ChemFiles

Vol. 4 No. 6

Organic Semiconductors for Advanced Electronics

- Conducting Polymers
- Light Emitting Polymers
- Charge Transport Materials
- Semiconducting Small Molecules
- Light Emitting Metal Complexes
- Spin Coating Equipment
- Anode Substrates
- Reference Materials

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Introduction

The field of organic electronics is an active emerging technology with immense promise for innovative, convenient and high-performance electronics. Breakthrough products employed in commercial technologies include organic light-emitting diodes (OLEDs) used in displays for car radios.[1] Organic field effect-transistors (OFETs) are showing promise as their efficiencies are being rapidly improved.[2] Organic photovoltaics and fuel cells also employ conducting polymers for a number of applications.[3] Two classes of materials are actively investigated for organic electronic applications:

Electronic Polymers: These materials contain an extended π-conjugated organic backbone, giving rise to their unique opto-electrical properties. The inherently (or intrinsically) conductive polymers (ICPs) possess the electrical properties of metals or semiconductors while exhibiting the mechanical properties and processing characteristics of polymers. Applications for ICPs include, electromagnetic-interference (EMI) shielding, conductive layers for OLEDs and OFETs, optically active layers for OLEDs, and anti-corrosion coatings for iron and steel. ICPs include polythiophene, PANI, and PPy. The light emitting polymers (LEPs) possess electronic bandgaps that allow for the emission of visible light. These polymers include PPV, CN-PPV, PFO, and PFE.

Semiconducting Oligomers: Small organic or organometallic molecules possessing extended π-conjugation that can form well-ordered crystalline films. These materials may be processed by either solution or thermal deposition techniques and include products like anthracene, rubrene, Alq_3, and sexithiophene.

Sigma-Aldrich, a leader in High Technology products, offers a broad portfolio of organic semiconductor materials for your research and development needs. In addition to a wide range of polymers and oligomers, we offer a complement of monomer precursors enabling you to develop your own new materials. If you can not find a product as needed, "please bother us," at matsci@sial.com

Product Locator

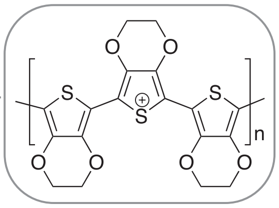
Properties	Products	Abbreviations	Processing Method		Page
			Vacuum	Solution	
Electroluminescent Materials	Aluminum hydroxyquinoline	Alq_3	X	X	11
	Bathocuproine	BCP		X	11
	Cyano polyphenylene vinylenes	CN-PPV		X	6
	Europium Triplets Emitters	–	X	X	11
	Polyfluorenes	PFO		X	8
	Polyfluoreneethynylenes	PFE		X	8
	Polyphenylene vinylenes	PPV		X	7
	Rubrenes	–	X	X	9
Electron Transport	Aluminum hydroxyquinoline	Alq_3	X	X	11
	Other metal quinolines	Zrq_4, Bq_4	X	X	11
Hole Blocking	N,N'-Dimethyl-quinacridone	DMQA		X	11
Hole Injection	Copper phthalocyanine	CuPc	X	X	11
	Poly(3,4-ethylenedioxythiophene)	PEDOT/PSS		X	1
	Polyanilines	PANI		X	3
	Sexithiophenes	6T, DH-6T	X	X	2
	Tetracyano materials	TCNE, TCQF	X	X	10
Hole Transport	Polyarylamines	TPD, NPD		X	9
	Polyphenylene vinylenes	PPV		X	7
	Polyvinylnaphthalene	PVN		X	9
	Titanium phthalocyanine	TiPc	X		9
Inherently Conductive Polymers (ICP)	Poly(3,4-ethylenedioxythiophene)	PEDOT/PSS		X	1
	Polyanilines	PANI		X	3
	Polypyrroles	PPy		X	4
	Polythioacetylenes	PA		X	5
	Polythiophenes	P3AT		X	1
Semiconducting Oligomers	Oligothiophenes	3T, 6T, DH-6T	X	X	2
	Other Small Molecule Organics	–	X	X	9
	Pentacene	–	X	X	9

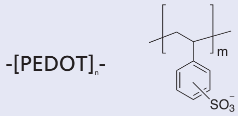
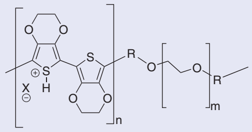
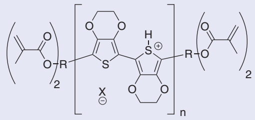
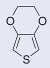
Contact us at matsci@sial.com to request absorption and spectra of any light emitting material in this brochure.

Conducting Polymers

PEDOT

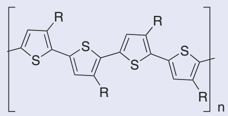
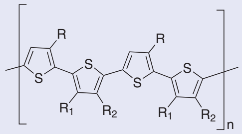
Poly(2,3-dihydrothieno-1,4-dioxin) combines optical transparency in the visible spectrum, good electrical conductivity and stability. PEDOT/PSS is the most widely used hole injecting material in OLEDs.[4] Sigma-Aldrich offers several grades of processable PEDOT. The EDOT monomer is available for your synthesis needs.



