Solar Cell Materials

Perovskite Solar Cell (PSC) Materials

Organic Photovoltaics (OPV) Materials

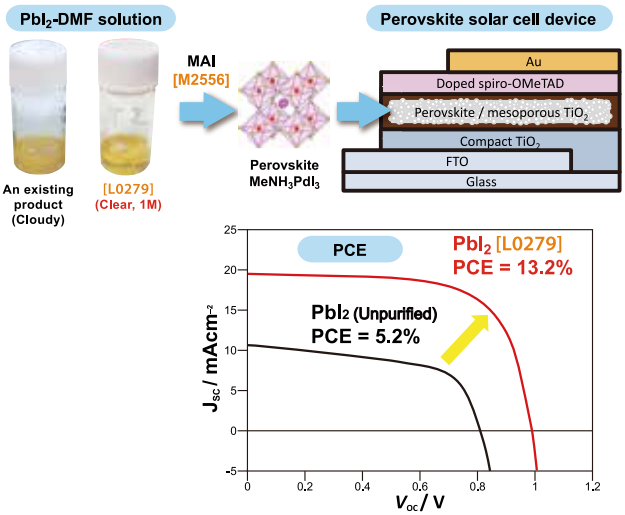
Dye-Sensitized Solar Cell (DSSC) Materials

Solar Cell Materials

Sunlight is one of the renewable energy sources that can globally contribute to environmental and energy solutions in the 21st century. In order to use sunlight as efficiently as possible, low cost and efficient solar cells have been vigorously developed for practical use. As is generally known, practical silicon-based solar cells involve high manufacturing cost, as well as any other inorganic-based solar cells. On the basis of the cost problem, we have developed new solar cells based on organic and organic-inorganic hybrid materials.

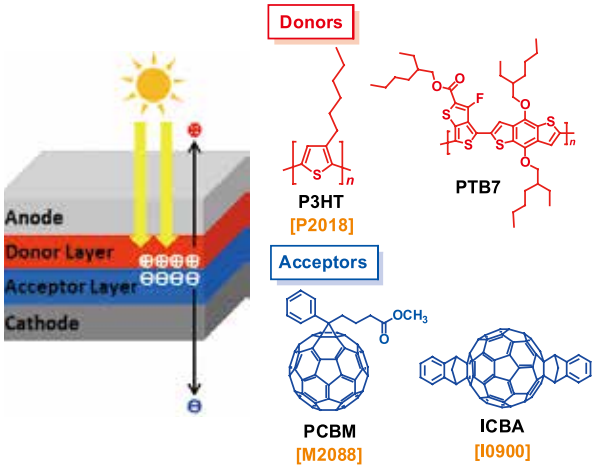
1. Perovskite Solar Cell (PSC) Materials

A perovskite solar cell, that was first reported by Miyasaka *et al.* in 2009, has recently received much attention.[1] The organic-inorganic perovskite, RNH_3PbX_3 (X = Cl, Br, I; R = Me, NH=CH, etc.), can function as a light absorption layer. Since 2012, power conversion efficiency (PCE) of the perovskite solar cell has been drastically improved and it has reached >15% better than those of OPV and DSSC.[2-5] A device of the perovskite solar cell is solution-processible for fabrication at low cost. The organic-inorganic perovskites RNH_3PbX_3 are easily prepared from HX salts of organic amines and lead halides. A modification of the halide X in the $(MeNH_3)PbX_3$ can control the range of absorption wavelength.[6] The perovskite compound with X = Br is useful for light absorption in shorter wavelengths and the compound with X = I is relatively useful for that in longer wavelengths. Wakamiya *et al.* reported that use of highly dried lead(II) iodide is a key to fabricate efficient perovskite solar cell devices (PCE > 10%) with high reproducibility.[7,8] Carrier behavior in the perovskite layer is different from that in OPV, thus there are free carriers in which electrons and holes can be movable freely.[9] According to the reason, the perovskite layer can transport both electron and hole carriers without recombination.



