Supporting Information

Heterojunction TiO_2@$TiOF_2$ Nanosheets as Superior Anode Materials for Sodium-ion Batteries

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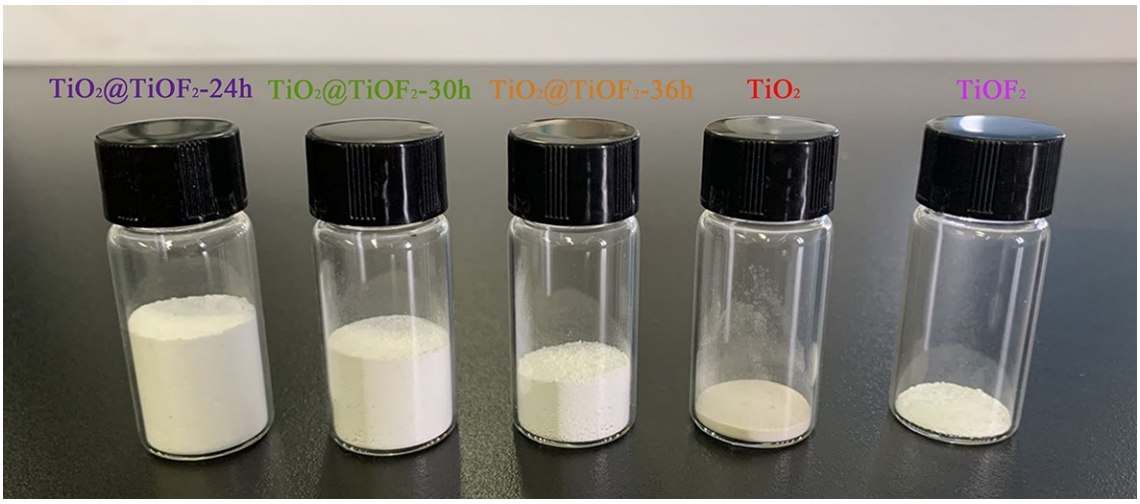

Figure S1. The photo of prepared samples.

