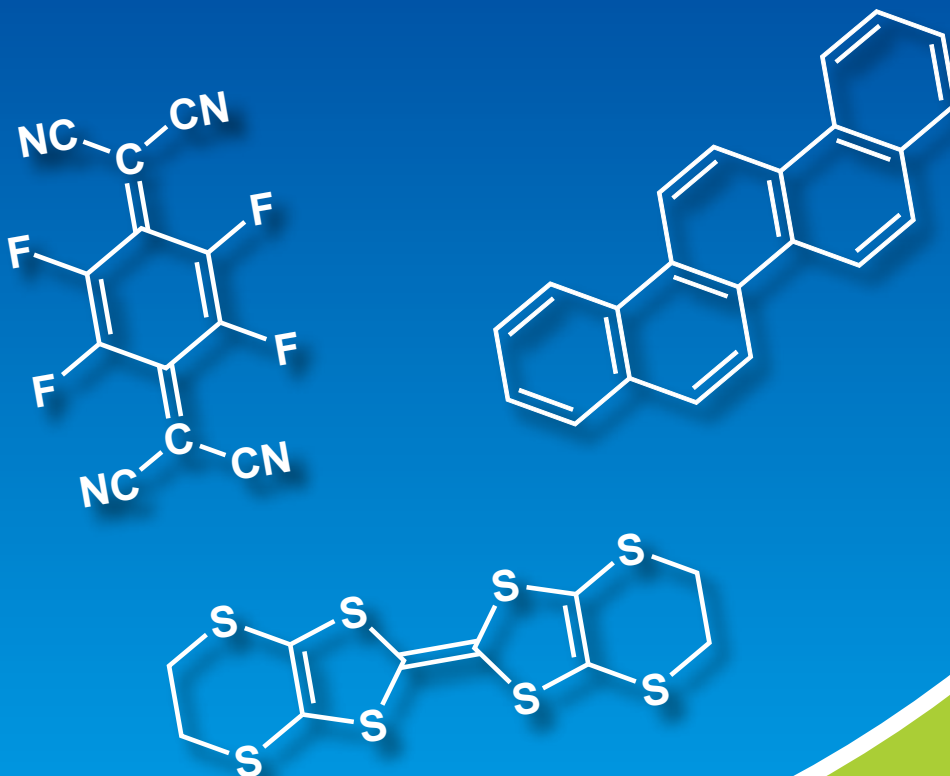


Molecular Conductors



Acceptor Molecules

Donor Molecules

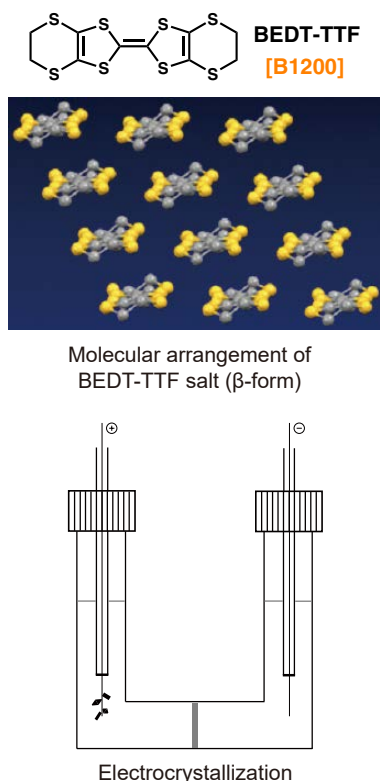
Electrocrystallization Supporting Electrolytes

