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Supporting information of

Electrospun Ta-doped TiO_2/C Nanofibers as High-Capacity and Long-Cycling Anode Materials for Li-ion and K-ion Batteries

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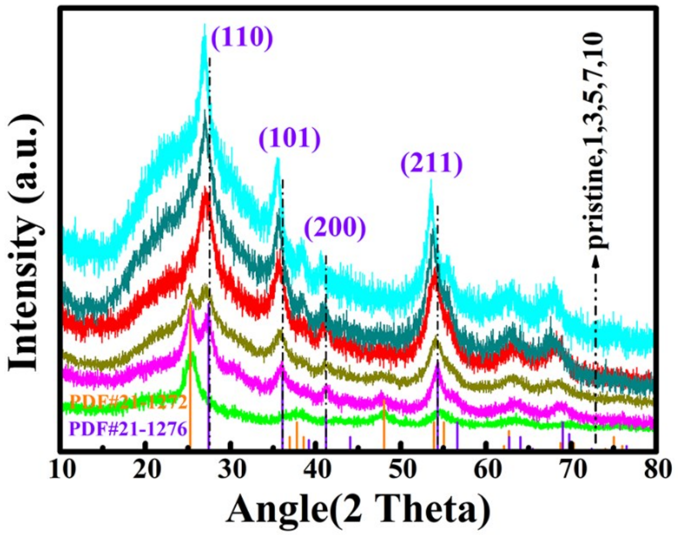

Fig. S1 XRD patterns of TiO_2-pristine/CNF and of Ta-doped TiO_2/C NFs with 1%, 3%, 5%, 7%, and 10% doping amounts.

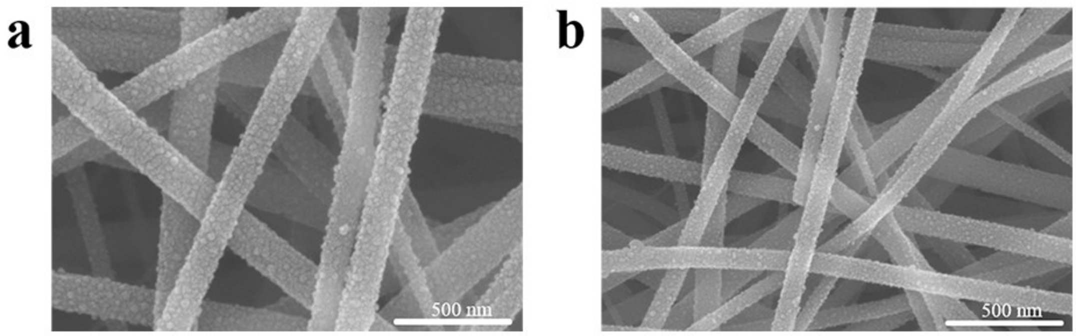

Fig. S2 FE-SEM of (a) precursor nanofibers for TiO_2-pristine/CNF and (b) TiO_2-pristine/CNF.