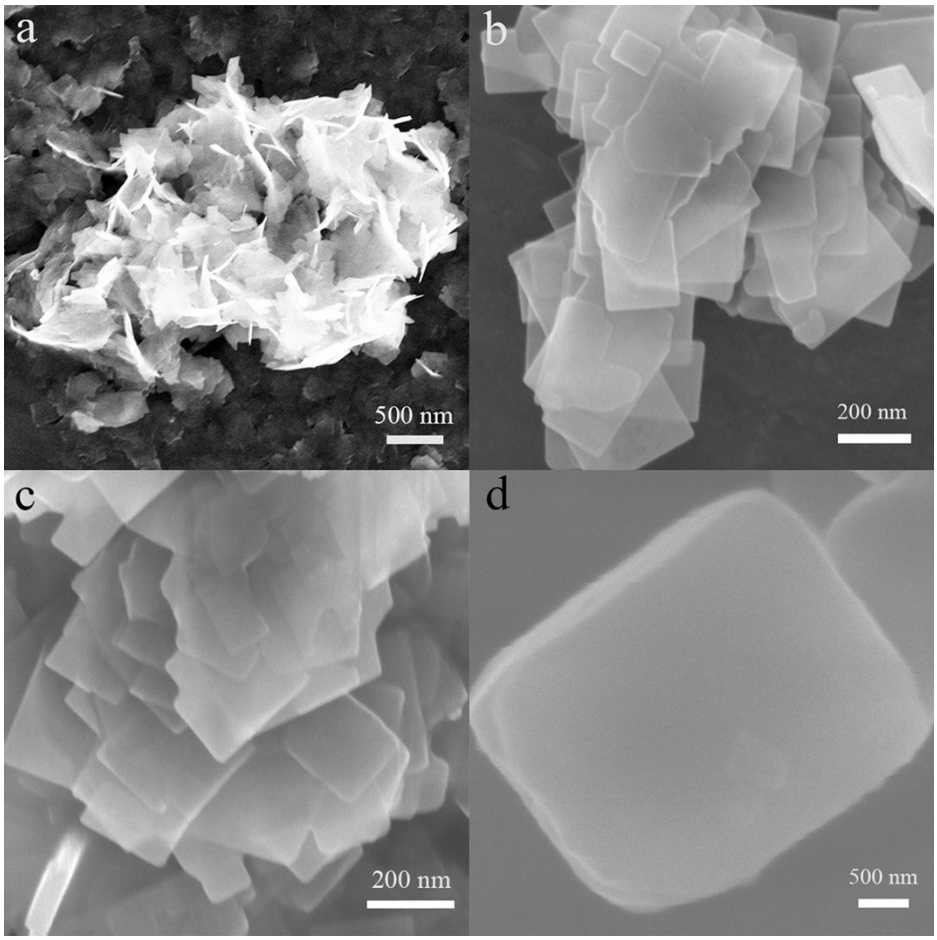

Figure S2. SEM images of TiO_2@$TiOF_2$-24h (a), TiO_2@$TiOF_2$-30h (b), and TiO_2@$TiOF_2$-36h samples (c, d).

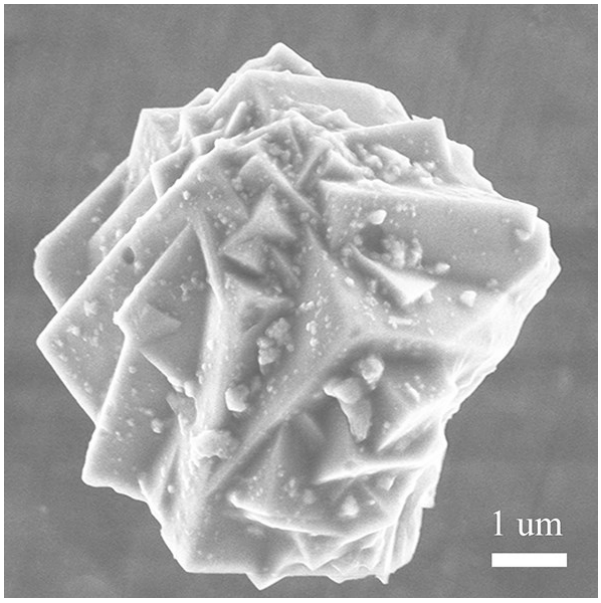

Figure S3. SEM image of $TiOF_2$ sample.

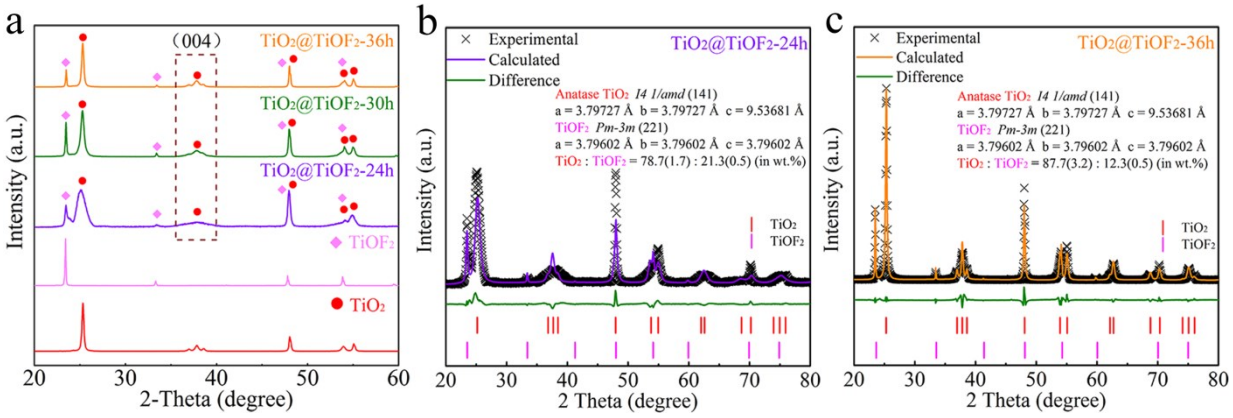

Figure S4. XRD patterns for prepared samples (a); XRD patterns with the corresponding Rietveld refinement for the TiO_2@$TiOF_2$-24h (b) and TiO_2@$TiOF_2$-36h (c) samples.

