Supporting Information

Effect of Interlayer Spacing on Sodium Ion Insertion in Nanostructured Titanium Hydrogeno Phosphates/Carbon Nanotube Composites

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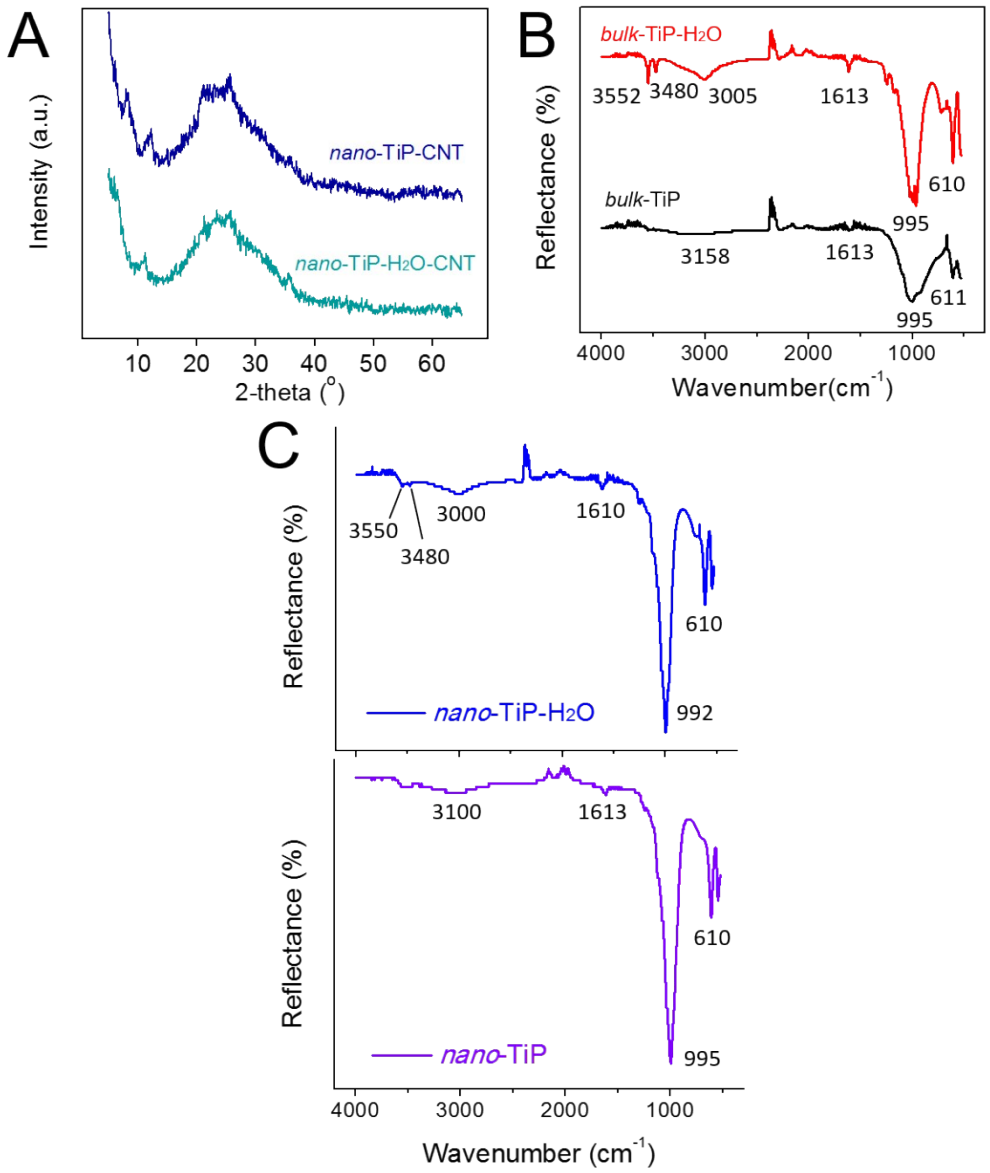

Figure S1: (A) XRD patterns of *nano*-TiP-H_2O-CNT and *nano*-TiP-CNT, (B) FT-IR spectra of *bulk*-TiP-H_2O, *bulk*-TiP, (C) *nano*-TiP-H_2O, and *nano*-TiP.