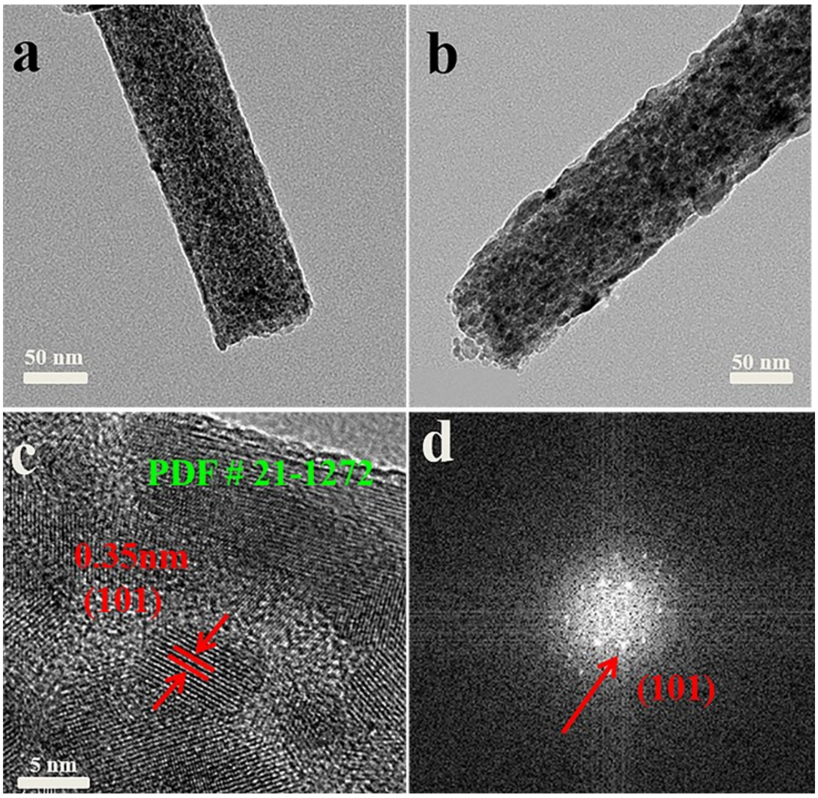

Fig. S3 (a, b) FE-TEM images, (c) HRTEM image and (d) FFT pattern of TiO_2-pristine/CNF.

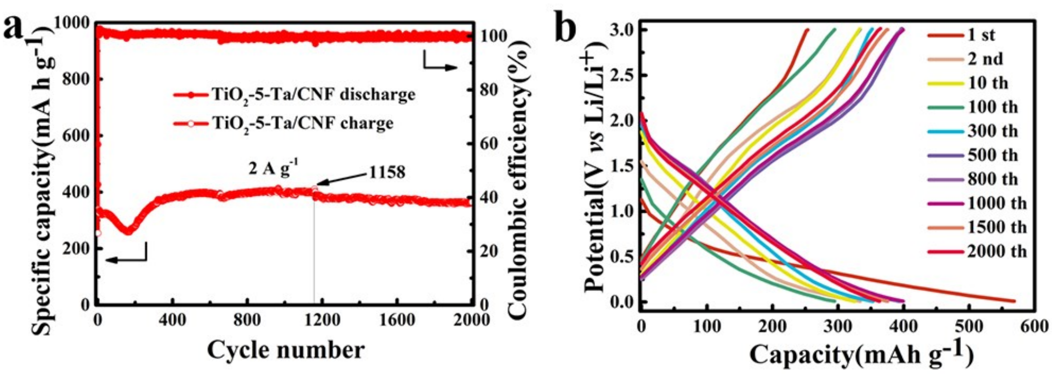

Fig. S4 The Li-metal half cell of TiO_2-5-Ta/CNF for 2000 cycles: (a) cycle performance at 2 A g^{-1} and (b) corresponding CDC.

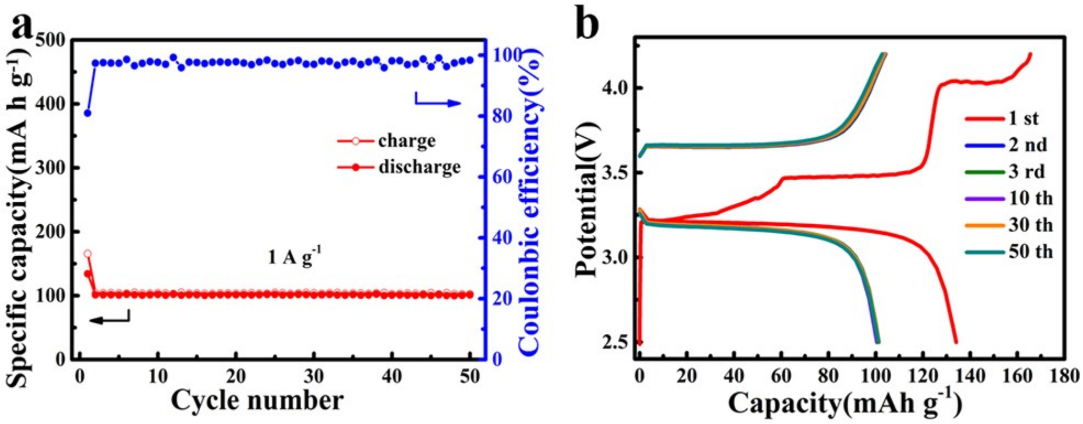

Fig. S5 (a) The cycling performance and (b) corresponding CDC of LFP electrode at 1 A g^{-1} in Li-metal half cell.