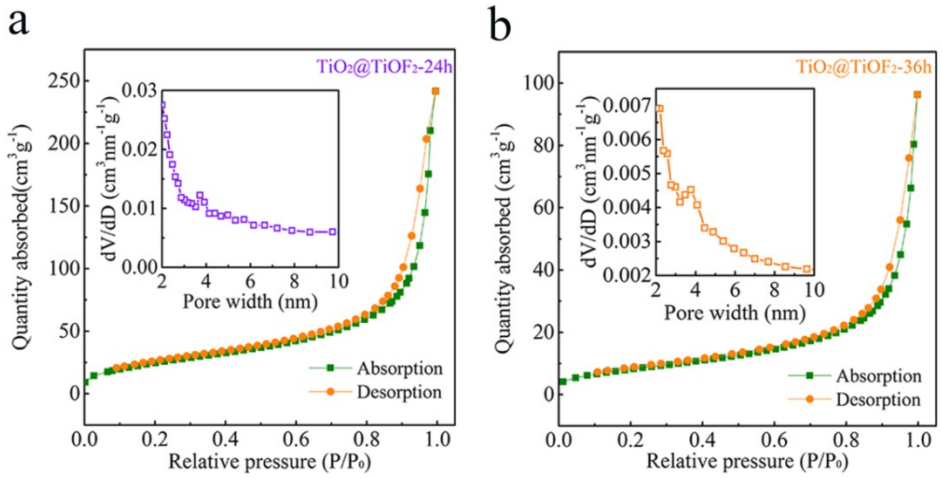

Figure S5. Nitrogen adsorption/desorption isotherms of TiO_2@$TiOF_2$-24h (a), TiO_2@$TiOF_2$-36h samples (b); The insets showing the corresponding Barrett-Joyner-Halenda (BJH) pore size distribution curves.

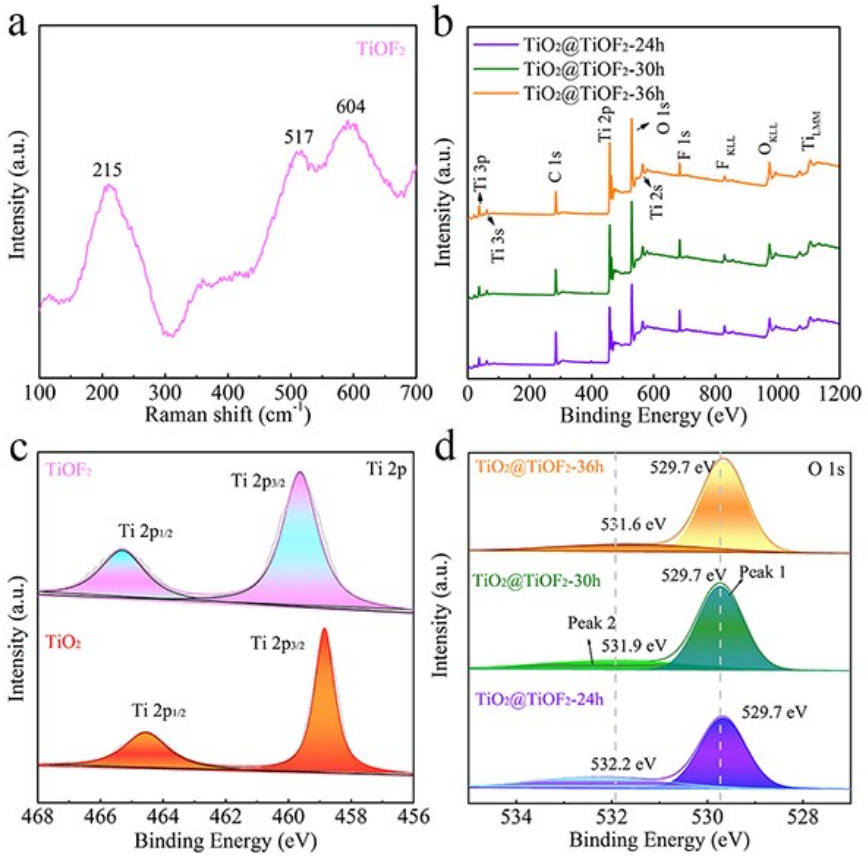

Figure S6. Raman spectra of $TiOF_2$ sample (a); XPS survey spectra of TiO_2@$TiOF_2$ samples (b); High-resolution XPS spectra of Ti 2p for TiO_2 and $TiOF_2$ samples (c) and O 1s for TiO_2@$TiOF_2$-24h, TiO_2@$TiOF_2$-30h and TiO_2@$TiOF_2$-36h samples (d).

