Supplementary Material

Ultra-long $Zn_3V_2O_7(OH)_2 \cdot 2H_2O$ nanowires grown on carbon cloth as cathode material for aqueous zinc-ion batteries

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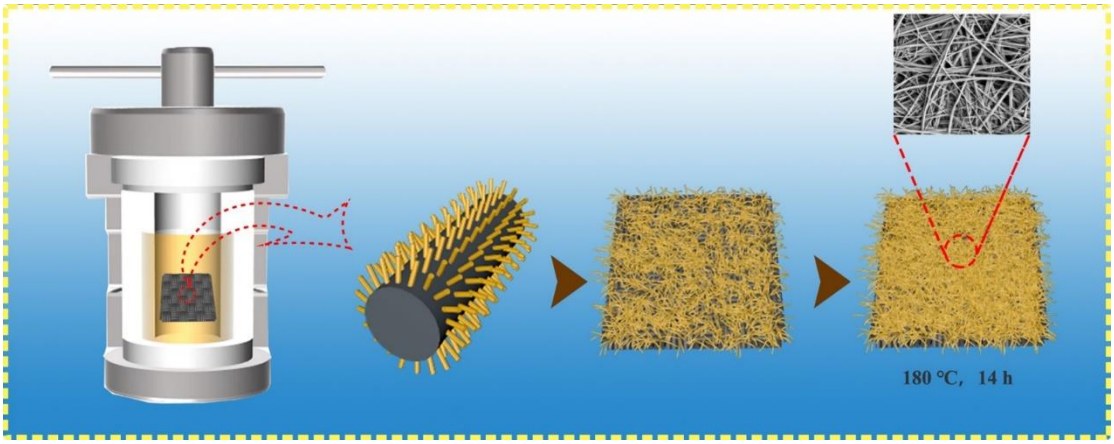
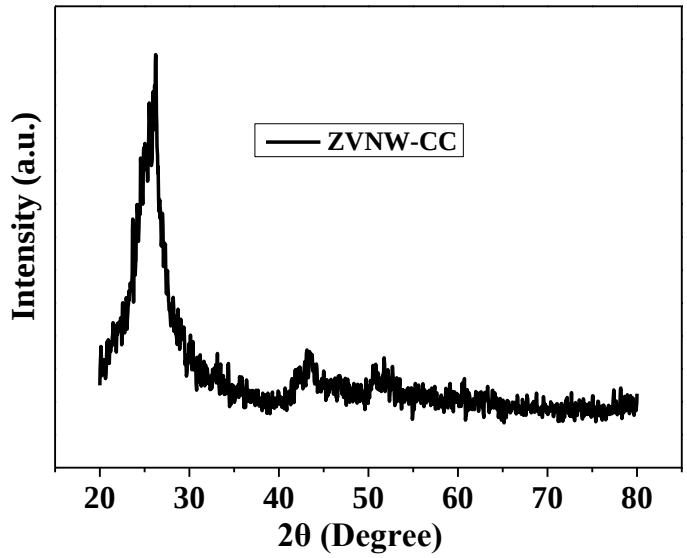
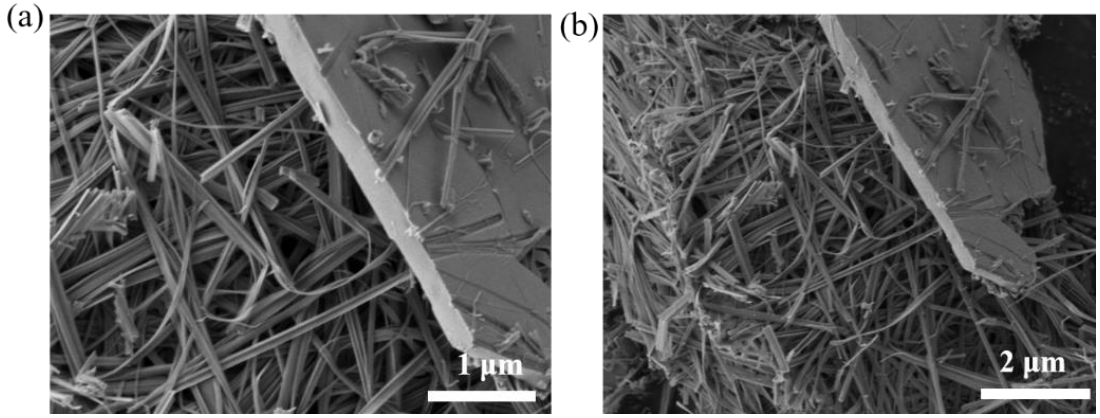