Cat #	Product Name	Size	Structure
48,309-5	PEDOT/PSS **1.3 wt% in water** poly(styrenesulfonate) doped	250 g	
56,059-6	**electronic grade, 2.8 wt% in water** poly(styrenesulfonate) doped	25 g 100 g	
64,978-3	PEDOT-block-PEG **1 wt% dispersion in propylene carbonate** perchlorate doped	25 g	 R=Propietary linker
64,979-1	**1 wt% dispersion in nitromethane** p-toluenesulfonate doped	25 g	
64,980-5	**1 wt% dispersion in nitromethane** perchlorate doped	25 g	
64,981-3	PEDOT tetramethacrylate end-capped **0.5 wt% in propylene carbonate** p-toluenesulfonate doped	25 g	 R=Propietary linker
64,982-1	**0.5 wt% in nitromethane** p-toluenesulfonate doped	25 g	
48,302-8	2,3-Dihydrothieno(3,4-b)-1,4-dioxin (EDOT) CAS#: 126213-50-1 MW: 142.18 g/mol	10 g	

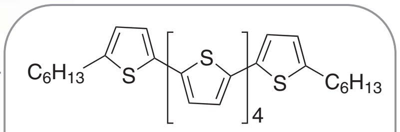
Polythiophenes

Some of the most extensively studied π-conjugated polymers, are the conducting and semiconducting poly-3-alkylthiophenes (P3AT) which are very stable and readily characterized. The mono-, di- and ring substituted polythiophenes exhibit good solubility and tunable band gaps. Applications include, OLEDs, OFETs and other molecular electronic devices.[5] Sigma-Aldrich offers highly regiocontrolled polyalkylthiophenes (>98.5% head-to-tail), which exhibit high charge mobilities, as well as regiorandom analogs.

Cat #	Product Names	R	Type	Size	Structure
44,570-3	Poly(3-hexylthiophene-2,5-diyl)	$-C_6H_{13}$	Regioregular	1 g	 Regioregular
44,571-1	Poly(3-octylthiophene-2,5-diyl)	$-C_8H_{17}$	Regioregular	1 g	
45,065-0	Poly(3-dodecylthiophene-2,5-diyl)	$-C_{12}H_{25}$	Regioregular	1 g	
49,533-6	Poly(3-butylthiophene-2,5-diyl)	$-C_4H_9$	Regioregular	1 g	
49,534-4	Poly(3-decylthiophene-2,5-diyl)	$-C_{10}H_{21}$	Regioregular	1 g	
65,004-8	Poly(3-(2-methoxyethoxy)-ethoxymethylthiophene-2,5-diyl)	–	Regioregular	1 g	
65,005-6	Poly(3-(2-methoxyethoxy)-ethoxythiophene-2,5-diyl)	–	Regioregular	1 g	
51,082-3	Poly(3-hexylthiophene-2,5-diyl)	$-C_6H_{13}$	Regiorandom	1 g	 If R_1 = R then R_2 = H If R_2 = R then R_1 = H Regiorandom
51,083-1	Poly(3-octylthiophene-2,5-diyl)	$-C_8H_{17}$	Regiorandom	1 g	
51,085-8	Poly(3-decylthiophene-2,5-diyl)	$-C_{10}H_{21}$	Regiorandom	1 g	
51,086-6	Poly(3-dodecylthiophene-2,5-diyl)	$-C_{12}H_{25}$	Regiorandom	1 g	
51,142-0	Poly(3-butylthiophene-2,5-diyl)	$-C_4H_9$	Regiorandom	1 g	
52,593-6	Poly(thiophene-2,5-diyl)	–	Br Terminated	1 g	
55,762-5	Poly(3-cyclohexylthiophene-2,5-diyl)	–	–	1 g	
55,763-3	Poly(3-cyclohexyl-4-methylthiophene-2,5-diyl)	–	–	1 g	

Oligothiophenes

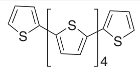
Oligothiophenes are generating interest in conductive polymer research for their high charge mobilities and on/off ratios as *p*-type semiconductors.[6] Garnier et al. fabricated the first all-organic transistor based on α-sexithiophene (6T). Substitution of the α and ω-positions on sexithiophene with alkyl chains increases the charge carrier mobility and improves the solubility in organic solvents, making DH-6T easier to process.



63,321-6
α,ω-Dihexylsexithiophene (DH-6T)
500 mg 93.50

α-Sexithiophene (6T)

59,468-7

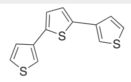


1 g

CAS NO: 88493-55-4
MF: $C_{24}H_{14}S_6$
FW: 494.76
mp: 290 °C (dec.)

3,2':5',3"-Terthiophene

65,138-9

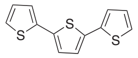


1 g

CAS NO: 81294-16-8
MF: $C_{12}H_8S_3$
MW: 248.39

2,2':5',2"-Terthiophene, 99%

31,107-3

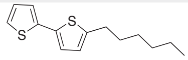


250 mg
1 g

CAS NO: 1081-34-1
MF: $C_{12}H_8S_3$
FW: 248.39
mp: 93-95 °C

5-Hexyl-2,2'-bithiophene, 97%

63,051-9

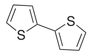


500 mg
1 g

CAS NO: 173448-31-2
MF: $C_{14}H_{18}S_2$
FW: 250.42
bp: 355 °C (760 mmHg)

2,2'-Bithiophene, 97%

24,163-6

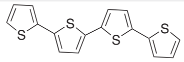


1 g
10 g

CAS NO: 492-97-7
MF: $C_8H_6S_2$
FW: 166.26
mp: 32-33 °C

2,2'5',2'',5'',2'''-Quaterthiophene, 96%

54,790-5



1 g

CAS NO: 5632-29-1
MF: $C_{16}H_{10}S_4$
FW: 330.49
mp: 211-214 °C

Thiophene, 99%

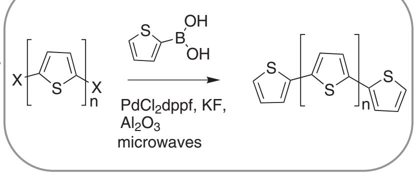
T3180-1

5 g
100 g
500 g

CAS NO: 110-02-1
MF: C_4H_4S
FW: 84.14
bp: 84 °C (760 mmHg)

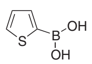
Monomers for Polythiophene Synthesis

Barbarella and co-workers recently demonstrated rapid microwave assisted synthesis of oligothiophenes via a Suzuki coupling route.[7] Sigma-Aldrich offers a complete line of thioboronic acids* and halogenated thiophenes for this application. We carry functionalized thiophenes for your tailored materials.