2. Organic Photovoltaics (OPV) Materials

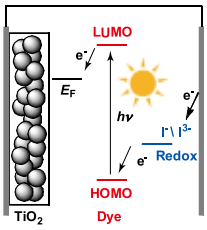
A prototype of organic photovoltaics (OPV) was reported by Tang *et al.* in 1986.[10] In order to fabricate an OPV device, we can use highly productive methods such as printing and roll-to-roll methods. The OPV device usually requires bulk heterojunctions (BHJ) which can be fabricated by mixing an electron-donor (*p*-type semiconductor) and electron-acceptor (*n*-type semiconductor).[11] The former material involves a π-conjugated polymer and a small molecule semiconductor, and the latter material is normally a fullerene derivative. PCBM, that is a solubility-enhanced fullerene, efficiently provides a bulk heterojunction.[12] ICBM gives a high open-circuit voltage because it has a higher energy LUMO than that of PCBM.[13] A C_{70} derivative usually gives higher cell efficiency compared with that of the corresponding C_{60} one, because the C_{70} derivative absorbs light better than the C_{60}.[14] We can introduce an acceptor component into the structure of a *p*-type semiconducting polymer to form a donor-acceptor (DA-type) polymer, that shows light absorption in the long wavelength area based on a charge transfer.[15]

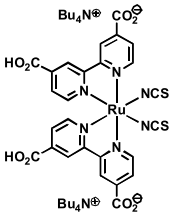


3. Dye-Sensitized Solar Cell (DSSC) Materials

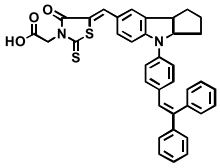
Grätzel *et al.* first developed a dye-sensitized solar cell (DSSC) in 1991.[16] The DSSC is a liquid-type device that involves nanoporous titanium oxide (TiO_2) as a semiconducting electrode, organic dye-sensitizer and an electrolyte solution containing a redox component. This is expected to be a low cost solar cell, because there is a simple device structure compared with other solar cells.[17] The DSSC is usable under conditions with weak light. Thus, it is expected that the DSSC may be installed in a room. A ruthenium complex with a bipyridine ligand is one popular organic dye for solar cells.[18] In the polypyridine ligand of

the ruthenium complex, we can introduce some carboxyl or phosphonic acid groups forming a linkage with TiO_2. In addition, metal-free organic dyes (eg. D-102, D-131 and D-358) were also developed, because they do not contain any expensive ruthenium atoms.[19,20] Recently, efficient green-colored zinc-porphyrin dyes were developed for DSSC showing more than 10% of PCE.[21,22] Furthermore, efficient blue-colored metal-free organic dyes having a diketopyrrolopyrrole structure were developed for DSSC (PCE > 10%).[23]





N719 dye
[B3514]



D102 dye
[D4430]

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Perovskite Solar Cell (PSC) Materials

Lead Halides

P2415 1g 5g 25g

$CH_3NH_3PbI_3$ / DMF

PbI_2/MAI(1:1) - DMF Complex (99.99%, trace metals basis) [for Perovskite precursor]

L0279 1g 5g 25g 100g 1kg

PbI_2

Lead(II) Iodide [for Perovskite precursor] [10101-63-0]

L0288 1g 5g 25g

$PbBr_2$

Lead(II) Bromide [for Perovskite precursor] [10031-22-8]

L0291 1g 5g

$PbCl_2$

Lead(II) Chloride (purified by sublimation) [for Perovskite precursor] [7758-95-4]

L0292 1g 5g 25g

$PbCl_2$

Lead(II) Chloride [for Perovskite precursor] [7758-95-4]

Cesium Halides

C2205 25g

CsI

Cesium Iodide [7789-17-5]

C2202 25g 100g

CsBr

Cesium Bromide [7787-69-1]

C2203 25g 100g

CsCl

Cesium Chloride [7647-17-8]

Organic Onium Salts

Iodide Salts

M2556 1g 5g 25g 100g

$CH_3NH_2 \cdot HI$

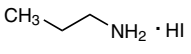
Methylamine Hydroiodide (Low water content) [14965-49-2]

E1045 1g 5g

$CH_3CH_2NH_2 \cdot HI$

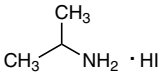
Ethylamine Hydroiodide [506-58-1]

P2212 1g 5g



Propylamine Hydroiodide [14488-45-0]

I0934 1g 5g



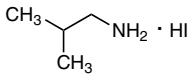
Isopropylamine Hydroiodide [66735-20-4]

