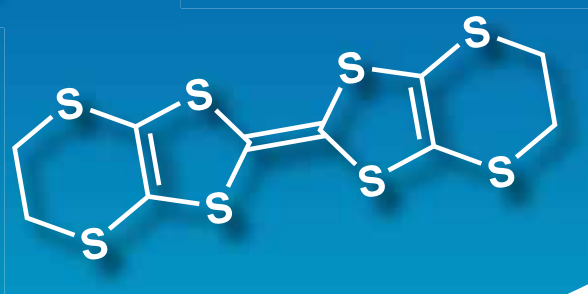
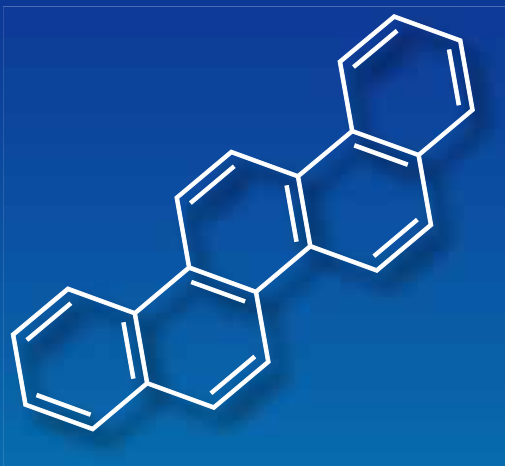


分子导体

Molecular Conductors



受体分子

供体分子

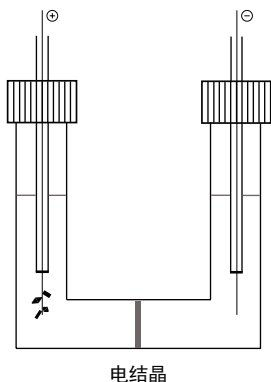
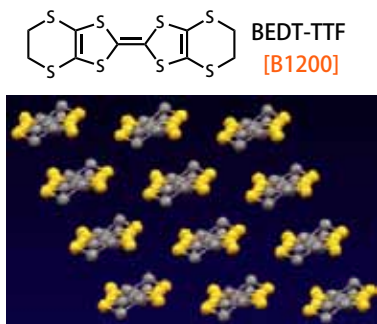
电结晶支持电解质

四硫富瓦烯(TTF)前体

分子导体

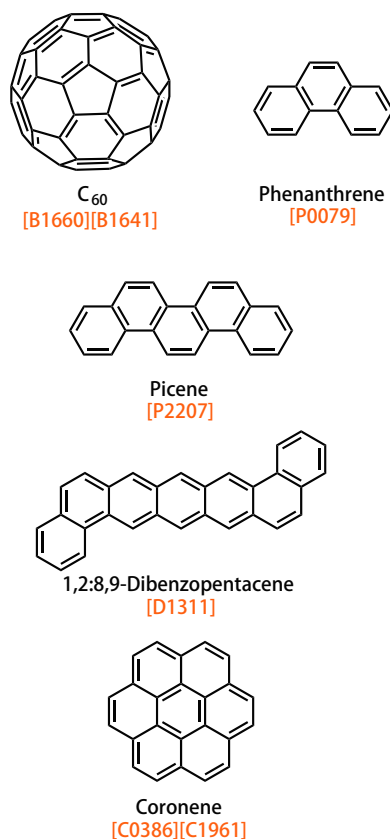
分子导体是基于分子组分的电导体。通过对分子进行化学修饰可以控制电子结构和物理性质。虽然有机分子通常是具有封闭壳结构的绝缘体，但我们可以通过载体的化学或电化学掺杂来合成开壳分子导体。第一个有机导体的例子是从溴掺杂的苝中观察到的¹⁾。之后，20世纪70年代，报道了一种基于四硫富瓦烯(TTF)的分子导体²⁾，20世纪80年代，从四硫富瓦烯的有机盐(TMTSF)₂X中观测到了首例有机分子超导体³⁾。这些TTF和TMTSF盐形成一维或伪一维分子排列。另一方面，双(亚乙基二硫代)四硫富瓦烯(BEDT-TTF)有利于形成二维分子排列，与一维排列相比，这是一种对温度相对稳定的金属状态⁴⁻⁶⁾。