Supplementary Figure 1. Schematic diagram of the fabrication process of ZVNW-CC electrode material



Supplementary Figure 2. XRD pattern of ZVNW nanowires grown on carbon cloth.

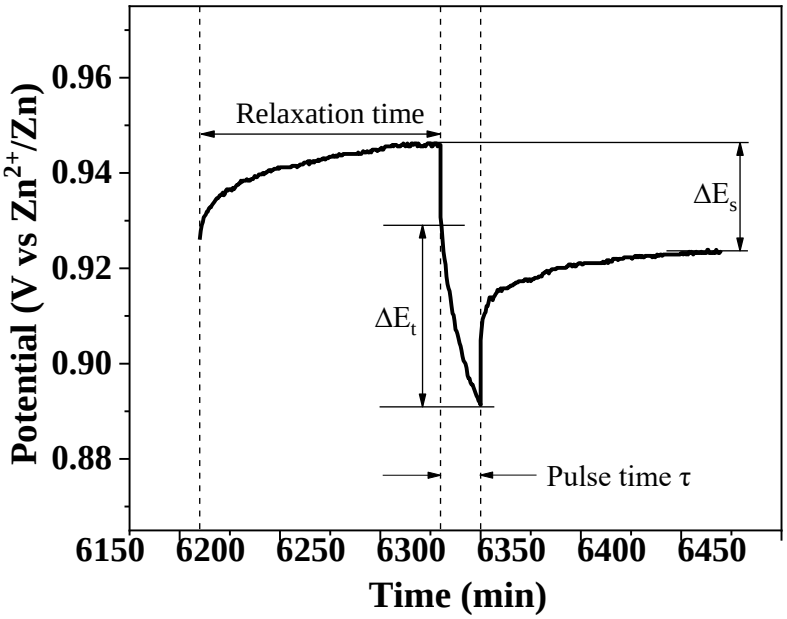


Supplementary Figure 3. The SEM images of ZVNW.

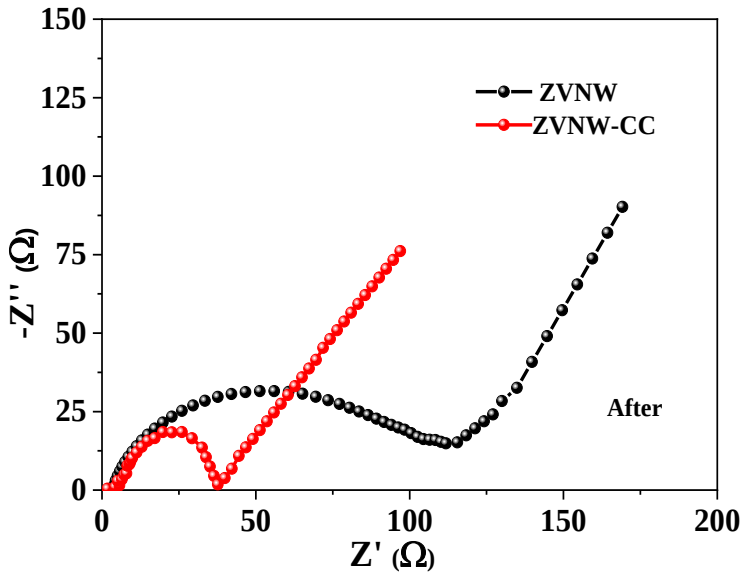
The Zn^{2+} solid-state diffusion coefficient was obtained through the Galvanostatic Intermittent Titration Technique (GITT) measurement based on the following equation:

$$D_{Zn^{2+}}^{GITT} = \frac{4}{\pi\tau}\left(\frac{n_m V_m}{S}\right)^2 \left(\frac{\Delta E_s}{\Delta E_t}\right)^2 \quad (1)$$

