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Supporting Information

Innovation and Challenges in Materials Design for Flexible Rechargeable Batteries: from 1D to 3D

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Table S1 to S3

Table S1. Summary of 1D (wire-type) flexible batteries

Battery type	Anode	Cathode	Electrolyte	Separator	Electrochemical performance		Ref.
					Discharge capacity	Cycling performance	
All-solid-state Zn-air battery	Spiral zinc foil	Air cathode based on Fe/N/C catalyst	Gel polymer	/	0.9 mAh cm^{-2} at 0.1 mA cm^{-2}	/	1
$Li-O_2$ battery	Lithium metal rod	Super P coated on carbon textiles	Gel polymer	/	4800 mAh g^{-1} at 100 mA g^{-1}	90 cycles	2

Lithium battery	Twisted bundle of Li and Cu mesh	Carbon cloth/Al mesh	Organic liquid electrolyte	Polyethylene	1.5 mAh cm^{-2}	50 cycles	3
Lithium -ion battery	Lithium wire	Spring-like fiber	Gel electrolyte	/	92.4 mAh g^{-1} at 0.1 mA cm^{-1}	100 cycles	4
Sodium-ion battery	Sodium foil	Prussian blue graphene composites coated Ni-coated cotton textile	/	Flexible membrane	110 mAh g^{-1} at 60 mA g^{-1}	1800 cycles at a high rate of 5 C	5
ZN-air battery	Zn plate	Strung Co_4N and intertwined N-C fibers	6.0 M KOH with 0.2 M zinc acetate	/	774 and 701 mAh g^{-1} at 10 and 50 mA cm^{-2}	136 h (up to 408 cycles)	6
Zn–air battery	Zinc spring	Aligned and cross-stacked carbon nanotube sheet and a RuO_2-based catalyst	Hydrogel polymer	/	1 A g^{-1}	30 cycles	7
Lithium -sulfur battery	Lithium wire	Sulfur-containing hybrid fiber	1 M Lithium bis-(trifluoromethanesulfonyl) imide (LiTFSI) and 1 wt% Lithium nitrate ($LiNO_3$) in a	Celgard 2400	335 mAh g^{-1} at 167.5 mA g^{-1} (0.1 C)	100 cycles	8

			mixture of DOL (DOL), 1,2-dimethoxyethane (DME) (volume ratio 1:1)				
Lithium -sulfur battery	Li foil	Binder-free fibrous reduced graphene oxide/carbon nanotube/sulfur composite	1 m LiTFSI in DME and DOL mixture (1:1 v/v) with 1 wt% of $lino_3$	Celgard 2400	1255 mAh g^{-1}; 2.49 mAh cm^{-2} at C/20	30 bending cycles	9
$Li–O_2$ battery	Lithium strip	RuO_2/N-carbon nanotubes And N-carbon nanotubes loaded metal/cotton yarn	0.5 M LiTFSI in tetraethylene glycol Dimethoxyethane (TEGDME)	Celgard 3500	1981 mAh g^{-1} at 320 mA g^{-1}	100 cycles (more than 600 hours)	10
Lithium ion battery	Ni–S-N-coated Cu wires	An aluminum wire around the hollow-helix electrode	1 M lithium hexafl uorophosphate ($LiPF_6$) in ethylene carbonate (EC) and propylene carbonate (PC) (1:1 by volume) containing 3 wt% vinylene carbonate (VC)	Modified poly(ethylen e terephthalate) nonwoven support	1 mAh cm^{-1}	slight loss of capacity after mechanical bending	7
Zinc–carbon battery	Zn powder/carbo n fiber or Zn wire	MnO_2/carbon fiber	The electrolyte consisted of NH_4Cl, $ZnCl_2$ and deionized water, with a weight percentage ratio of	An insulated enameled wire	0.15, 0.14, 9.3*10^{-2}, and 7.2*10^{-2} mAh/cm at	/	11

			26:8.8:62.2		0.15, 0.3, 0.6 and 1.5 mA		
Silver–zinc Battery	Plate zinc	Wrap silver electrode	Polyvinyl alcohol (PVA)-KOH polymer electrolyte	Cellophane film	1.2 and 1.8 mAh cm^{-1} at a 0.5C discharge rate	170 cycles	12

