

## **Electrolytes**

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## A. Salts for Electrolytes

No.	Description
1.	Lithium Hexafluorophosphate, LiPF <sub>6</sub>
2.	Lithium Tetrafluoroborate, LiBF <sub>4</sub>
3.	Lithium Perchlorate, LiClO <sub>4</sub>
4.	Lithium Trifluoromethanesulfonate, LiCF <sub>3</sub> SO <sub>3</sub>
5.	Lithium bis(oxalato)borate, LiBC <sub>4</sub> O <sub>8</sub>
6.	Tetraethylammonium Tetrafluoroborate, (C <sub>2</sub> H <sub>5</sub> ) <sub>4</sub> NBF <sub>4</sub>
7.	Lithium bis(trifluoromethanesulfonyl)imide, LiN(CF <sub>3</sub> SO <sub>2</sub> ) <sub>2</sub>
8.	Methyltriethylammonium Tetrafluoroborate, CH <sub>3</sub> (C <sub>2</sub> H <sub>5</sub> ) <sub>3</sub> NBF <sub>4</sub>

### Specifications for Salts:

Molecular Formula	Purity	Moisture	Free acid	SO <sub>4</sub> <sup>2-</sup>	Na/K/Ca/Fe/Pb	Cl-
LiPF <sub>6</sub>	≥99.9%	≤10ppm	≤100ppm	≤10ppm	≤5ppm	≤5ppm
LiBF <sub>4</sub>	≥99.0%	≤200ppm	/	/	≤10ppm	≤5ppm
LiClO <sub>4</sub>	≥99.0%	≤200ppm	/	≤50ppm	≤10ppm	≤15ppm
LiCF <sub>3</sub> SO <sub>3</sub>	≥99.5%	≤200ppm	≤100ppm	≤50ppm	≤10ppm	≤10ppm
LiBC <sub>4</sub> O <sub>8</sub>	≥99.0%	≤300ppm	≤100ppm	≤50ppm	≤10ppm	≤10ppm
(C <sub>2</sub> H <sub>5</sub> ) <sub>4</sub> NBF <sub>4</sub>	≥99.0%	≤150ppm	≤100ppm	≤50ppm	≤10ppm	≤10ppm
LiN(CF <sub>3</sub> SO <sub>2</sub> ) <sub>2</sub>	≥99.5%	≤200ppm	/	≤50ppm	≤10ppm	≤10ppm
CH <sub>3</sub> (C <sub>2</sub> H <sub>5</sub> ) <sub>3</sub> NBF <sub>4</sub>	≥99.0%	≤200ppm	≤100ppm	≤50ppm	≤10ppm	≤10ppm

## B. High Purity Solvents

No.	Description
1.	Dimethyl carbonate, C <sub>3</sub> H <sub>6</sub> O <sub>3</sub>
2.	Diethyl carbonate, C <sub>5</sub> H <sub>10</sub> O <sub>3</sub>
3.	Ethylene carbonate, C <sub>3</sub> H <sub>4</sub> O <sub>3</sub>
4.	Propylene carbonate, C <sub>4</sub> H <sub>6</sub> O <sub>3</sub>
5.	Ethyl methyl carbonate, C <sub>4</sub> H <sub>8</sub> O <sub>3</sub>
6.	Methyl propylene carbonate, C <sub>5</sub> H <sub>10</sub> O <sub>3</sub>
7.	1,2-dimethoxyethane, C <sub>4</sub> H <sub>10</sub> O <sub>2</sub>
8.	1,4-Butyrolactone, C <sub>4</sub> H <sub>6</sub> O <sub>2</sub>
9.	Ethyl acetate, C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>
10.	1,3-dioxolane, C <sub>3</sub> H <sub>6</sub> O <sub>2</sub>
11.	Tetrahydrofuran, C <sub>4</sub> H <sub>8</sub> O