TTF衍生物的导电盐通常可以通过电化学氧化(电结晶)获得⁷⁾。这些TTF衍生物可以用作带有空穴载体的供体分子。金属二硫烯配合物(M(dmit)₂), 7,7,8,8-四氰基醌二甲烷(TCNQ)和富勒烯(C₆₀)是具有电子载体的受体分子。由M(dmit)₂盐产生了首例基于受体的有机超导体⁸⁾。通过改变中心金属原子和抗衡阳离子对M(dmit)₂盐进行化学修饰，产生出大量的有机超导体⁹⁾。



多种碱掺杂的纳米碳和纳米石墨烯化合物显示出了超导性。众所周知，铷和铯掺杂的富勒烯在30 K以上具有超导性¹⁰⁾。最近，有报道称Cs₃C₆₀在38K时具有超导性¹¹⁾。虽然由TTF和M(dmit)₂合成的分子导体呈现低维分子排列，但这些富勒烯盐可以形成三维结构¹²⁾。Kubozono等人报道了碱掺杂的苝在18k时表现出了超导性¹³⁾。这一结果表明，超导性也可以从平面纳米碳材料中观察到。除基于苝的超导体外，碱掺杂的菲(Tc=5k)¹⁴⁾，碱掺杂的晕苯(Tc=15k)¹⁵⁾，和碱掺杂的1,2:8,9-二苯并五苯(Tc=33k)¹⁶⁾也显示出超导性。

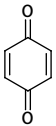
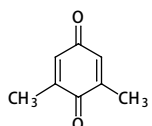
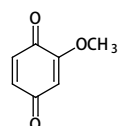
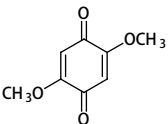
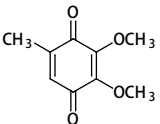
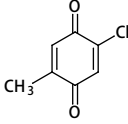
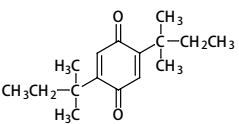
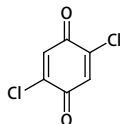
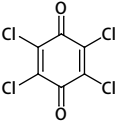
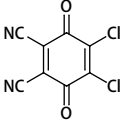
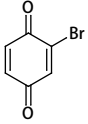
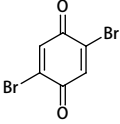
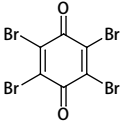
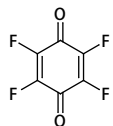
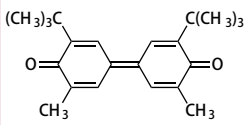
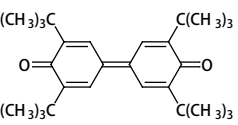
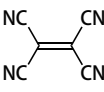
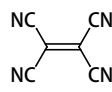
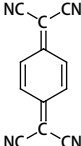
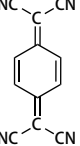
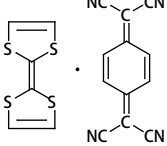
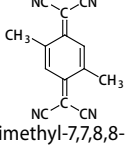
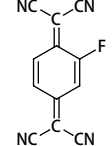
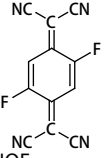
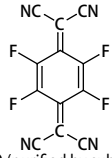
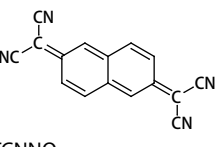
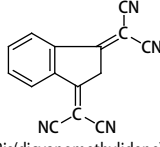
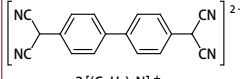
碱金属掺杂的超导材料