Tetrathiafulvalene (TTF) Precursors

Molecular Conductors

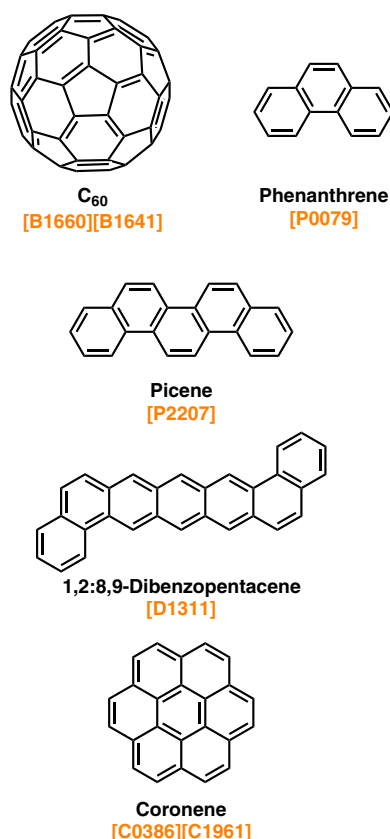
A molecular conductor is an electrical conductor based on a molecular component. A chemical modification of the molecule can control the electronic structure and physical properties. We can synthesize an opened-shell molecular conductor by chemical or electrochemical doping of a carrier, although an organic molecule is usually an insulator with a closed-shell structure. The first example of an organic conductor was observed from a bromine-doped perylene.¹⁾ After this observation, a molecular conductor based on tetrathiafulvalene (TTF) was reported in the 1970s,²⁾ and the first case of an organic molecular superconductor was observed from the organic salt of tetraselenafulvalene, (TMTSF)₂X in the 1980s.³⁾ These TTF and TMTSF salts form a one-dimensional or pseudo one-dimensional molecular arrangement. On the other hand, bis(ethylenedithio)-tetrathiafulvalene (BEDT-TTF) favors forming a two-dimensional molecular arrangement, which is a relatively stable molecular metal toward temperature.⁴⁻⁶⁾

Conducting salts of TTF derivatives can be normally obtained by an electrochemical oxidation (electrocrystallization).⁷⁾ These TTF derivatives can function as donor molecules with a hole carrier. Metal dithiolene complexes (M(dmit)₂), 7,7,8,8-Tetracyanoquinodimethane (TCNQ) and fullerene (C₆₀) are acceptor molecules with an electron carrier. An M(dmit)₂ salt produced the first example of an acceptor-based organic superconductor.⁸⁾ Chemical modifications of the M(dmit)₂ salt produced plenty of those organic superconductors by changing the central metal atom and counter cation.⁹⁾



Several alkali-doped nanocarbon and nanographene compounds have shown superconductivity. It is well known that rubidium- and cesium-doped fullerenes have demonstrated superconductivity at more than 30 K.¹⁰⁾ Recently, superconductivity of Cs₃C₆₀ at 38 K was reported.¹¹⁾ Although the molecular conductors synthesized from TTF and M(dmit)₂ exhibit low-dimensional molecular arrangements, these fullerene salts can form three-dimensionality.¹²⁾ Kubozono *et al.* reported that an alkali-doped picene demonstrated superconductivity at 18 K.¹³⁾ This result indicates that one can observe superconductivity from a planar nanocarbon material as well. In addition to the picene-based superconductor, an alkali-doped phenanthrene (*T_c* = 5 K),¹⁴⁾ alkali-doped coronene (*T_c* = 15 K),¹⁵⁾ and alkali-doped 1,2:8,9-dibenzopentacene (*T_c* = 33 K)¹⁶⁾ have also shown superconductivity.

Superconducting materials by alkali metal doping

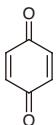
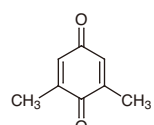
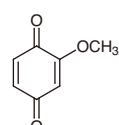
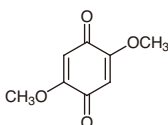
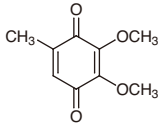
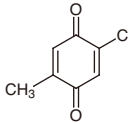
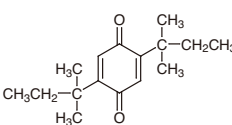
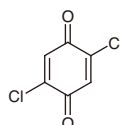
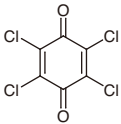
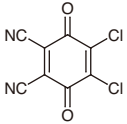
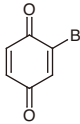
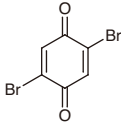
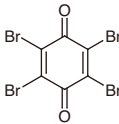
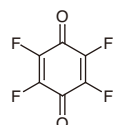
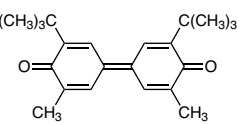
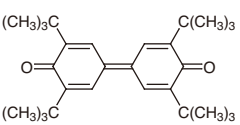
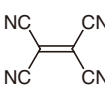
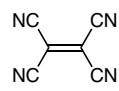
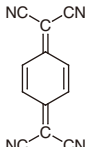
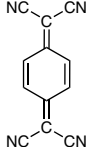
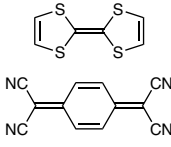
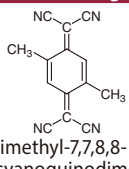
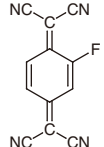
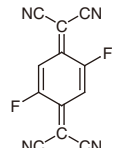
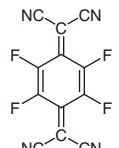
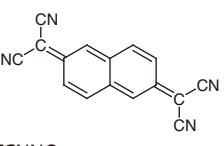
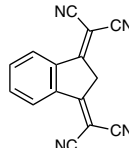
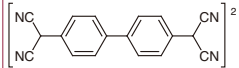