2-Thiopheneboronic acid

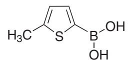
43,683-6



1 g
5 g

5-Methyl-2-thiopheneboronic acid

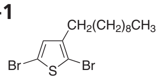
51,219-2



1 g
5 g

2,5-Dibromo-3-decylthiophene, 96%

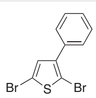
45,638-1



250 mg
1 g
5 g

2,5-Dibromo-3-phenylthiophene, 97%

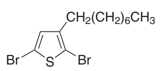
52,550-2



1 g
5 g

2,5-Dibromo-3-octylthiophene, 96%

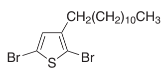
52,548-0



1 g
5 g

2,5-Dibromo-3-dodecylthiophene, 97%

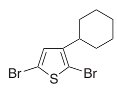
45,640-3



250 mg
1 g
5 g

2,5-Dibromo-3-cyclohexylthiophene, 97%

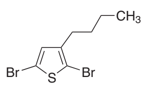
52,551-0



1 g
5 g

2,5-Dibromo-3-butylthiophene, 96%

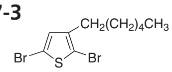
52,549-9



1 g
5 g

2,5-Dibromo-3-hexylthiophene, 97%

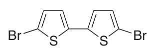
45,637-3



250 mg
1 g
5 g

5,5'-Dibromo-2,2'-bithiophene, 99%

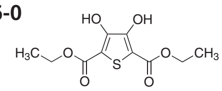
51,549-3



1 g
5 g

3,4-Dihydroxy-thiophene-2,5 dicarboxylic acid diethyl ester

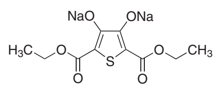
54,736-0



5 mL

3,4-Dihydroxy-thiophene-2,5 dicarboxylic acid diethyl ester, disodium salt

54,147-8

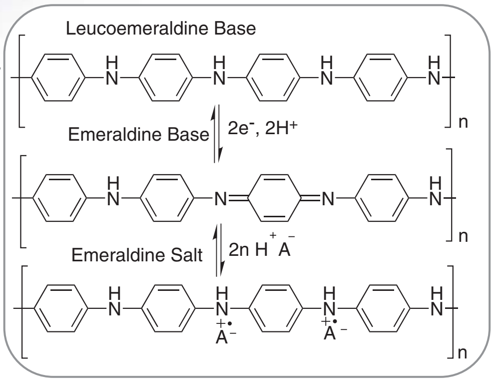


1 g

*For additional thioboronic acids for Suzuki coupling, see Chemfile Vol. 4 No. 2, "Reagents for C-C Bond Formation" (GW4), available from Sigma-Aldrich.

Polyanilines

Polyaniline (PANI) is a versatile conducting polymer with a myriad of applications because of its unique physical and chemical properties.[8] PANI is easily processed by melt or solution processes, and is environmentally and thermally stable. PANI exists in three stable oxidation states (as shown) and a fourth, unstable, fully oxidized form known as pernigraniline. The doped emeraldine salt form of PANIs exhibit very high conductivities. Sigma-Aldrich offers a full line of the stable, doped and undoped PANIs for a variety of processing needs. We also offer high performance dopants for our undoped PANIs.

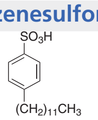


Catalog #	Polyaniline Product	Dopant	Avg. Mw	Conductivity (S/cm)	Size
65,001-3	Emeraldine salt, 2-3 wt.% dispersion in xylene	Organic Sulfonic Acid	-	10-20 (as film)	10 mL 50 mL
64,999-6	Emeraldine salt, 0.5 wt.% dispersion in mixed solvents	Organic Sulfonic Acid	-	~1 (as film)	10 mL 50 mL
42,832-9	Emeraldine salt	Organic Sulfonic Acid	>15,000	2-4	5 g 25 g
53,056-5	Emeraldine salt, composite with carbon black	Organic Sulfonic Acid	-	40	5 g 25 g
57,707-3	Emeraldine salt coated on Nylon	Organic Sulfonic Acid	-	0.2	10 g
56,109-6	Emeraldine salt, ~20% wt in water, short chain grafted to lignin	Ligno-sulfonic acid	-	1-2	10 g 50 g
56,111-8	Emeraldine salt, ~20% wt in water, long chain grafted to lignin	Ligno-sulfonic acid	-	4-6	10 g 50 g
56,112-6	Emeraldine salt, powder, short chain grafted to lignin	Ligno-sulfonic acid	-	1-2	2 g 10 g
56,113-4	Emeraldine salt, powder, long chain grafted to lignin	Ligno-sulfonic acid	-	4-6	2 g 10 g
55,645-9	Emeraldine base	Undoped	5,000	-	5 g 25 g
47,670-6	Emeraldine base	Undoped	10,000	-	10 g 50 g
55,637-8	Emeraldine base	Undoped	20,000	-	5 g 25 g
55,638-6	Emeraldine base	Undoped	50,000	-	5 g 25 g
53,068-9	Emeraldine base	Undoped	65,000	-	10 g 50 g
57,637-9	Emeraldine base	Undoped	100,000	-	5 g 25 g
57,647-6	Emeraldine base	Undoped	300,000	-	5 g 25 g
53,067-0	Leucoemeraldine base	-	-	-	5 g