Table S2. Summary of 2D (paper-type) flexible batteries

Battery type	Anode	Cathode	Electrolyte	Separa tor	Electrochemical performance		Ref.
					Discharge capacity	Cycling performance	
Lithium ion battery	Graphene paper	Lithium metal foil	1.15 m $LiPF_6$ dissolved in a mixture of EC, ethyl methyl carbonate (EMC) , and dimethyl carbonate (DC) (3:2:5 volume ratio)	Porouspolyp ropylene film	1300 mAh g^{-1} at 60 mA g^{-1}	No more than 10 cylcle	13
Lithium recharge able battery	Graphene papers	Lithium sheets	1 m $LiPF_6$ solution in a 1:1 (volume) mixture of EC and DMC	/	1350 mA h g^{-1} at 50 mA g^{-1}	100 cycles	14
$Li\text{-}O_2$ battery	Li metal	Graphene nanoplatelets/g raphene oxides film	1.0 M $LiNO_3$ in dimethylacetamide (DMA)	Glass microfiber filter	9760 mAh/g at 9760 mAh/g	20 cycles	15

Lithium–sulfur battery	Lithium foil	Mesoporous graphene paper	1 m LiTFSI and 1 wt% $LiNO_3$ in DOL and DME (volume ratio 1 : 1)	/	1393 mA h g^{-1}	50 cycles	16
Li-ion battery	Lithium metal	Exfoliated graphite attaching silicon nanoparticles	1.0 M $LiPF_6$ dissolved in a mixture of EC and DC (1: 1, v/v) with VC (5 v.% VC by volume)	Celgard 2400	902.8 mAh g^{-1} at 200 mA g^{-1}	40 cycles	17
Li-O_2 battery	Lithium foil	Graphene oxide paper	1 M $LiPF_6$ dissolved in TEGDME	Glass fibers	612 mAh g-1 at 0.01 mA cm^{-2}	10 cycles	18
Li–O_2 battery	Lithium belt	Paper-ink air cathode	1M $LiCF_3SO_3$ in TEGDME electrolyte	Glass fiber	6500 mAh g^{-1} at 200 mA g^{-1}	1000 cycles	19
Lithium-ion battery	Additive-free thick graphene film	Lithium foil	1 M $LiPF_6$ mixed with EC and DC 1 : 1 by volume	Polypropylene film	350 mA h g^{-1}	50 cycles	20
Lithium-ion battery	Lithium metal foil	Coral-like magnetite@cobalt(ii) oxide@graphene foam	1.0 M $LiPF_6$ solution in a mixture of EC and DEC (7:3 by volume)	/	1551.2 mA h g^{-1} at 0.5 A g^{-1}	400 cycles	21
Lithium-ion battery	CuO nanosheets/reduced-graphene oxide	Li metal foil	50:50 (w/w) EC and DC mixture solution with 1 M $LiPF_6$	/	698.0 mA g^{-1} at 0.1C	50 cycles	22

	composite						
All-solid-state zinc–air battery	Zinc foil	Bimetal FeCo nanoparticles encapsulated in in situ grown N-doped graphitic carbon nanotubes	Gel polymer (6 M KOH with 0.2 M zinc acetate)	/	872.2 mAh g^{-1}	240 cycles	23
Lithium ion battery	$Li_4Ti_5O_{12}$ nanosheets with a N-doped carbon	Lithium metal foil	1m $LiPF_6$ in EC and DC (1:1 vol)	Celgard 2400	170 mAh g^{-1} at a rate of 1 C	100 cycles	24
Lithium ion battery	$Li_4Ti_5O_{12}$ nanowire arrays on freestanding ultrathin graphite	Lithium metal foil	1 M $LiPF_6$ solution in a 1 : 1 (v/v) mixture of EC and DMC	Polyethylene film	154 mAh g^{-1}	500 cycles	25
Lithium-ion battery	MoS_2 on freestanding graphene films	Lithium metal foil	1 M $LiPF_6$ in EC/DEC (1:1 by volume)	Polypropylene film	580 mAh/g (@50 mA/g)	30 cycles	26
Lithium-ion battery	MoS_2–graphene hybrid paper	Lithium metal foil	1 M solution of $LiPF_6$ in EC–DCat a vol ratio of 1 : 1	Celgard 2400	1240 mAh g^{-1}	100 cycles	27