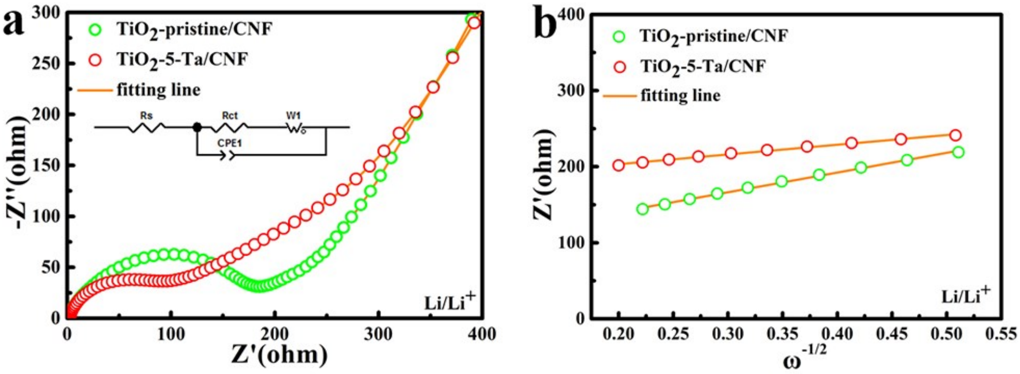

Fig. S6 (a) A.C. impedance of TiO_2-pristine/CNF electrode and TiO_2-5-Ta/CNF electrode at 50 mA g^{-1} after the first cycle in Li-metal half cells (the inset part is the equivalent circuit model), (b) The relationship plot between *Z′* and $\omega^{-1/2}$ at low frequency region.

Table S1 Simulated impendence parameters of the TiO_2-pristine/CNF and the TiO_2-5-Ta/CNF in Li-metal half cells.

Samples	R_s (Ω)	R_{ct}(Ω)	i_0 (mA cm^{-2})	δ_w (Ω s$^{-1/2}$)	D_{Li^+}(cm^{-2} s^{-1})
TiO_2-pristine/CNF	2.6	155	0.16	243.1	1.2 ×10^{-14}
TiO_2-5-Ta/CNF	2.2	68	0.37	127.7	4.3 ×10^{-14}

Table S2 The electrochemical performance comparison of TiO_2-5-Ta/CNF with other reported rutile TiO_2 anodes in Li-metal half cells in recent five years.

Samples	A: B: C* (wt. %)	Current density(mA g^{-1})	Capacity (mA h g^{-1})	Voltage range (V)	Reference
Nb-doped TiO_2 nanorods	70: 20: 10	250	290 after 120 cycles	0.05-3.0	10.1016/j.solidstatesciences.2018.07.004[25]
Nano-Sn doped carbon-coated TiO_2 spheres	80: 10: 10	500	219 after 200 cycles	0.01-3.0	10.1039/c6ra04672j[15]
3D mesoporous N-doped carbon-assembling TiO_2	80: 10: 10	168	223 after 200 cycles	0.01-3.0	10.1016/j.jpowsour.2019.02.094[52]
Mesostructured Nb-TiO_2-C	70: 20: 10	670	79 after 500 cycles	0.01-2.5	10.1016/j.jpowsour.2017.12.055[53]
Nb-doped TiO_2 mesocrystals	70: 20: 10	840	140 after 600 cycles	1.0-3.0	10.1002/chem.201605115[54]
SnO_2/TiO_2/C quasi-nanospheres	80: 10: 10	200	642.5 after 450 cycles	0.01-3.0	10.1016/j.matlet.2018.06.062[55]
Sn-doped TiO_2 hollow nanocrystals	80:10:10	5000	110 after 500 cycles	0.01-3.0	10.1021/acsomega.7b01340[1]
The core-shell mesoporous TiO_2 N-doped C	80:10:10	20,000	172.2 after 500 cycles	0.05-3.0	10.1016/j.jallcom.2019.07.225[56]
TiO_2-5-Ta/CNF	**70:20:10**	**2000**	**399.3 after 1000 cycles**	0.01-3.0	**This work**