B4433 1g 5g

$CH_3(CH_2)_3NH_2 \cdot HI$

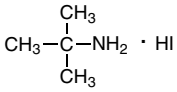
Butylamine Hydroiodide [36945-08-1]

I0935 1g 5g



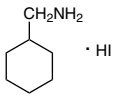
Isobutylamine Hydroiodide [205508-75-4]

B4434 1g 5g



tert-Butylamine Hydroiodide [39557-45-4]

C3425 1g 5g



Cyclohexanemethylamine Hydroiodide

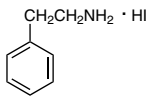
A2778 1g 5g

Aniline Hydroiodide [45497-73-2]

B4566 1g 5g

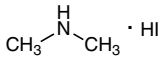
Benzylamine Hydroiodide (Low water content) [45579-91-7]

P2213 1g 5g



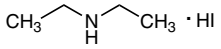
2-Phenylethylamine Hydroiodide [151059-43-7]

D4555 1g 5g



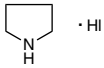
Dimethylamine Hydroiodide [51066-74-1]

D4643 1g 5g



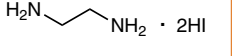
Diethylamine Hydroiodide [19833-78-4]

P2486 1g 5g



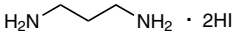
Pyrrolidine Hydriodide [45361-12-4]

E1222 1g 5g



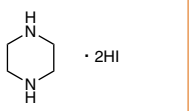
Ethylenediamine Dihydroiodide [5700-49-2]

D5091 1g 5g



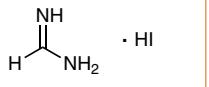
1,3-Diaminopropane Dihydroiodide [120675-53-8]

P2492 1g 5g



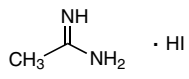
Piperazine Dihydriodide [58464-47-4]

F0974 1g 5g



Formamidine Hydroiodide (Low water content) [879643-71-7]

A2902 1g 5g



Acetamidine Hydroiodide [1452099-14-7]

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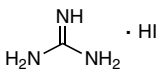

Guanidine Hydroiodide [19227-70-4]

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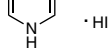
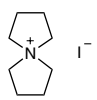


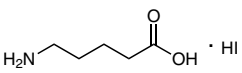
Imidazole Hydroiodide [68007-08-9]

A3093 1g 5g



5-Azoniaspiro[4.4]nonane Iodide [45650-35-9]

A2984 1g 5g



5-Aminovaleric Acid Hydroiodide (Low water content) [1705581-28-7]

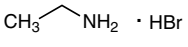
Bromide Stalts

M2589 1g 5g

$CH_3NH_2 \cdot HBr$

Methylamine Hydrobromide [6876-37-5]

E0056 25g 500g



Ethylamine Hydrobromide [593-55-5]

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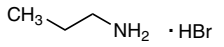
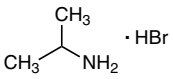
P2502 1g 5g



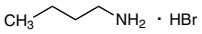
Propylamine Hydrobromide [4905-83-3]

I1041 1g 5g



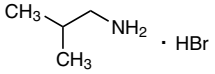
Isopropylamine Hydrobromide [29552-58-7]

B5186 1g 5g



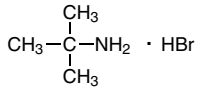
Butylamine Hydrobromide [15567-09-6]

I1007 1g 5g



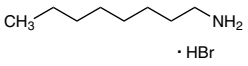
Isobutylamine Hydrobromide [74098-36-5]

B5187 1g 5g



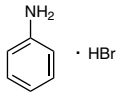
tert-Butylamine Hydrobromide [60469-70-7]

O0442 1g 5g



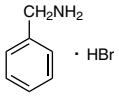
n-Octylamine Hydrobromide [14846-47-0]

A2985 1g 5g



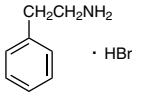
Aniline Hydrobromide [542-11-0]

B5185 1g 5g



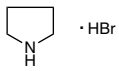
Benzylamine Hydrobromide [37488-40-7]

P2388 1g 5g



2-Phenylethylamine Hydrobromide [53916-94-2]

P2484 1g 5g

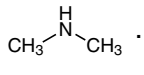


Pyrrolidine Hydrobromide [55810-80-5]