Sodium-ion battery	Sb/rGO Nanocomposites	$Na_3V_2(PO_4)_3$ /rGO nanocomposites	A mixture of EC and DC1:1 (w/w) containing 1 M $NaClO_4$	Glass fiber	400 mAh g^{-1} at 100 mA g^{-1}	100 cycles	28
Lithium-ion battery	Ultrasmall SnS_2 nanocrystals decorated on flexible rGO	Lithium metal foil	A solution of 1 M $LiPF_6$ in EC–DMC–DC (1 : 1 : 1, by wt%)	Celgard 2400	1034 mAh g^{-1}	450 cycles	29
Lithium-ion battery	Yolk–shell CoS_2 and N-doped graphene sheets	Lithium metal foil	1.0 M $LiPF_6$ solution in EC and DC(1:1 by volume)	Celgard 2400	992 mAh g^{-1} 100 mAh g^{-1}	150 cycles	30
Li-ion battery	Graphene/S composite	Lithium metal foil	1.0 M $LiN(CF_3SO_2)_2$ and 0.2 M $LiNO_3$ in a mixture of DME and DOL mixed in a 1 : 1 volumetric ratio	Celgard 2320	~1500 mAh g^{-1}	250 cycles	31
Li–sulfur battery	Lithium-metal	Graphene-based porous carbon films	1 M LiTFSI and 0.2 M $LiNO_3$ in DOL and DME (the volume ratio was 1 : 1)	Glass fiber	1017 mAh g^{-1} at 0.2C	300 cycles	32
Lithium-sulfur battery	Lithium foils	Reduced graphene oxide–sulfur composite	1.0 M LiTFSI in a mixture solution of DOL and DME (1:1, vol. Ratio) with 1 wt% $LiNO_3$ addition	Celgard 2320	1302 mAh g^{-1} at 0.1 C	70 cycles	33
Lithium-sulfur	Lithium foil	Lithium foil	1 M LiTFSI and 0.25 M $LiNO_3$ additive in DOL:DME	Hybrid separator with n and s	1267 mAh g^{-1} at 0.2C	500 cycles	34

battery			(1:1 v/v)	dual-doped mesoporous carbon			
Li-ion battery	Si/rGO hybrid film	Lithium foil	A solution of 1 M $LiPF_6$ in EC/DMC/DEC (1:1:1 in volume)	Celgard 2400	904 mAh g^{-1} at 200 mAh g^{-1}	150 cycles	[35]
Li–S battery	Lithium foil	Dual-confined flexible sulfur cathodes encapsulated in N-doped double-shelled hollow carbon spheres and wrapped with graphene	1.0 M $LiCF_3SO_3$, 1 M in DOL and DME (1:1 by volume) with 0.1 M $LiNO_3$ additive	Celgard 2500	1360 mA h g^{-1} at 0.2C	200 cycles	[36]
Lithium-sulfur battery	Infiltrated porous polymer sheets	Pure Li foil	2.4 M LiTFSI salt solution in distilled DME:DOL (1:1, v:v) with 0.24 M LiI additive	Celgard 2400	1640 mAh g^{-1} at C/20	200 cycles	[37]
Solid-state lithium battery	Lithium foil	$LiFePO_4$	/	Composite membranes consisting of lithium garnet particles and Li-salt-free polyethylen	153.3 mAh g^{-1} at 0.05C	200 cycles	[38]

				e oxides			
Li-ion battery	Lithium metal	Nano-fibrillated cellulose, $LiFePO_4$ and super-P carbon particles based paper	1M $LiPF_6$ in EC: DEC 1:1 by weight	Whatman Glass microfiber	151mAh/g at C/10	50 cycles	[39]
Lithium-ion battery	Graphite	$LiCoO_2$	1 M $LiPF_6$ in EC/DMC/DEC (1:1:1, v/v/v)	Compliant gel polymer electrolyte based on poly(methyl acrylate-co-acrylonitrile)/poly(vinyl alcohol)	140 mAh g^{-1}	50 cycles	[40]
Lithium–sulfur battery	Lithium foil	Ultra-small sulfur nanoparticles configured inside a flexible organic mixed conducting network	1m LiTFSI in DOL : DME (1:1 v/v)	Whatman glass fiber	1669 mA h g^{-1}	100 cycles	[41]
Lithium-ion	$Li_4Ti_5O_{12}$	$LiCoO_2$	Plastic crystal composite polymer electrolyte	Polyethylene	123 mA h g^{-1} at 0.2C	40 cycles	[42]

battery							
Lithium-ion battery	Lithium metal foil	$LiFePO_4/C$	1.0 M $LiPF_6$ solution in a 1:1 v/v mixture of EC and DMC	Zirconium oxide based-ceramic	123 mA h g^{-1} at 0.1C	100 cycles	43
Lithium-ion battery	Li metal	$LiMn_2O_4$	1 m $LiPF_6$ in EC/DEC = 1/1 v/v	Flexible/functional porous ceramic membranes	~100 mA h g^{-1}	100 cycles	44
Lithium ion battery	Nitridated hematite (a-Fe_2O_3) nanorods	Li metal	1 m $LiPF_6$ in a mixture of EC and DMC (1:1 by volume)	Celgard 2400	1086 mAh g^{-1} at 0.2C	200 cycles	45
Na-ion battery	Nanopore-structured g-Fe_2O_3 film	Li metal	1 M $NaCF_3SO_3$ in TEGME	Celgard 2300	450 mA h g^{-1}	100 cycles	46
Li-ion battery	$Li_{\delta}Ni_{0.75-z}Co_{0.11}Mn_{0.14}V_zO_2$ doping layer	Multishelled $LiNi_{0.75}Co_{0.11}Mn_{0.14}O_2$	1.15 M $LiPF_6$ in EC/DMC/DC (3/4/3 vol %)	Microporous polyethylene	211 mAh g^{-1}	200 cycles	47
Li-ion battery	Li metal	$LiCoO_2$ layer	/	/	106 $\mu Ah/cm_2$	100 cycles	48
Lithium-ion battery	Si nanopillar	Li foil	1M $LiPF_6$ in 1:1 EC: DC electrolyte	Celgard 2500	3000 mAh/g	40 cycles	49
Li-ion	Cellulose	Lithium foil	1.0 M $LiPF_6$ in a 1:1 mixture	/	350 mA h g^{-1}	50 cycles	50

