Supporting Information

A Novel Dual Ion Desalination System

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The detailed calculation about D_{Na}

The galvanostatic intermittent titration technique (GITT) measurements are performed at the first discharge-charge curves at 2C. Subsequently, a galvanostatic pulse (charge or discharge) for 3 min and then rest for 60 min to reach the voltage equilibrium until 0.7 V (1.55 V). The Na^+ ion diffusion coefficients can be calculated based on the following formula:

$$D_{Na} = \frac{4}{\pi\tau}\left(\frac{m_B V_m}{M_B S}\right)^2\left(\frac{\Delta E_s}{\Delta E_\tau}\right)^2 \left(\tau \ll \frac{L^2}{D_{Na}}\right)$$

where τ is the duration time of current pulse, m_B, M_B and V_M correspond to the mass of the active material (g), molecular weight (g mol^{-1}) and molar volume (cm^3 mol^{-1}), respectively. A represents the total contacting area between electrode and electrolyte (cm^2). ΔE_τ is the voltage change in the over cell voltage upon each current pulse, while ΔE_s is the voltage change about steady state voltage between two adjacent steps.

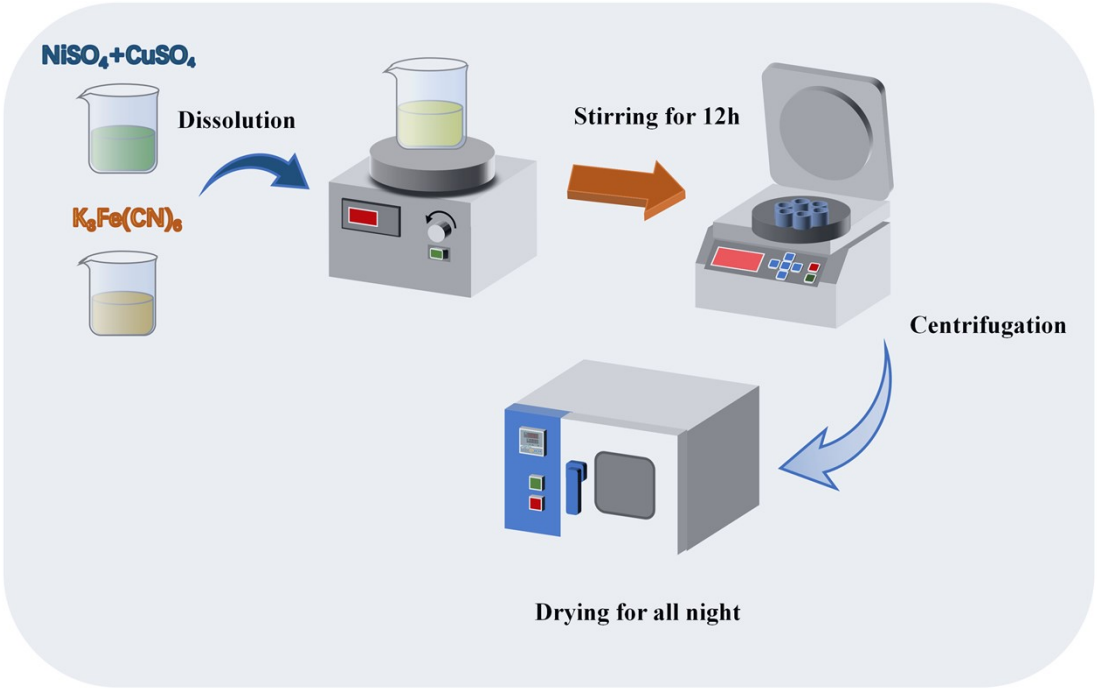

Figure S1. Synthetic procedure of NiCuHCF.