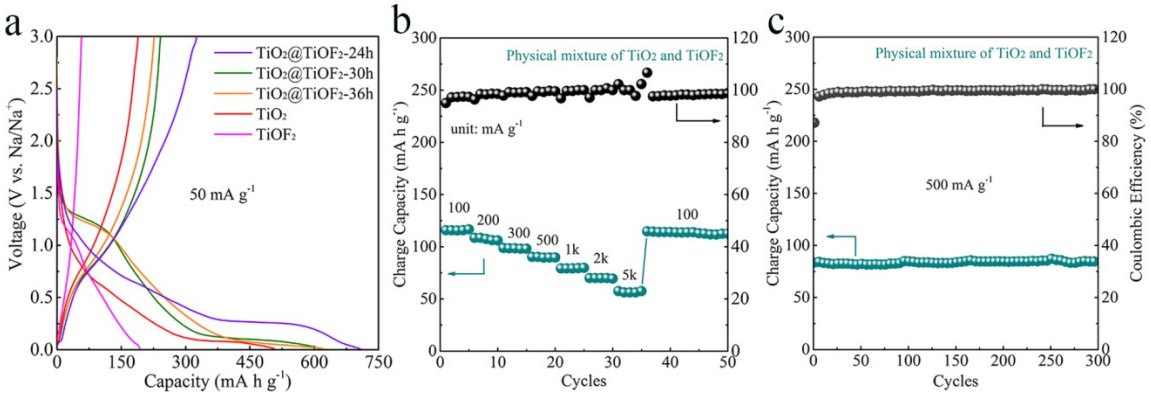

Figure S7. Galvanostatic charge/discharge profiles of the five samples as indicated for the first cycle at 50 mA g^{-1} (a); Rate performance of TiO_2 and $TiOF_2$ physical mixture (b) and the corresponding cyclic stability (c) at current density of 500 mA g^{-1}.

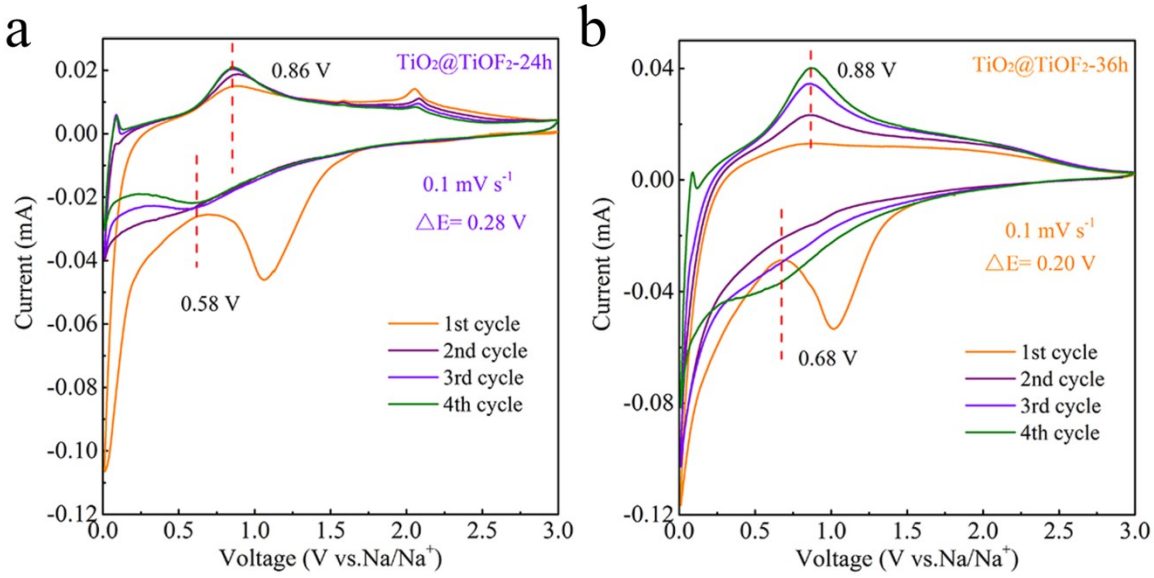

Figure S8. CV curves of TiO_2@$TiOF_2$-24h (a) and TiO_2@$TiOF_2$-36h (b) samples during the initial 4 cycles.