battery	based paper		of EC and DEC				
Li–S battery	Lithium metal foil	Sulfur-graphene-polypropylene separator	1.0 M LiTFSI in DOL and DME (1:1 by volume) with 1.0 wt% $LiNO_3$ additive	Celgard 2400	1278 mA h g^{-1} at 0.3 A g^{-1}	50 cycles	51
Lithium-ion battery	Lithium metal	In situ polymerized polyimide/single-wall carbon nanotube film	1 M $LiN(CF_3SO_2)_2$ solution in a mixed solvent of DOL and DME (1:1, in weight)	Glass fiber	226 mA h g^{-1} at 0.1C	200 cycles	52
Li-ion battery	Graphite	$LiCoO_2$	Graphene-oxide embedded in solid polymer electrolyte (1 M $LiPF_6$ in EC and DC (1 : 1 vol/vol))	/	0.14 mAh cm^{-2}	100 cycles	53
Lithium-ion battery	Polymer–carbon nanotube composite	Lithium metal	1 M of $LiPF_6$ in a 1:1 mixture of EC and DMC	Celgard 2400	190 mAh g^{-1}	15 cycles	54
Zinc–air battery	$LaNiO_3$/NCNT	Co_3O_4	/	PVA-gelled membrane	450 mAh g^{-1} at 50 A kg^{-1}	120 cycles	55
Lithium-ion battery	Lithium titanate/carbon nanotube/cellulose nanofiber hybrid	Lithium metal	1 m $LiPF_6$ in a 1:1 (volume) mixture of EC and DEC	Celgard 2400	142 mAh g^{-1} at 10C	500 cycles	56

	network film						
Li-ion battery	Carbon-coated lithium iron phosphate	Carbon-coated lithium iron phosphate	1 M $LiPF_6$ in EC:DEC 1 : 1 by weight with an addition of 2 wt% VC	/	146 mA h g^{-1} at C/10	50 cycles	57
Lithium-ion battery	TiO_2/graphene/PVDF films	Lithium metal	1 M $LiPF_6$ solution in EC+DMC (1:1, v/v)	Celgard 2400	202mAh g^{-1} at 60mAg^{-1}	40 cycles	58
Lithium ion battery	Lithium wafer	N-CNT film	Common electrolyte (Lb_3O_3)	Polyethylene	390 mAh g^{-1} at 4C	200 cycles at 4C	59
Lithium-ion battery	Li-foil	$Li_4Ti_5O_{12}$, carbonized cellulose nanofiber and carbon nanotubes hybrid film	1 m $LiPF_6$ in a 1:1 (v:v) mixture of EC and DEC	Celgard 2400	160 mAh g^{-1} at 0.5C	1000 cycles	60
Lithium-ion battery	Lithium foils	PCNF@MoS_2 core/sheath fiber	$LiPF_6$ (1 M) in a mixture of EC, EMC and DMC (1/1/1 in v/v/v)	Celgard-2400	475 mA h g^{-1} at 1 A g^{-1}	50 cycles	61
Lithium ion battery	$Li_4Ti_5O_{12}$/ carbon nanotube	$LiFePO_4$/ carbon nanotube	$LiPF_6$ electrolyte	Celgard 2400	220 mAh cm^{-2} at 1000 mA cm^{-2}	50 cycles at 1000 mA cm^2	62
Lithium ion battery	Metallic Li	Carbon nanotubes /Fe_3O_4	1.0 M $LiPF_6$ in EC/DC (1:1 by volume) with additional VC (2% by volume)	Glass fiber papers	837 mAh g^{-1} at 100 mA g^{-1}	100 cycles	63

