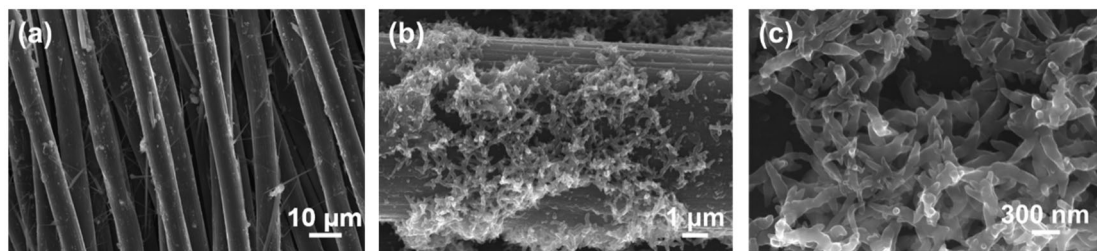
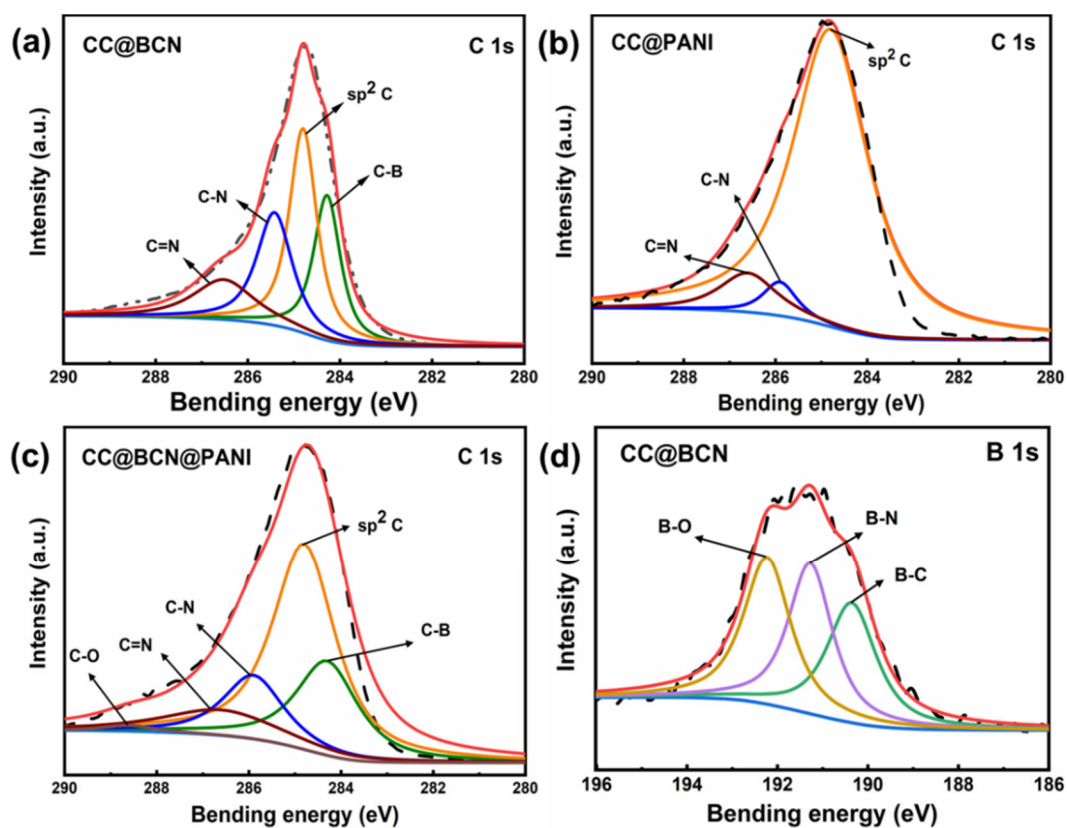


