Electronic Supporting Information

Advances in Electrochemical Energy Storage with Covalent Organic Frameworks

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Table S1. Summary of linkages in COFs used for electrochemical applications.

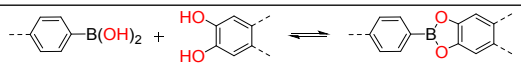
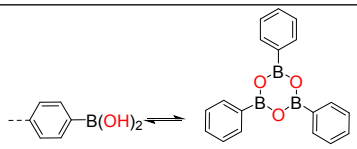
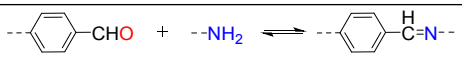
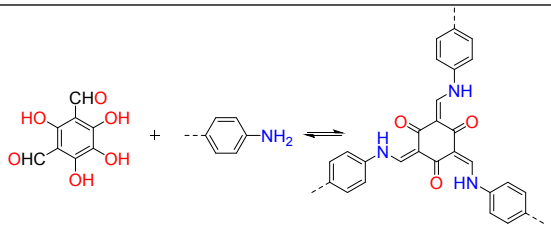
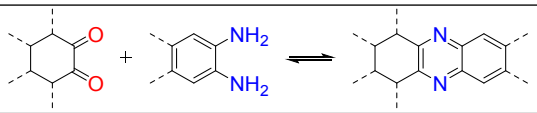
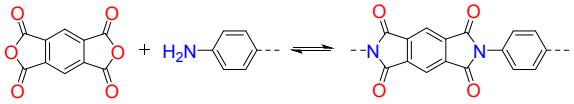
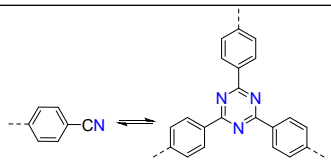
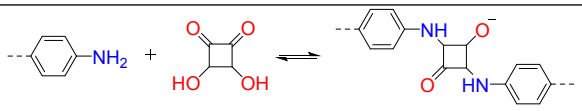
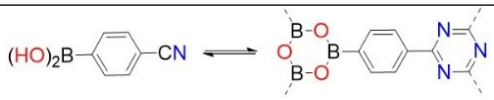
Entry	Linkage	Chemical structure
1	Boronate ester	
2	Boroxine	
3	Imine	
4	β-ketoenamine	
5	Phenazine	
6	Imide	
7	Triazine	
8	Squaraine	
9	Traizine-Boroxine	

Table S2. Summary of COFs-based capacitors.