Polyaniline Dopants

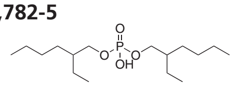
Dodecylbenzenesulfonic acid (DBSA)

52,295-3 500 mL



Bis(2-ethylhexyl) phosphate (DEHHP)

23,782-5 25 g, 100 g



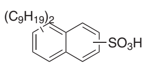
Dinonylnaphthalenesulfonic acid (DNSA)

50 wt. % solution in heptane

52,296-1 100 mL

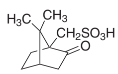
55 wt. % solution in isobutanol

52,298-8 100 mL



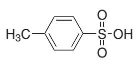
(±)-Camphor-10-sulfonic acid (β) (CSA)

14,792-3 5 g, 100 g, 500 g

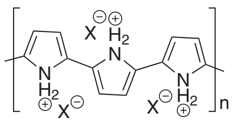


p-Toluenesulfonic Acid (pTSA)
Monohydrate 98.5+%
ACS Reagent

40,288-5 5 g, 100 g, 500 g



Polypyrroles (PPy)



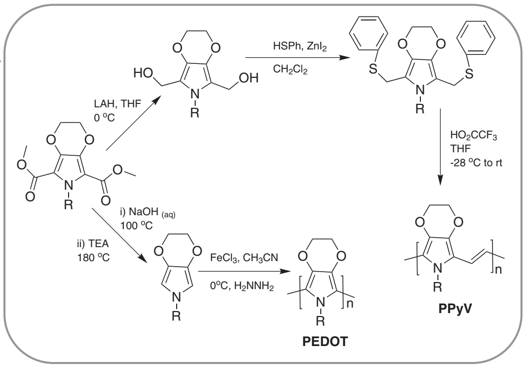
PPy exhibits high conductivity and good stability.[9] PPy films are easily fabricated on a number of surfaces. In the oxidized state, PPy is a radical cation charge balanced by dopant anions. PPy finds applications in batteries, chemical sensors, ion selective electrodes, and conductive coatings for nanomaterials. PPy nanowires have also been fabricated.[10]

Catalog #	Polypyrrole	Conductivity (S/cm)	Size
57,703-0	Polypyrrole* powder	10-40 pressed pellet	10 g
48,255-2	Polypyrrole 5 wt. % solution in water	10-40 pressed pellet	100 mL
53,057-3	Polypyrrole* composite 20 wt% loading on carbon black	30 bulk	25 g
57,706-5	Polypyrrole composite, undoped 20 wt% loading on carbon black	13-20 bulk	10 g
57,817-7	Polypyrrole* composite 5 wt% loading on TiO_2	0.8-1.0 pressed pellet	10 g

*Doped with proprietary organic sulfonic acid

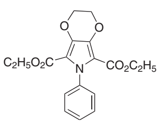
New Polypyrrole Starting Materials

Sigma-Aldrich offers a complete line of monomers for the synthesis of polyethylenedioxypyrrole (PEDOP) and polypropylenedioxypyrrole (PPDOP). Ethylene and propylene substitution of pyrrole serves to enhance the electronic properties of pyrroles and the alkyl substitutions improve processability. Carboxylic ester substituted EDOPs are precursors to both PEDOP and the conducting pyrrolylene vinylenes (PPyV)[11] as shown in the reaction schemes. One solution processable PPyV, PDPV (R=dodecyl) has a band gap of 1.67 eV.[12]



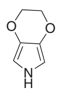
Diethyl 1-benzyl-3,4 ethylenedioxypyrrole-2,5 dicarboxylate, 95%

63,708-4 1 g



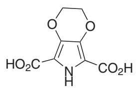
3,4-Ethylenedioxypyrrole, 2% (w/v) solution in THF

64,831-0 2 mL, 10 mL



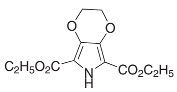
3,4-Ethylenedioxypyrrole-2,5 dicarboxylic acid, 95%

63,720-3 500 mg



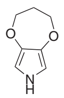
Diethyl-3,4-ethylenedioxypyrrole-2,5 dicarboxylate, 98%

63,716-5 500 mg



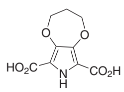
3,4-Propylenedioxypyrrole 2% (w/v) solution in THF

64,832-9 250 mg



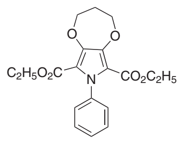
3,4-Propylenedioxypyrrole-2,5 dicarboxylic acid, hydrate, 95%

63,743-2 500 mg



Diethyl 1-benzyl-3,4 propylenedioxypyrrole-2,5 dicarboxylate

63,741-6 1 g

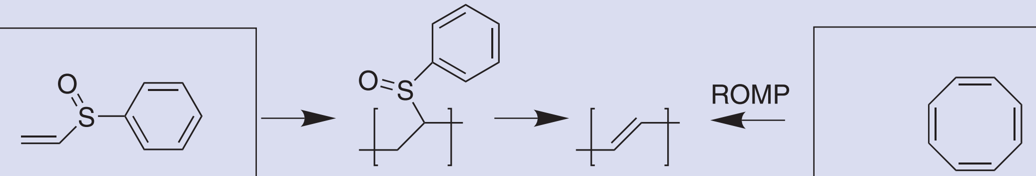


Polyacetylenes

The simplest π conjugated polymer. In 1977 Heeger, MacDiarmid and Shirakawa discovered that polyacetylene becomes conductive upon doping with bromine or iodine vapor.[13] This discovery opened up the field of conductive polymer research and the trio were awarded the 2000 Nobel Prize in chemistry. Polyacetylene can be regarded as an intrinsic semiconductor with a band gap of 1.5 eV.