## Electronic Supplementary Material



**Fig. S1** SEM characterization of electrode materials

(a) CC; (b) low multiples of CC@PANI; (c) high multiples of CC@PANI



**Fig. S2** XPS spectra characterization of electrode materials

(a) C 1s of CC@BCN; (b) C 1s of CC@PANI; (c) C 1s of CC@BCN@PANI and (d) B 1s of CC@BCN

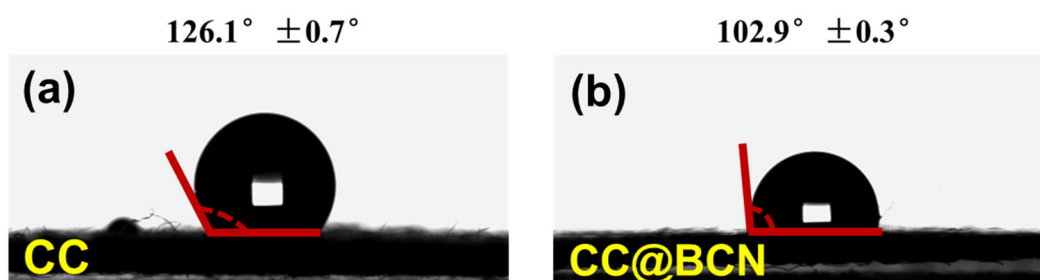


Fig. S3 Contact angles with electroplate liquid

(a) CC; (b) CC@BCN

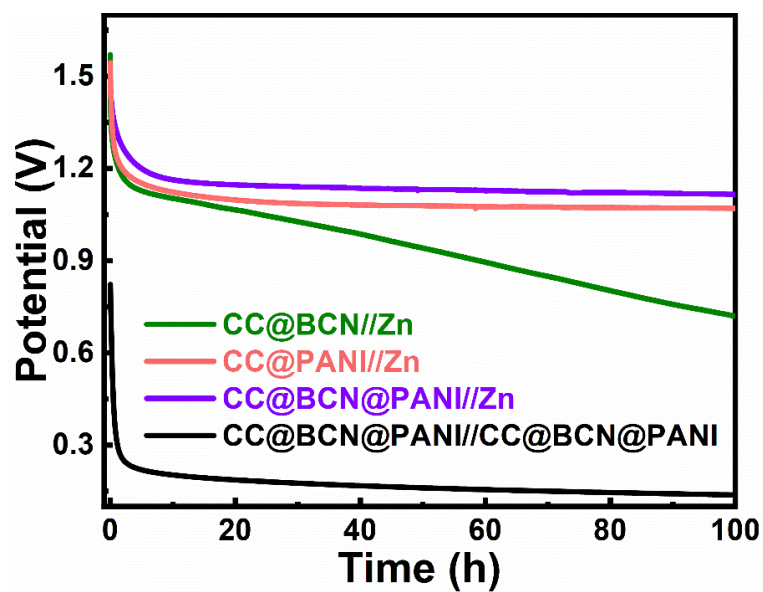


Fig. S4 Self-discharge behaviors of the coin-types ZHSCs: CC@BCN//Zn; CC@PANI//Zn, CC@BCN@PANI//Zn and CC@BCN@PANI//CC@BCN@PANI symmetric SCs.