P2487 1g 5g

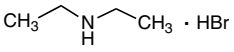
Piperidine Hydrobromide [14066-85-4]

D5092 1g 5g



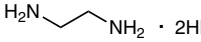
Dimethylamine Hydrobromide [6912-12-5]

D4667 1g 5g



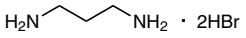
Diethylamine Hydrobromide [6274-12-0]

E1221 1g 5g



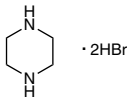
Ethylenediamine Dihydrobromide [624-59-9]

D5090 1g 5g



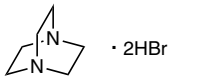
1,3-Diaminopropane Dihydrobromide [18773-03-0]

P2490 1g 5g



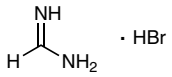
Piperazine Dihydrobromide [59813-05-7]

D5250 1g 5g



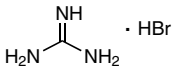
1,4-Diazabicyclo[2.2.2]-octane Dihydrobromide [54581-69-0]

F0973 1g 5g



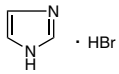
Formamidine Hydrobromide [146958-06-7]

G0449 1g 5g



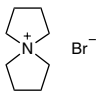
Guanidine Hydrobromide [19244-98-5]

I1006 1g 5g



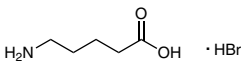
Imidazole Hydrobromide (Low water content) [101023-55-6]

A3091 1g 5g



5-Azoniaspiro[4.4]nonane Bromide [16450-38-7]

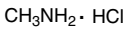
A3094 1g 5g



5-Aminovaleric Acid Hydrobromide (Low water content)

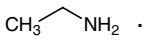
Chloride Salts

M0138 25g 500g



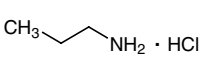
Methylamine Hydrochloride [593-51-1]

E0205 25g 500g



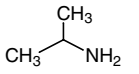
Ethylamine Hydrochloride [557-66-4]

P0522 25g



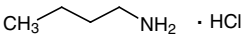
Propylamine Hydrochloride [556-53-6]

I0166 25g 100g 500g



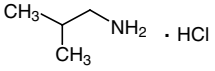
Isopropylamine Hydrochloride [15572-56-2]

B0710 25g 500g



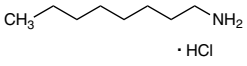
Butylamine Hydrochloride [3858-78-4]

I0096 25g 500g



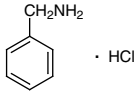
Isobutylamine Hydrochloride [5041-09-8]

O0484 1g 5g



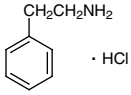
n-Octylamine Hydrochloride [142-95-0]

B0407 25g 100g 500g



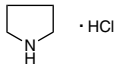
Benzylamine Hydrochloride [3287-99-8]

P0086 25g 100g 500g



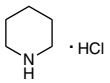
2-Phenylethylamine Hydrochloride [156-28-5]

P2485 1g 5g



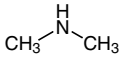
Pyrrolidine Hydrochloride [25150-61-2]

P2488 1g 5g



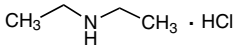
Piperidine Hydrochloride (Low water content) [6091-44-7]

D0644 25g 500g



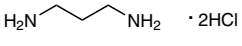
Dimethylamine Hydrochloride [506-59-2]

D0468 25g 500g



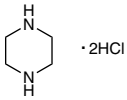
Diethylamine Hydrochloride [660-68-4]

D5253 1g 5g



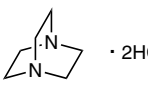
1,3-Diaminopropane Dihydrochloride (Low water content) [10517-44-9]

P2491 1g 5g



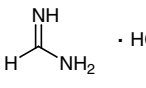
Piperazine Dihydrochloride [142-64-3]

D5251 1g 5g



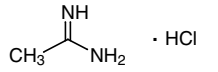
1,4-Diazabicyclo[2.2.2]-octane Dihydrochloride [49563-87-3]

F0103 5g 25g



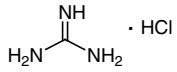
Formamidine Hydrochloride [6313-33-3]