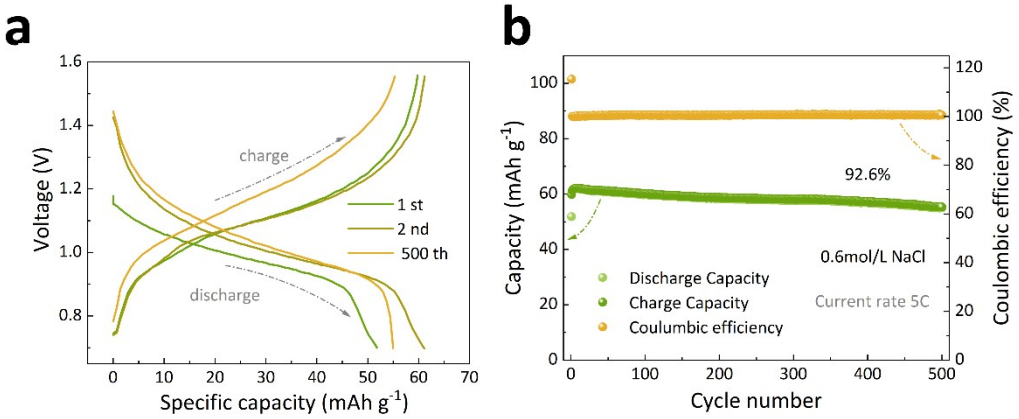

Figure S2. (a) GCD curves of NiCuHCF/Pb cell at 5C. (b) Cycling performance of NiCuHCF/Pb cell at 5C.

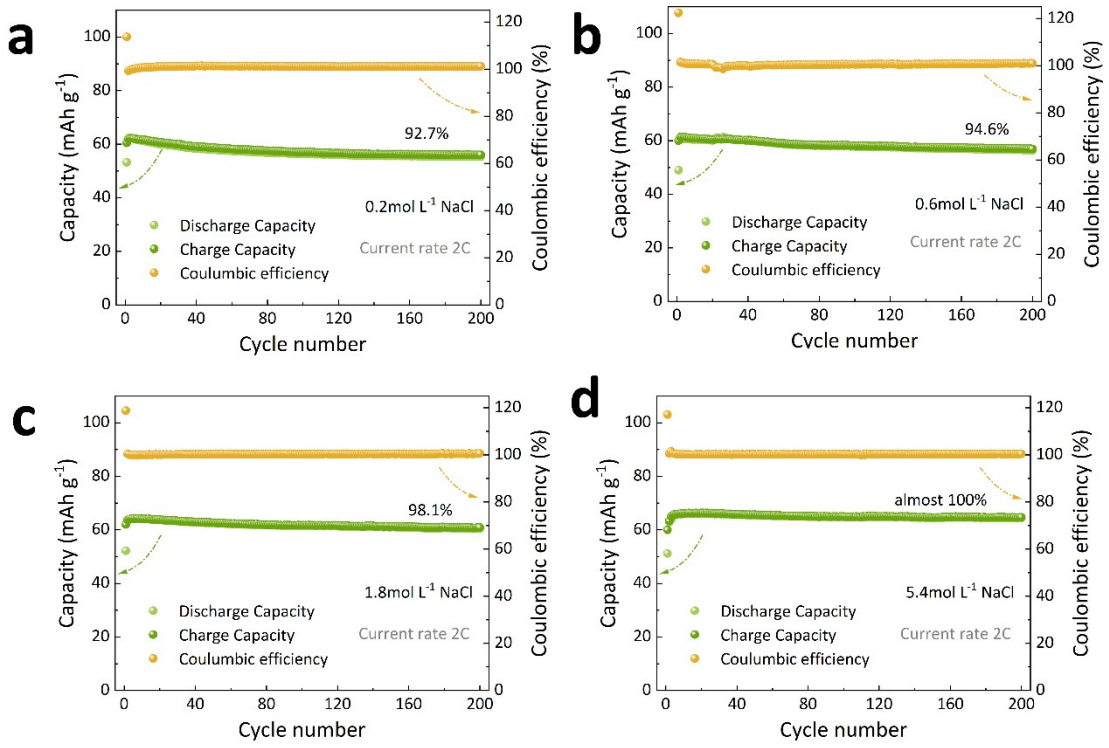

Figure S3. Cycling performance of NiCuHCF/Pb cell at 2C within (a) 0.2, (b) 0.6, (c) 1.8, and (d) 5.4 mol L^{-1} of electrolyte.