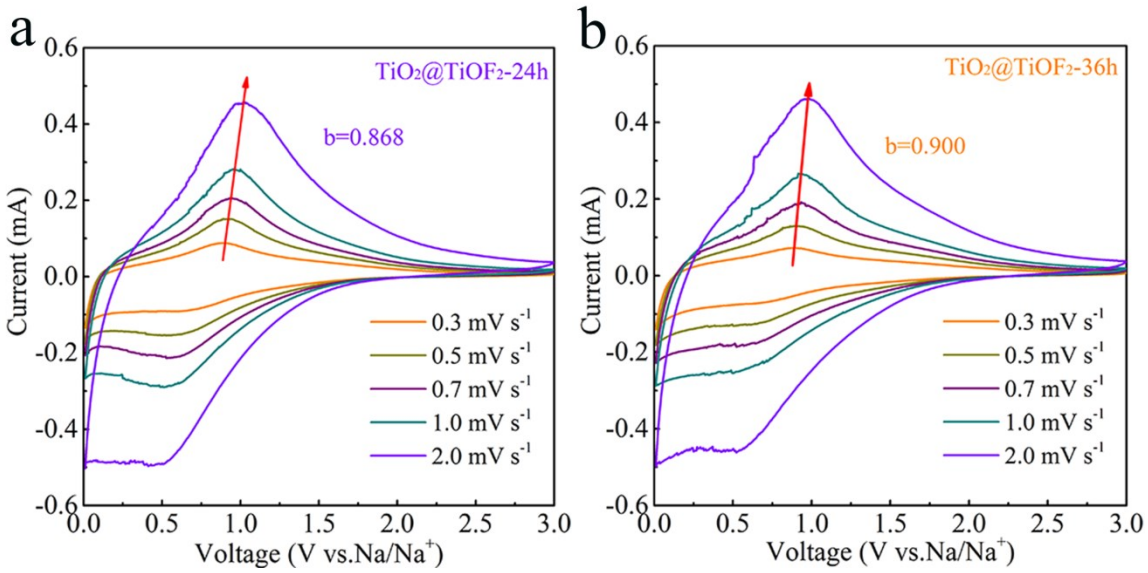

Figure S9. CV curves at different scan rates from 0.3 to 2.0 mV s^{-1} for TiO_2@$TiOF_2$-24h (a) and TiO_2@$TiOF_2$-36h (b) samples.

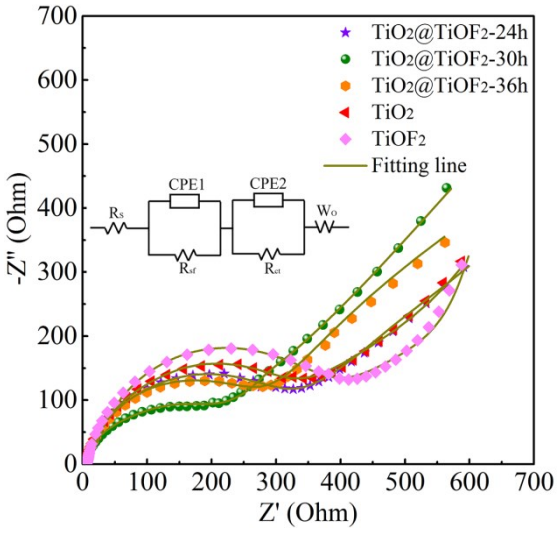

Figure S10. EIS data for the five samples as indicated, the inset picture showing the equivalent circuit for the impedance spectra.