### Specifications of high purity solvents:

Item	Unit	Specification	Test Method
Purity	%	≥99.9%	GC
Moisture	Wt ppm	≤20	Karl-Fischer
Alkaline Metals	Wt ppm	≤1	AAS
Heavy Metals	Wt ppm	≤1	AAS
Chloride	Wt ppm	≤1	Nephelometry
Sulfate	Wt ppm	≤10	Nephelometry
Colority	APHA	≤10	Pt-Co Colorimetry

### C. Electrolytes for Secondary Lithium Ion Battery

No.	Description
1.	EC/DMC 1:1(W/W) LiPF <sub>6</sub> 1mol/l
2.	EC/DEC 1:1(W/W) LiPF <sub>6</sub> 1mol/l
3.	EC/DEC/DMC 1:1:1(W/W) LiPF <sub>6</sub> 1mol/l
4.	EC/DMC/DEC 2:2:1(W/W) LiPF <sub>6</sub> 1mol/l
5.	EC/DMC/EMC 1:1:1(V/V) LiPF <sub>6</sub> 1mol/l
6.	EC/DMC/EMC 1:1:1(W/W) LiPF <sub>6</sub> 1mol/l

#### Specifications of secondary electrolytes:

Item	Unit	Specification	Item	Test Method
Moisture	Wt ppm	≤20	Purity	Karl-Fischer
HF	Wt ppm	≤50	Moisture	Titration
Cl	Wt ppm	≤1	Alkaline Metals	Nephelometry
SO <sub>4</sub>	Wt ppm	≤10	Heavy Metals	Nephelometry
Pb	Wt ppm	≤1	Chloride	AAS
Fe、Na、K、Ca	Wt ppm	≤1	Sulfate	AAS
Colority	APHA	≤50	Colority	Pt-Co Colorimetry

### D. Primary Lithium Battery Electrolytes

No.	Description
1.	PC/DME 1:1(W/W) LiClO <sub>4</sub> 1mol/l
2.	PC/DME/THF 2:1:1 (W/W) LiClO <sub>4</sub> 1mol/l
3.	PC/DME/DOL/THF 3:3:2:2 (W/W) LiClO <sub>4</sub> 1mol/l
4.	PC/DME 1:1 (W/W) LiCF <sub>3</sub> SO <sub>3</sub> 1mol/l
5.	PC/DME/THF 2:1:1 (W/W) LiCF <sub>3</sub> SO <sub>3</sub> 1mol/l

#### Specifications of primary electrolyte:

Item	Specification	Item	Specification
Moisture	≤50ppm	Na	≤10ppm
Colority	≤50APHA	K	≤10ppm
Fe	≤5PPM		

## E. Supercapacitors Electrolytes

No.	Description
1.	TEATFB/AN
2.	TEATFB/AN
3.	MTEATFB/AN
4.	TEATFB/PC
5.	MTEATFB/PC
6.	TEATFB/GBL

### Specifications of supercapacitor electrolytes:

Item	Specification	Item	Specification
Moisture	≤50ppm	Na	≤3ppm
Colority	≤50APHA	K	≤3ppm
Free acid(as HF)	≤5PPM	Fe	≤3PPM