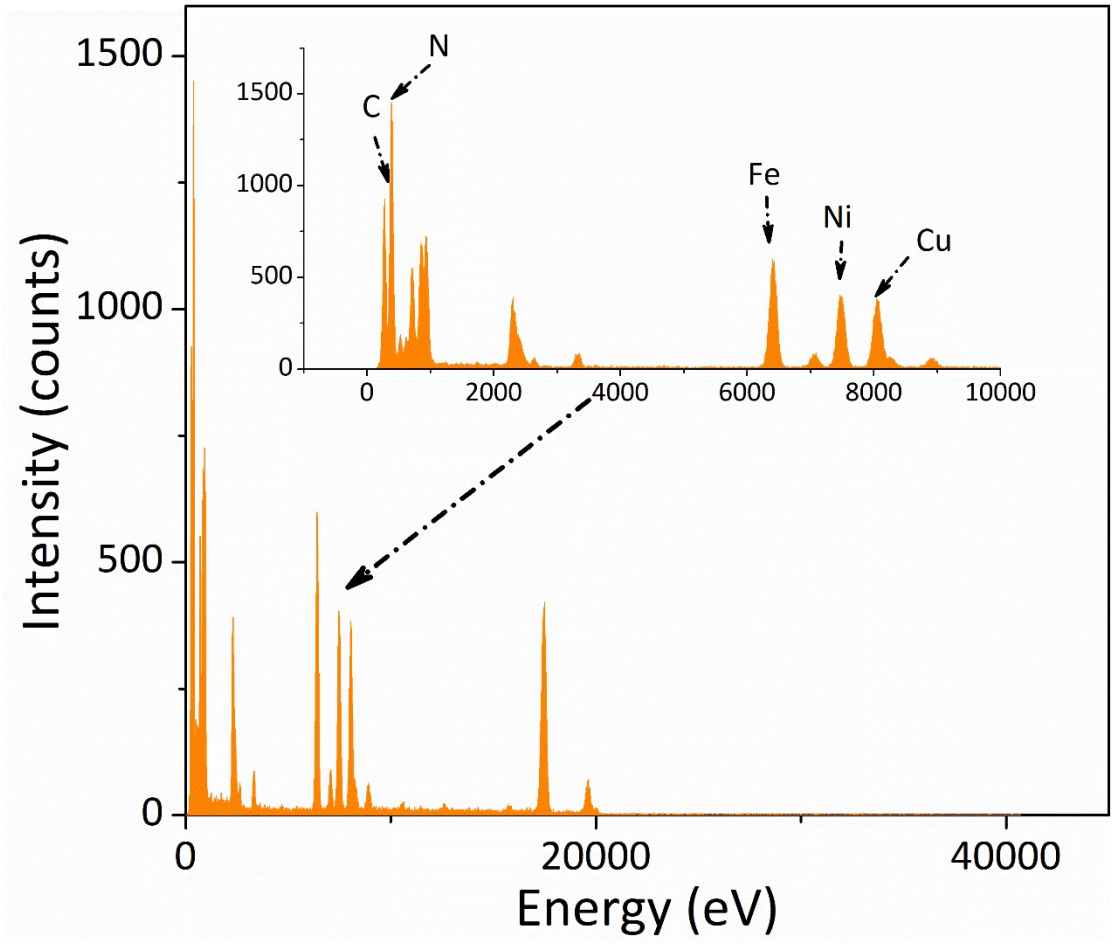

Figure S4. EDS of NiCuHCF.