*A: B: C = active materials: binder: conductive additive

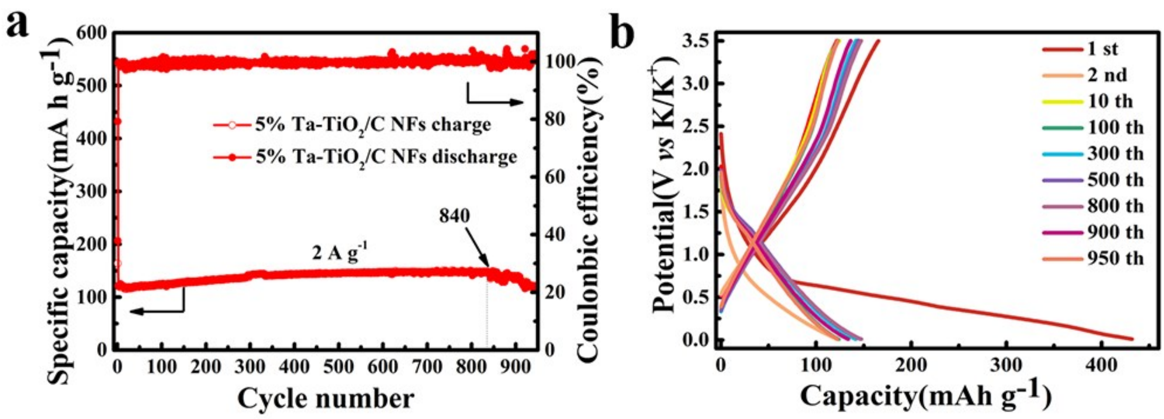

Fig. S7 The K-metal half cell of TiO_2-5-Ta/CNF for 950 cycles: (a) cycle performance at 2 A g^{-1} and (b) corresponding CDC.

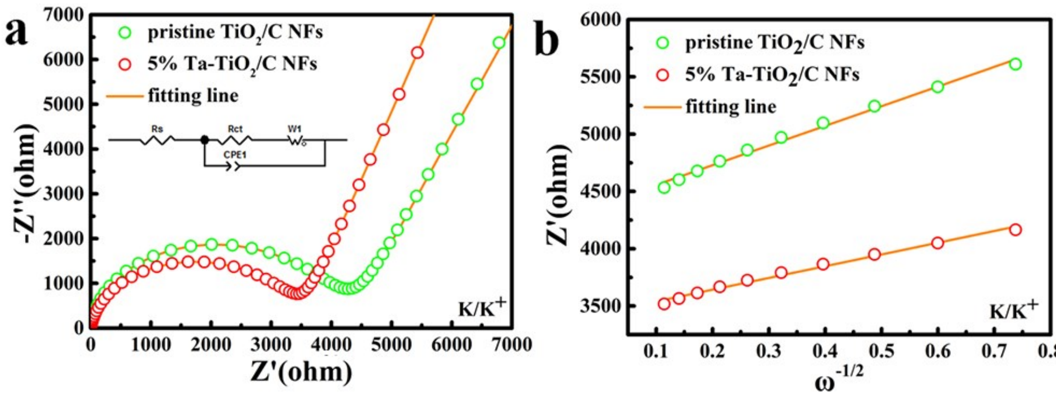

Fig. S8 (a) A. C. impedance of TiO_2-pristine/CNF electrode and TiO_2-5-Ta/CNF electrode at 50 mA g^{-1} after the first cycle in K-metal half cells (the inset part is the equivalent circuit model), (b) The relationship plot between Z' and $\omega^{-1/2}$ at low frequency region.

