Supplementary Information

Historical development and novel concepts upon electrolytes for aqueous rechargeable batteries

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Table S1 A summary of recently representative works upon additive-added electrolytes for ARBs.

Electrolyte	Electrode	ESW	Energy density	Cyclic stability	Working temperature	Reference
SDS-added 1 M Na_2SO_4+1 M $ZnSO_4$	Zn//$Na_2MnFe(CN)_6$	2.5 V	170 $Wh\cdot kg^{-1}$ (cathode)	2000 cycles (5 C)	RT	Ref. 1
2 vol.% Et_2O added 3 M $Zn(CF_3SO_3)_2$+0.1 M $Mn(CF_3SO_3)_2$	Zn//MnO_2	n/a	n/a	4000 cycles (5 $A\cdot g^{-1}$)	RT	Ref. 2
SDBS added 1 M $LiSO_3CF_3$ and 1 M $Zn(SO_3CF_3)_2$	Zn//$LiFePO_4$	n/a	113 $Wh\cdot kg^{-1}$ (total electrode)	500 cycles (5 C)	RT	Ref. 3
0.5 m $Me_3EtNOTF$ added 4 m $Zn(OTF)_2$	Zn//$VOPO_4$	2.7 V	136 $Wh\cdot kg^{-1}$ (total electrode)	6000 cycles (2 $A\cdot g^{-1}$)	RT	Ref. 4
DMSO added 2 M $NaClO_4$	$Na_3V_2(PO_4)_3$//$Na_3V_2(PO_4)_3$	3.1 V	n/a	100 cycles (1 $A\cdot g^{-1}$)	RT	Ref. 5
2 M HBF_4 + 2 M $Mn(BF_4)_2$	Alloxazine//MnO_2	~1.8 V	110 $Wh\cdot kg^{-1}$ (total electrode)	500 cycles (4 C)	-60 °C	Ref. 6
ZnF_2 added 2 M $ZnSO_4$+1 M Li_2SO_4	Anode-free//$LiMn_2O_4$	n/a	n/a	100 cycles (200/400 $mA\cdot g^{-1}$)	RT	Ref. 7
5 M H_2SO_4	Pb//PCHL-rGO	n/a	n/a	3000 cycles (10 $A\cdot g^{-1}$)	RT to -70 °C	Ref. 8

Table S2 A summary of recently representative works upon pH-adjusted electrolytes for ARBs.

Electrolyte	Electrode	ESW	Energy density	Cyclic stability	Working temperature	Reference
1 M $ZnSO_4$+1.5 M HOAc+1.5 M NaOAc|1 M $FeSO_4$+1.5 M $FeCl_2$	Zn//Fe	n/a	n/a	200 cycles (30 $mA\cdot cm^{-2}$)	RT	Ref. 9
1 M $ZnSO_4$-P2VP	Zn//I_2	n/a	220 $Wh\cdot kg^{-1}$ (cathode)	250 cycles (0.3 $A\cdot g^{-1}$)	RT	Ref. 10
0.1 M H_2SO_4+1 M $ZnSO_4$+1 M $MnSO_4$	Zn//MnO_2	2.41 V	409 $Wh\cdot kg^{-1}$ (total electrode)	2000 cycles (30 $mA\cdot cm^{-2}$)	RT	Ref. 11
6 M KOH+0.2 M ZnO+5 mM vanillin|3 M H_2SO_4+0.1 M $MnSO_4$	Zn//MnO_2	n/a	1621.7 $Wh\cdot kg^{-1}$ (cathode)	200 cycles (500 $mA\cdot g^{-1}$)	RT	Ref. 12
3 M NaOH+0.2 M ZnO|2 M $ZnSO_4$+0.5 $MnSO_4$	Zn//MnO_2	3.46 V	n/a	4000 cycles (10 $mA\cdot cm^{-2}$)	RT	Ref. 13
1 M LiOH+1 M $Li_2Zn(OH)_4$|5 M $LiNO_3$	Zn//$LiMn_2O_4$	3.0 V	208 $Wh\cdot kg^{-1}$ (total electrode)	1000 cycles (1.69 C)	RT	Ref. 14

Table S3 A summary of recently representative works upon gelled electrolytes for ARBs.