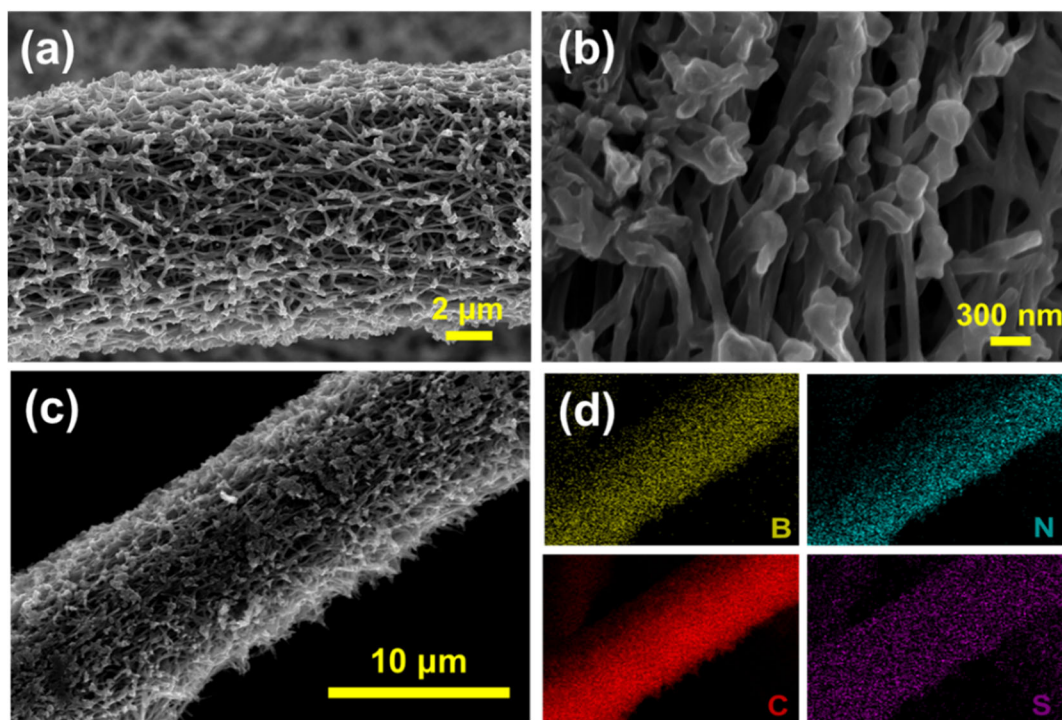


Fig. S5 The SEM of the coin-types ZHSCs with CC@BCN@PANI cathodes after 8000 cycles at the current density of 2 A/g

(a) low multiples; (b) high multiples; (c-d) elemental mappings of B, C, N, and S.

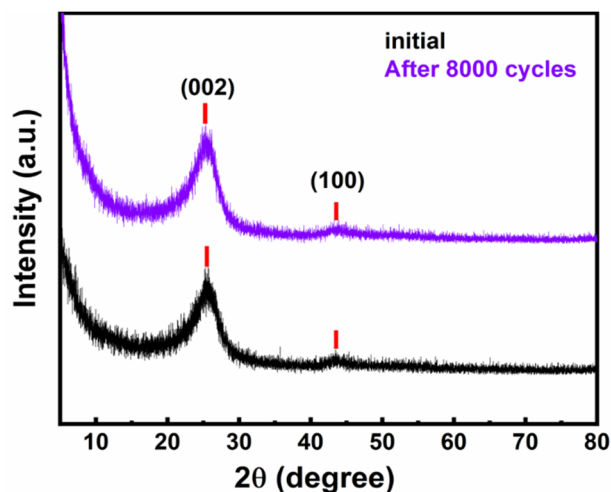


Fig. S6 XRD patterns of the coin-types ZHSCs with CC@BCN@PANI cathodes after 8000 cycles at the current density of 2 A/g.