		composite electrodes					
Lithium ion battery	SnO_x-ZnO/carbon nanofiber composites	Metallic Li sheet	1 M $LiPF_6$ in a solvent mixture of EC, DMC, and EMC (1:1:1 by volume)	Celgard 2400	1910 $mA \cdot h \cdot g^{-1}$ at 100 $mA \cdot g^{-1}$	55 cycles at 100 $mA \cdot g^{-1}$	64
Lithium-ion battery	Lithium pellets	Flexiblecnts@ TiO_2 hybrid mesoporous nanocables	The solution of $LiPF_6$ (1M) in EC/DMC	/	~ 210mAhg^{-1} at 20C (1C = 170mAg^{-1}),	1000 cycles at 20C	65
Lithium ion battery	Aligned CNT-based silicon films	Lithium ribbon	1 m $LiPF_6$ /EC + DMC + DEC (1:1:1 by volume)	/	3322 mA g^{-1} at 50 mA g^{-1}	30 cycles	66
Lithium-ion battery	SnO_2/N-doped carbon nanofiber films	Li foil	1 M $LiPF_6$ in EC and DC solvent (1:1 v/v)	Celgard 2325	890.5 mAh g^{-1} at 100 mA g^{-1}	300 cycles at 1 A g^{-1}	67
Lithium ion battery	Fe_2O_3 nanoshells coated on carbonized bacterial cellulose nanofibers	Lithium metal	1.0 M $LiPF_6$ in EC and DC mixture (1:1 by volume)	Celgard 2250 film	1135 mAh g^{-1} at 400mA g^{-1}	200 cycles at 400mA g^{-1}	68
Lithium ion	Li film	$LiNi_{0.5}Mn_{1.5}O_4$ /carbon	1.2 M solution of $LiPF_6$ in EC and DMC (3:7)	/	135 mAh/g at C/2 (1C=140	100cycles at C/2 (1C=140	69

battery		nanotube film			mAh/g)	mAh/g)	
Sodium ion battery	Na foil	$Na_{2+2x}Fe_{2x}(SO_4)_3$@porous carbon nanofiber hybrid films	1 M $NaClO_4$ dissolved in propylene carbonate (PC)	/	~100 mAh g^{-1} at 0.03C (97 mA g^{-1})	500 cycles at alternate rates of 40C and 5C	70
Li-S battery	Lithium metal foil	Sulphur–carbon nanotubes	1.0 M LiTFSI in DOL and DME (1 : 1 by volume) with 0.1 wt% $LiNO_3$ additive	/	712 mA h/$g_{sulphur}^{-1}$ (23 wt% S)	100 cycles	71
Li-S battery	Lithium metal	Sulfur@graphene nanoscroll composite	1.0 M LiTFSI dissolved in a mixed solvent of DOL and DME (1:1 by volume) with 0.1 m $LiNiO_3$ additive	Celgard 2400	1377 mAh g^{-1} at 0.05C (1C = 1675 mA g^{-1})	100 cycles	72

Table S3. Summary of 3D (porous-type) flexible Batteries

Battery type	Anode	Cathode	Electrolyte	Separator	Electrochemical performance		Ref.
					Discharge capacity	Cycling performance	
Lithium ion battery	Carbon nanotube /Si hybrid electrodes	Lithium foil	1 M $LiPF_6$ in a mixture of EC and DC (volume ratio: 1/1)	/	2562 mA h g^{-1} at 1 A g^{-1}	1000 cycles at 5 A g^{-1}	73

Lithium-ion battery	Fe_3O_4-bacterial cellulose-carbon nanofiber electrode	Metallic lithium	1 m $LiPF_6$ in EC-DMC–EMC (1 : 1 : 1 by volume)	Celgard 2400	754 mA h g^{-1}	100 cycles at 100 mA g^{-1}	[74]
Li-ion battery	3D MWCNTs grown on Cu mesh	Li metal foil	1 M solution of $LiPF_6$ salt in 1:1 (v/v) mixture solvent of EC and DEC	Separator 2400	~250 mAhg^{-1}	50 cycles	[75]
Lithium ion battery	Graphene and carbon nanotube hybrid foams	Lithium metal foil	1 M $LiPF_6$ in EC/DMC electrolyte solution	Celgard battery separator	2640 mA h g^{-1} at 0.186 A g^{-1} and 236 mA h g^{-1} at 27.9 A g^{-1}	300 cycles	[76]
Lithium-ion battery	Nanostructur Tio_2 supported on N-doped carbon foams	Metallic lithium sheets	/	/	188 mA h g^{-1} at 200 mA g^{-1}	100 cycles	[77]
Lithium-ion battery	Three-dimensional graphene network-supported polyimide	Al foil	1M LiTFSI DOL/DME solution	Glass fiber	175 mA h g^{-1} at 0.1 C	150 cycles	[78]
Lithium-sulfur	Lithium foil	Reduced graphene	1 M LiTFSI and 0.1 M $LiNO_3$ in 1:1 (v/v) mixture of DME	Borosilicate glass	1098 mA h g^{-1}	500 cycles	[79]

