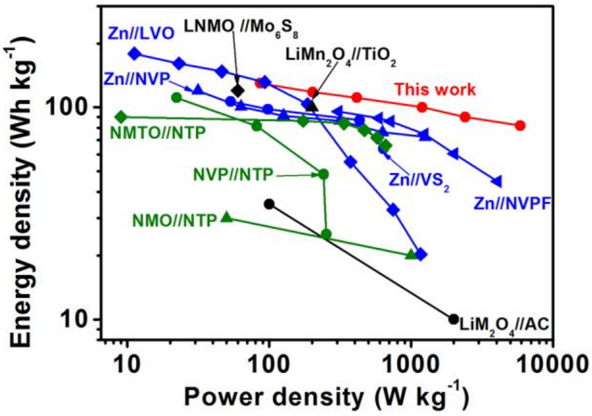

Fig. S8. Ragone plot comparing the electrochemical performance of the $Zn//Zn(CF_3SO_3)_2//Na_3V_2(PO_4)_3$ battery with other recently reported aqueous metal-ion batteries. The black dots represent data from aqueous Li-ion batteries of $LiMn_2O_4//TiO_2$,[1,2] $LiMn_2O_4//AC$,[3] $LiNi_{0.5}Mn_{1.5}O_2//Mo_6S_8$;[4] the green dots represent data from aqueous Na-ion batteries of $Na_{0.66}[Mn_{0.66}Ti_{0.34}]O_2//NaTi_2(PO_4)_3/C$,[5] $NaMnO_2//NaTi_2(PO_4)_3$,[6] $Na_3V_2(PO_4)_3//NaTi_2(PO_4)_3$;[7] the blue dots represent data from aqueous Zn-ion batteries of $Zn//LiV_3O_8$,[8] $Zn//Na_3V_2(PO_4)_3$,[9] $Zn//VS_2$,[10] $Zn//Na_3V_2(PO_4)_2F_3$.[11]

References

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