A0008 25g 500g



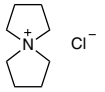
Acetamidine Hydrochloride [124-42-5]

G0162 25g 500g



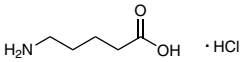
Guanidine Hydrochloride [50-01-1]

A3092 1g 5g



5-Azoniaspiro[4.4]nonane Chloride [98997-63-8]

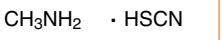
A0436 1g 5g



5-Aminovaleric Acid Hydrochloride (Low water content) [627-95-2]

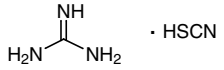
Pseudo Halide Salts

M2991 1g 5g



Methylamine Thiocyanate [61540-63-4]

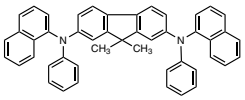
G0230 25g 500g



Guanidine Thiocyanate [593-84-0]

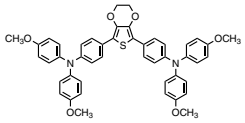
Carrier Transport Materials

B4926 200mg 1g



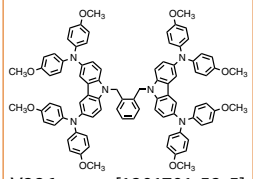
DMFL-NPB [222319-05-3]

D5155 200mg



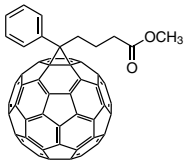
H101 [1622008-73-4]

V0146 1g 5g



V886 [1801701-58-5]

M2088 100mg

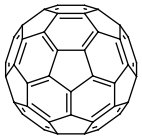


PCBM [160848-22-6]

Organic Solar Cell (OPV) Materials

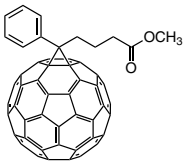
Acceptor Materials

B1641 100mg 1g



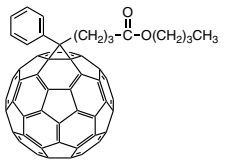
C_{60} (pure) [99685-96-8]

M2088 100mg



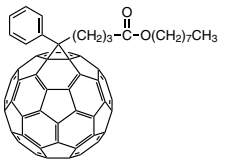
PCBM [160848-22-6]

P2013 100mg



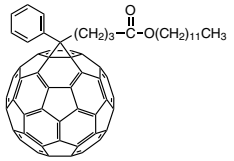
PCBB [571177-66-7]

P2014 100mg



PCBO [571177-68-9]

P2015 100mg

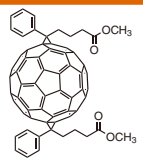


[60]PCB-C_{12} [571177-69-0]

I0900 50mg

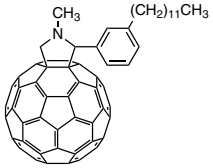
ICBA [1207461-57-1]

B4576 50mg



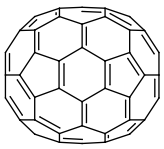
Bis-PCBM (mixture of isomers) [1048679-01-1]

C2415 100mg



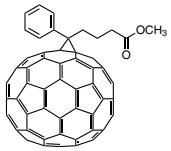
$C_{60}MC_{12}$ [403483-19-2]

B1694 100mg



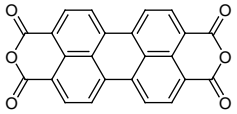
C_{70} [115383-22-7]

M2550 50mg



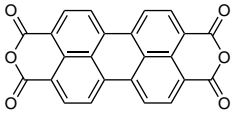
[70]PCBM (mixture of isomers) [609771-63-3]

P0972 25g 100g 500g



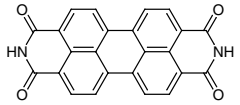
Pigment Red 224 [128-69-8]

P2102 1g



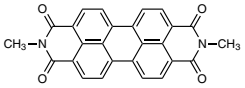
Pigment Red 224 (purified by sublimation) [128-69-8]

P0984 25g



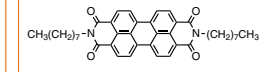
3,4,9,10-Perylene-tetracarboxylic Diimide [81-33-4]

D4429 1g 5g



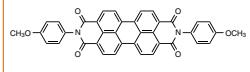
Pigment Red 179 [5521-31-3]