Where τ is the constant current pulse time (s); n_m and V_m are the moles (mol) and molar volume ($cm^3\ mol^{-1}$) of active material, respectively; S is the electrode/electrolyte contact area (cm^2); ΔE_s is the change in the steady-state voltage during a single step GITT experiment; ΔE_t is the change in a total cell voltage after the application of a constant current pulse during a single step GITT experiment. In our GITT measurement, a cell was charged or discharged at the current density of 50 mAh g^{-1} for 20 min, followed by a 2 h open circuit step to allow relaxation back to equilibrium.

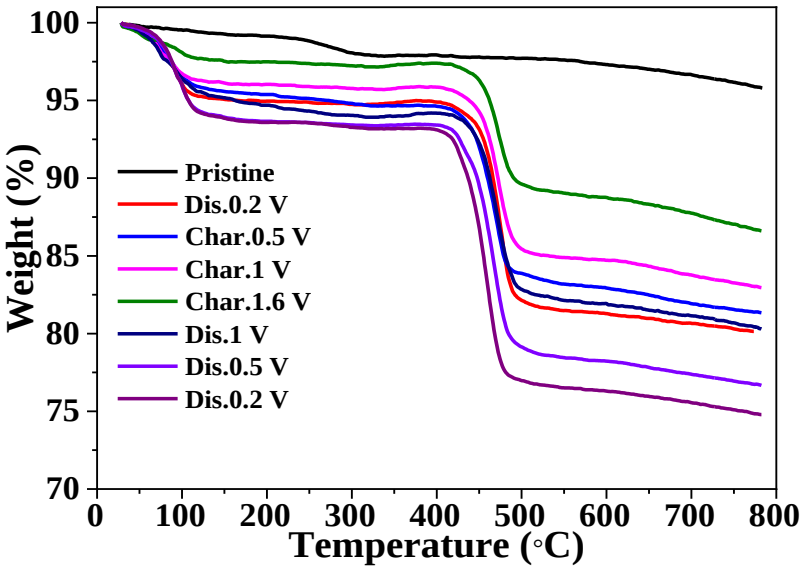


Supplementary Figure 4. Schematic illustration of a single step of the GITT



Supplementary Figure 5. Nyquist plots of ZVNW-CC and ZVNW electrodes after cycling in the frequency range of 0.01Hz to 100 kHz.

There are two stages of weight changes: one is the slight weight loss of adsorbed water before 100 ℃, and the other is the weight loss of structural water molecules from 400 to 500 ℃ [S1]. When charged from 0.5 to 1.6 V, the structural water molecules content of ZVNW-CC materials decreases gradually (as shown in Figure 7c), and their weight loss of structural water molecules is reduced from 10.72% to 7.58%, and then discharged from 1.0 to 0.2 V, the structural water molecules content of ZVNW-CC materials starts to increase gradually, and their weight loss of structural water molecules is also increased. It was consistent with the XPS results.



Supplementary Figure 6. Thermogravimetric curves of ZVNW-CC electrodes under different charging and discharging conditions.

REFERENCES

[1] Y.H. Du, X.Y. Liu, X.Y. Wang, J.C. Sun, Q.Q. Lu, J.Z. Wang. Freestanding strontium vanadate/carbon nanotube films for long-life aqueous zinc-ion batteries. Rare Metals 2021; 41; 415-424. [DOI: 10.1007/s12598-021-01777-2]