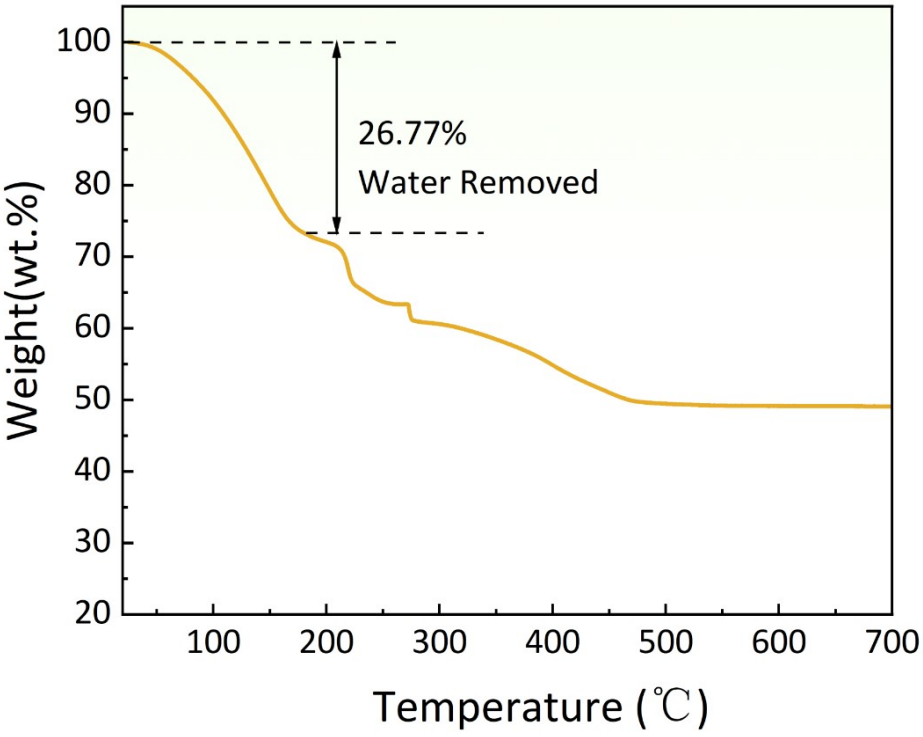

Figure S5. TGA curve of NiCuHCF from 25 to700 °C.