Polyacetylene Synthesis

Polyacetylene can be formed by either polymerization of phenyl vinyl sulfoxide, followed by removal of benzenesulfinic acid, or by ring-opening metathesis polymerization (ROMP) of cyclooctatetraene.



21,330-6
Phenyl vinyl sulfoxide

1 g
5 g

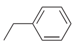
Polyacetylene

13,892-4
1,3,5,7-Cyclooctatetraene

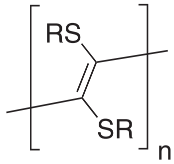
250 mg
1 g
5 g

Polythioacetylenes

Polythioacetylenes are a soluble, processable derivative of polyacetylene. When irradiated with laser light, the polymers exhibit conductivities from 10-200 S/cm.

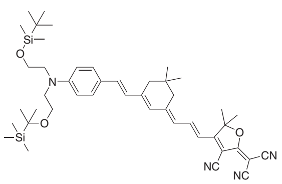
Catalog #	Polyacetylene Products	Avg. Mn*	R group	Size
44,600-9	Poly(bis(methylthio)acetylene)	4000	$-CH_3$	50 mg 250 mg
44,601-7	Poly(bis(ethylthio)acetylene)	1200	$-CH_2CH_3$	50 mg 250 mg
44,602-5	Poly(bis(benzylthio)acetylene)	900		100 mg 250 mg

*by vapor pressure osmometry (vpo)



New Technologies for OLEDs

CLD-1 Dye and Ready-to-Cast Solution



CLD-1 is a high μβ chromophore possessing excellent thermal stability, low optical loss and low modulation voltage. Now Sigma-Aldrich offers CLD-1 as a powder and as a ready-to-cast solution with an amorphous poly-carbonate (APC) support.

64,413-7

CLD-1

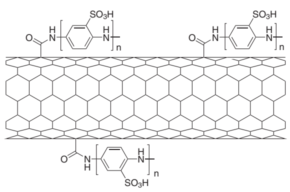
100 mg

65,158-3

10% CLD-1 in Dichloroethane (25% solids with APC support)

5 mL

Water Soluble Carbon Nanotubes



NEW single walled carbon nanotubes coated in a water soluble conductive polymer to aid in solution processing.

Solubility in H_2O = 5.0 mg/mL

63,923-0

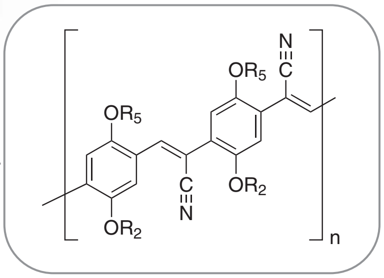
Carbon nanotube, single-walled, polyamino benzene sulfonic acid coating (65/35)

50 mg

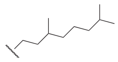
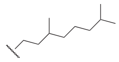
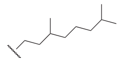
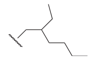
Ready to scale up? For competitive quotes on larger quantities or custom synthesis, contact Sigma-Aldrich Fine Chemicals at 1-800-336-9719 (USA), or visit www.sigma-aldrich.com/safc.

Light-Emitting Polymers

Cyano-Polyphenylene vinylenes (CN-PPV)

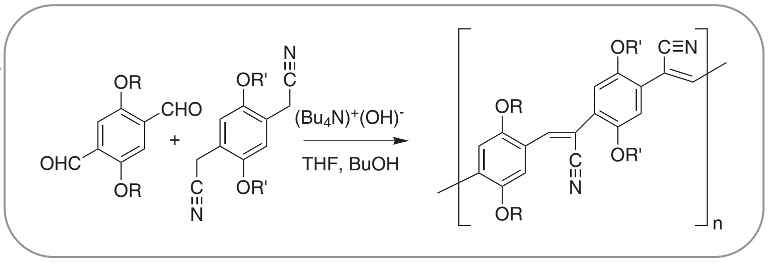


CN-PPV acts as the electron accepting material in light emitting polymer heterojunctions. OLEDs incorporating CN-PPV exhibit quantum efficiencies of ~30%.

Product	Cat. No.	Size	R2	R5
Poly(2,5-di(3,7-dimethyloctyloxy)-cyanoterephthalylidene)	64,657-1	250 mg		
Poly(5-(3,7-dimethyloctyloxy)-2-methoxy-cyanoterephthalylidene)	64,662-8	250 mg	$-CH_3$	
Poly(5-(2-ethylhexyloxy)-2-methoxy-cyanoterephthalylidene)	64,664-4	250 mg	$-CH_3$	
Poly(2,5-di(hexyloxy)cyanoterephthalylidene)	64,665-2	250 mg	$-C_6H_{13}$	$-C_6H_{13}$
Poly(2,5-di(octyloxy)cyanoterephthalylidene)	64,666-0	250 mg	$-C_8H_{17}$	$-C_8H_{17}$

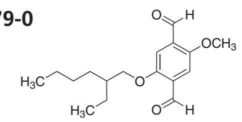
Monomers for CN-PPV

Sigma-Aldrich has a wide selection of monomers for Knoevenagle condensation to CN-PPV. If you don't see the monomer you need, send a suggestion to **matsci@sial.com**.



