

# Electrochemical Performance of $\text{Na}_3\text{V}_2(\text{PO}_4)_2\text{F}_3$ Electrode Material in a Symmetric Cell

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## Supplementary Information

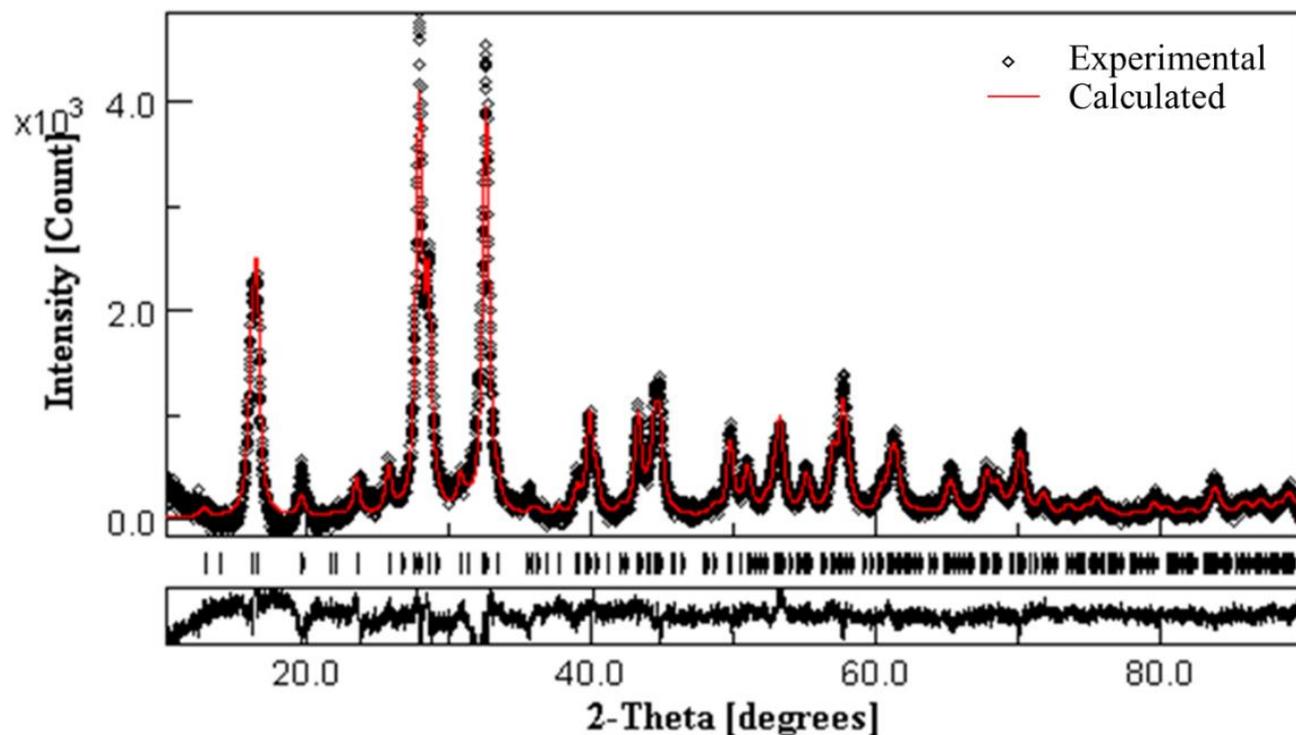


Figure S1: Refined XRD spectrum of the synthesized NVPF sample.