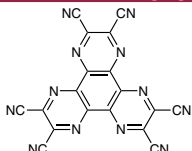
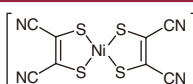
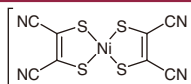
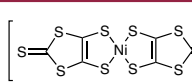
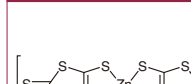
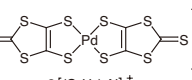
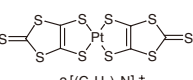
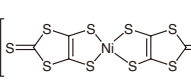
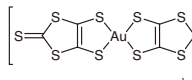
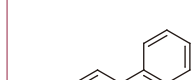
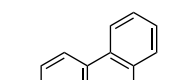
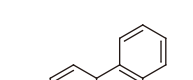
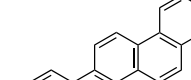
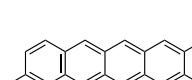
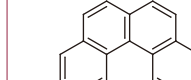
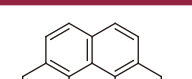
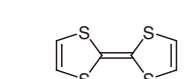
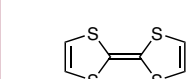
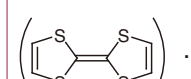
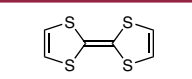
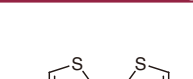
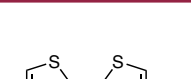
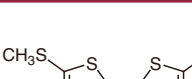
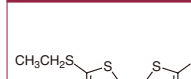
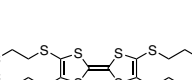
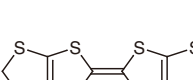
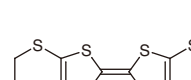
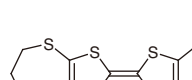
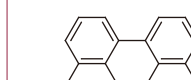
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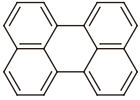
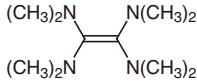
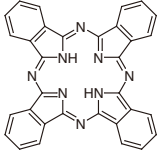
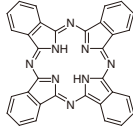
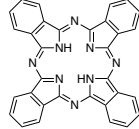
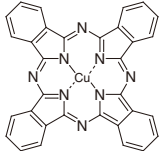
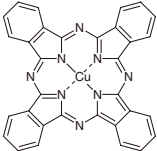
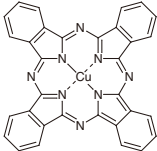
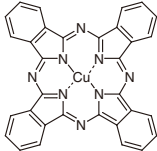
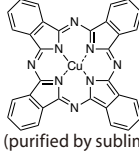
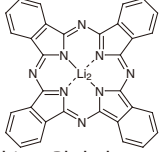
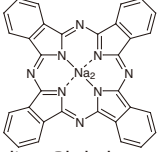
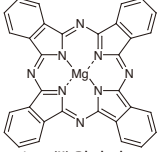
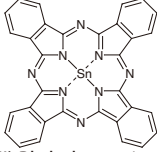
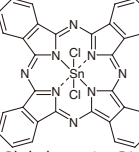
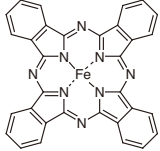
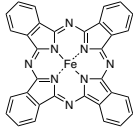
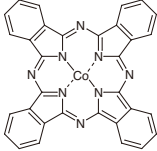
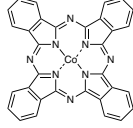
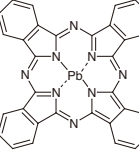
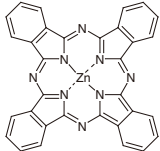
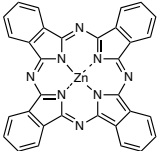
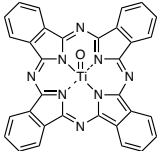
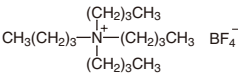
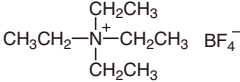
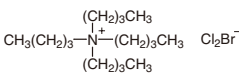
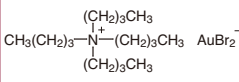
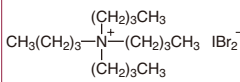
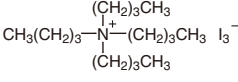
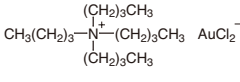
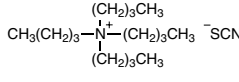
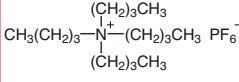
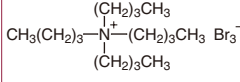
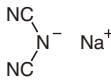
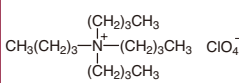
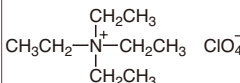
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Acceptor Molecules