Electrolyte	Electrode	ESW	Energy density	Cyclic stability	Working temperature	Reference
25 m LiTFSI-PVA	$LiVPO_4F$// $LiVPO_4F$	3.2 V	141 $Wh{\cdot}kg^{-1}$ (total electrode)	4000 cycles (20 C)	RT	Ref. 15
2 m LiTFSI-PEG	$Li_4Ti_5O_{12}$//$LiMn_2O_4$	3.2 V	110 $Wh{\cdot}kg^{-1}$ (total electrode)	300 cycles (1 C)	RT	Ref. 16
1 M NaCl+1 M $ZnCl_2$-SA	Zn//CuHCF-CNT	2.72 V	440 $Wh{\cdot}kg^{-1}$ (cathode)	450 cycles (1 $A{\cdot}g^{-1}$)	RT	Ref. 17
1 M $ZnSO_4$-gelatin∣1 M $CuSO_4$-gelatin	Zn//S	n/a	2372 $Wh{\cdot}kg^{-1}$ (cathode)	100 cycles (500 $mA{\cdot}g^{-1}$)	RT	Ref. 18
7 M LiCl-SBMA+HEA	AC//AC	2.2 V	n/a	10000 cycles (5 $mA{\cdot}cm^{-2}$)	-30 °C, RT, 60 °C	Ref. 19
2 M $ZnSO_4$+0.2 M $MnSO_4$-PVA-B-G	Zn//MnO_2	~2.0 V	25.8 $mWh{\cdot}cm^{-3}$	2000 cycles (1 $A{\cdot}g^{-1}$)	-30 °C	Ref. 20

Table S4 A summary of recently representative works upon interface-tuning electrolytes for ARBs.

Electrolyte	Electrode	ESW	Energy density	Cyclic stability	Working temperature	Reference
20 mM $Zn(NO_3)_2$+3 M $Zn(OTf)_2$	Zn//MnO_2	n/a	168 $Wh\cdot kg^{-1}$ (total electrode)	700 cycles (10 C)	RT	Ref. 21
21 m LiTFSI+7 m LiOTf-PVA	LiTFSI-HFE+PEO+DMC/graphite//$LiMn_2O_4$ or $LiVPO_4F$	~3.1 V	approaching state-of-art LiBs	50 cycles (0.3 C)	RT	Ref. 22
9.5 M $LiNO_3$+LiOH (pH=10)	AC//$LiNO_2$	n/a	n/a	50 cycles (1 C)	RT	Ref. 23
15 m $NaClO_4$	TiS_2-Al_2O_3//MFCN-TiO_2	3.5 V	100 $Wh\cdot kg^{-1}$ (total electrode)	200 cycles (1 C)	RT	Ref. 24
2 M $ZnSO_4$	Zn-graphite//MnO_2	n/a	164 $Wh\cdot kg^{-1}$ (total electrode)	1000 cycles (8 $mA\cdot cm^{-2}$)	RT	Ref. 25
2 M $Al(OTf)_3$	Zn/Al//Al_xMnO_2	n/a	n/a	80 cycles (100 $mA\cdot g^{-1}$)	RT	Ref. 26

Table S5 A summary of recently representative works upon beyond concentrated electrolytes for ARBs.

Electrolyte	Electrode	ESW	Energy density	Cyclic stability	Working temperature	Reference
33 m $LiNO_3$-PVA	VO_2//$LiNi_{0.5}Mn_{1.5}O_4$ or $LiMn_2O_4$	3.2 V	176 $Wh{\cdot}kg^{-1}$ (total electrode)	700 cycles (3 C)	RT to 80 °C	Ref. 27
1 m $Zn(ClO_4)_2$+10 m $LiClO_4$-PVA	Zn//$LiMn_2O_4$	3.3 V	183 $Wh{\cdot}kg^{-1}$ (cathode)	300 cycles (1 C)	RT to 80 °C	Ref. 28
1 m $Zn(OAc)_2$+40 m KOAc-PAA	Zn//MnO_2	3.45 V	386 $Wh{\cdot}kg^{-1}$ (cathode)	2000 cycles (5 C)	RT to 80 °C	Ref. 29
1 M $Zn(ClO_4)_2$	Zn//AC	n/a	n/a	70000 cycles (1 $A{\cdot}g^{-1}$)	-30 °C & -60 °C	Ref. 30
45 m $ZnBr_{0.5}Cl_{1.5}$+1 m $Zn(OAc)_2$	Zn/GFF//PGA	n/a	908.5 $Wh{\cdot}kg^{-1}$ (cathode)	500 cycles (1 $A{\cdot}g^{-1}$)	RT	Ref. 31
42 m LiTFSI+21 m $Me_3EtN{\cdot}TFSI$	$Li_4Ti_5O_{12}$//$LiMn_2O_4$	3.25 V	145 $Wh{\cdot}kg^{-1}$ (total electrode)	150 cycles (0.2 C)	RT	Ref. 32

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