battery		oxide/Mn_3O_4@ hybrid polyaniline/sodium alginate matrix	and DOL	microfiber filters	at 2 A g^{-1}		
Li-ion battery	3D ordered macroporous MoS_2@C on carbon cloth	Lithium foil	1 M $LiPF_6$ in EC/DMC (1:1 in volume)	Celgard 2400	3.802 mAh cm^{-2} at 0.1 mA cm^{-2}	100 cycles	80
Lithium-ion battery	3D flexible Si based-composite/ carbon nanofibers electrode	Lithium foil	1.1 M $LiPF_6$ in EC: DMC (1:1)	Celgard 2400	665 mAh g^{-1} at 10 A g^{-1}	2000 cycles	81
Li-ion battery	3D N-doped graphene foam with encapsulated germanium/N-doped graphene yolk-shell nanoarchitecture	Lithium foil	1 M solution of $LiPF_6$ in a volumetric ratio of 1:1:1 mixture of EC and DME	Porous polypropylene film	1220mAhg^{-1}	1000 cycles	82
Lithium-ion battery	$NiCo_2S_4$ nanotube arrays grown on flexible N-	Lithium foil	1 M $LiPF_6$ dissolved in a 1 : 1 (v/v) mixture of EC and DMC	Celgard 2400	1721 mA h g^{-1} at 500 mA g^{-1}	100 cycles	83

	doped carbon foams						
Lithium ion battery	3D interconnected carbon nanotube conducting polymer hydrogel network	Lithium discs	1 M $LiPF_6$ in EC/DC/VC (1:1:0.02 v/v/v)	Celgard 2500	2.2 mAh cm^{-2} or 2180 mAh g^{-1} at 0.1C rate	100 cycles	84
Lithium ion battery	Graphene foam loaded with $Li_4Ti_5O_{12}$	Graphene foam loaded with $LiFePO_4$	$LiPF_6$ in EC/DMC	Polypropylene separator	~143 mAh/g at 0.2C	100 cycles	85
Lithium and sodium battery	Lithium foil	3D graphene/polyimide composites	1M $LiPF_6$ in EC/DMC (1 : 1 by volume ratio)	Cellgard 2400	240 mA h g^{-1} at 40 mA g^{-1}	1000 cycles	86
Lithium-ion battery	Graphene/Sn sandwich nanosheets	Lithium metal	$LiPF_6$ (1 M) in EC/DC/DC (1 : 1 : 1 vol%)	/	1487 mA h g^{-1} at 0.2 A g^{-1}	500 cycles	87
Lithium-ion and sodium-ion battery	$NiCo_2O_4$ nanowire arrays	Lithium-foil/sodium-foil	1 M $LiPF_6$ in a mixture of EC/DEC/EMC (1 : 1 : 1 by volume)	Celgard 2400	507 mA h g^{-1} at 4000 mA g^{-1}	100 cycles	88
Ni/Fe	3D graphene foam/carbon	Graphene foam/carbon	6 m KOH	/	120 mAh g^{-1} at	1000 cycles	89

battery	nanotubes/Ni(OH)$_2$ hybrid film	nanotubes/Fe_2O_3 hybrid film			0.3 A g^{-1}		
Lithium-ion battery	3D SnO_2@TiO_2 double-shell nanotubes on carbon cloth	Lithium foil	1 M solution of $LiPF_6$ in EC and DEC (1:1 by volume)	Microporous polypropylene membrane	778.8 mA h g^{-1} at 780 mA g^{-1}	100 cycles	90
Li-ion battery	3D ordered macroporous TiO_2 electrode	Li metal	7:3 (v/v) EC and DC electrolyte solution containing 1M $LiPF_6$	Celgard 2500	174 mAh g^{-1} at 2 A g^{-1}	1000 cycles	91
Lithium-ion battery	3D carbon nanotubes on graphene/PET film	Lithium metal	1M solution of $LiPF_6$ salt in a solvent mixture of EC and DMC (1:1 (v/v))	Polyester–cellulose blend paper	0.25 mAh cm^{-2}/397 mAh g^{-1} at 0.1C	80 cycles	92
Li-ion battery	TiO_2 coated 3D carbon nanostructures	Li foil	1 M $LiPF_6$ dissolved in EC and DC (1:1 by volume) containing 5.0 vol% fluoro EC	/	351mA h g^{-1} at 0.2C	8000 cycles	93
Lithium-ion battery	Cloth substrate supported $Li_4Ti_5O_{12}$ nanowall arrays	Self-standing porous $LiMn_2O_4$ nanowall arrays	1 M $LiPF_6$ in EC/DEC (v/v=1:1) solution	Celgard 2400	124.8mAhg^{-1} at 1C and 92.1 mAhg^{-1} at 20C	200 cycles	86
Lithium ion	Sn– and SnO_2–graphene	Lithium metal foil	1.2 M $LiPF_6$ in EC and DC1 : 1 (v/v)	/	1010 mA h g^{-1} at 0.05 A g^{-1} and (470 mA h	50 cycles	94