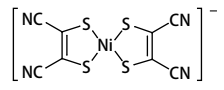
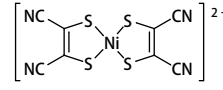
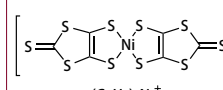
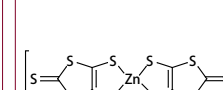
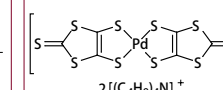
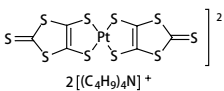
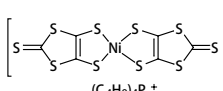
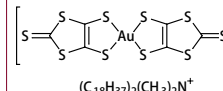
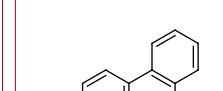
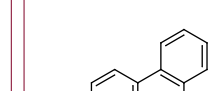
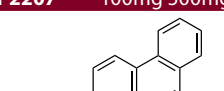
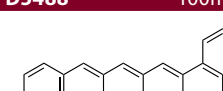
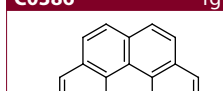
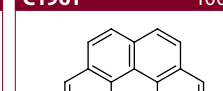

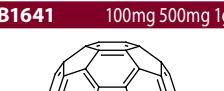
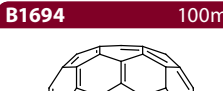
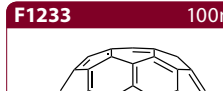


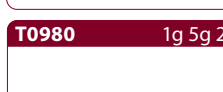


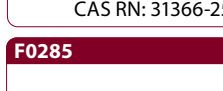
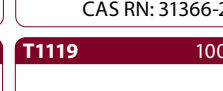
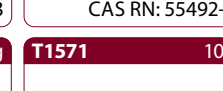
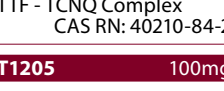
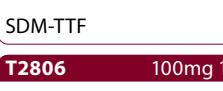
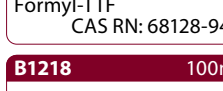
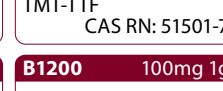
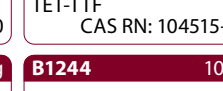

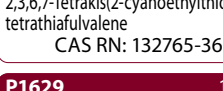



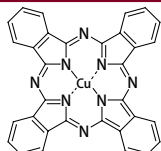
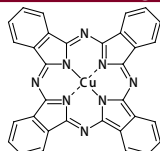
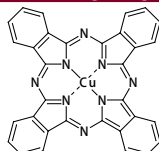
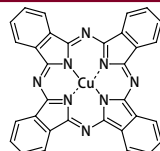
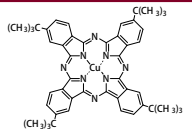
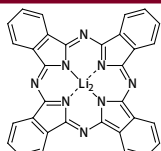
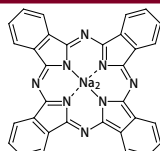
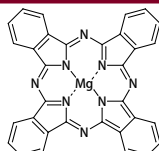
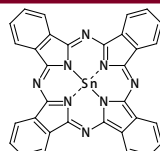
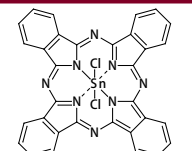
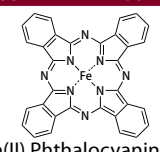
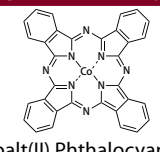
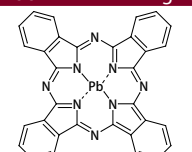
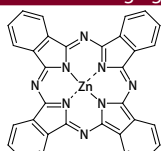
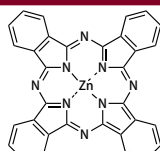
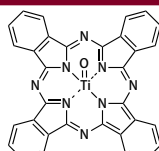
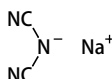
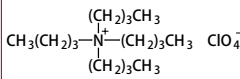
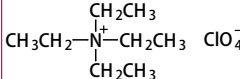
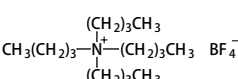
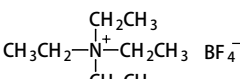
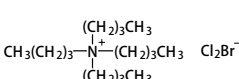
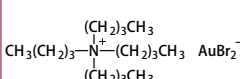
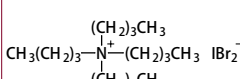
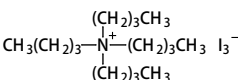
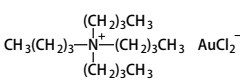
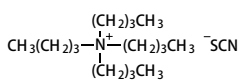
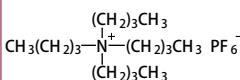
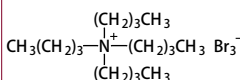
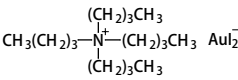
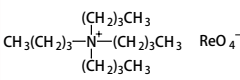
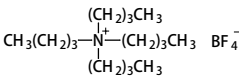
参考文献