## F. Silane Coupling Agents

No.	Description
1.	<b>Basic</b>
2.	Methyldiethoxysilane, $\text{HSiCH}_3(\text{OCH}_3)_2$
3.	Trimethoxysilane, $\text{HSi}(\text{OCH}_3)_3$
4.	Triethoxysilane, $\text{HSi}(\text{OCH}_2\text{CH}_3)_3$
5.	Tetramethoxysilane, $\text{Si}(\text{OCH}_3)_4$
6.	Tetraethoxysilane, $\text{Si}(\text{OCH}_2\text{CH}_3)_4$
7.	Methyltrimethoxysilane, $\text{CH}_3\text{Si}(\text{OCH}_3)_3$
8.	Methyltriethoxysilane, $\text{CH}_3\text{Si}(\text{OCH}_2\text{CH}_3)_3$
9.	3-Chloropropylmethyl-dimethoxysilane, $\text{Cl}(\text{CH}_2)_3\text{SiCH}_3(\text{OCH}_3)_2$
10.	3-Chloropropylmethyl-diethoxysilane, $\text{Cl}(\text{CH}_2)_3\text{SiCH}_3(\text{OCH}_2\text{CH}_3)_2$
11.	3-Chloropropyltrimethoxysilane, $\text{Cl}(\text{CH}_2)_3\text{Si}(\text{OCH}_3)_3$
12.	3-Chloropropyltriethoxysilane, $\text{Cl}(\text{CH}_2)_3\text{Si}(\text{OCH}_2\text{CH}_3)_3$
13.	<b>Amino</b>
14.	3-aminopropylmethyl dimethoxysilane, $\text{NH}_2(\text{CH}_2)_3\text{SiCH}_3(\text{OCH}_3)_2$
15.	3-aminopropylmethyldiethoxysilane, $\text{NH}_2(\text{CH}_2)_3\text{SiCH}_3(\text{OCH}_2\text{CH}_3)_2$
16.	3-aminopropyltrimethoxysilane, $\text{NH}_2(\text{CH}_2)_3\text{Si}(\text{OCH}_3)_3$
17.	3-aminopropyltriethoxysilane, $\text{NH}_2(\text{CH}_2)_3\text{Si}(\text{OCH}_2\text{CH}_3)_3$
18.	Bis[[3-trimethoxysilyl]-propyl]amine, $(\text{CH}_3\text{O})_3\text{Si}(\text{CH}_2)_3\text{NH}(\text{CH}_2)_3\text{Si}(\text{OCH}_3)_2$
19.	Bis[[3-triethoxysilyl]-propyl]amine, $(\text{C}_2\text{H}_5\text{O})_3\text{Si}(\text{CH}_2)_3\text{NH}(\text{CH}_2)_3\text{Si}(\text{OC}_2\text{H}_5)_2$
20.	3-(2-aminoethyl)-aminopropylmethyldimethoxysilane, $\text{NH}_2(\text{CH}_2)_2\text{NH}(\text{CH}_2)_3\text{SiCH}_3(\text{OCH}_3)_2$
21.	3-(2-aminoethyl)-aminopropyltrimethoxysilane, $\text{NH}_2(\text{CH}_2)_2\text{NH}(\text{CH}_2)_3\text{Si}(\text{OCH}_3)_3$
22.	3-(2-aminoethyl)-aminopropyltriethoxysilane, $\text{NH}_2(\text{CH}_2)_2\text{NH}(\text{CH}_2)_3\text{Si}(\text{OC}_2\text{H}_5)_3$
23.	N,N-diethyl-3-aminopropyltrimethoxysilane, $(\text{CH}_2\text{CH}_3)_2\text{N}(\text{CH}_2)_3\text{Si}(\text{OCH}_3)_3$
24.	3-(N,N-dimethylaminopropyl)-aminopropyl-methyldimethoxysilane, $(\text{CH}_3)_2\text{N}(\text{CH}_2)_3\text{NH}(\text{CH}_2)_3\text{SiCH}_3(\text{OCH}_3)_2$
25.	<b>Alkyl</b>
26.	n-hexyltrimethoxysilane, n-C <sub>6</sub> H <sub>13</sub> Si(OCH <sub>3</sub> ) <sub>3</sub>
27.	n-hexyltriethoxysilane, n-C <sub>6</sub> H <sub>13</sub> Si(OCH <sub>2</sub> CH <sub>3</sub> ) <sub>3</sub>