battery	flexible foams				g^{-1} at 2 A g^{-1} (~2 C)		
Solid-state zinc–air battery	Zinc powder	Co_3O_4 nanoparticles on carbon cloth	/	Conductive nanoporous cellulose membrane	492 mA h g^{-1} at 25 mA g^{-1}	over 2100 min	95
Solid lithium battery	Li metal foil	Aligned multiwalled carbon nanotubes and carbon nanohorns electrode	Poly(ethylene glycol) borate ester	/	352 mAh/g	/	11
Solid-state zinc–air battery	Zn electrode	N-doped Co_3O_4 mesoporous nanowire arrays	The gel electrolyte	NKK separator	603.7 mAh g^{-1} at 2.5 mA cm^{-3}	28 h	96
Lithium ion battery	SnO_2 nanosheets/Nickel/polyvinylidene fluoride ternary composite	Lithium metal foil	1 M $LiPF_6$ in EC and DEC (1:1 by volume) solution	Celgard 2400	1533 mAh g^{-1} at 200 mA g^{-1}	60 cycles	97
Li-ion battery	$Li_4Ti_5O_{12}$-c nanotube arrays	$LiCoO_2$ on al foil	1 M $LiPF_6$ in EC/DEC (1:1 in volume)	/	165 mAh g^{-1} At 1C (1C = 175 mA g^{-1})	500 cycles at 10C	98

Sodium/ sulfur battery	Sodium metal disc	Sulfurized polyacrylonitrile nanofiber web	1M $NaPF_6$ in EC and DEC (1:1 = v/v)	Glass fiber filter	604 mAh g^{-1} at 0.01C	200 cycles at 0.1C	99
Lithium ion battery	Metallic lithium foils	Hybrid paper of $Na_2V_6O_{16}$-x H_2O nanowires and multi-wall carbon nanotubes or carbon black	1 $MLiPF_6$ in EC/DEC (1 : 1, volume ratio)	Celgard 2400	350 mA h g^{-1} or 270 at mA h g^{-1} 50 mA g^{-1}	100 cycles at 150 mA g^{-1}	100
Lithium-ion battery	Metal fibril mat-supported silicon	Li metal	1.15 M $LiPF_6$ in EC/EMC (30/70 by vol %)) containing 5 wt % fluoroEC	Polyethylene	~3000 mAh g^{-1} at 300 mA g^{-1}	200 cycles at a 1C rate (2000 Ma g^{-1})	101
Lithium-ion battery	Lithium foil	V_2O_5 nanobelt electrode	1 M $LiPF_6$ in EC-EMC-DMC (1:1:1,volumeratio)	Porous polypropylene film	127.4 $mAhg^{-1}$ at 60 mAg^{-1}	200 cycles	102
Li-ion battery	$MgCo_2O_4$ nanowires on Ni foam	Lithium foil	1 M $LiPF_6$ dissolved in a mixture of DMC, DC, and EC (1:1:1 by Volume)	Microporous polypropylene film	1357 mAh g^{-1} at 2.5 A g^{-1}	60 cycles at 2.5 A g^{-1}	103
Li-ion battery	Carbon-Coated Germanium Nanowires on carbon	Li metal	1 M $LiPF_6$ in a mixture of EC and DEC (1:1 = w: w)	Celgard 2400	1440 mA h g^{-1} at 0.1C	100 cycles at 0.1C	104