- 1) H. Akamatu, H. Inokuchi, Y. Matsunaga, *Nature* **1954**, 173, 168.
- 2) F. Wudl, D. Wobschall, E. J. Hufnagel, *J. Am. Chem. Soc.* **1972**, 94, 670.
- 3) D. Jérôme, A. Mazaud, M. Ribault, K. Bechgaard, *J. Phys. Lett.* **1980**, 41, 95.
- 4) T. Mori, *Chem. Rev.* **2004**, 104, 4947.
- 5) R. P. Shibaeva, E. B. Yagubskii, *Chem. Rev.* **2004**, 104, 5347.
- 6) H. Mori, *Int. J. Mod. Phys. B* **1994**, 8, 1.
- 7) P. Batail, K. Boubekeur, M. Fourmigué, J.-C. P. Gabriel, *Chem. Mater.* **1998**, 10, 3005.

- 8) L. Brossard, M. Ribault, M. Bousseau, L. Valade, P. Cassoux, *C. R. Acad. Sci., Ser. II* **1986**, 302, 205.
- 9) R. Kato, *Chem. Rev.* **2004**, 104, 5319.
- 10) K. Tanigaki, T. W. Ebbesen, S. Saito, J. Mizuki, J. S. Tsai, Y. Kubo, S. Kuroshima, *Nature* **1991**, 352, 222.
- 11) A. Y. Ganin, Y. Takabayashi, Y. Z. Khimyak, S. Margadonna, A. Tamai, M. J. Rosseinsky, K. Prassides, *Nat. Mater.* **2008**, 7, 367.
- 12) Y. Takabayashi, A. Y. Ganin, P. Jeglič, D. Arčon, T. Takano, Y. Iwasa, Y. Ohishi, M. Takata, N. Takeshita, K. Prassides, M. J. Rosseinsky, *Science* **2009**, 323, 1585.
- 13) R. Mitsuhashi, Y. Suzuki, Y. Yamanari, H. Mitamura, T. Kambe, N. Ikeda, H. Okamoto, A. Fujiwara, M. Yamaji, N. Kawasaki, Y. Maniwa, Y. Kubozono, *Nature* **2010**, 464, 76.
- 14) X. F. Wang, R. H. Liu, Z. Gui, Y. L. Xie, Y. J. Yan, J. J. Ying, X. G. Luo, X. H. Chen, *Nat. Commun.* **2011**, 2, 1513.
- 15) Y. Kubozono, H. Mitamura, X. Lee, X. He, Y. Yamanari, Y. Takahashi, Y. Suzuki, Y. Kaji, R. Eguchi, K. Akaike, T. Kambe, H. Okamoto, A. Fujiwara, T. Kato, T. Kosugi, H. Aoki, *Phys. Chem. Chem. Phys.* **2011**, 13, 16476.
- 16) M. Xue, T. Cao, D. Wang, Y. Wu, H. Yang, X. Dong, J. He, F. Li, G. F. Chen, *Sci. Rep.* **2012**, 2, srep00389.