D4175 1g



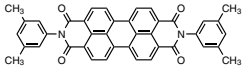
PTCDI-C_8 [78151-58-3]

B2892 1g 5g



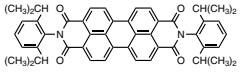
Pigment Red 190 [6424-77-7]

B4231 1g 5g



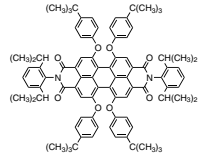
Pigment Red 149 [4948-15-6]

B4268 1g 5g



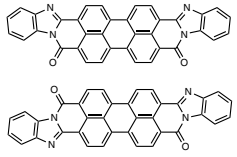
Perylene Orange [82953-57-9]

T3061 200mg



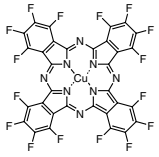
1,6,7,12-Tetrakis(4-*tert*-butylphenoxy)-*N*,*N*'-bis(2,6-diisopropylphenyl)-3,4,9,10-perylenetetracarboxylic Diimide [112078-08-7]

P2119 200mg



PTCBI (*cis*- and *trans*-mixture) [79534-91-1]

H1194 100mg 1g

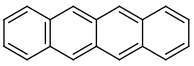


$F_{16}CuPc$ (purified by sublimation) [14916-87-1]

Please inquire for pricing and availability of listed products to our local sales representatives.

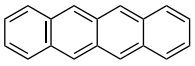
Donor Materials

N0001 100mg 1g 5g



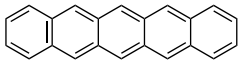
Naphthacene [92-24-0]

N0951 200mg 1g



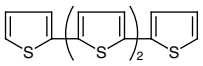
Naphthacene (purified by sublimation) [92-24-0]

P0030 100mg 1g



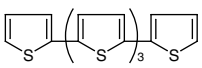
Pentacene (purified by sublimation) [135-48-8]

Q0078 100mg



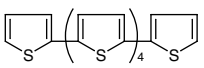
α-Quaterthiophene [5632-29-1]

Q0079 100mg 500mg



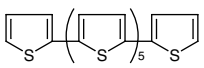
α-Quinquethiophene [5660-45-7]

S0504 100mg 1g



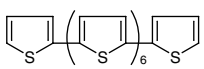
6T (purified by sublimation) [88493-55-4]

S0505 100mg



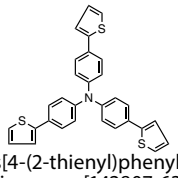
α-Septithiophene [86100-63-2]

O0313 100mg



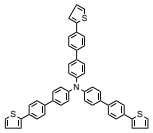
α-Octithiophene [113728-71-5]

T3050 1g 5g



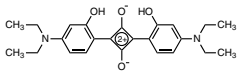
Tris[4-(2-thienyl)phenyl]-amine [142807-63-4]

T3337 200mg



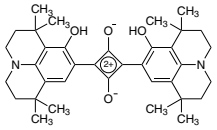
Tris[4'-(2-thienyl)-4-biphenylyl]amine [1092356-36-9]

B4342 1g 5g



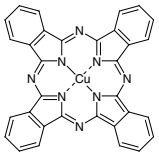
2,4-Bis[4-(diethylamino)-2-hydroxyphenyl]-squaraine [68842-66-0]

B4649 1g 5g



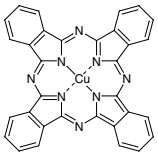
2,4-Bis[8-hydroxy-1,1,7,7-tetramethyljulolidin-9-yl]-squaraine [358727-55-6]

P1005 25g 250g



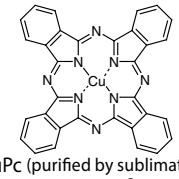
Copper(II) Phthalocyanine (α-form) [147-14-8]

P1006 25g 100g 500g



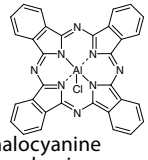
Copper(II) Phthalocyanine (β-form) [147-14-8]

P1628 1g



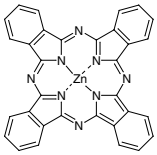
CuPc (purified by sublimation) [147-14-8]

C1167 1g 5g



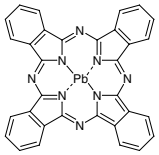
Phthalocyanine Chloroaluminum [14154-42-8]