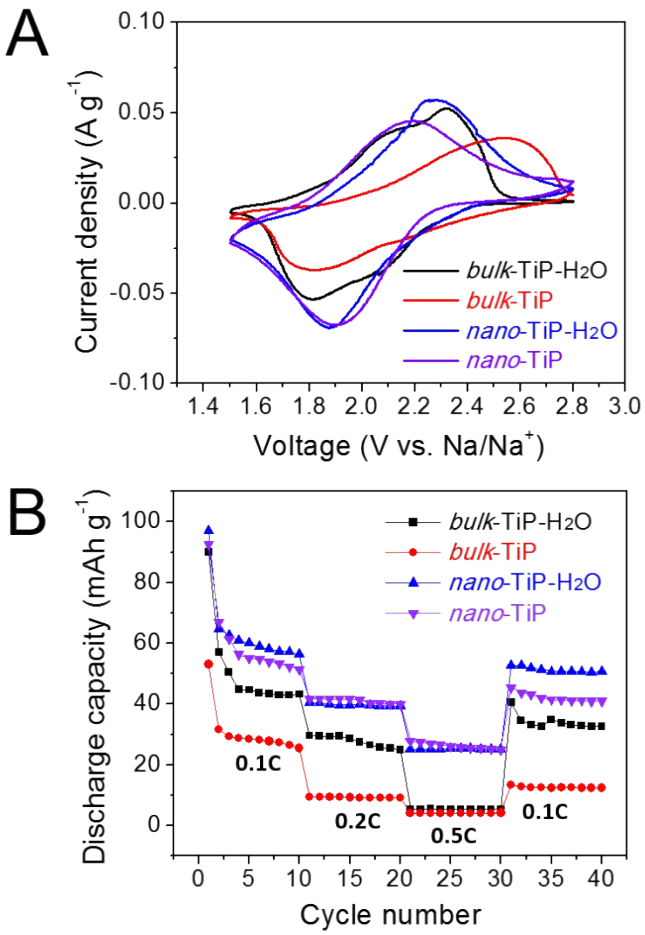

Figure S2: Comparisons of (A) CV curves measured at 0.1 mV s^{-1} and (B) specific capacity of *bulk*-TiP-H_2O, *bulk*-TiP, *nano*-TiP-H_2O, and *nano*-TiP at various current rates of 0.1, 0.2, and 0.5 C.

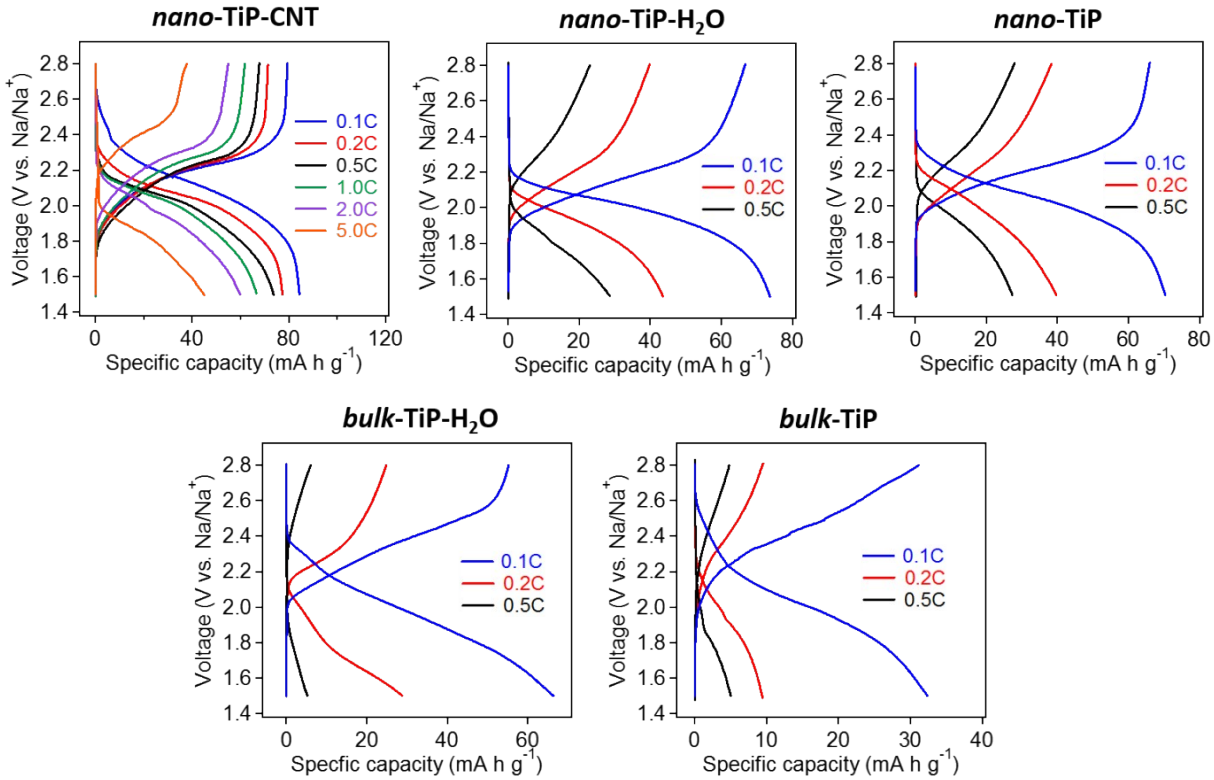

Figure S3: Charge-discharge curves of *nano*-TiP-CNT, *nano*-TiP-H_2O, *nano*-TiP, *bulk*-TiP-H_2O, and *bulk*-TiP at various current rates of 0.1, 0.2, 0.5, 1.0, 2.0, and 5.0 C.