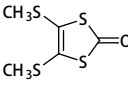
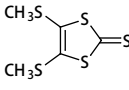
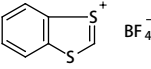
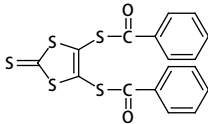
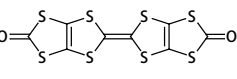
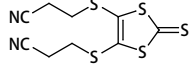
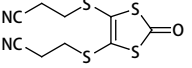
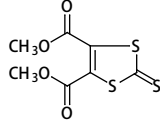

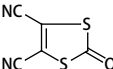
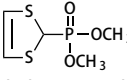
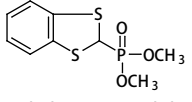
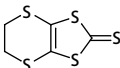
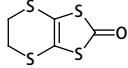
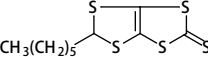
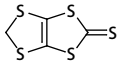
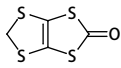
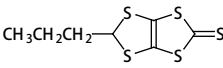
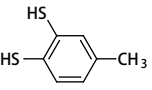
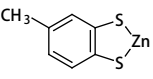
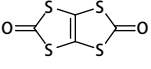
| 受体分子 Acceptor Molecules | | B0089 25g 100g 500g | D2234 1g 5g 25g | M1045 1g 5g |
|---|--|---|---|---|
| | |  1,4-Benzoquinone CAS RN: 106-51-4 |  2,6-Dimethyl-1,4-benzoquinone CAS RN: 527-61-7 |  Methoxybenzoquinone CAS RN: 2880-58-2 |
| D2250 5g 25g | D1956 1g 5g | C1336 5g | D2152 5g | D0343 1g 5g |
|  2,5-Dimethoxy-1,4-benzoquinone CAS RN: 3117-03-1 |  Coenzyme Qo CAS RN: 605-94-7 |  2-Chloro-5-methyl-1,4-benzoquinone CAS RN: 19832-87-2 |  2,5-Di-tert-amylbenzoquinone CAS RN: 4584-63-8 |  2,5-Dichloro-1,4-benzoquinone CAS RN: 615-93-0 |
| T0061 25g 100g 500g | D1070 25g 250g | B1601 1g 5g | D2249 1g 5g | T0617 5g 25g |
|  Chloranil CAS RN: 118-75-2 |  DDQ CAS RN: 84-58-2 |  2-Bromo-1,4-benzoquinone CAS RN: 3958-82-5 |  2,5-Dibromo-1,4-benzoquinone CAS RN: 1633-14-3 |  Bromanil CAS RN: 488-48-2 |
| T0790 1g 5g | D4407 1g | T1503 1g | T3264 1g 5g | T0077 5g 25g |
|  Fluoranil CAS RN: 527-21-9 |  3,3'-Di-tert-butyl-5,5'-dimethyldiphenquinone CAS RN: 2417-00-7 |  3,3',5,5'-Tetra-tert-butyl-4,4'-diphenquinone CAS RN: 2455-14-3 |  TCNE (purified by sublimation) CAS RN: 670-54-2 |  Tetracyanoethylene CAS RN: 670-54-2 |
| T0078 5g 25g | T3034 1g 5g | T2468 1g | D2021 100mg 500mg | F0509 100mg |
|  TCNQ CAS RN: 1518-16-7 |  TCNQ (purified by sublimation) CAS RN: 1518-16-7 |  TTF - TCNQ Complex CAS RN: 40210-84-2 |  2,5-Dimethyl-7,7,8,8-tetracyanoquinodimethane CAS RN: 1487-82-7 |  FTCNQ CAS RN: 69857-37-0 |
| D3200 100mg | T1131 100mg 1g | T1246 100mg | B1416 1g 5g | B1466 100mg |
|  2,5-TCNQF ₂ CAS RN: 73318-02-2 |  F ₄ TCNQ (purified by sublimation) CAS RN: 29261-33-4 |  TCNNO CAS RN: 6251-01-0 |  1,3-Bis(dicyanomethylidene)indan CAS RN: 38172-19-9 |  Bis(tetrabutylammonium) Tetracyanodiphenylquinodimethane CAS RN: 68271-98-7 |