P0767 1g 5g 25g



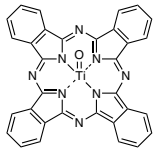
Zinc Phthalocyanine [14320-04-8]

P0766 1g 25g



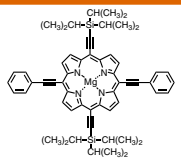
Lead(II) Phthalocyanine [15187-16-3]

T2272 200mg 1g



TiOPc (purified by sublimation) [26201-32-1]

B4314 50mg

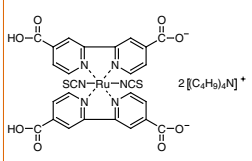


[5,15-Bis(phenylethynyl)-10,20-bis[(triisopropylsilyl)ethynyl]-porphyrinato]magnesium(II) [1397288-30-0]

Dye-Sensitized Solar Cell (DSSC) Materials

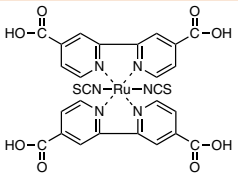
Dye Sensitizers

B3514 100mg



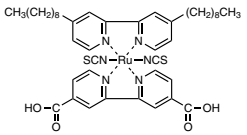
N719 Dye [207347-46-4]

B4372 200mg



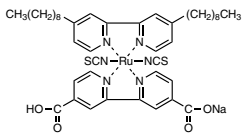
N3 Dye [141460-19-7]

B4373 200mg



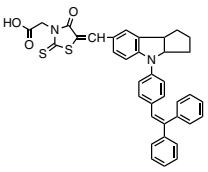
Z907 Dye [502693-09-6]

B4432 200mg



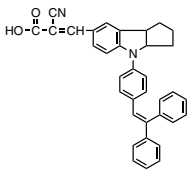
Z907 Dye Sodium Salt [871466-65-8]

D4430 50mg



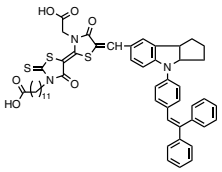
D 102 [652145-28-3]

D4431 50mg



D 131 [652145-29-4]

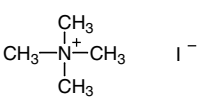
D4432 50mg



D 358 [1207638-53-6]

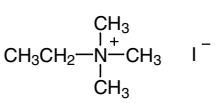
Electrolytes

T0139 25g 100g 500g



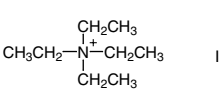
Tetramethylammonium Iodide [75-58-1]

E0190 25g



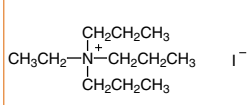
Ethyltrimethylammonium Iodide [51-93-4]

T0097 25g 100g 500g



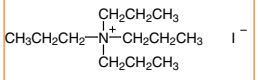
Tetraethylammonium Iodide [68-05-3]

E0191 25g



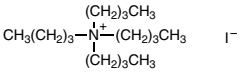
Ethyltripropylammonium Iodide [15066-80-5]

T0172 25g 500g



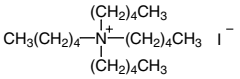
Tetrapropylammonium Iodide [631-40-3]

T0057 25g 100g 500g



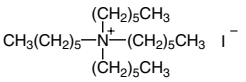
Tetrabutylammonium Iodide [311-28-4]

T1011 5g 25g



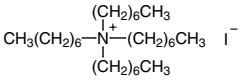
Tetraamylammonium Iodide [2498-20-6]

T1010 5g 25g



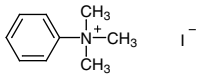
Tetrahexylammonium Iodide [2138-24-1]

T1396 25g



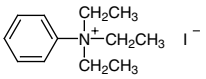
Tetraheptylammonium Iodide [3535-83-9]

P0246 25g



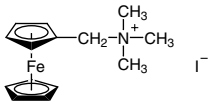
Trimethylphenylammonium Iodide [98-04-4]

P0242 25g



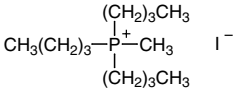
Triethylphenylammonium Iodide [1010-19-1]