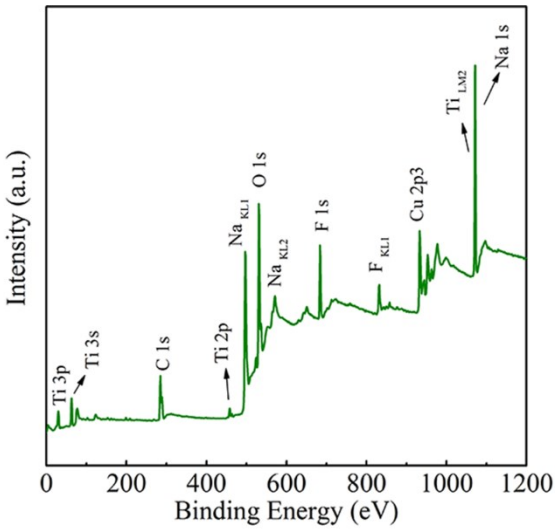

Figure S11. XPS survey spectra of TiO_2@$TiOF_2$-30h sample after 10 cycles (charge to 3 V).

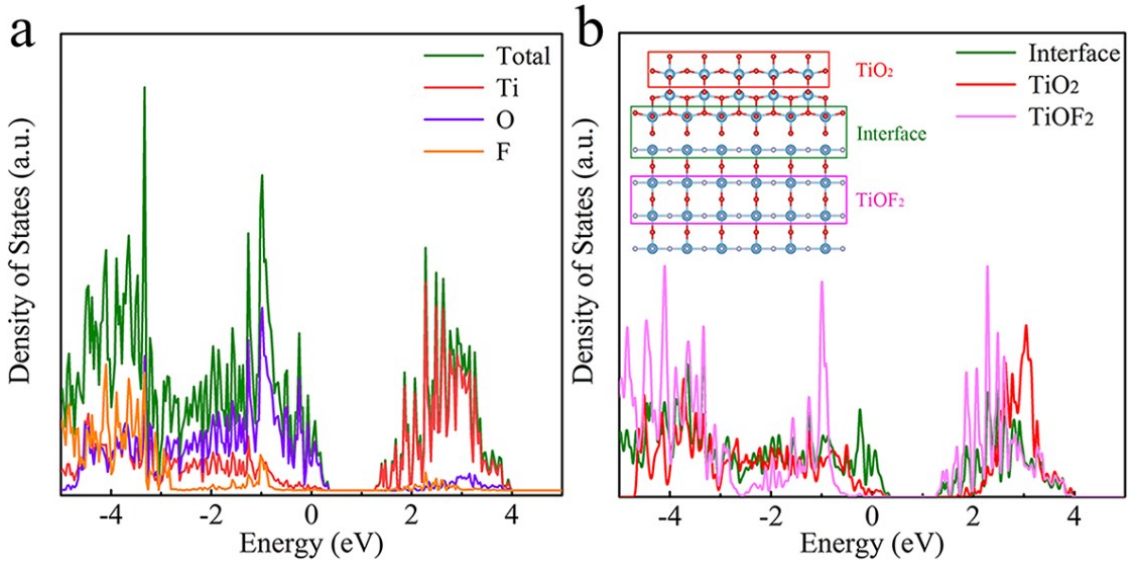

Figure S12. Projected DOS on each atomic species of the TiO_2@$TiOF_2$ heterojunction (a); Projected DOS on different regions of the TiO_2@$TiOF_2$ heterojunction (b).

Table S1 Impedance parameters of the fitting equivalent circuit.

Samples	TiO_2@$TiOF_2$-30h	TiO_2@$TiOF_2$-24h	TiO_2@$TiOF_2$-36h	TiO_2	$TiOF_2$
Rs (Ω cm^{-2})	3.831	4.899	4.433	4.944	6.061
R_{sf} (Ω cm^{-2})	170.9	325.6	242.7	345.6	463.9
R_{ct} (Ω cm^{-2})	317.0	415.1	395.2	454.4	530.8

Experimental details

Electrochemical impedance fitting

The equivalent circuit for the impedance spectra includes two series connected (parallel RC circuit) and a Warburg impedance element, which is used to fit the EIS results. *Rs* element symbolizing internal resistance is at the initial point, R_{sf} and *CPE1* elements symbolizing the Na^+ migration through the surface film of the anode materials are at the semicircle of high frequency. The another semicircle at medium frequency represents the charge transfer process including R_{ct} and *CPE2* elements, the Warburg impedance (*Wo*) element symbolizing the Na^+ diffusion in anode material is at the slope line.[1]

References

1 D. Yan, C. Yu, Y. Bai, W. Zhang, T. Chen, B. Hu, Z. Sun and L. Pan, *Chem. Commun.*, 2015, **51**, 8261-8264.