Supporting Information

3D Nanostructured Conductive PANI/MXene Hydrogels for Durable Aqueous Zn-ion Batteries

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Supporting Figures
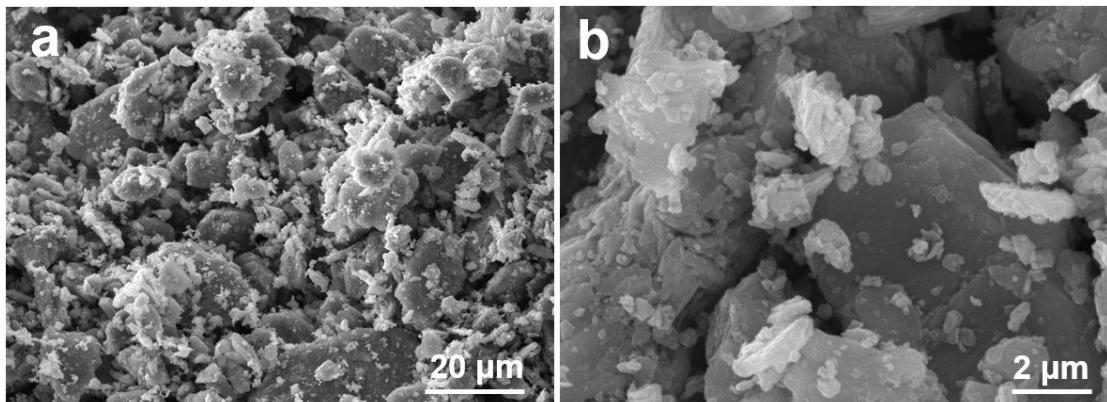
**Fig. S1**. SEM images of the Ti$_3$AlC$_2$ MAX phase.
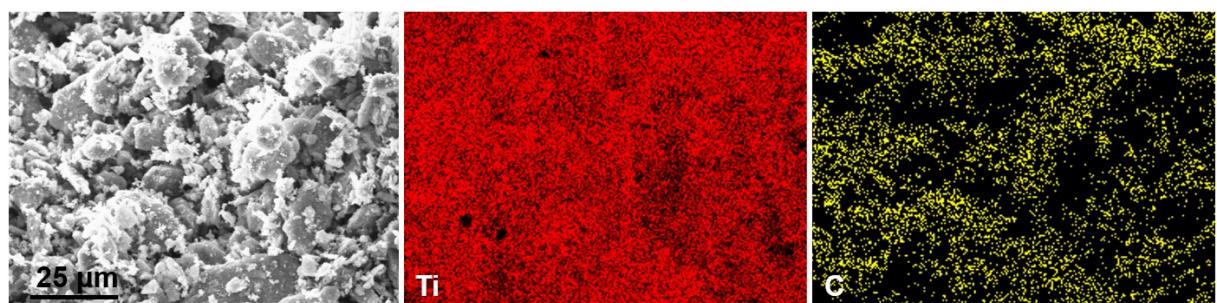