F0167 5g



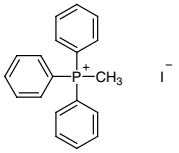
(Ferrocenylmethyl)-trimethylammonium Iodide [12086-40-7]

M1455 5g 25g



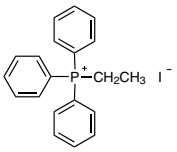
Tributylmethylphosphonium Iodide [1702-42-7]

M0253 25g 100g 500g



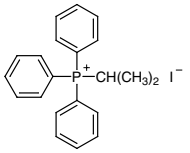
Methyltriphenylphosphonium Iodide [2065-66-9]

E0549 25g 250g



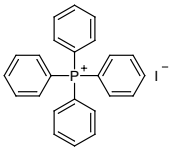
Ethyltriphenylphosphonium Iodide [4736-60-1]

I0552 5g 25g



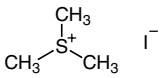
Isopropyltriphenylphosphonium Iodide [24470-78-8]

T1450 10g



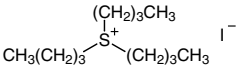
Tetraphenylphosphonium Iodide [2065-67-0]

T1056 25g 500g



Trimethylsulfonium Iodide [2181-42-2]

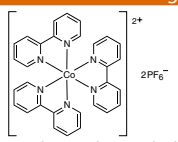
T1564 1g



Tributylsulfonium Iodide [18146-62-8]

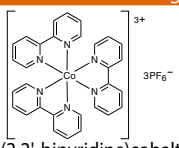
Hole Conductor Cobalt Dopants

T3255 1g 5g



Tris(2,2'-bipyridine)cobalt(II) Bis(hexafluorophosphate) [79151-78-3]

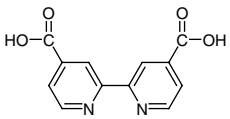
T3256 200mg 1g



Tris(2,2'-bipyridine)cobalt(III) Tris(hexafluorophosphate) [28277-53-4]

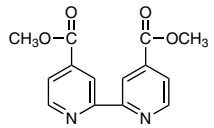
Ligands

B1876 100mg 1g



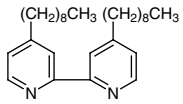
2,2'-Biisonicotinic Acid [6813-38-3]

D4635 1g 5g



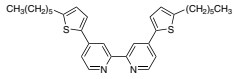
Dimethyl 2,2'-Bipyridine-4,4'-dicarboxylate [71071-46-0]

D3917 1g 5g



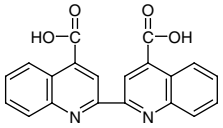
4,4'-Dinonyl-2,2'-bipyridyl [142646-58-0]

B4420 200mg



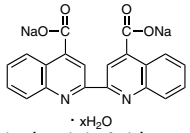
4,4'-Bis(5-hexyl-2-thienyl)-2,2'-bipyridyl [1047684-56-9]

B3509 1g 5g



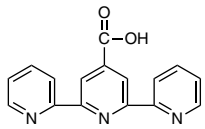
2,2'-Bicinchoninic Acid [1245-13-2]

B4509 1g 5g



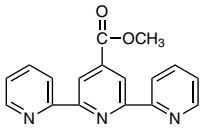
Bicinchoninic Acid Disodium Salt Hydrate [979-88-4]

T3245 200mg 1g



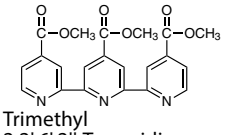
2,2':6',2''-Terpyridine-4'-carboxylic Acid [148332-36-9]

M2464 100mg



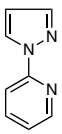
Methyl 2,2':6',2''-Terpyridine-4'-carboxylate [247058-06-6]

T2959 200mg



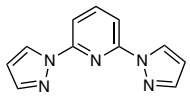
Trimethyl 2,2':6',2''-Terpyridine-4,4',4''-tricarboxylate [330680-46-1]

P2239 1g 5g



2-(1-Pyrazolyl)pyridine [25700-11-2]

D4672 1g 5g



2,6-Di(1-pyrazolyl)pyridine [123640-38-0]

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TOKYO CHEMICAL INDUSTRY CO., LTD.
Tel : +81 (0)3-5640-8878
Fax : +81 (0)3-5640-8902
E-mail : globalbusiness@TCIchemicals.com