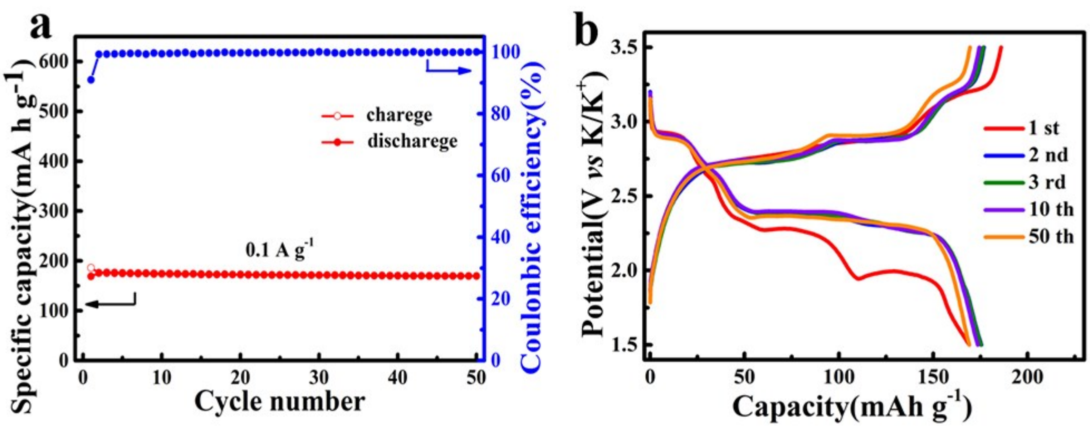

Fig. S9 (a) The cycling performance and (b) corresponding CDC of PTCDA electrode at 0.1 A g^{-1} in K-metal half cell.

Table S3 Simulated impendence parameters of the TiO_2-pristine/CNF and TiO_2-5-Ta/CNF in K-metal half cells.

Samples	R_s (Ω)	R_{ct}(Ω)	i_0(× 10^{-3} mA cm^{-2})	δ_w (Ω $s^{-1/2}$)	D_{k^+} (cm^2 s^{-1})
TiO_2-pristine/CNF	3.8	3670	6.9	1716	2.4 ×10^{-16}
TiO_2-5-Ta/CNF	2.9	3100	8.3	1024	6.7 ×10^{-16}

Table S4 The electrochemical performance comparison of TiO_2-5-Ta/CNF with other reported Ti-based oxides in K-metal half cells.

Samples	A: B: C * (wt. %)	Current density (mA g^{-1})	Capacity (mAh g^{-1})	Voltage range (V)	Reference
Lepidocrocite-Type Layered TiO_2	80: 10: 10	25	37 after 45 cycles	0.01-2.0	10.1021/acsaem.8b00170 [30]
Ti_6O_{11}/CNT	80: 10: 10	200	80 after 500 cycles	0.01-2.5	10.1021/acsomega.9b00045 [57]
$K_2Ti_4O_9$	75:20:10	100	45 after 30 cycles	0.01-2.5	10.1149/2.0421613jes [58]
$K_2Ti_6O_{13}$ nanorods	70: 20: 10	100	83 after 50 cycles	0.01-3.0	10.1016/j.jelechem.2019.04.020 [59]
$K_2Ti_8O_{17}$	70: 20: 10	20	110.7 after 50 cycles	0.01-3.0	10.1039/C6CC05102B [60]
$KTiOPO_4$/C	80:10:10	5	90 after 50 cycles	0.01-2.0	10.1002/anie.201909202[61]
MXene-derived TiO_2/RGO	80: 10: 10	1000	88 after 1000 cycles	0.01-3.0	10.1039/C8TA12069B [31]
$K_2Ti_6O_{13}$ microscaffolds	80: 10: 10	500	40 after 1000 cycles	0.01-3.5	10.1021/acsami.7b15314 [62]
$K_2Ti_2O_5$@C	80: 10: 10	16	75 after 1000 cycles	0.01-3.0	10.1002/smll.201906131 [63]
$LiBaF_3$ modified Zr-doped $Li_4Ti_5O_{12}$	70: 20: 10	850	96 after 1000 cycles	0.01-2.5	10.1002/asia.201900873[64]
$Na_2Ti_3O_7$/N doped C	70: 20: 10	100	88.9 after 1555 cycles	0.01-2.5	10.1021/acsami.8b11354[65]
Hierarchical TiO_2-C micro-tubes	super P and CMC in water	500	132.8 after 1200 cycles	0.01-3.0	10.1016/j.nanoen.2019.03.002 [29]

TiO_2-5-Ta/CNF	**70:20:10**	**2000**	**148.8 after 800 cycles**	0.01-3.5	**This work**

* A: B: C = active materials: binder: conductive additive