| | | | | |
|--|--|---|---|--|
| <p>T1415 1g</p>  <p>(C₄H₉)₄N⁺ Tetrabutylammonium Bis(maleonitriledithiolato)-nickel(III) Complex CAS RN: 6251-01-0</p> | <p>B1371 1g</p>  <p>2[(C₄H₉)₄N]⁺ Bis(tetrabutylammonium) Bis(maleonitriledithiolato)-nickel(II) Complex CAS RN: 18958-57-1</p> | <p>T1272 100mg</p>  <p>(C₄H₉)₄N⁺ Tetrabutylammonium Bis(1,3-dithiole-2-thione-4,5-dithiolato)nickel(III) Complex CAS RN: 68401-88-7</p> | <p>B1221 5g 25g</p>  <p>2[(C₄H₉)₄N]⁺ BTBA-BDZT Zn Complex CAS RN: 68449-38-7</p> | <p>B1437 100mg 1g</p>  <p>2[(C₄H₉)₄N]⁺ Bis(tetrabutylammonium) Bis(1,3-dithiole-2-thione-4,5-dithiolato)palladium(II) Complex CAS RN: 72688-90-5</p> |
| <p>B1438 100mg</p>  <p>2[(C₄H₉)₄N]⁺ Bis(tetrabutylammonium) Bis(1,3-dithiole-2-thione-4,5-dithiolato)platinum(II) Complex CAS RN: 72688-91-6</p> | <p>T1416 1g</p>  <p>(C₄H₉)₄P⁺ Tetrabutylphosphonium Bis(1,3-dithiole-2-thione-4,5-dithiolato)nickel(III) Complex CAS RN: 105029-70-7</p> | <p>D2134 100mg</p>  <p>(C₁₈H₃₇)₂(CH₃)₂N⁺ Dioctadecyldimethylammonium Bis(1,3-dithiole-2-thione-4,5-dithiolato)aurate(III) Complex CAS RN: 120141-26-6</p> | <p>P0079 25g 100g 500g</p>  <p>Phenanthrene CAS RN: 85-01-8</p> | <p>P0331 1sample</p>  <p>Phenanthrene Zone Refined (number of passes:30) CAS RN: 85-01-8</p> |
| <p>P2207 100mg 500mg</p>  <p>Picene (purified by sublimation) (>99.9%) CAS RN: 213-46-7</p> | <p>D5488 100mg</p>  <p>Dibenzo[a,h]pentacene CAS RN: 227-09-8</p> | <p>C0386 1g 5g</p>  <p>Coronene CAS RN: 191-07-1</p> | <p>C1961 100mg</p>  <p>Coronene (purified by sublimation) CAS RN: 191-07-1</p> | <p>B1660 100mg 1g</p>  <p>Fullerene C₆₀ CAS RN: 99685-96-8</p> |
| <p>B1641 100mg 500mg 1g</p>  <p>Fullerene C₆₀ (pure) CAS RN: 99685-96-8</p> | <p>B1694 100mg</p>  <p>Fullerene C₇₀ CAS RN: 115383-22-7</p> | <p>F1233 100mg</p>  <p>Fullerene C₇₀ [for organic electronics] CAS RN: 115383-22-7</p> | <div style="text-align: center;"> <p>供体分子</p> <p>Donor Molecules</p> </div> | |
| <p>T2468 1g</p>  <p>TTF - TCNQ Complex CAS RN: 40210-84-2</p> | <p>D2067 100mg 1g</p>  <p>SDM-TTF</p> | <p>T0980 1g 5g 25g</p>  <p>Tetrathiafulvalene CAS RN: 31366-25-3</p> | | |
| <p>T1205 100mg</p>  <p>TPT-TTF CAS RN: 106920-29-0</p> | <p>T2806 100mg 1g</p>  <p>2,3,6,7-Tetrakis(2-cyanoethylthio)-tetrathiafulvalene CAS RN: 132765-36-7</p> | <p>F0285 1g</p>  <p>Formyl-TTF CAS RN: 68128-94-9</p> | <p>T1119 100mg</p>  <p>TMT-TTF CAS RN: 51501-77-0</p> | <p>T1571 100mg</p>  <p>TET-TTF CAS RN: 104515-79-9</p> |
| <p>B1200 100mg 1g 5g</p>  <p>BEDT-TTF CAS RN: 66946-48-3</p> | <p>B1218 100mg</p>  <p>BMDT-TTF CAS RN: 68550-20-9</p> | <p>B1244 100mg</p>  <p>BPDT-TTF CAS RN: 66946-49-4</p> | <p>P0078 5g 25g</p>  <p>Perylene CAS RN: 198-55-0</p> | <p>P1629 1g</p>  <p>Perylene (purified by sublimation) CAS RN: 198-55-0</p> |
| <p>P0355 25g</p>  <p>Phthalocyanine CAS RN: 574-93-6</p> | <p>T1221 5g 25g</p>  <p>TDAE CAS RN: 996-70-3</p> | <p>P1795 1g</p>  <p>Phthalocyanine (purified by sublimation) CAS RN: 574-93-6</p> | | |