Fig. S2. Mapping images of the Ti$_3$AlC$_2$ MAX phase.
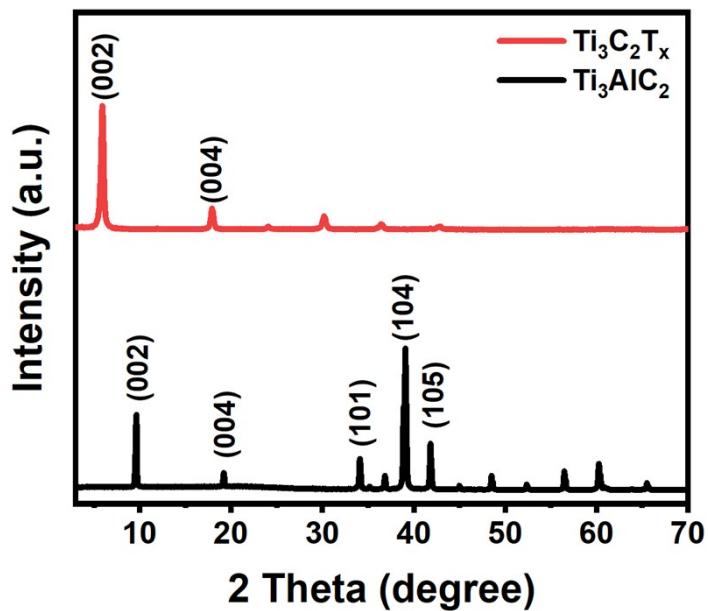
Fig. S3. XRD patterns of the Ti$_3$AlC$_2$ MAX and Ti$_3$C$_2$T$_x$.
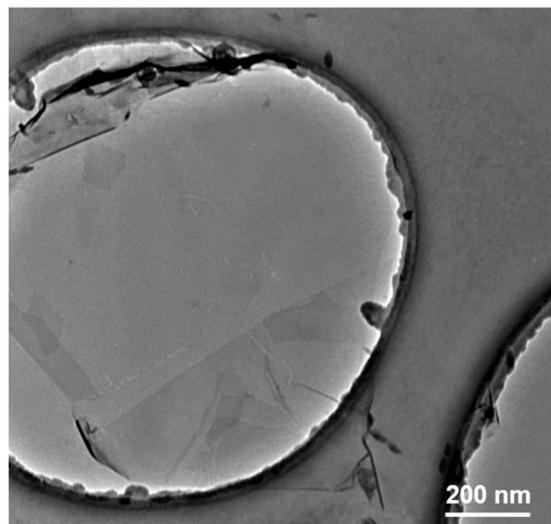
**Fig. S4**. TEM images of the Ti$_3$C$_2$T$_x$ nanosheets.
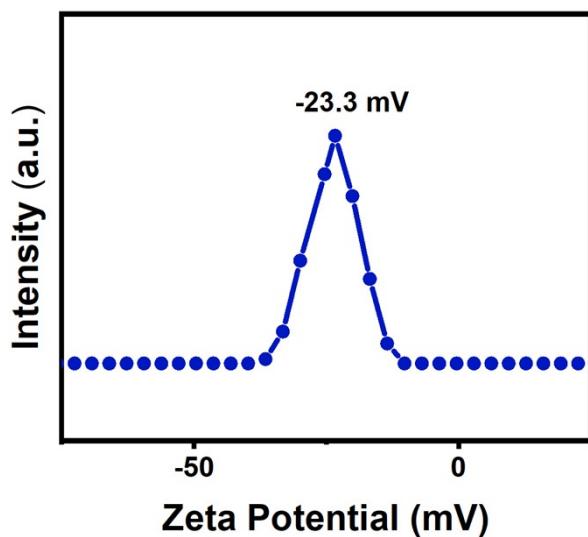
Fig. S5. Zeta potentials of the Ti$_3$C$_2$T$_x$ MXene solution.
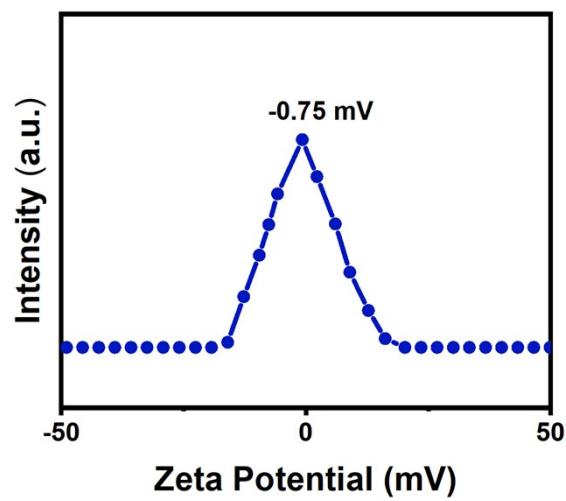
**Fig. S6**. Zeta potentials of the PANI/MXene solution.
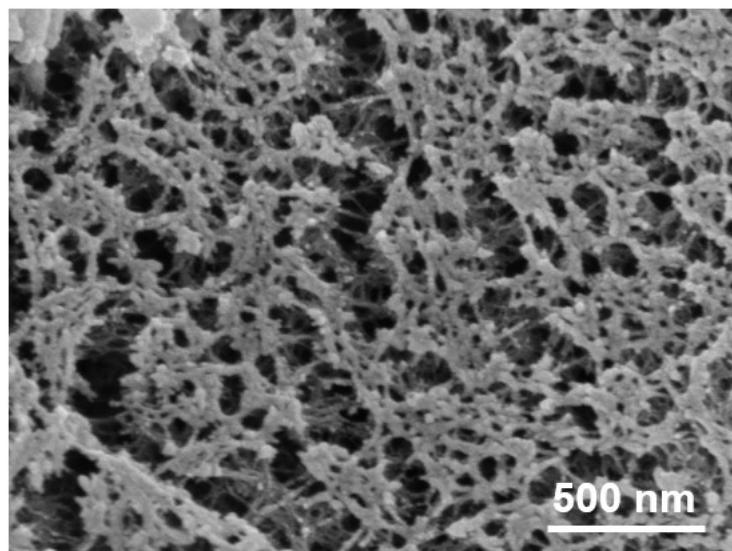