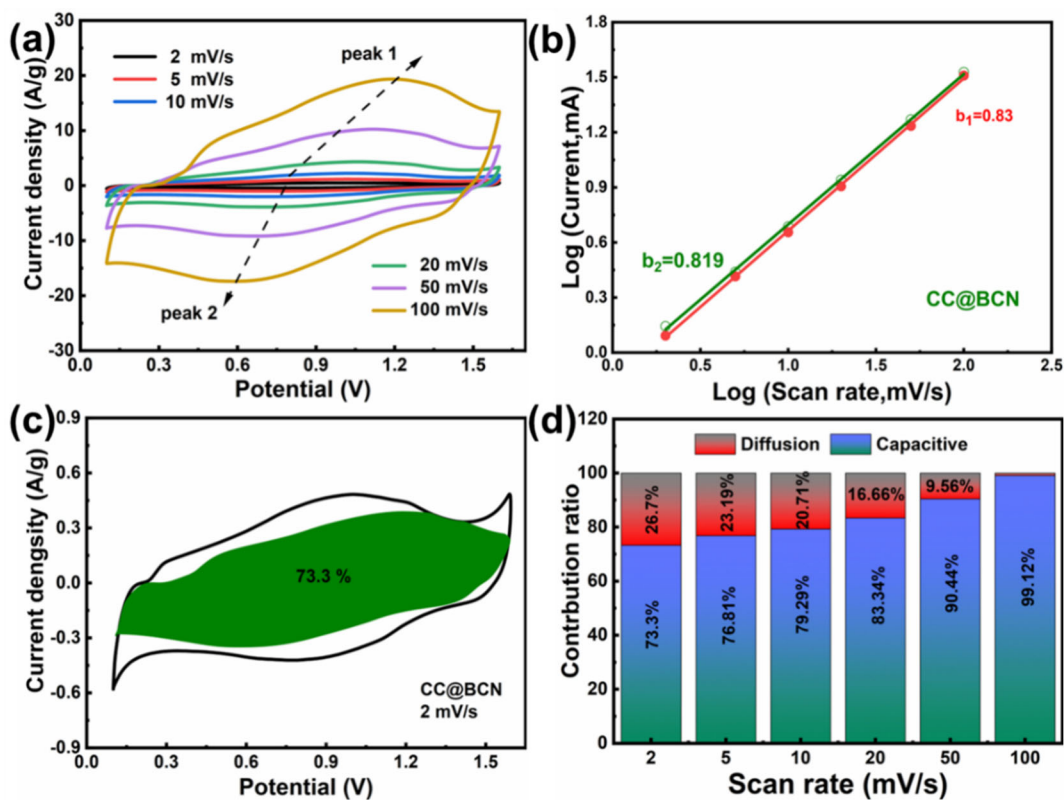
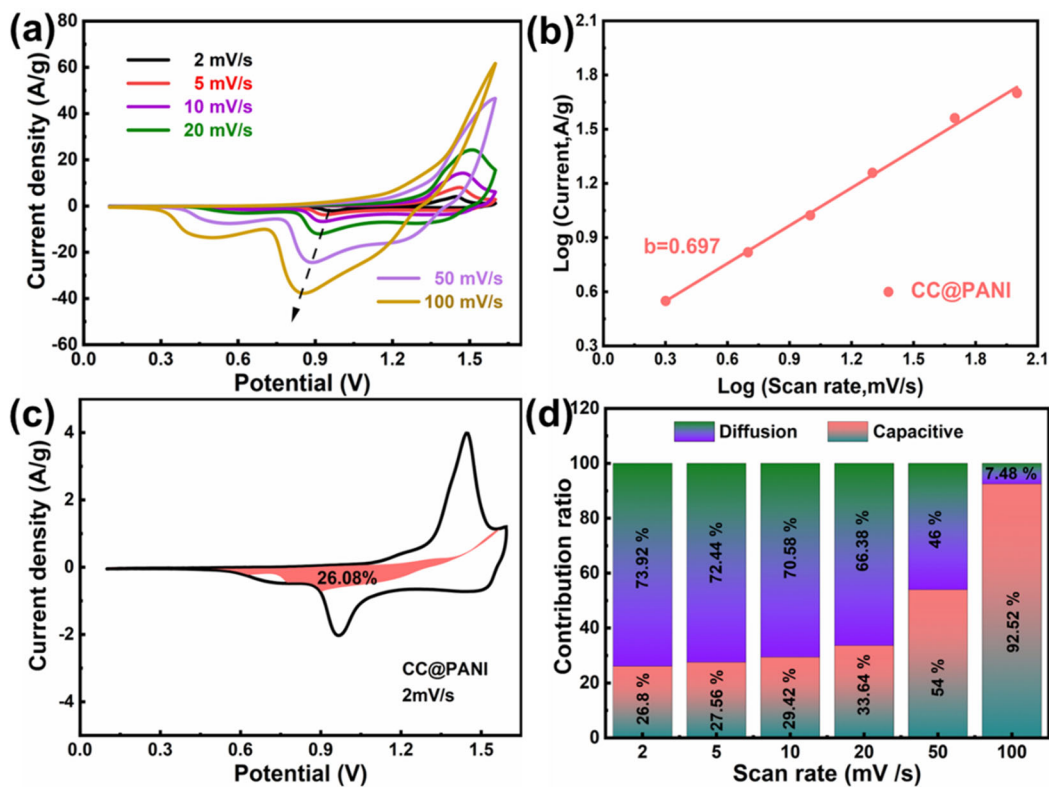