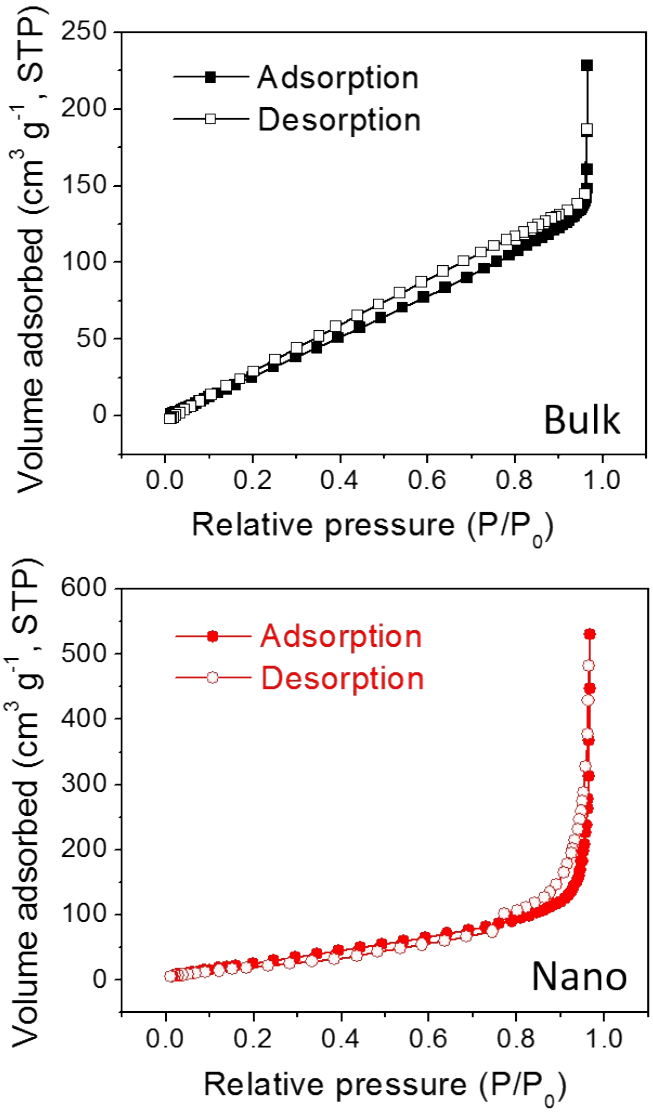

Figure S4: N_2 adsorption and desorption isotherms of *bulk*-TiP-H_2O and *nano*-TiP-H_2O.