Entry	COF name	COF composition	Surface area of COF (Pore size)	Capacitance performance (initial cycle)	Cyclability (Capacitance retention)	Ref #
1	$COF_{TTA\text{-}DHTA}$	2,5-dihydroxyterethaldehyde **and** 4,4',4''-(1,3,5-triazine-2,4,6-triyl)trianiline)	1591 $m^2 g^{-1}$ (3.42 nm)	92.4 F g^{-1} at 0.4 A g^{-1} (**EDLC**)	NH_2-f-MWCNT@$COF_{TTA\text{-}DHTA}$ = 1000 cycles with 96% retention for	78
	NH_2-f-MWCNT@$COF_{TTA\text{-}DHTA}$		1157 $m^2 g^{-1}$ (3.54 nm)	127.5 F g^{-1} at 0.4 A g^{-1} (**EDLC**)		
2	JUC-510 (used in exfoliated form) e-JUC-510	JUC = 5,10,15,20-tetrakis[(4-aminophenyl) porphyrin **and** 4,4′-(1,2-ethynediyl)bis-2-hydroxybenzaldehyde	1170 $m^2 g^{-1}$ (3.4 nm)	4.17 mF cm^{-2} at 1 V s^{-1} (**EDLC**)	10000 cycles with 100% retention for e-JUC-511 and e-JUC-512	80
	JUC-511 and e-JUC-511	Cu metal centre in porphyrin unit	842 $m^2 g^{-1}$ (3.4 nm	5.46 mF cm^{-2} at 1 V s^{-1} (**EDLC**)		
	JUC-512 and e-JUC512	Ni metal centre in porphyrin unit	704 $m^2 g^{-1}$ (3.4 nm)	5.85 mF cm^{-2} at 1 V s^{-1} (**EDLC**)		
3	g-$C_{34}N_6$-COF and thin film on SWCNT	1,3,5-tris-(4-formyl-phenyl)triazine **and** 3,5-dicyano-2,4,6-trimethylpyridine	g-$C_{34}N_6$-COF = 1003 $m^2 g^{-1}$ (1.45 nm)	g-$C_{34}N_6$-COF@SWCNT = 15.2 mF cm^{-1} at 2 mV s^{-1} (**EDLC**)	5000 cycles with 93.1% retention with COF device	79
4	DAAQ-Tp	2,6-diamonioanthraquinone **and** 1,3,5-triformylphloroglucinol	1124 ± 422 $m^2 g^{-1}$ (2.0 nm)	40 ± 9 F g^{-1} at 0.1 A g^{-1} (**pseudocapacitive**)	5000 cycles with insignificant capacitance loss for DAAQ-Tp COF	64
	DAB-Tp	1,4-diaminobenzene **and 1**,3,5-triformylphloroglucinol	365 $m^2 g^{-1}$ (Not available)	15 ± 6 F g^{-1} at 0.1 A g^{-1} (**pseudocapacitive**)		
5	DAAQ-BTA used in composite form with 3D graphene	DAAQ-BTA = 2,6-diamonioanthraquinone **and** benzene-1,3,5-tricarbaldehyde	Not available (COF loading on 3D graphene at 0.053 ± 0.014 mg cm^{-2} and 180 nm thickness[j]	31.7 mF cm^{-2} at 0.5 mA cm^{-2} for 180 nm thick sample (**pseudocapacitive**)	70% capacitance loss over 500 cycles and stabilized at 7.6 mF cm^{-2} for 2000 cycles.	65
6	DAAQ-Tp thin film on Au substrate	DAAQ-Tp = 2,6-diamonioanthraquinone **and** 1,3,5-triformylphloroglucinol	Same as entry #5 (60-560 nm thickness)	3.0 mF cm^{-2} at 0.15 mA cm^{-2} for 250nm thick sample (**pseudocapacitive**)	5000 cycles wit 93% retention	54
7	poly(3,4-ethylenedioxythiophene modified DAAQ-Tp COF film on gold substrate	2,6-diamonioanthraquinone **and** 1,3,5-triformylphloroglucinol	Same as entry #5 (1 µm thickness)	350 F cm^{-3} at 1600 C and 450 F cm^{-3} at 100 C (**pseudocapacitive**)	10000 cycles with full retention at 100 C	49
8	$TpPa\text{-}(OH)_2$	2,5-diaminohydroquinone **and** 1,3,5-triformylpholoroglucinol	369 $m^2 g^{-1}$ (1.38 nm)	396 F g^{-1} at 2 mV s^{-1} (**pseudocapacitive**)	66% retention over 10000 cycles for $TpPa\text{-}(OH)_2$	72
	$TpBD\text{-}(OH)_2$	4,4′-diamino-3,3′-diolbiphenyl **and** 1,3,5-triformylpholoroglucinol	197 $m^2 g^{-1}$ (1.4 nm)	86 F g^{-1} at 2 mV s^{-1} (**pseudocapacitive**)		
9	$DAAQ_xDa_yTp$ When X = 0, 1 or 2 then Y= 1, 2 or 1 Used as free-standing films	2,6-diamonioanthraquinone (DAAQ), 2,6-diaminoanthracene (Da) **and** 1,3,5-triformylphloroglucinol	$DAAQ_2Da_1Tp$ = 1004 $m^2 g^{-1}$	$DAAQ_2Da_1Tp$ = 122 F g^{-1} at 1.56 mA cm^{-2} $DAAQ_1Da_1Tp$ = 111 F g^{-1} at 1.56 mA cm^{-2} (**pseudocapacitive**)	78% retention over 7000 cycles for $DAAQ_1Da_1Tp$	68
			$DAAQ_1Da_2Tp$ = 1400 $m^2 g^{-1}$			
			$DAAQ_1Da_1Tp$ = 804 $m^2 g^{-1}$			
10	$[TEMPO]_{50\%}$-NiP	2,5- bis(2-propynyloxy)terephthalaldehyde **and** 2,5-dimethoxyterephthalaldehyde	264 $m^2 g^{-1}$ (1.65 nm)	101 F g^{-1} at 2 A g^{-1} (**pseudocapacitive**)	Full retention over 100 cycles at 0.5 A g^{-1}	69
	$TEMPO]_{100\%}$-NiP		5.2 $m^2 g^{-1}$ (1.4 nm)	113 F g^{-1} at 2 A g^{-1} (**pseudocapacitive**)		
11	TpPa-Py	TpPa-Py = 1,4-diaminopyridine **and** 1,3,5-triformylphloroglucinol	687 $m^2 g^{-1}$ (1.5 nm)	209 F g^{-1} at 0.5 A g^{-1} (**pseudocapacitive**)	92% retention over 6000 cycles at 2 A g^{-1} for TpPa-Py	70
	DAB-Tp	DAB-Tp = 1,4-diaminobenzene **and** 1,3,5-triformylphloroglucinol	385 $m^2 g^{-1}$ (NA)	98 F g^{-1} at 0.5 A g^{-1} (**pseudocapacitive**)		
12	TDFP-1	1,3,5-tris-(4-aminophenyl)triazine **and** 2,6-diformyl-4-methylphenol	651 $m^2 g^{-1}$ (1.5 nm)	354 F g^{-1} at 2 mV s^{-1} (**pseudocapacitive**)	95% retention over 1000 cycles at 10 A g^{-1}	71
13	IISERP-COF10	(5,5′,5′′-(1,3,5-triazine-2,4,6-triyl)tris(pyridine-2-amine) **and** 2-hydroxybenzene-1,3,5-tricarbaldehyde	1233 $m^2 g^{-1}$ (1.08 nm)	546 F g^{-1} at 0.5 A g^{-1} (**pseudocapacitive**)	70% retention over 5000 cycles at 5 A g^{-1}	73
	IISERP-COF11	2,4-dihydroxybenzene-1,3,5-tricarbaldehyde	921 $m^2 g^{-1}$ (0.54 nm)	390 F g^{-1} at 0.5 A g^{-1} (**pseudocapacitive**)	75% retention over 5000 cycles at 5 A g^{-1}	
	IISERP-COF-12	2,4,6-dihydroxybenzene 1,3,5-tricarbaldehyde	1067 $m^2 g^{-1}$ (0.54 nm	300 F g^{-1} at 0.5 A g^{-1} (**pseudocapacitive**)	82% retention over 5000 cycles at 5 A g^{-1}	