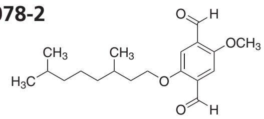
2-Methoxy-5-(2'-ethylhexyloxy) terephthalaldehyde

56,079-0 1 g



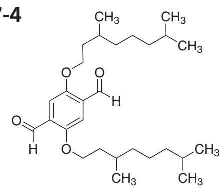
2-Methoxy-5-(3',7'-dimethyloctyloxy) terephthalaldehyde

56,078-2 1 g



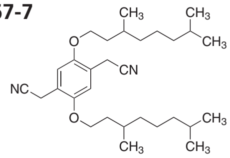
2,5-Bis(3',7'-dimethyloctyloxy) terephthalaldehyde

56,077-4 1 g



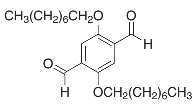
2,5-Bis(3',7'-dimethyloctyloxy) benzene-1,4-diacetonitrile

56,067-7 1 g



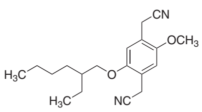
2,5-Bis(octyloxy)terephthalaldehyde

56,671-3 1 g



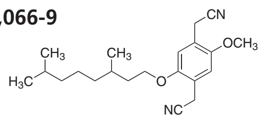
2-Methoxy-5-(2'-ethylhexyloxy) benzene-1,4-diacetonitrile

56,064-2 1 g



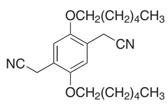
2-Methoxy-5-(3',7'-dimethyloctyloxy) benzene-1,4-diacetonitrile

56,066-9 1 g



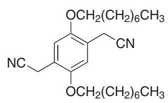
2,5-Bis(hexyloxy)benzene-1,4-diacetonitrile

56,069-3 1 g



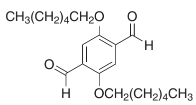
2,5-Bis(octyloxy)benzene-1,4 diacetonitrile

56,672-1 1 g



2,5-Bis(hexyloxy)terephthalaldehyde

56,076-6 1 g

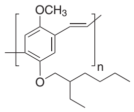


TO ORDER: Contact your local Sigma-Aldrich office (see back cover), call 1-800-558-9160 (USA), or visit sigma-aldrich.com.

Polyphenylene vinylenes (PPV)

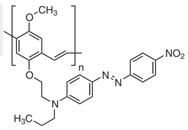
Among the best studied light emitting conjugated polymers, PPV combines good mechanical and processing properties with excellent luminescent abilities.[14] Substitution of the intractable PPV backbone with alkyl and alkoxy substituants improves the solubility and tunes the optical band gap. PPV derivatives are commonly employed as the electroluminescent layer in LEPs used in mobile phones. Sigma-Aldrich presents a range of substituted PPVs and PPV co-polymers to combine emission color characteristics and processing requirements.

Poly(2-methoxy-5-(2'-ethylhexyloxy)-1,4-phenylenevinylene) MEH-PPV



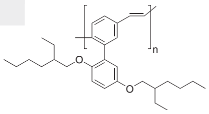
Catalog #	Avg Mn	λ_{max} (nm)	Size
54,144-3	51,000	497	1 g
54,143-5	86,000	497	1 g
53,651-2	125,000	498	1 g

Poly(1-methoxy-4-(o-disperse red 1))-2,5-phenylenevinylene



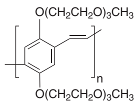
63,032-2 100 mg, 500 mg
λ_{max} (nm): 465

Poly(2-(2',5'-bis(2"-ethylhexyloxy) phenyl)-1,4-phenylenevinylene), BEHP-PPV



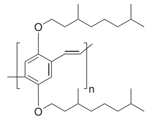
54,661-5 1 g
λ_{max} (nm): 278

Poly(2,5-bis(1,4,7,10-tetraoxaundecyl)-1,4-phenylenevinylene)



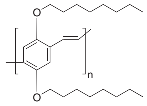
64,421-8 1 g
λ_{max} (nm): 510

Poly(2,5-bis(3',7'-dimethyloctyloxy)-1,4-phenylenevinylene)



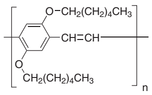
54,651-8 1 g
λ_{max} (nm): 488

Poly(2,5-bisoctyloxy)-1,4-phenylenevinylene



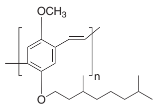
55,503-7 1 g
λ_{max} (nm): 491

Poly(2,5-dihexyloxy-1,4-phenylenevinylene)



56,080-4 1 g
λ_{max} (nm): 496

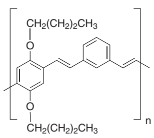
Poly(2-methoxy-5-(3',7'-dimethyloctyloxy)-1,4-phenylenevinylene)



54,646-1 1 g
λ_{max} (nm): 491

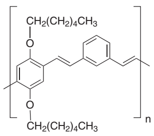
PPV Copolymers

Poly(m-phenylenevinylene)-*alt*-(2,5-dibutoxy-p-phenylenevinylene)



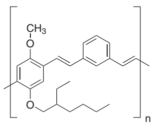
57,540-2 1 g
λ_{max} (nm): 403

Poly(m-phenylenevinylene)-*alt*-(2,5-dihexyloxy-p-phenylenevinylene)



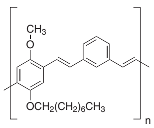
57,541-0 1 g
λ_{max} (nm): 403

Poly(m-phenylenevinylene)-*alt*-(2-methoxy-5-(2-ethylhexyloxy)-p-phenylenevinylene)



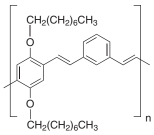
59,431-8 1 g
λ_{max} (nm): 401

Poly(m-phenylenevinylene)-*alt*-(2-methoxy-5-octyloxy-p-phenylenevinylene)



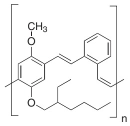
59,441-5 1 g
λ_{max} (nm): 399

Poly(m-phenylenevinylene)-*co*-(2,5-dioctoxy-p-phenylenevinylene)