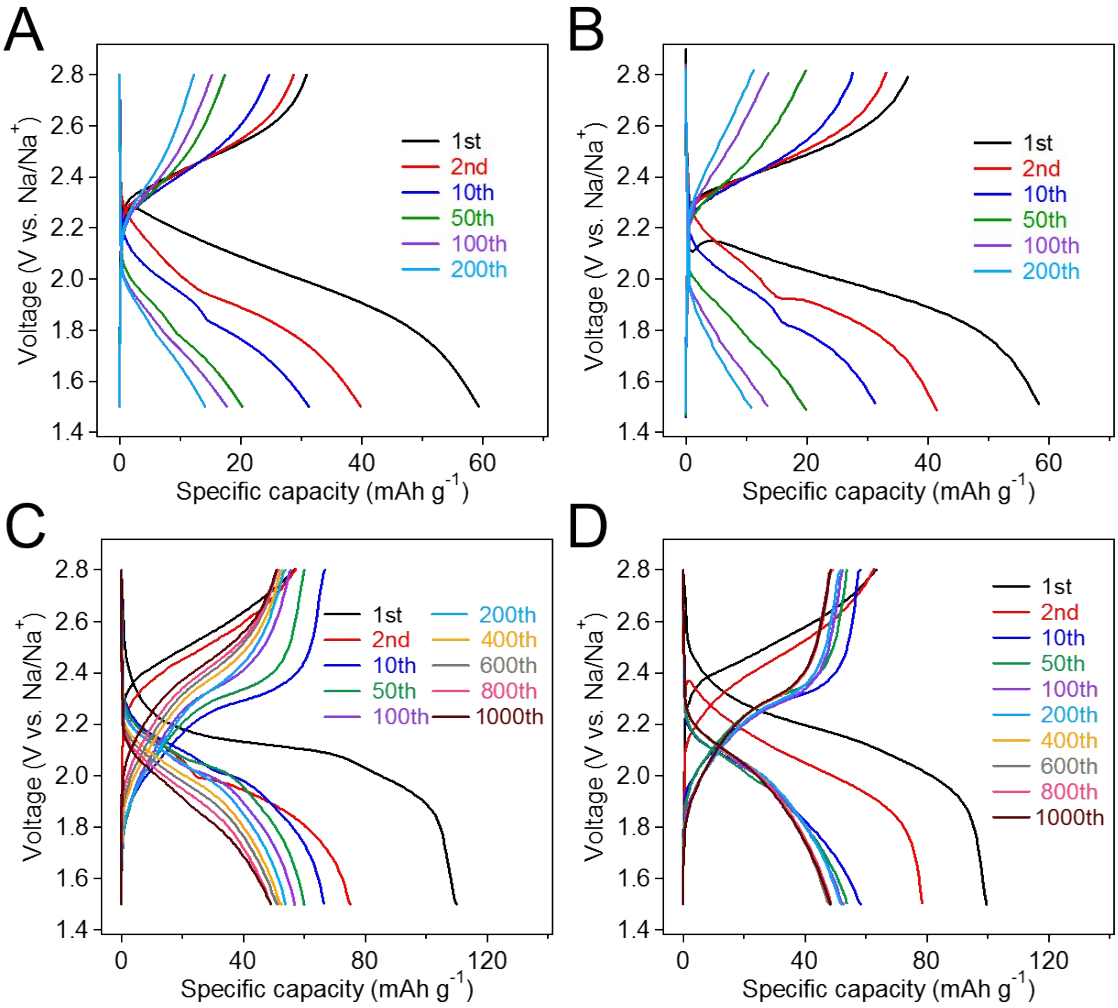

Figure S5: Charge and discharge capacity changes of *nano*-TiP-H_2O, *nano*-TiP, *nano*-TiP-H_2O-CNT, and *nano*-TiP-CNT during long term cycle tests performed at 2.0 C.

The Na-ion diffusion coefficient was calculated using the following equation:

$$D_{Na^+} = R^2T^2/2A^2n^4F^4C^2\sigma^2$$

where D_{Na^+} is the Na-ion diffusion coefficient, R is gas constant, T is the temperature, n represents the number of electrons per molecule during Na-ion insertion, F is Faraday constant, A (0.64 cm^2) is the area of the interface between the electrode and electrolyte, C is the concentration of Na-ion.[1] The Warburg coefficient, σ can be determined from the relationship between the real part of Z and square root frequency, $1/\omega^{1/2}$ ($\omega = 2\pi f$, f is frequency) in the low frequency region (Figure S6).

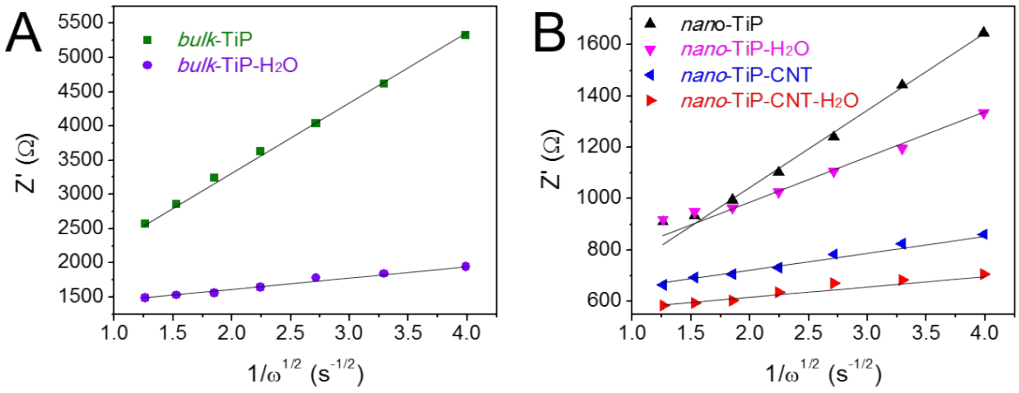

Figure S6: The diffusion specific plots for *bulk*-TiP, *bulk*-TiP-H_2O, *nano*-TiP, *nano*-TiP-H_2O, *nano*-TiP-CNT, and *nano*-TiP-H_2O-CNT. The real part is plotted vs. $1/\omega^{1/2}$. The slop of the line represents the Warburg coefficient, σ.

Reference

1. L. Wang, J. Zhao, X. He, J. Gao, J. Li, C. Wan, C. Jiang, *Int. J. Electrochem. Sci.,* 2012, **7**, 345 – 353.