14	PDC-MA	1,4-piperazinedicarboxaldehyde **and** melamine	748.2 $m^2 g^{-1}$ (1.9 nm)	335 F g^{-1} at 1 A g^{-1} (**pseudocapacitive**)	78% retention over 9000 cycles at 5 A g^{-1}	74
15	Hex-AZA-COF-1	hexaketocyclohexane octahydrate **and** 1,2,4,5-benzenetetramine	85 $m^2 g^{-1}$ (NA)	220 F g^{-1} at 1 A g^{-1} (**pseudocapacitive**)	RuO_2//Hex-Aza-COF-3 device fabricated 64 F g^{-1} at 1 A g^{-1} and 89.5% capacitance retention over 7500 cycles	76
	Hex-AZA-COF-2	hexaketocyclohexane octahydrate **and** 1,2,4,5-tetramino-benzoquinone	96 $m^2 g^{-1}$ (NA)	585 F g^{-1} at 1 A g^{-1} (**pseudocapacitive**)		
	Hex-AZA-COF-3	hexaketocyclohexane octahydrate **and** 2,3,6,7-tetraamino-phenazine hydrochloride	124 $m^2 g^{-1}$ (NA)	663 F g^{-1} at 1 A g^{-1} (**pseudocapacitive**)		

Table S3. Summary of COFs in Alkali and Zinc ion Battery.