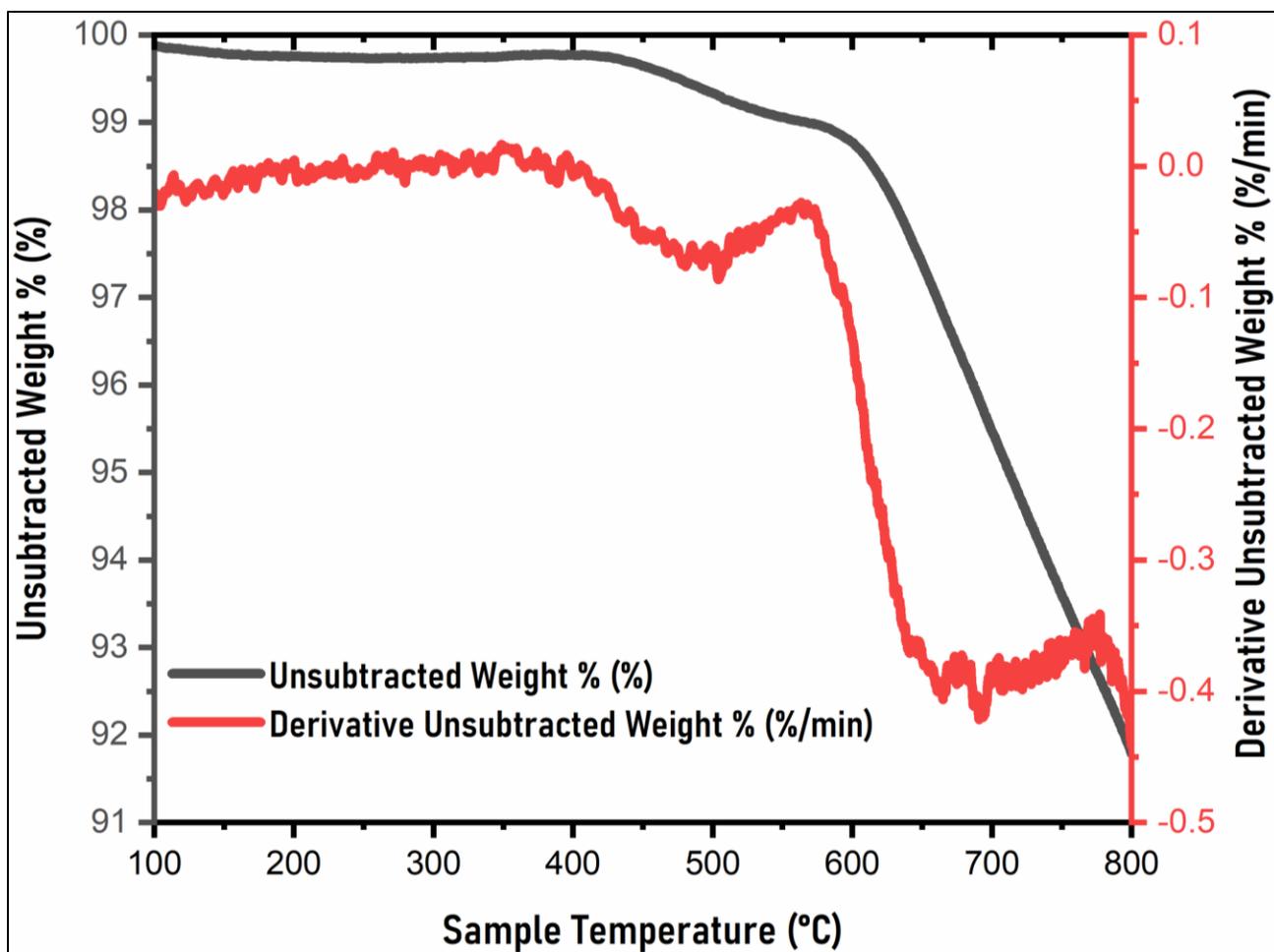


Figure S2: Thermogravimetric Analysis (TGA) of the synthesized NVPF material.

The Randles–Sevcik equation is used to calculate the diffusion coefficient  $D$  from the CV curves.

The following equation is used to calculate the diffusion coefficient.

$$i_p = 0.4463nFAC \left( \frac{nFvD}{RT} \right)^{\frac{1}{2}} \quad (\text{Eq. S1})$$

Where,

$i_p \rightarrow$  Maximum current (A),  $n \rightarrow$  Active electrons during redox reaction

$F \rightarrow$  Faraday Constant ( $\text{C mol}^{-1}$ ),  $A \rightarrow$  Electrode area ( $\text{cm}^2$ )

$C \rightarrow$  Concentration ( $\text{mol cm}^{-3}$ ),  $D \rightarrow$  Diffusion coefficient ( $\text{cm}^2 \text{s}^{-1}$ )

$v \rightarrow$  Scan rate ( $\text{V s}^{-1}$ ),  $R \rightarrow$  Gas constant ( $\text{J K}^{-1} \text{mol}^{-1}$ ),  $T \rightarrow$  Temperature (K)