Fig. S7. SEM images of the PANI/MXene.
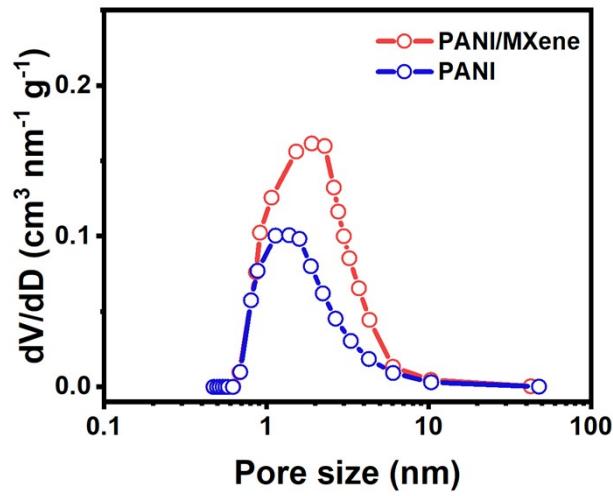
**Fig. S8**. The pore size distribution of the PANI/MXene and PANI cathode.
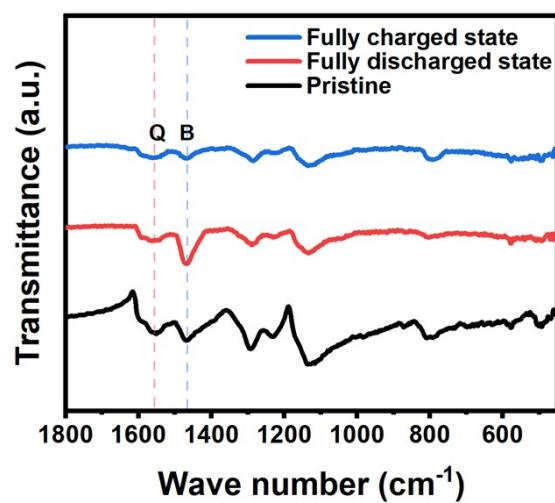
Fig. S9. The FTIR spectra in pristine, fully discharged, and fully charged states.
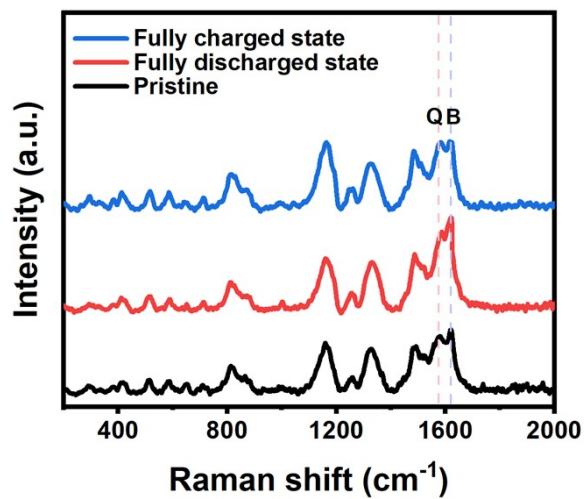
Fig. S10. The Raman spectra in pristine, fully discharged, and fully charged states.
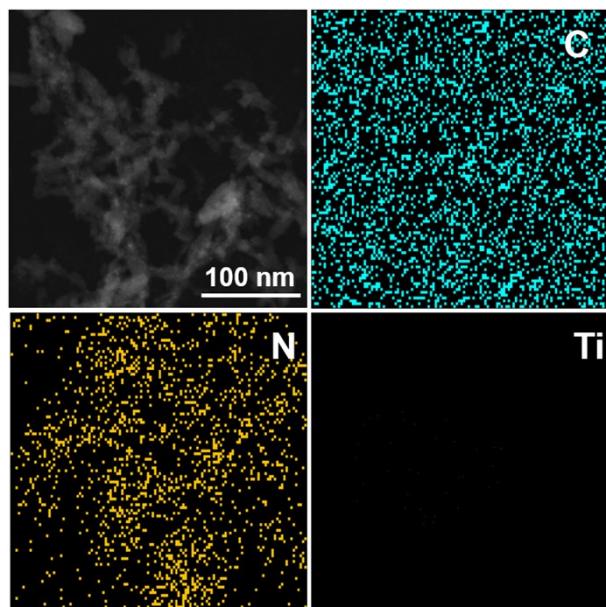