Entry	COF name	COF composition	Surface area of COF (Pore Size)	Electrolyte (COF loading %)	Battery Performance (Initial cycle)	Cyclability (capacity retention)	Ref #
1 (LIB)	D_{TP}-A_{NDI} COF	2,3,6,7,10,11-hexahydoxytriphenylene **and** N,N'-di-(4-boronophenyl)-naphthalene-1,4,5,8-tetracarboxylic acid diimide	1583 $m^2 g^{-1}$ (5.06 nm)	1.0 M $LiPF_6$ in EC/DMC (1:1, wt%) [64 wt%]	42 mAh g^{-1} at 0.2 A g^{-1}	Not Available	88
	D_{TP}-A_{NDI} COF@CNT		678 $m^2 g^{-1}$ (5.06 nm)		67 mAh g^{-1} at 0.2 A g^{-1}	100% retention over 700 cycles	
2 (LIB)	PIBN	Tetramino-benzoquinone **and** Pyromellitic dianhydride with and without graphene	Not Available (1.5 nm)	1.0 M LiTFSI in DOL/DME (1:1, v/v) [60 wt%]	244.8 mAh g^{-1} at 0.1 C	Not Available	89
	PIBN-G				280 mAh g^{-1} at 0.1 C	88% retention over 300 cycles at 5C	
3 (LIB)	BQ1-COF	Tetramino-benzoquinone **and** hexaketocyclohexane octahydrate	94.73 $m^2 g^{-1}$ (1.35 nm)	1.0 M LiTFSI in DOL/DME (1:1, v/v) [50 wt%]	502.4 mA h g^{-1} at 0.05C	81% retention over 1,000 cycles at 2C	90
4 (LIB)	PPTODB with CNT	4,5,9,10-tetraone-pyrene-2,7-diboronic acid	Not Available	1.0 M $LiPF_6$ in EC/DMC (1:1, v/v) [70 wt%]	198 mAh g^{-1} at 20 mA g^{-1}	68.3% retention over 150 cycles at 20 mA g^{-1}	91
5 (LIB)	DAAQ-ECOF (exfoliated, 3-5 nm thick)	2,6-diamonioanthraquinone **and** 1,3,5-triformylphloroglucinol	216 $m^2 g^{-1}$ (Not Available)	1.0 M LiTFSI in TEGDME [60 wt%]	145 mAh g^{-1} at 20 mA g^{-1}	98% retention over 1800 cycles at 0.5 A g^{-1}	60
6 (LIB)	PI-ECOF-1	tris(4-aminophenyl)amine **and** pyromellitic anhydride	223 $m^2 g^{-1}$ (3.1 nm)	1.0 M LiTFSI in DOL/DME (1:1, v/v) [60 wt%]	151 mA h g^{-1} at 1C (used as 50 wt% rGO composites)	72.8% retention at 1C	92
	PI-ECOF-2 (LIB)	1,3,5-tris(4-aminophenyl)benzene and pyromellitic anhydride	173 $m^2 g^{-1}$ (3.7 nm)		124 mA h g^{-1} at 1C (used as 30 wt% rGO composites)	72.5% retention over 300 cycles at 1C	
7 (LIB)	Tp-DANT	2,7-diamino naphthalene diimide **and** 1,3,5-triformylphloroglucinol	511 $m^2 g^{-1}$ (1.6 nm)	1.0 M $LiPF_6$ in EC/DEC (1:1, v/v) [60 wt%]	104.3 mAh g^{-1} at 0.37C	Full retention after 200 cycles at 1.5 C	93
	Tb-DANT	2,7-diamino naphthalene diimide **and** 1,3,5-tricarbaldehyde	376 $m^2 g^{-1}$ (1.6 nm)		144.4 mAh g^{-1} at 0.34C	63% retention after 200 cycles at 1.4C	
8 (LIB)	DAPH-Tp	2,7-diaminophenazine·benzophenoneimine **and** 1,3,5-triformylphloroglucinol	1155 $m^2 g^{-1}$ (2.2 nm)	1.0 M $LiPF_6$ in EC/DEC (1:1, v/v) [60 wt%]	81.7 mAh g^{-1} at 0.5C	60% retention over 500 cycle at 20C	94
	PEDOT@DAPH-Tp		230 $m^2 g^{-1}$ (Not Available)		93.2 mAh g^{-1} at 0.5C	51% retention over 500 cycle at 20C	
9 (LIB)	TFPB	1, 2, 4, 5-Tetrakis-(4-formylphenyl) benzene **and** 1,4-diaminobenzene	458 $m^2 g^{-1}$ (2.2 nm)	1.0 M $LiPF_6$ in EC/DEC (1:1, v/v) [80 wt%]	126 mAh g^{-1} at 0.1 A g^{-1}	No loss in 300 cycles at 0.1 A g^{-1}	82
	E-TFPB/MnO_2 (1.6-2.0 nm thickness)		345 $m^2 g^{-1}$ (2.2 nm)		1349 mAh g^{-1} at 0.1 A g^{-1}		
10 (LIB)	FCTF	2,3,5,6-tertrafluorobenzonitrile	1006 $m^2 g^{-1}$ (1.4 nm)	1.0 M $LiPF_6$ in EC/DEC (1:1, v/v)	576 mAh g^{-1} at 0.1 A g^{-1}	No loss in 300 cycles at 0.1 A g^{-1}	96