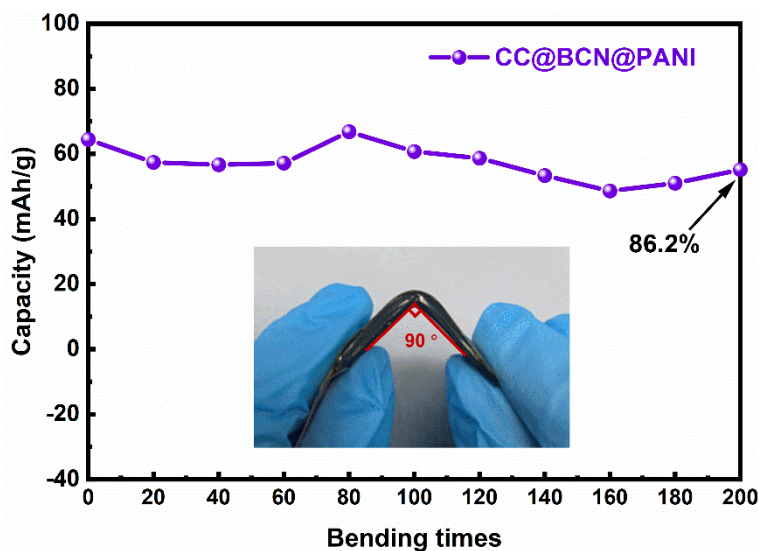
Fig. S7 Electrochemical kinetics analysis of coin-type aqueous ZHSCs with the CC@BCN cathode

- (a) CV curves; (b)  $b$  values of redox peaks on CV curves; (c) Total current (black line) and current derived from capacitive process (shadow region) of CC@BCN cathode at 2 mV/s; (d) Contribution ratios of capacitive process at various scan rates.



**Fig. S8** Electrochemical kinetics of ZHSCs with the CC@PANI cathode.

(a) CV curves; (b)  $b$  values of redox peaks; (c) Total current (black line) and current derived from capacitive process (shadow region) at 2 mV/s; (d) Contribution ratios of capacitive process at various scan rates.



**Fig. S9** Discharge capacity of the FZHSCs after bending for different cycles

**Table. S1** Summary of cycle stability for electrode materials.

Cathode	Current density (A/g) @ cycles @ capacity retention	Ref.
Q-PANI	2 @ 1500 @ 88 %	[1]
PANI-10	10 @ 10000 @ 95.2 %	[2]
SPANI	5 @ 1000 @ 80 %	[3]
MGP-1	2 @ 1000 @ 72.7 %	[4]
PANI-GO/CNT	3 @ 2500 @ 78.74 %	[5]
PANI100-V <sub>2</sub> O <sub>5</sub>	5 @ 2500 @ 75.64 %	[6]
S-Ti <sub>3</sub> C <sub>2</sub> T <sub>x</sub> /PANI	15 @ 5000 @ 64.4 %	[7]
PANI-VOH	1 @ 800 @ 80 %	[8]
PANI-CNT	14 @ 2000 @ 50 %	[9]
PAVO-1	0.1 @ 100 @ 90 %	[10]
MnVO-PANI	5 @ 10000 @ 85 %	[11]
<b>CC@BCN@PANI</b>	<b>2 @ 8000 @ 86.2 %</b>	<b>This work</b>

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