**Fig. S11**. STEM and the corresponding elemental mapping images of the PANI.
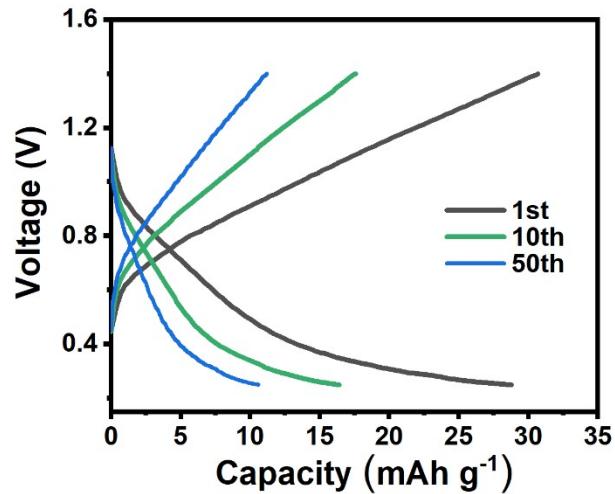
Fig. S12. Charge/discharge curves of MXene nanosheets at 0.2 A g^{-1}.
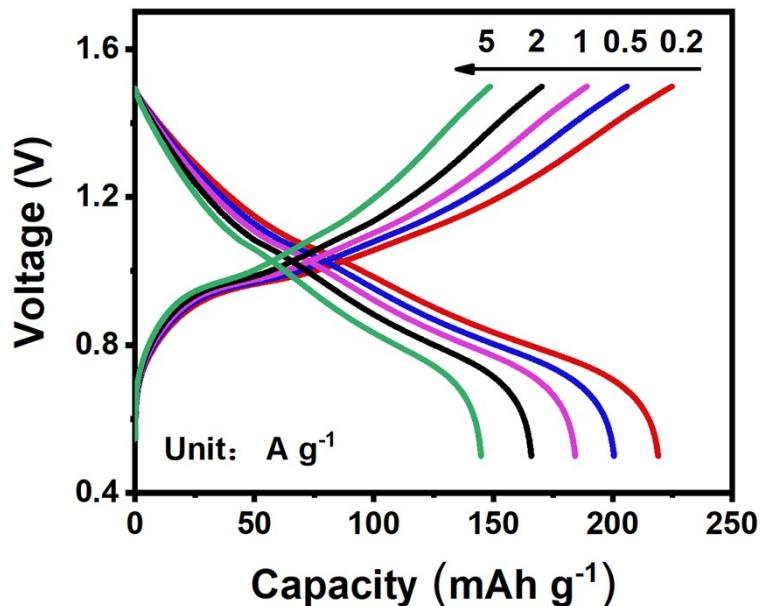
Fig. S13. Charge/discharge curves of the PANI/MXene at different current densities.
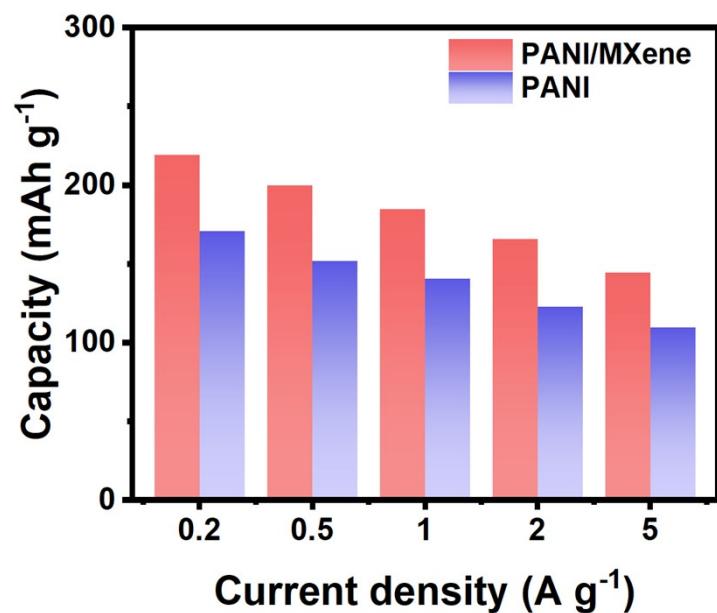
Fig. S14. The average capacities of the PANI/MXene and PANI.
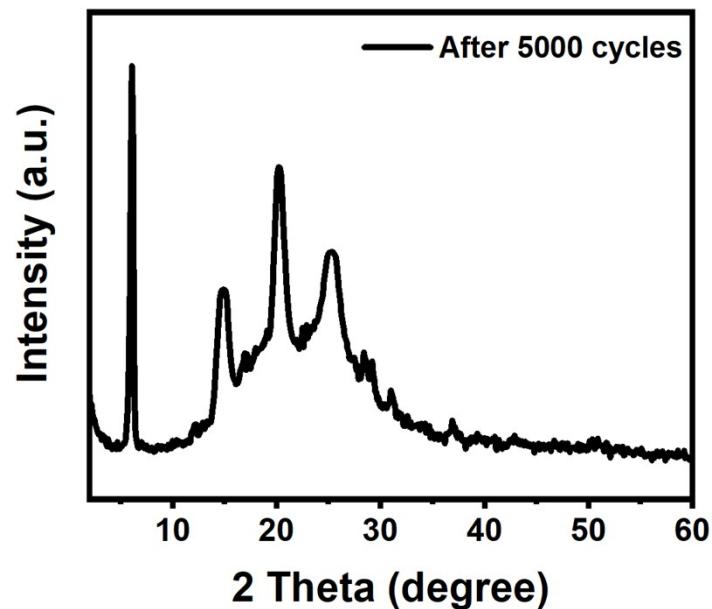
Fig. S15. The XRD pattern of the PANI/MXene after 5000 cycles.
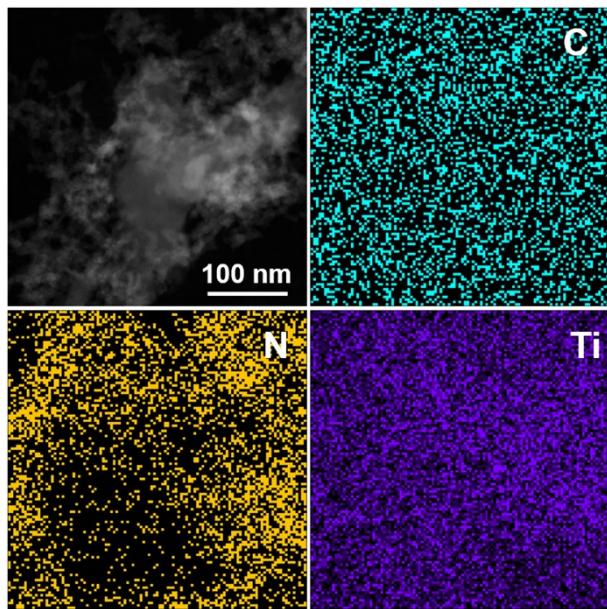
Fig. S16. STEM and the corresponding elemental mapping images of the PANI/MXene after