	E-FCTF (exfoliated, 4-5 nm thickness)		583 $m^2 g^{-1}$ (1.4 nm)	[80 wt%]	1035 mAh g^{-1} at 0.1 A g^{-1}		
11 (LIB)	IISERP-CON-1	1,3,5-triformylphloroglucinol **and** 3,5-diamino-1,2,4-triazole	507 m2 g-1 (1.3-1.7 nm)	1.0 M $LiPF_6$ in EC/DMC (1:1, v/v) [75 wt%]	720 mAh g^{-1} at 0.1 A g^{-1}	98% retention over 1000 cycles at 0.5 A g^{-1}	97
12 (LIB)	Tp-Azo	4,4′-diaminoazobenzene **and** 1,3,5-triformylphloroglucinol	632 $m^2 g^{-1}$ (2.6 nm)	1.0 M LiTFSI in DOL/DME (1:1, v/v) with 5 wt% $LiNO_3$ [80 wt%]	306 mAh g^{-1} at 1 A g^{-1}	Full capacity retention over 3000 cycles	98
13 (LIB)	COF-TRO	Truxenone-based triamine **and** 1,3,5-triformylphloroglucinol	156 $m^2 g^{-1}$ (1.6 nm)	Li_6PS_5Cl and A77.5 (solid state electrolyte) [50 wt%]	268 mAh g^{-1} at 0.1C	99.9% retention over 100 cycles at 0.1C	93
14 (LIB)	Thiazole-fused ring-linked azo COF	4,4′-diaminoazobenzene, benzene-1,3,5-tricarbaldehyde and elemental sulfur	649 $m^2 g^{-1}$ (2.8 nm)	1.0 M LiTFSI in DOL/DME (1:1, v/v)	120 mAh g^{-1} at 1C	99.99% retention over 5000 cycles at 10C	102
15 (SIB)	TFPB-TAPT	1,3,5-tris(4-formyl phenyl) benzene and 1,3,5-tris(4-amino phenyl)-triazine	120 $m^2 g^{-1}$ (2.3 m)	1.0 M $NaPF_6$ in EC/DMC (1:1, v/v) [NA]	246 mAh g^{-1} at 30 mA g^{-1}	50.8% retention over 500 cycles	109
16 (SIB)	DAAQ-COF (4-12 nm, 50-85 nm, 100-180 nm and 100-25 nm thickness)	1,3,5-triformylphloroglucinol **and** 2,6-diaminoanthraquinone	NA (NA)	1.0 M $NaClO_4$ in EC/DMC (1:1, v/v) [60 wt%]	420 mAh g^{-1} at 100 mA g^{-1} (4-12 nm thick sample)	99% retention over 10000 cycles at 5 A g^{-1}	113
17 (PIB)	COF-10	4,4′-biphenyldiboronic acid **and** 2,3,6,7,10,11-hexahydroxytriphenylene	3.06 nm	1.0 M KFSI in DEC/EC (1:1, v/v) [70 wt%]	203 mAh g^{-1} at 25 mA g^{-1}	Stable capacity retention over initial few cycles	116
	COF-10@CNT		3.09 nm		330 mAh g^{-1} at 25 mA g^{-1}		
18 (ZIB)	HqTp	1,3,5-triformylphloroglucinol **and** 1,4-hydroquinone	113 $m^2 g^{-1}$ (1.5 nm)	3.0 M $ZnSO_4$ in water [1 mg cm^{-2}]	276 mAh g^{-1} at 125 mA g^{-1}	95% retention over 1000 cycles at 3.75 A g^{-1}	118
19 (ZIB)	PA-COF	hexaketocyclohexane **and** 2, 3, 7, 8-phenazinetetramine	19.6 $m^2 g^{-1}$ (2-5 nm)	1.0 M $ZnSO_4$ in water [60 wt%]	247 mAh g^{-1} at 0.1 A g^{-1}	62% retention over 10000 cycles at 1.0 A g^{-1}	120

Table S4. Summary of COFs in Li-sulfur battery.