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

D5248 200mg 1g 5g  HAT-CN 6 CAS RN: 105598-27-4	T1415 1g  (C ₄ H ₉) ₄ N ⁺ Tetrabutylammonium Bis(maleonitriledithiolato)- nickel(III) Complex CAS RN: 55401-12-2	B1371 1g  2 [(C ₄ H ₉) ₄ N] ⁺ Bis(tetrabutylammonium) Bis(maleonitriledithiolato)- nickel(II) Complex CAS RN: 18958-57-1	T1272 100mg  (C ₄ H ₉) ₄ N ⁺ Tetrabutylammonium Bis(1,3-dithiole-2-thione-4,5- dithiolato)nickel(III) Complex CAS RN: 68401-88-7	B1221 5g 25g  2 [(C ₄ H ₉) ₄ N] ⁺ BTBA-BDTD Zn Complex CAS RN: 68449-38-7
B1437 100mg 1g  2 [(C ₄ H ₉) ₄ N] ⁺ Bis(tetrabutylammonium) Bis(1,3-dithiole-2-thione- 4,5-dithiolato)palladium(II) CAS RN: 72688-90-5	B1438 100mg  2 [(C ₄ H ₉) ₄ N] ⁺ Bis(tetrabutylammonium) Bis(1,3-dithiole-2-thione- 4,5-dithiolato)platinum(II) CAS RN: 72688-91-6	T1416 1g  (C ₄ H ₉) ₄ P ⁺ Tetrabutylphosphonium Bis(1,3-dithiole-2-thione-4,5- dithiolato)nickel(III) Complex CAS RN: 105029-70-7	D2134 100mg  (C ₁₈ H ₃₇) ₂ (CH ₃) ₂ N ⁺ Dioctadecyldimethylammonium Bis(1,3-dithiole-2-thione- 4,5-dithiolato)aurate(III) CAS RN: 120141-26-6	P0079 25g 100g 500g  Phenanthrene CAS RN: 85-01-8
P2877 5g 25g  Phenanthrene (purified by sublimation) CAS RN: 85-01-8	P0331 1sample  Phenanthrene Zone Refined (number of passes:30) CAS RN: 85-01-8	P2207 100mg 500mg  Picene (purified by sublimation) (>99.9%) CAS RN: 213-46-7	D5488 100mg  Dibenz[a,h]pentacene CAS RN: 227-09-8	C0386 1g 5g  Coronene CAS RN: 191-07-1
C1961 100mg  Coronene (purified by sublimation) CAS RN: 191-07-1	B1660 100mg 1g  Fullerene C ₆₀ CAS RN: 99685-96-8	B1641 100mg 500mg 1g  Fullerene C ₆₀ (pure) CAS RN: 99685-96-8	F1232 100mg  Fullerene C ₆₀ [for organic electronics] CAS RN: 99685-96-8	B1694 100mg  Fullerene C ₇₀ CAS RN: 115383-22-7
F1233 100mg  Fullerene C ₇₀ [for organic electronics] CAS RN: 115383-22-7	Donor Molecules			
T0980 1g 5g 25g  TTF CAS RN: 31366-25-3				
T3380 200mg 1g  TTF (purified by sublimation) CAS RN: 31366-25-3				
T1282 1g  Tetrathiafulvalene Fluoroborate CAS RN: 55492-86-9				
T2468 1g  TTF - TCNQ Complex CAS RN: 40210-84-2	D2067 100mg 1g  SDM-TTF	F0285 1g  Formyl-TTF CAS RN: 68128-94-9	T1119 100mg  TMT-TTF CAS RN: 51501-77-0	T1571 100mg  TET-TTF CAS RN: 104515-79-9
T2806 100mg 1g  2,3,6,7-Tetrakis(2-cyanoethylthio)- tetrathiafulvalene CAS RN: 132765-36-7	B1218 100mg  BMDT-TTF CAS RN: 68550-20-9	B1200 100mg 1g 5g  BEDT-TTF CAS RN: 66946-48-3	B1244 100mg  BPDT-TTF CAS RN: 66946-49-4	P0078 1g 5g 25g  Perylene CAS RN: 198-55-0