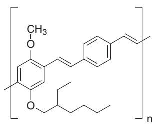
55,516-9 1 g
λ_{max} (nm): 402

Poly[(o-phenylenevinylene)-*alt*-(2-methoxy-5-(2-ethylhexyloxy)-p-phenylenevinylene)]



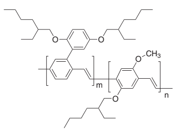
59,408-3 1 g
λ_{max} (nm): 385

Poly[(p-phenylenevinylene)-*alt*-(2-methoxy-5-(2-ethylhexyloxy)-p-phenylenevinylene)]



59,419-9 1g

Poly{[2-[2',5'-bis(2"-ethylhexyloxy)phenyl]-1,4-phenylenevinylene]-*co*-[2-methoxy-5-(2'-ethylhexyloxy)-1,4-phenylenevinylene]}



57,026-5 1 g
λ_{max} (nm): 492

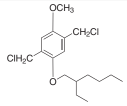
Contact us at matsci@sial.com to request absorption and photoluminscence spectra or additional analytical data of any light emitting material in this brochure.

PPV Monomers

PPV materials are often prepared by the Wessling sulfonium precursor route,* which yields PPVs upon heating cast films of the precursors. An alternate route is the solution phase dehydrohalogenation method. Sigma-Aldrich offers several precursors for your PPV synthesis.

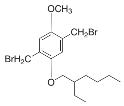
2,5-Bis(chloromethyl)-1-methoxy-4-(2-ethylhexyloxy)benzene, 98%

53,625-0 1 g



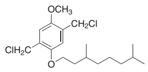
2,5-Bis(bromomethyl)-1-methoxy-4-(2-ethylhexyloxy)benzene, 98%

53,653-9 1 g



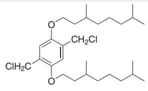
2,5-Bis(chloromethyl)-1-methoxy-4-(3',7'-dimethyloctyloxy)benzene, 98%

54,644-5 1 g



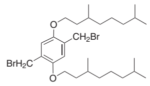
2,5-Bis(chloromethyl)-1,4-bis(3',7'-di methyloctyloxy)benzene, 98%

54,648-8 1 g



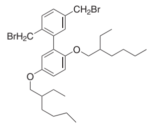
2,5-Bis(bromomethyl)-1,4-bis(3',7'-di methyloctyloxy)benzene, 98%

54,649-6 1 g



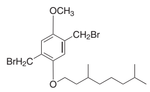
2,5-Bis(bromomethyl)-2',5'-bis(2-ethyl hexyloxy)-1,1'-biphenyl, 98%

54,660-7 1 g



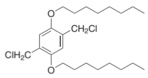
2,5-Bis(bromomethyl)-1-methoxy-4-(3',7'-dimethyloctyloxy)benzene, 98%

54,645-3 1 g



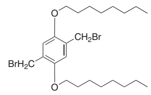
2,5-Bis(chloromethyl)-1,4-bis(octyloxy)benzene, 98%

55,505-3 1 g



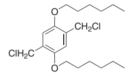
2,5-Bis(bromomethyl)-1,4-bis(octyloxy)benzene, 98%

55,504-5 1 g



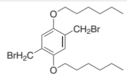
2,5-Bis(chloromethyl)-1,4-bis(hexyloxy)benzene, 98%

56,073-1 1 g



2,5-Bis(bromomethyl)-1,4-bis(hexyloxy)benzene, 98%

56,075-8 1 g

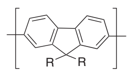


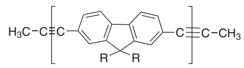
*Poly(p-xylene tetrahydrothiophenium chloride) is available as a film (**54,077-3**) or solution (**54,076-5**). For this and phosphonium monomers to PPV, contact us at **matsci@sial.com**.

Polyfluorenes (PFO, PFE)

Alkylpolyfluorenes are an attractive class of conjugated polymers for OLED applications, because of their pure blue emission and efficient electroluminescence coupled with a high charge-carrier mobility and good processability.

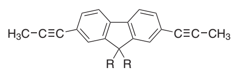
Catalog #	Polyacetylene Products	R	Size
57,103-2	Poly[9,9-di-(2'-ethylhexylfluorenyl-2,7'-diyl)]	$-C_6H_{13}$	1 g
57,104-0	Poly(9,9-di-n-hexylfluorenyl-2,7'-diyl)	$-C_6H_{13}$	1 g
57,165-2	Poly(9,9-di-n-octylfluorenyl-2,7'-diyl)	$-C_8H_{17}$	500 mg
57,166-0	Poly(9,9-di-n-dodecylfluorenyl-2,7-diyl)	$-C_{12}H_{25}$	500 mg
54,658-5	Poly(9,9-dioctylfluorenyl-2,7-yleneethynylene)	$-C_8H_{19}$	500 mg
55,499-5	Poly[9,9-di(2'-ethylhexyl)fluoren-2,7-yleneethynylene]		500 mg
55,497-9	Poly[9,9-di(3',7'-dimethyloctyl)fluoren-2,7-yleneethynylene]		500 mg
55,500-2	Poly(9,9-didodecylfluorenyl-2,7-yleneethynylene)	$-C_{12}H_{25}$	500 mg