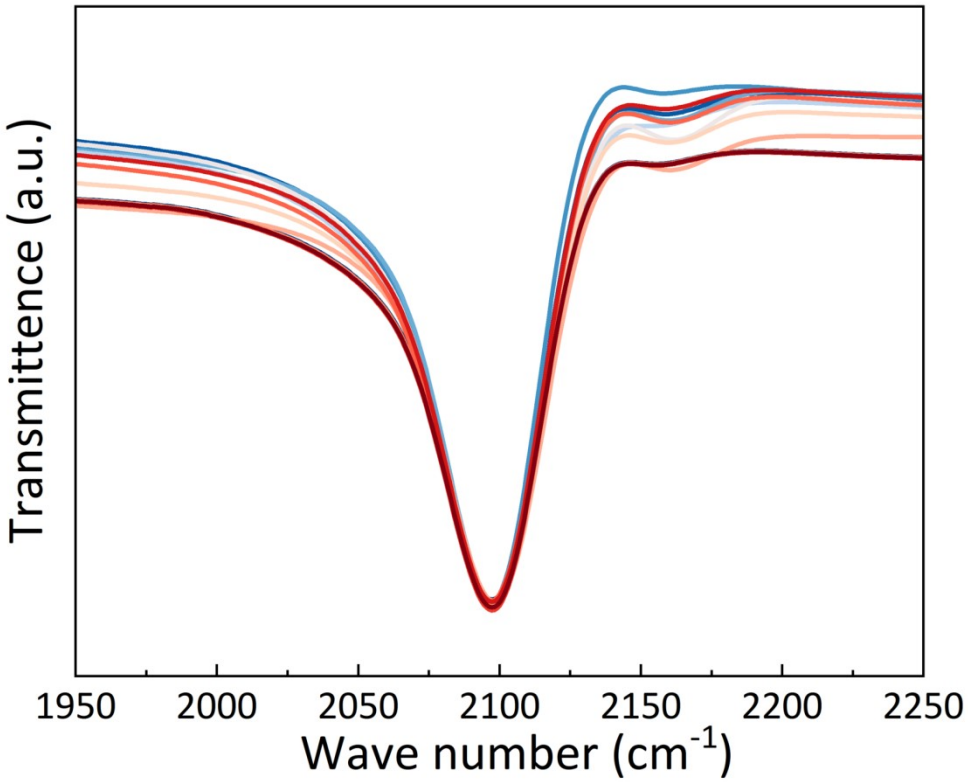

Figure S6. Ex situ FTIR spectra of NiCuHCF during the first two cycles from 1950 to 2250 cm^{-1}.

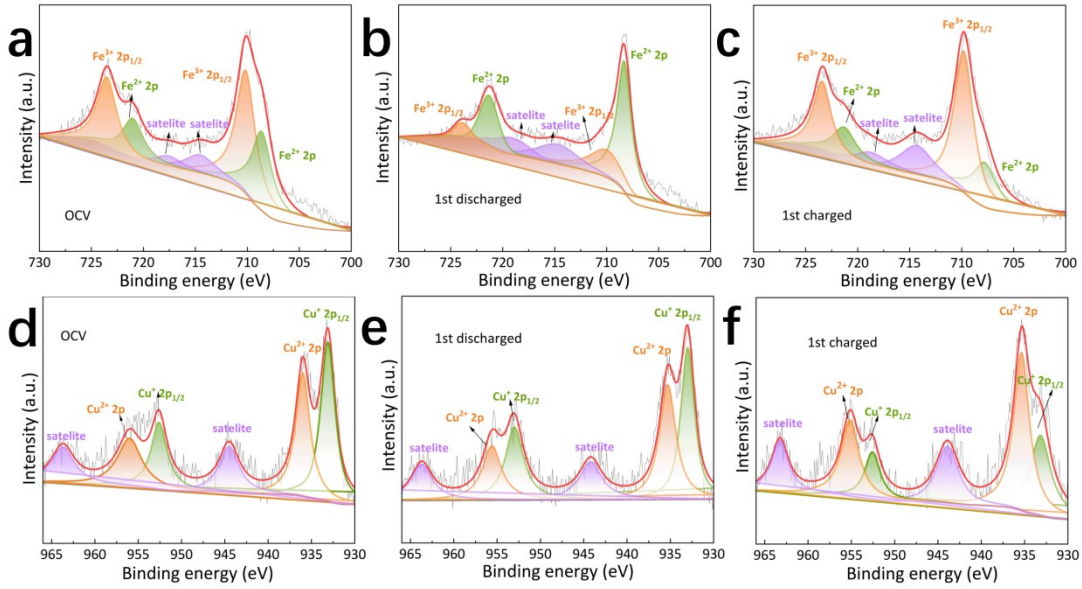

Figure S7. Ex situ XPS spectra of Fe 2p and Cu 2p in NiCuHCF at different states. (a-c) The XPS spectra of Fe 2p at OCV, 1st discharged, and 1st charged states. (d-f) The XPS spectra of Cu 2p at OCV, 1st discharged, and 1st charged states.