Entry	COF name	COF composition	Surface area of COF (Pore Size)	Electrolyte [Sulfur loading %]	Battery Performance (Initial cycle)	Cyclability (capacity retention)	Ref #
1	CTF-1	1,4-dicyanobenzene **and** $ZnCl_2$	789 $m^2 g^{-1}$ (1.23nm)	1.0 M LiTFSI in DOL/DME (1:1, v/v) [34 wt%]	541 mAh g^{-1} at 1C	63.65% retention at 0.1C over 50 cycles	121
2	Azo-COF	4,4′-diaminoazobenzene **and** 1,3,5-triformylphloroglucinol	1150 $m^2 g^{-1}$ (2.6 nm)	1.0 M LiTFSI in DOL/DME (1:1, v/v) [40 wt%]	1044 mAh g^{-1} at 1C	70% retention at 1C over 100 cycles	122
3	Por-COF	*p*-phenylenediamine **and** tetraformylphenylporphyrin	1095 $m^2 g^{-1}$ (1.55 nm)	1.0 M LiTFSI in DOL/DME (1:1, v/v) 0.2 M $LiNO_3$ [55 wt%]	1000 mAh g^{-1} at 0.1 C	`68% retention at 0.5C over 200 cycles	123
4	FCTF	Tetrafluoroterephthalonitrile **and** $ZnCl_2$	NA	1.0 M LiTFSI in DOL/DME (1:1, v/v) 0.5 wt% $LiNO_3$ [51 wt%]	1131 mA h g^{-1} at 0.5 C	73.7% retention at 0.5C over 50 cycles	127
5	COF-F	2,3,5,6-tetrafluoroterephthalaldehyde **and** 4,4′,4″-(1,3,5-triazine-2,4,6-triyl)trianiline	1532 $m^2 g^{-1}$ (2.8 nm)	1.0 M LiTFSI in DOL/DME (1:1, v/v) 1.0 wt% $LiNO_3$ [60 wt%]	1120 mA h g^{-1} at 0.1 C	55.3% retention at 1C over 1000 cycles	128
6	COF-V	2, 5- divinylterephthalaldehyde **and** 1,3, 5-tris(4-aminophenyl)benzene	1800 $m^2 g^{-1}$ (3.0 nm)	1.0 M LiTFSI in DOL/DME (1:1, v/v) 0.1 M $LiNO_3$ [67 wt%]	1324 mAh g^{-1} at 0.2C	69% retention at 1C over 1000 cycles	129
7	COF-1	4, 4- biphenyldiboronic acid **and** 2, 3, 6, 7, 10, 11-hexahydroxytriphenylene	430 $m^2 g^{-1}$ (1.5 nm)	1.0 M LITFSI in TEGDME, 2 wt% $LiNO_3$ [40 wt%]	1628 mAh g^{-1} at 0.2C	57% retention at 0.2C over 100 cycles	130
8	TB-COF	4-cyanophenylboronic acid	708 $m^2 g^{-1}$ (1.2 nm)	1.0 M LiTFSI in DOL/DME (1:1, v/v) 1.0 wt% $LiNO_3$ [40 wt%]	1390 mAh g^{-1} at 0.2C	68% retention at 0.2C over 250 cycles	131
9	EB-COF-Br	1,3,5-triformylphloroglucinol **and** ethidium bromide	704 $m^2 g^{-1}$ (1.3 nm)	1.0 M LiTFSI in DOL/DME (1:1, v/v) 0.1 M $LiNO_3$ [71.7wt%]	787 mAh g^{-1} at 0.5C	70% retention at 0.5C over 500 cycles	132
10	TiO_2/COF	1,4-dicyanobenzene	809 m^2 g-1 (1.71 m)	1.0 M LITFSI in TEGDME, 2 wt% $LiNO_3$ [70 wt%]	1224 mAh g^{-1} at 0.2C	76% retention at 0.5C over 800 cycles	133

Table S5. Summary of COFs as proton conductors.