| | | | | |
|---|--|--|---|--|
| P0655 25g  Pigment Blue 15 CAS RN: 147-14-8 | P1005 25g 250g  CuPc (α -form) CAS RN: 147-14-8 | P1006 25g 100g 500g  CuPc (β -form) CAS RN: 147-14-8 | P1628 1g  CuPc (purified by sublimation) CAS RN: 147-14-8 | T1256 100mg  Copper(II) 2,9,16,23-Tetra-tert-butylphthalocyanine CAS RN: 39001-64-4 |
| P1049 1g 5g  Dilithium Phthalocyanine CAS RN: 25510-41-2 | P0973 1g 5g  Disodium Phthalocyanine CAS RN: 25476-27-1 | P1018 1g  Magnesium(II) Phthalocyanine CAS RN: 1661-03-6 | P1024 1g 5g  Tin(II) Phthalocyanine CAS RN: 15304-57-1 | P0997 1g  Tin(IV) Phthalocyanine Dichloride CAS RN: 18253-54-8 |
| P0774 5g 25g  Iron(II) Phthalocyanine CAS RN: 132-16-1 | I0783 200mg 1g  Iron(II) Phthalocyanine (purified by sublimation) CAS RN: 132-16-1 | P0887 5g 25g  Cobalt(II) Phthalocyanine CAS RN: 3317-67-7 | C3252 200mg  Cobalt(II) Phthalocyanine (purified by sublimation) CAS RN: 3317-67-7 | P0766 1g 25g  Lead(II) Phthalocyanine CAS RN: 15187-16-3 |
| P0767 1g 5g 25g  Zinc Phthalocyanine CAS RN: 14320-04-8 | Z0037 500mg  ZnPc (purified by sublimation) CAS RN: 14320-04-8 | T2272 200mg 1g  TiOPc (purified by sublimation) CAS RN: 26201-32-1 | P0660 25g Pigment Green 7 CAS RN: 1328-53-6 | |
| 电结晶支持电解质 Electrocrystallization Supporting Electrolytes | | | | |
| | | S0838 25g 100g  Sodium Dicyanamide CAS RN: 1934-75-4 | T0836 25g 100g 500g  Tetrabutylammonium Perchlorate CAS RN: 1923-70-2 | T0839 25g  Tetraethylammonium Perchlorate CAS RN: 2567-83-1 |
| T0914 25g 100g 500g  Tetrabutylammonium Tetrafluoroborate CAS RN: 429-42-5 | T0983 5g 25g  Tetraethylammonium Tetrafluoroborate CAS RN: 429-06-1 | T1186 5g 25g  Tetrabutylammonium Dichlorobromide CAS RN: 13053-75-3 | T1261 1g  Tetrabutylammonium Dibromoaurate CAS RN: 50481-01-1 | T1269 1g 10g  Tetrabutylammonium Dibromoiodide CAS RN: 15802-00-3 |
| T1271 5g 25g  Tetrabutylammonium Triiodide CAS RN: 13311-45-0 | T1273 100mg  Tetrabutylammonium Dichloroaurate CAS RN: 50480-99-4 | T1278 25g 250g  Tetrabutylammonium Thiocyanate CAS RN: 3674-54-2 | T1279 25g 250g  Tetrabutylammonium Hexafluorophosphate CAS RN: 3109-63-5 | T1284 25g 100g 500g  Tetrabutylammonium Tribromide CAS RN: 38932-80-8 |
| T1357 100mg 1g  Tetrabutylammonium Diodoaurate | T1803 1g 5g  Tetrabutylammonium Perrhenate CAS RN: 16385-59-4 | T2648 25g  Tetrabutylammonium Tetrafluoroborate CAS RN: 429-42-5 | | |