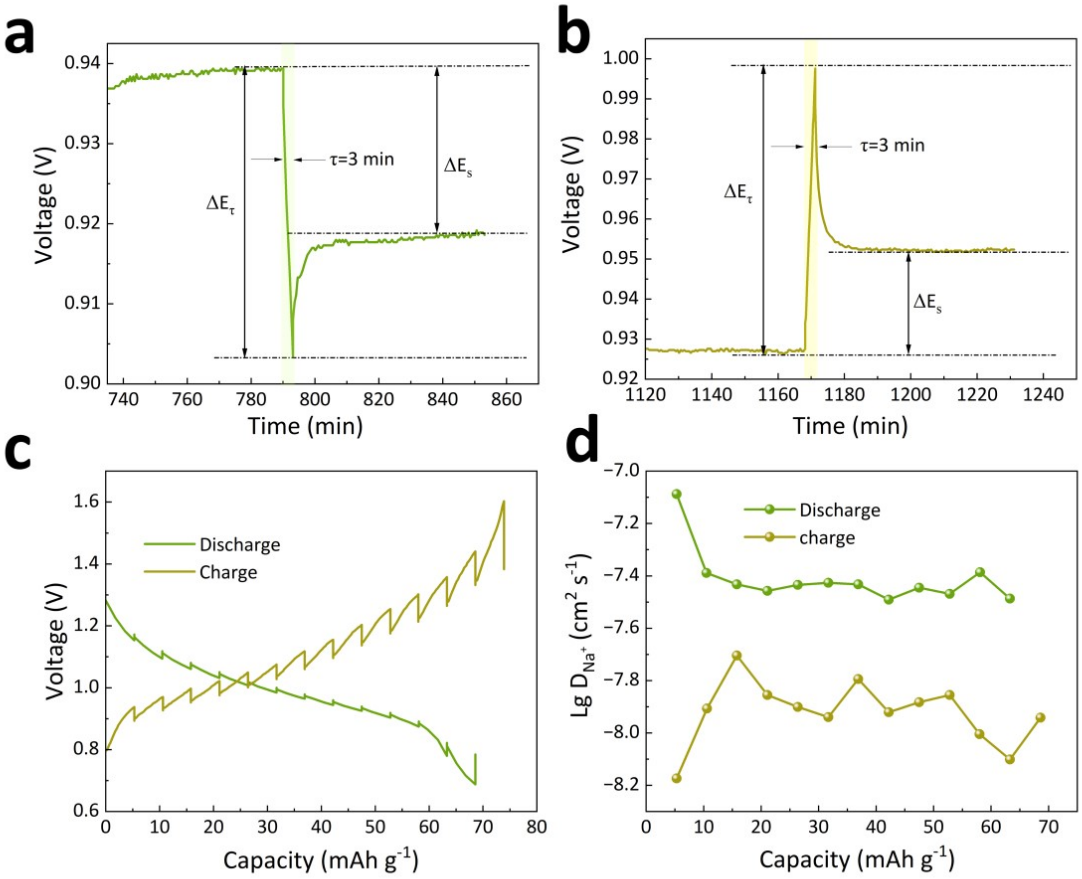

Figure S8. (a, b) The selected steps of GITT curves of NiCuHCF//Pb full cell. (c) GITT curves for the full cell at 2C. (d) The diffusion coefficient of Na^+ calculated from GITT.

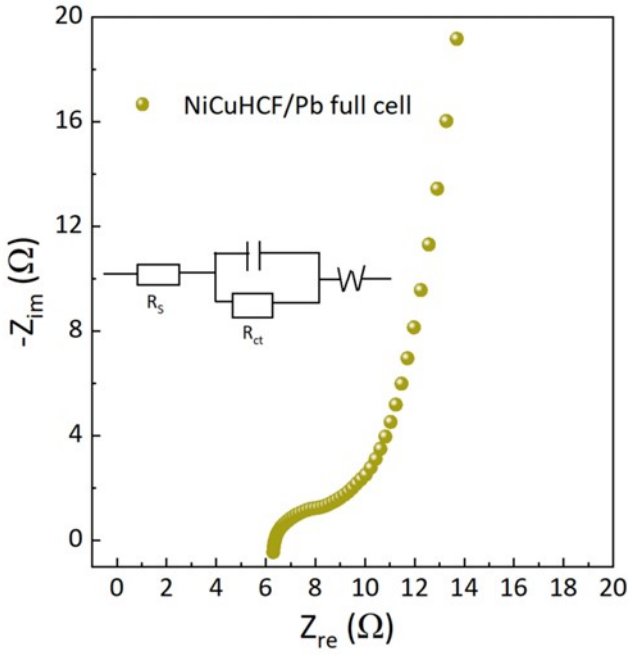

Figure S9. The Nyquist plot of the full cell.