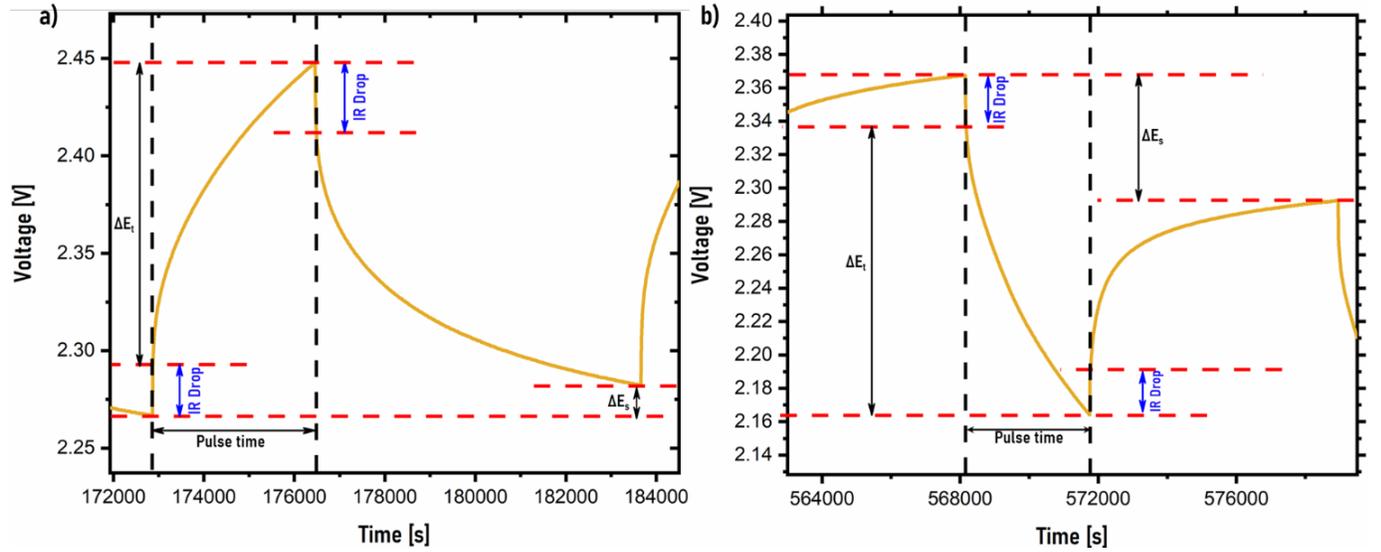


Figure S3: Potential vs Time curves for a single step of GITT stating different variables during a) charge b) discharge.

The Na-ion diffusion coefficient  $D_{Na^+}$  from GITT is calculated using Fick's second law [1].

The following equation is used to calculate the diffusion coefficient.

$$D_{Na^+} = \frac{4}{\pi t} \left( \frac{m_B V_M}{M_B S} \right)^2 \left( \frac{\Delta E_s}{\Delta E_t} \right)^2 \quad (\text{Eq. S2})$$

Where,

$D_{Na^+}$  → Diffusion coefficient of Na-ion ( $\text{cm}^2 \text{s}^{-1}$ )

$t$  → pulse time (s),  $m_B$  → mass (g)

$V_M$  → molar volume ( $\text{cm}^3 \text{mol}^{-1}$ ),  $M_B$  → molar mass ( $\text{mol g}^{-1}$ )

$S$  → Area of electrode-electrolyte contact ( $\text{cm}^2$ )

$\Delta E_s$  → Steady state voltage change due to current pulse

$\Delta E_t$  → Voltage change during constant current pulse – IR drop

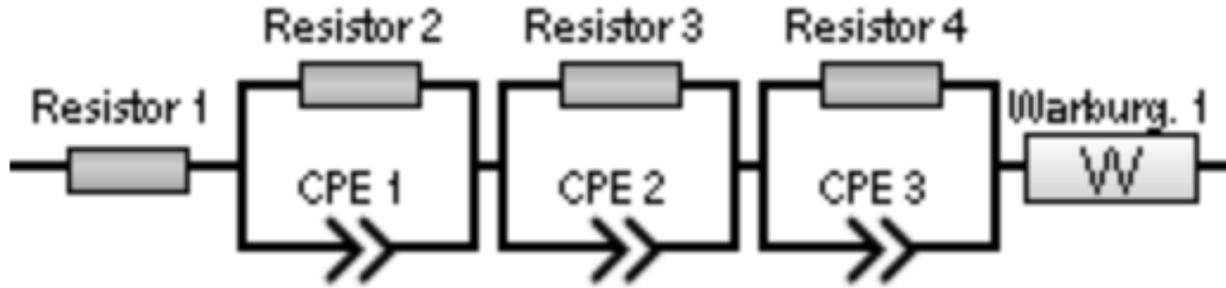


Figure S4: The circuit used in fitting of EIS spectra

The following equation was used to calculate the diffusion coefficient using EIS spectra and the corresponding nyquist plots.

$$\sigma = \frac{RT}{n^2 F^2 A \sqrt{2}} \left( \frac{1}{CD_{Na^+}^{\frac{1}{2}}} \right) \quad (\text{Eq. S3})$$

Where,

$\sigma \rightarrow$  Warburg Impedance Coefficient,  $R \rightarrow$  Gas constant ( $\text{J K}^{-1} \text{mol}^{-1}$ )