	nanofibers						
Li-Se/Na-Se battery	carbon-selenium composite nanofibers	Li (or Na) metal	1 M $LiPF_6$/$NaClO_4$ in EC-DMC(1:1, in weight)	Glass fiber (Whatman)	1081 mAh g^{-1} at 0.05 A g^{-1}	500 cycles at 0.5 A g^{-1}/ 240 cycles at 0.5 A g^{-1}	105
Li-ion battery	Carbon nanotubes – $LiNBO_3$ nanoplate–polypyrrole hybrid	Lithium metal	1 M $LiPF_6$ in 1:1 EC/DMC	Celgard 3501	300 mA h g^{-1} at 0.4 A g^{-1}	500 cycles	106
Lithium ion battery	Carbon nanotubes/TiO_2 nanofibres composite electrodes	Lithium foil	1 M $LiPF_6$ in EC and DC (1:1 ratio)	/	200 mAh g^{-1} at 16.7 mA/g	100 cycles	107
Lithium-ion battery	CoO–graphene–carbon nanofiber mats	Lithium foil	1 M $LiPF_6$ in EC–DC (1 : 1 by volume)	Celgard 2400	400 mA h g^{-1} at 2 A g^{-1}	352 cycles at 500 mA g^{-1}	108
Lithium-ion battery	Lithium foil	Polyimide/SWCNT nanocable composite	1 M $LiN(CF_3SO_2)_2$ (LiTFSI) solution in a mixed solvent of DOL and DME (1:1, in weight)	Celgard 2325	160 mAh g^{-1} at 0.1 C	at 0.5 C for 200 cycles	109
Lithium ion	Lithium foil	Polyimide-single-walled carbon	1 m $LiN(CF_3SO_2)_2$ (LiTFSI) solution dissolved in a mixed solvent of DOL and DME (1 :	Celgard 2325	190 mA h g^{-1} at 20C	/	110

battery		nanotubes film	1, in weight)				
Lithium-ion battery	Tin nanoparticles embedded in carbon nanotubes on carbon cloth	Lithium metal	1M solution of $LiPF_6$ in EC and DEC (1:1 by vol.)	Polypropylene	2.15 $mAhcm^{-2}$ at 0.1 $mAcm^{-2}$	80 cycles	[111]
Lithium-ion battery	Aligned CuO nanosheets on conductive carbon cloth	Li foil	1M $LiPF_6$ in a 50:50 w/w mixture of EC and DEC	Celgard 2400	711.2mAh g^{-1} at 500mA g^{-1}	100 cycles	[112]
Na-ion battery	Na-metal foil	$Na_2FeP_2O_7$ nanoparticles on porous carbon cloth	1 M $NaClO_4$ dissolved in a solution of EC and PC (volume ratio of 1 : 1)	Glass microfiber	95 mA h g^{-1}	10 000 cycles	[113]
Lithium-ion battery	Carbon-coated silicon nanowires on carbon fabric	Lithium foils	1 M $LiPF_6$ in a 1:1 (v/v) mixture of EC and DMC with 5 wt% fluorinated EC	Celgard 2500	~3500 mA h g^{-1} at 100 mA g^{-1}	500 cycles at 1.0 A g^{-1}	[114]
$Na\text{-}O_2$ battery	Sodium metal foil	Co_3O_4 nanowire arrays vertically grown onto carbon textiles	0.5 M $NaCF_3SO_3$ in TEGDME	Glass fiber	4687 mAh/g	62 cycles	[38]
Lithium-ion	Lithium metal	Activated cotton textile	1 M $LiPF_6$ in EC+DMC+DEC organic solvent (1:1:1 in	Celgard	~1710 mAh g^-	at 1 C after	[115]

battery		with porous tubular fibers embedded with NiS_2 nanobowls and wrapped with conductive graphene sheets	volume)	2400	^{1} at 0.01 C	100 cycles	
Lithium ion battery	Fe_2N nanoparticles on carbon textile	Lithium foil	1M $LiPF_6$ in 1:1 by volume of EC/DMC	Celgard 2400	900mAh/g	300 cycles at 6000mA/g	116
Lithium ion battery	Red P/hollow carbon cloth composite	Lithium metal foil	1M solution of $LiPF_6$ in EC and DC (1:1 in volume)	/	1063 mAh g_{-1}	200 cycles	117
Lithium –oxygen battery	Lithium belt	TiO_2 nanowire arrays grown onto carbon textiles	1M $LiCF_3SO_3$ in TEGDME electrolyte	Glass fibre	3,000 mAhg^{-1} at 100 mAg^{-1}	1,000 cycles	118
Lithium-ion battery	$ZnCo_2O_4$ nanowire arrays/carbon cloth	Lithium foil	1 M $LiPF_6$ in EC And DEC (1:1 by volume)	Celgard 2400	1300-1400 mAh g^{-1}	160 cycles	119
Lithium-oxygen battery	Li foil	Needle-like $NiCo_2O_4$ nanowire arrays	1 M LiTFSI in TEGDME electrolyte	Glass-fiber	4221 mAh g^{-1}	200 cycles	120

Lithium ion battery	Zn_3P_2 nanowire arrays grafted on carbon fabrics	Li foil	1 M $LiPF_6$ dissolved in the mixed solvents of EC and DEC (volume Ratio = 1 : 1)	Polymer–aluminum membranes	1200 mA h g^{-1}	200 cycles	[121]

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