Entry	COF name	COF composition	Surface area of COF (Pore Size)	External Loading (extrinsic conductivity)	Protonic Conductivity	Ref. #
1	TpAZO	4,4′-diaminoazobenzene **and** 1,3,5-triformylphloroglucinol	1328 $m^2 g^{-1}$ (2.7 nm)	Phosphoric acid (NA)	6.7 x $x10^{-5}$ S cm^{-1} at 340 K under anhydrous conditions	100
					9.9 x 10^{-4} S cm^{-1} at 332 K at 98% RH	
2	TpPa-SO_3H	1,4-diaminobenzene-2-sulphonic acid **and** 1,3,5-triformylphloroglucinol	215 $m^2 g^{-1}$ (1.45 nm)	Phytic acid (NA)	3.0 x 10^{-4} S cm^{-1} at 393 K Under anhydrous conditions	137
	TpPa-(SO_3H-Py)	1,4-diaminobenzene-2-sulphonic acid, 1,4-diamino-2pyridine **and** 1,3,5-triformylphloroglucinol	370 $m^2 g^{-1}$ (1.45nm)		5 x 10^{-4} S cm^{-1} at 393 K under anhydrous conditions	
3	TPB-DMTP-COF	1,3,5-tri(4-aminophenyl) benzene **and** 2,5-dimethoxyterephthalaldehyde	2098 $m^2 g^{-1}$ (3.26 nm)	Triazole (180 wt%)	1.1 x 10^{-3} S cm^{-1} at 403 K	139
				Imidazole (155 wt%)	4.37 x 10^{-3} S cm^{-1} at 403 K	
4	EB-COF-PW_{12}	1,3,5-triformylphloroglucinol **and** ethidium bromide (Br^- exchanged with $PW_{12}O_{40}^{3-}$)	8 $m^2 g^{-1}$ (NA)	NO external loading	3.32 x x10-3 S cm^{-1} at RT and 97% RH	140
5	Aza-COF-1	Hexaaminotriphenylene hexahydrochloride **and** hexaketocyclohexane octahydrate	99 $m^2 g^{-1}$ (0.99 nm)	Phosphoric acid	to 1.23 × 10^{-3} S cm^{-1} at 323 K and 97% RH	141
	Aza-COF-2	1,2,4,5-benzenetetramine tetrahydrochloride **and** hexaketocyclohexane octahydrate	102 $m^2 g^{-1}$ (0.99 nm)		4.80 × 10^{-3} S cm^{-1} at 323 K and 97% RH	
6	TpAZo	4,4′-diaminoazobenzene **and** 1,3,5-triformylphloroglucinol	~2600 $m^2 g^{-1}$ (2.8 nm)	*p-T*oluenesulfonic acid (8-12 wt%)	7.8 x 10^{-2} S cm^{-1} at 353 K and 95% RH	144
7	NKCOF-1	2,4,6-trihydroxybenzene-1,3,5-tricarbaldehyde **and** Boc-protected trisazophenylphloroglucinol	1011 $m^2 g^{-1}$ (1.8 nm)	Phosphoric acid (8.1 wt%)	1.13 x 10^{-1} S cm^{-1} for at 353 K with 98%	145
8	COF-F_6	1,3,5-triformylbenzene **and** fluorocarbon-based hydrazide	233 $m^2 g^{-1}$ (1.1 nm)	Phosphoric acid (62 wt%)	4.2 x 10^{-2} S cm^{-1} at 313 K under anhydrous conditions	147
9	EB-COF	1,3,5-triformylphloroglucinol **and** ethidium bromide	670 m+ g^{-1} (1.66 nm)	Phosphoric acid	2.77 x 10^{-2} S cm^{-1} at 453 K under anhydrous conditions	148
10	Py-BT-COF	1,3,6,8-Tetrakis(4-aminophenyl)pyrene **and** 2,2′-bithiophene-5,5′-dicarboxaldehyde	1895 $m^2 g^{-1}$ (2.5 nm)	Imidazole (50 wt%)	3.08 × 10^{-3} S cm^{-1} at 403 K under anhydrous conditions	149
	Py-TT-COF	1,3,6,8-Tetrakis(4-aminophenyl)pyrene **and** thieno[3,2-*b*]thiophene-2,5-dicarboxaldehyde	NA		2.92 × 10^{-3} at 403 K under anhydrous conditions	
	Py-BD-COF	1,3,6,8-Tetrakis(4-formylphenyl)pyrene **and** 4,4′-biphenyldiamine	NA		8.20 × 10^{-4} S cm^{-1} at 403 K under anhydrous conditions	

Table S6. Summary of COFs as ion conductors.