5000 cycles.
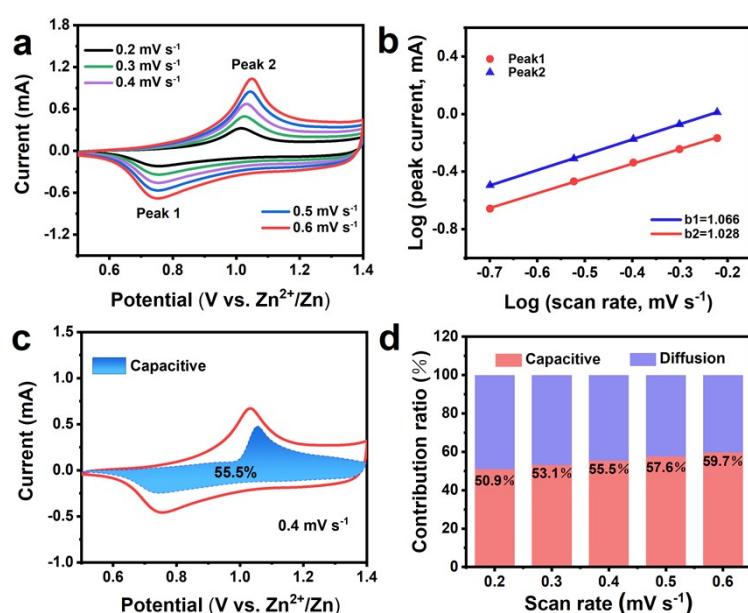
Fig. S17 The electrochemical kinetics of the PANI cathode. a) CV curves at various scan rates.