$T \rightarrow$  Temperature (K),  $n \rightarrow$  Active electrons during redox reaction

$F \rightarrow$  Faraday Constant ( $\text{C mol}^{-1}$ ),  $A \rightarrow$  Electrode area ( $\text{cm}^2$ )

$C \rightarrow$  Concentration ( $\text{mol cm}^{-3}$ ),  $D_{Na^+} \rightarrow$  Diffusion coefficient ( $\text{cm}^2 \text{s}^{-1}$ )

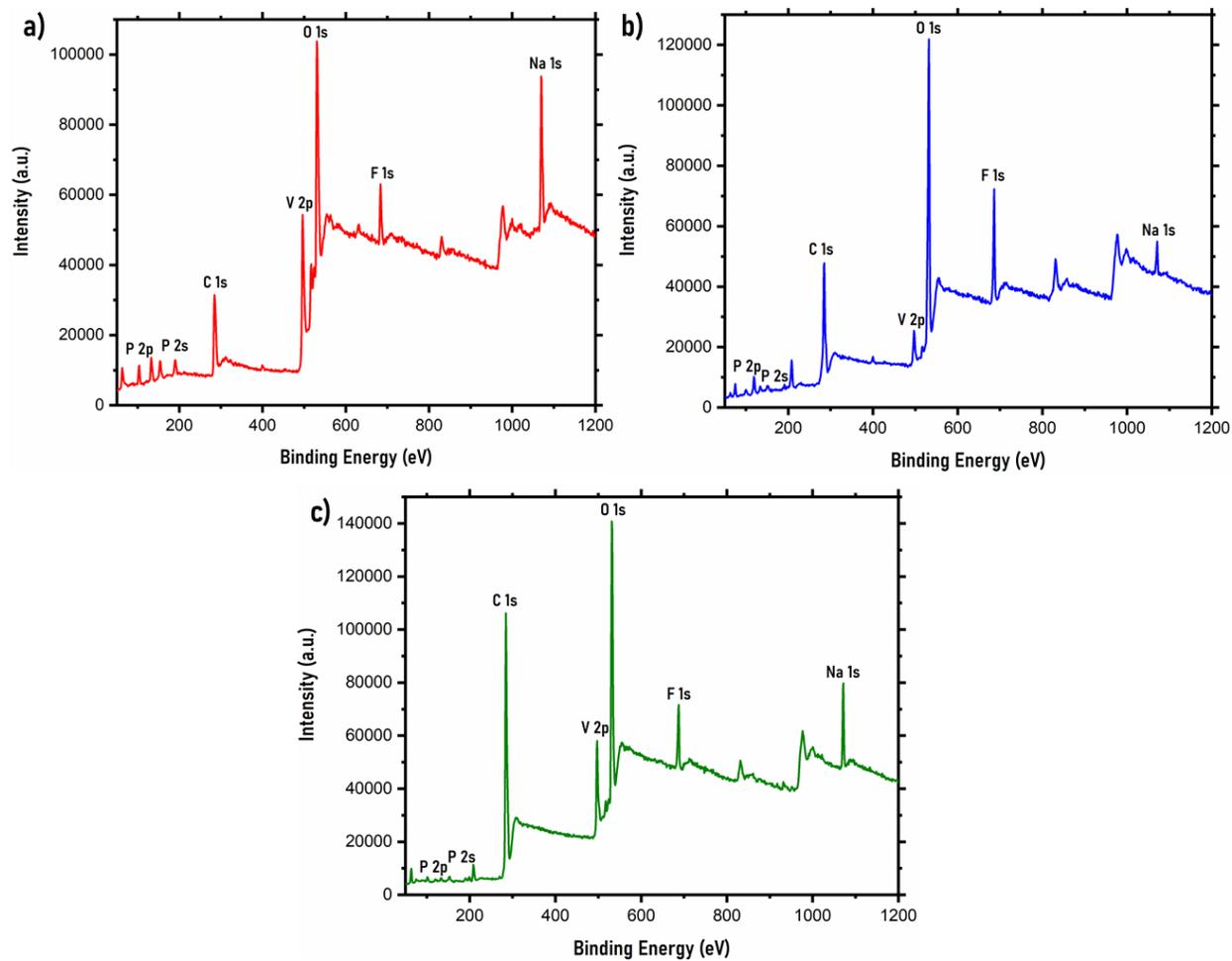


Figure S5: XPS survey patterns for a) Pristine NVPF, b) NVPF cathode after 1000 cycles, and c) NVPF anode after 1000 cycles at 1C.