四硫富瓦烯TTF前体

Tetrathiafulvalene (TTF) Precursors

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|---|--|--|---|---|
| <p>B1777 1g</p>  <p>4,5-Bis(methylthio)-1,3-dithiol-2-one CAS RN: 61485-46-9</p> | <p>B1778 1g</p>  <p>4,5-Bis(methylthio)-1,3-dithiole-2-thione CAS RN: 49638-64-4</p> | <p>B1151 5g</p>  <p>1,3-Benzodithiolium Tetrafluoroborate CAS RN: 57842-27-0</p> | <p>B1199 1g 5g</p>  <p>4,5-Bis(benzoylthio)-1,3-dithiole-2-thione CAS RN: 68494-08-6</p> | <p>B1272 1g</p>  <p>Bis(carbonyldithio)tetrathiafulvalene CAS RN: 64394-47-4</p> |
| <p>B2228 1g</p>  <p>4,5-Bis(2-cyanoethylthio)-1,3-dithiole-2-thione CAS RN: 132765-35-6</p> | <p>B2233 1g</p>  <p>4,5-Bis(2-cyanoethylthio)-1,3-dithiol-2-one CAS RN: 158871-28-4</p> | <p>D2127 10g 25g</p>  <p>Dimethyl 1,3-Dithiole-2-thione-4,5-dicarboxylate CAS RN: 7396-41-0</p> | <p>D2133 1g 5g</p>  <p>1,3-Dithiole-2-thione CAS RN: 930-35-8</p> | <p>D3252 1g</p>  <p>4,5-Dicyano-1,3-dithiole-2-one CAS RN: 934-31-6</p> |
| <p>D3981 1g 5g</p>  <p>Dimethyl 2-(1,3-Dithiole-2-yl)phosphonate CAS RN: 133113-76-5</p> | <p>D3992 1g</p>  <p>Dimethyl 1,3-Benzodithiol-2-ylphosphonate CAS RN: 62217-35-0</p> | <p>E0429 1g 5g 25g</p>  <p>4,5-Ethylenedithio-1,3-dithiole-2-thione CAS RN: 59089-89-3</p> | <p>E0460 1g 5g</p>  <p>4,5-Ethylenedithio-1,3-dithiol-2-one CAS RN: 74962-29-1</p> | <p>H1163 1g</p>  <p>5-Hexyl-1,3-dithiole[4,5-d]-[1,3]dithiole-2-thione CAS RN: 202126-51-0</p> |
| <p>M1112 1g</p>  <p>4,5-Methylenedithio-1,3-dithiole-2-thione CAS RN: 70800-59-8</p> | <p>M1154 100mg</p>  <p>4,5-Methylenedithio-1,3-dithiol-2-one CAS RN: 85720-62-3</p> | <p>P1635 250mg 1g</p>  <p>5-Propyl-1,3-dithiole[4,5-d]-[1,3]dithiole-2-thione CAS RN: 202126-48-5</p> | <p>T0266 1g 5g 25g</p>  <p>Toluene-3,4-dithiol CAS RN: 496-74-2</p> | <p>T0279 1g 5g</p>  <p>Zinc Dithiol CAS RN: 29726-21-4</p> |
| <p>T1132 1g 5g 25g</p>  <p>1,3,4,6-Tetrathiapentalene-2,5-dione CAS RN: 64394-45-2</p> | | | | |



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