28.	n-propyltrimethoxysilane, n-C <sub>3</sub> H <sub>7</sub> Si(OCH <sub>3</sub> ) <sub>3</sub>
29.	n-propyltriethoxysilane, n-C <sub>3</sub> H <sub>7</sub> Si(OCH <sub>2</sub> CH <sub>3</sub> ) <sub>3</sub>
30.	n-octyltrimethoxysilane, n-C <sub>8</sub> H <sub>17</sub> Si(OCH <sub>3</sub> ) <sub>3</sub>
31.	n-octyltriethoxysilane, n-C <sub>8</sub> H <sub>17</sub> Si(OCH <sub>2</sub> CH <sub>3</sub> ) <sub>3</sub>
32.	n-Decyltrimethoxysilane, n-C <sub>12</sub> H <sub>25</sub> Si(OCH <sub>3</sub> ) <sub>3</sub>
33.	n-Decyltriethoxysilane, n-C <sub>12</sub> H <sub>25</sub> Si(OCH <sub>2</sub> CH <sub>3</sub> ) <sub>3</sub>
34.	n-hexadecyltrimethoxysilane, n-C <sub>16</sub> H <sub>33</sub> Si(OCH <sub>3</sub> ) <sub>3</sub>
35.	<b>Vinyl</b>
36.	Vinyltrimethoxysilane, CH <sub>2</sub> =CH Si (OCH <sub>3</sub> ) <sub>3</sub>
37.	Vinyltriethoxysilane, CH <sub>2</sub> =CH Si (OC <sub>2</sub> H <sub>5</sub> ) <sub>3</sub>
38.	vinyltri(2-methoxyethoxy)silane, CH <sub>2</sub> =CH Si (OCH <sub>2</sub> CH <sub>2</sub> OCH <sub>3</sub> ) <sub>3</sub>
39.	<b>Mercapto</b>
40.	3-Mercaptopropylmethyldimethoxysilane, HS(CH <sub>2</sub> ) <sub>3</sub> SiCH <sub>3</sub> (OCH <sub>3</sub> ) <sub>2</sub>
41.	3-Mercaptopropyltrimethoxysilane, HS(CH <sub>2</sub> ) <sub>3</sub> Si(OCH <sub>3</sub> ) <sub>3</sub>
42.	3-Mercaptopropyltriethoxysilane, HS(CH <sub>2</sub> ) <sub>3</sub> Si(OCH <sub>2</sub> CH <sub>3</sub> ) <sub>3</sub>
43.	3-thiocyanatopropyltriethoxysilane, NCS-(CH <sub>2</sub> ) <sub>3</sub> Si(OCH <sub>2</sub> CH <sub>3</sub> ) <sub>3</sub>
44.	<b>Ureido</b>
45.	3-ureidopropyltrimethoxysilane, NH <sub>2</sub> CONH(CH <sub>2</sub> ) <sub>3</sub> Si(OCH <sub>3</sub> ) <sub>3</sub>
46.	3-ureidopropyltriethoxysilane, NH <sub>2</sub> CONH(CH <sub>2</sub> ) <sub>3</sub> Si(OCH <sub>2</sub> CH <sub>3</sub> ) <sub>3</sub>
47.	<b>Glycidoxy</b>
48.	3-glycidoxypropylmethyl- diethoxysilane
49.	3-glycidoxypropyltrimethoxysilane
50.	3-glycidoxypropyltriethoxysilane
51.	<b>Phenyl</b>
52.	Diphenyldimethoxysilane, (C <sub>6</sub> H <sub>5</sub> ) <sub>2</sub> Si(OCH <sub>3</sub> ) <sub>2</sub>
53.	Phenyltrimethoxysilane, C <sub>6</sub> H <sub>5</sub> Si(OCH <sub>3</sub> ) <sub>3</sub>
54.	Phenyltriethoxysilane, C <sub>6</sub> H <sub>5</sub> Si(OC <sub>2</sub> H <sub>5</sub> ) <sub>3</sub>
55.	<b>Others</b>
56.	1.1.1.3.5.5.5-Heptamethyltrisiloxane, (CH <sub>3</sub> ) <sub>3</sub> O(H)Si (CH <sub>3</sub> ) <sub>3</sub> O (CH <sub>3</sub> ) <sub>3</sub>
57.	Phenoxytrimethylsilane, (CH <sub>3</sub> ) <sub>3</sub> SiOC <sub>6</sub> H <sub>5</sub>
58.	tri((trimethylsiloxy)methyl)propane, (CH <sub>3</sub> ) <sub>3</sub> SiOCH <sub>2</sub> ) <sub>3</sub> CC <sub>2</sub> H <sub>5</sub>

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