b) log ᵛ vs. log i plots according to the CV curves. c) The CV curve with a capacitive contribution

at 0.4 mV s⁻¹. d) The capacitive contribution ratios at various scan rates.
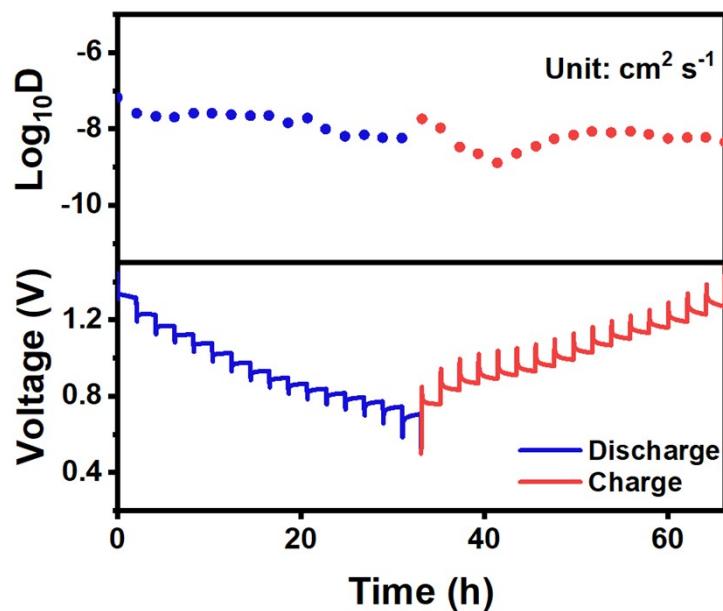
Fig. S18. GITT curves of the PANI/MXene and the corresponding ion diffusion coefficients.
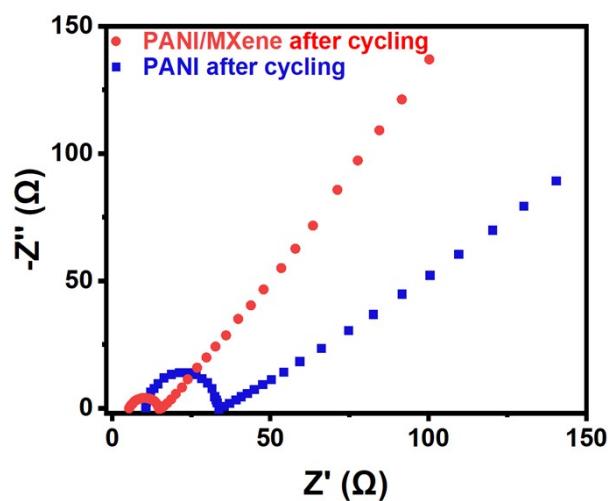
Fig. S19. Nyquist plots of the PANI/MXene and PANI after 5000 cycles.

Table S1. Comparisons of the electrochemical performance of PANI/MXene with other PANI-based electrodes.

| Cathode material	Mass loading (mg cm^{-2})	Capacity (mAh/g)	Capacity retention (%)	Ref.
PANI/MXene	1.5	147.4 (5 A/g)	88.3 % (5000 cycles)	This work
PANI/carbon felts	1.5	89.1 (5 A/g)	92.0 % (3000 cycles)	[S1]
PANI-S	1.2	130.1 (10 A/g)	84.6 % (2000 cycles)	[S2]
PANI/SWCNTs film	1.5	135.8 (1 A/g)	97.3 % (1000 cycles)	[S3]
PANI-SWCNT-sponge	3.0	115 (1 A/g)	94.0 % (500 cycles)	[S4]
OCF/PANI	2.4	119.4 (0.1 A/g)	95.4 % (200 cycles)	[S5]
PANI@CNT	–	107.6 (0.5 A/g)	91.1 % (150 cycles)	[S6]
ZnHCF/PANI	1.5	85.0 (0.5 A/g)	75.0 % (350 cycles)	[S7]
KCY@PANI	0.83	141.9 (2 A/g)	88.0 % (2000 cycles)	[S8]

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