P1629 1g  Perylene (purified by sublimation) CAS RN: 198-55-0	T1221 1g 5g 25g  TDAE CAS RN: 996-70-3	P0355 25g  Phthalocyanine CAS RN: 574-93-6	P1795 1g  Phthalocyanine (purified by sublimation) CAS RN: 574-93-6	P2734 100mg 500mg  Phthalocyanine (purified by sublimation) [for organic electronics] CAS RN: 574-93-6
P0655 25g  CuPc 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	C3645 100mg 500mg  CuPc (purified by sublimation) [for organic electronics] CAS RN: 147-14-8
P1049 1g  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	
Electrocrystallization Supporting Electrolytes				
T0914 25g 100g 500g  Tetrabutylammonium Tetrafluoroborate CAS RN: 429-42-5	T0983 5g 25g  Tetraethylammonium Tetrafluoroborate CAS RN: 429-06-1	T1186 25g  Tetrabutylammonium Dichlorobromide CAS RN: 13053-75-3	T1261 1g  Tetrabutylammonium Dibromoaurate CAS RN: 50481-01-1	T1269 1g 10g  Tetrabutylammonium Dibromiodide 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 5g 25g 250g  Tetrabutylammonium Hexafluorophosphate CAS RN: 3109-63-5	T1284 25g 100g 500g  Tetrabutylammonium Tribromide CAS RN: 38932-80-8
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		

T1357 100mg 1g Tetrabutylammonium Diiodoaurate	T1803 1g 5g Tetrabutylammonium Perrhenate CAS RN: 16385-59-4	T2648 25g Tetrabutylammonium Tetrafluoroborate CAS RN: 429-42-5	T3659 5g 25g Tetraethylammonium Hexafluorophosphate CAS RN: 429-07-2
Tetrathiafulvalene (TTF) Precursors			
B1777 1g 4,5-Bis(methylthio)- 1,3-dithiol-2-one CAS RN: 61485-46-9	B1778 1g 4,5-Bis(methylthio)- 1,3-dithiole-2-thione CAS RN: 49638-64-4	B2228 1g 4,5-Bis(2-cyanoethylthio)- 1,3-dithiole-2-thione CAS RN: 132765-35-6	B1151 5g 1,3-Benzodithiolium Tetrafluoroborate CAS RN: 57842-27-0
B2233 1g 4,5-Bis(2-cyanoethylthio)- 1,3-dithiol-2-one CAS RN: 158871-28-4	B1199 1g 5g 4,5-Bis(benzoylthio)- 1,3-dithiole-2-thione CAS RN: 68494-08-6	D2127 10g 25g Dimethyl 1,3-Dithiole- 2-thione-4,5-dicarboxylate CAS RN: 7396-41-0	B1272 1g Bis(carbonyldithio)- tetrathiafulvalene CAS RN: 64394-47-4
D2133 1g 5g 1,3-Dithiole-2-thione CAS RN: 930-35-8	D3252 1g 4,5-Dicyano-1,3-dithiol-2-one CAS RN: 934-31-6	D3981 1g 5g Dimethyl 2-(1,3-Dithiole)- phosphonate CAS RN: 133113-76-5	D3992 1g Dimethyl 1,3-Benzo- dithiol-2-ylphosphonate CAS RN: 62217-35-0
E0429 1g 5g 25g 4,5-Ethylenedithio- 1,3-dithiole-2-thione CAS RN: 59089-89-3	E0460 1g 5g 4,5-Ethylenedithio- 1,3-dithiol-2-one CAS RN: 74962-29-1	H1163 1g 5-Hexyl-1,3-dithiolo[4,5-d]- [1,3]dithiole-2-thione CAS RN: 202126-51-0	M1112 1g 4,5-Methylenedithio- 1,3-dithiole-2-thione CAS RN: 70800-59-8
M1154 100mg 4,5-Methylenedithio- 1,3-dithiol-2-one CAS RN: 85720-62-3	P1635 250mg 1g 5-Propyl-1,3-dithiolo[4,5-d]- [1,3]dithiole-2-thione CAS RN: 202126-48-5	T0266 1g 5g 25g Toluene-3,4-dithiol CAS RN: 496-74-2	T1132 1g 5g 25g 1,3,4,6-Tetrathiapentalene- 2,5-dione CAS RN: 64394-45-2
T0279 1g 5g Zinc Dithiol CAS RN: 29726-21-4	B1322 1g 5g Benzene-1,2-dithiol CAS RN: 17534-15-5		

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