Entry	COF name	COF composition (nature)	Surface area of COF (Pore Size)	External loading	Ion Conductivity (transference number)	Ref. #
1	ICOF-1	(3, 6-di (prop-1-yn-1-yl)-9H-fluorene-9, 9-diyl)bis(methylene)diacetate based macrocycle **and** trimethyl borate **(anionic)**	1022 $m^2 g^{-1}$ (1.1 nm)	Propylene carbonate (55 wt%)	NA	151
	ICOF-2	(3, 6-di (prop-1-yn-1-yl)-9H-fluorene-9, 9-diyl)bis(methylene)diacetate based macrocycle **and** trimethyl borate **(anionic)**	1259 $m^2 g^{-1}$ (2.2 nm)		3.05 x 10^{-5} S cm^{-1} at RT (0.80)	
2	CD-COF-Li	γ-cyclodextrin **and** trimethyl borate **(anionic)**	760 $m^2 g^{-1}$ (0.64 nm)	$LiPF_6$ (20 wt%)	2.7 x 10^{-3} S cm^{-1} at 303 K (NA)	151
3	Ge-COF-1	germanium dioxide **and** 9,10-dimethyl-2,3,6,7-tetrahydroxy-anthracene **(anionic)**	808 $m^2 g^{-1}$ (1.5 nm)	$LiPF_6$ (20 wt%)	3.5 x 10^{-3} S cm^{-1} at 373 K (0.67)	152
4	Li-CON-TFSI	Triaminoguanidinium halide **and** 1,3,5-triformylphloroglucinol **(cationic)**	118 $m^2 g^{-1}$ (NA)	LiTFSI (NA)	2.09 × 10^{-4} S cm^{-1} at 343 K (0.61)	153
5	TPB-DMTP-COF	1,3,5-tri(4-aminophenyl)benzene **and** 2,5-dimethoxyterephthalaldehyde **(neutral)**	2658 $m^2 g^{-1}$ (3.26 nm)	$LiClO_4$ (5.0 wt% Li^+)	5.37 × 10^{-6} S cm^{-1} at 353 K (NA)	155
	TPB-BMTP-COF	1,3,5-tri(4-aminophenyl)benzene **and** 2,5-bis((2-methoxyethoxy)methoxy)terephthalaldehyde **(neutral)**	1746 $m^2 g^{-1}$ (3.02 nm)	$LiClO_4$ (4.6 wt% Li^+)	1.66 × 10^{-4} S cm^{-1} at 353 K (NA)	
6	COF-PEO-9	1,3,5-Trisformylbenzene **and** 2,5-bis((2,5,8,11,14,17,20,23,26- nonaoxaoctacosan-28-yl)oxy)terephthalohydrazide **(neutral)**	5 $m^2 g^{-1}$ (NA)	LiTFSI (O/Li = 5.9/1.0 wt%)	1.33 x 10^{-3} S cm^{-1} at 473 K (NA)	157
7	DBC-2P	N,N',N'',N'''-(dibenzo[g,p]chrysene-2,7,10,15-tetrayl)tetrakis(1,1-diphenylmethanimine) **and** 1,1'-biphenyl]-4,4'-dicarbaldehyde **(neutral)**	1203 $m^2 g^{-1}$ (1.19 nm and 3.24 nm)	Polyethylene glycol-$LiBF_4$ (34 wt%)	2.31×10^{-3} Scm^{-1} at 343 K and 98% RH	159
8	TpPa-SO_3Li	1,3,5-triformylphloroglucinol **and** 1,4-diaminobenzene-2-sulphonic acid (anionic) (anionic)	348 $m^2 g^{-1}$ (1.18 nm)	LiOAc 2.31 wt% Li^+	2.7 × 10^{-5} S cm^{-1} (0.9)	160
9	H-Li-ImCOF	1,3,5-Trisformylbenzene **and** 4,7-di(4-aminophenyl)-5,6-dimethyl-1H-benzimidazole (anionic)	1120 $m^2 g^{-1}$ (3.0 nm)	NONE added (Lithaition done using *n*-BuLi)	5.3 × 10^{-3} S cm^{-1} (0.88)	161
	CH_3-Li-ImCOF	1,3,5-Trisformylbenzene **and** 4,7-di(4-aminophenyl)-2,5,6-trimethyl-1H-benzimidazole (anionic)	460 $m^2 g^{-1}$ (2.3.18 nm)		8.0 x 10^{-5} S cm^{-1} (0.93)	
	CF_3-Li-ImCOF	1,3,5-Trisformylbenzene **and** 4,7-di(4-aminophenyl)-5,6-dimethyl-2-(trifluoromethyl)-1H-benzimidazole (anionic)	705 $m^2 g^{-1}$ (2.2 nm)		7.2 × 10^{-3} S cm^{-1} (0.81)	
10	TpPa$SO_3Zn_{0.5}$	1,3,5-triformylphloroglucinol **and** 1,4-diaminobenzene-2-sulphonic acid (anionic)	472 $m^2 g^{-1}$ (1.3 nm)	$Zn(OAc)_2$ (9.82 wt% Zn^{2+})	2.2 × 10^{-4} S cm^{-1} at RT (0.91)	162