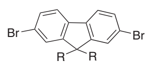


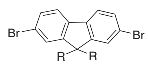


Monomers for PFO/PFE synthesis

Catalog #	Polyacetylene Products	R	Size
54,662-3	9,9-Dioctyl-2,7-di-1-propynyl-9H-fluorene, 98%	$-C_8H_{17}$	1 g
55,496-0	9,9-Didodecyl-2,7-di-1-propynyl-9H-fluorene, 98%	$-C_{12}H_{25}$	1 g
55,501-0	9,9-Di(3',7'-dimethyloctyl)-2,7-di-1-propynyl-9H-fluorene, 98%		500 mg
55,502-9	9,9-Di(2'-ethylhexyl)-2,7-di-1-propynyl-9H-fluorene, 98%		500 mg
57,206-3	9,9-Didodecylfluorene-2,7-bis(trimethylene borate) 0.5M solution in toluene	$-C_{12}H_{25}$	500 mg
56,935-6	9,9-Dihexylfluorene-2,7-bis(trimethyleneborate)	$-C_8H_{17}$	500 mg
56,668-3	9,9-Dihexylfluorene-2,7-bis(trimethyleneborate)	$-C_6H_{13}$	500 mg
57,207-1	9,9-Di(2'-ethylhexyl)fluorene-2,7-bis (trimethylene borate) solution (0.5 M in Toluene)		500 mg
56,005-7	9,9-Didodecyl-2,7-dibromofluorene	$-C_{12}H_{25}$	500 mg
56,007-3	9,9-Dioctyl-2,7-dibromofluorene	$-C_8H_{17}$	500 mg
56,006-5	9,9-Dihexyl-2,7-dibromofluorene	$-C_6H_{13}$	500 mg
56,008-1	9,9-Di-(2'-ethylhexyl)-2,7-dibromofluorene		500 mg







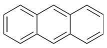
Charge Transport Materials

Semiconducting Small Molecules

OLEDs and OFETs are commercially available because of these high-charge mobility materials. The aromatic oligometers form well ordered crystalline films of high purity through vacuum processing. Sigma-Aldrich can prepare these materials with extremely low metals content for electronic grade applications. We have additional products not listed below, so if you don't see something you need, contact us at **matsci@sial.com** or visit our on-line catalog at **sigma-aldrich.com/matsci**.

Anthracene, Zone Refined, 99+%

33,148-1 250 mg, 1 g

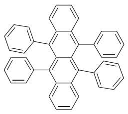


CAS NO: 120-12-7
MF: $C_{14}H_{10}$
FW: 178.23
mp: 216-218 °C

Rubrene

55,407-3, 98+% 100 mg, 500 mg

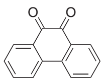
55,111-2, sublimed 100 mg, 500 mg



CAS NO: 517-51-1
MF: $C_{42}H_{28}$
FW: 532.69
mp: >315 °C

9,10 Phenanthrenequinone, 99+%

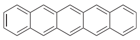
15,650-7 5 g, 25 g



CAS NO: 84-11-7
MF: $C_{14}H_8O_2$
FW: 208.22
mp: 209-211 °C

Pentacene

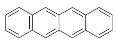
P180-2 50 mg, 100 mg, 1 g



CAS NO: 135-48-8
MF: $C_{22}H_{14}$
FW: 278.35
mp: >300 °C

2,3-Benzanthracene, 98% (tetracene)

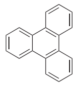
B240-3 100 mg, 500 mg, 1 g



CAS NO: 92-24-0
MF: $C_{18}H_{12}$
FW: 228.29
mp: >300 °C

Triphenylene, 98%

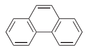
T8,260-0 250 mg, 1 g



CAS NO: 217-59-4
MF: $C_{18}H_{12}$
FW: 228.29
mp: 197-200 °C

Phenanthrene, 99.5+%

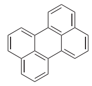
26,087-8 500 mg, 1 g



CAS NO: 85-01-8
MF: $C_{14}H_{10}$
FW: 178.23
mp: 99-101 °C

Perylene, 99.5+%

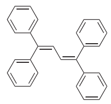
39,447-5 1 g, 5 g



CAS NO: 198-55-0
MF: $C_{20}H_{12}$
FW: 252.32
mp: 278-280 °C (dec)

1,1,4,4-Tetraphenyl-1,3-butadiene, 99+%

18,521-3 1 g, 5 g



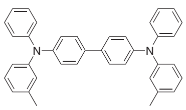
CAS NO: 1450-63-1
MF: $C_{28}H_{22}$
FW: 358.49
mp: 207-209 °C

Hole Transport Materials (HTM)

Sigma-Aldrich features a wide variety of molecular organic and organometallic HTMs. We also have precursors to several[15] polyarylamines. As always, if you need a new HTM not listed here, "please bother us," at **matsci@sial.com**.

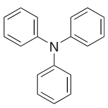
N,N'-Bis(3-methylphenyl)-N,N'-diphenylbenzidine, (TPD), 99%

44,326-3 1 g, 5 g



Triphenylamine, 98%

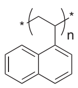
T8,160-4 25 g, 100 g



Poly(1-vinylnaphthalene), average Mn. ca. 100,000

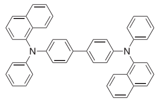
19,196-5 Mn=100,000 1 g

54,145-1 Mn=30,000 1 g



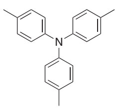
N,N'-Di-[(1-naphthalenyl)-N,N'-diphenyl]-1,1'-biphenyl-4,4'-diamine, (NPD) sublimed grade, 99%

55,669-6 500 mg



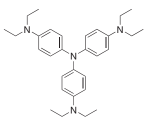
Tri-p-tolylamine, 97%

45,976-3 1 g, 5 g



Tris(4-(diethylamino)phenyl)amine, 99+%

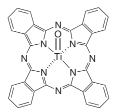
55,639-4 1 g, 10 g



Titanyl phthalocyanine

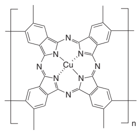
40,455-1 95% Dye Content 250 mg, 1 g

55,618-1 γ-modification 250 mg, 1 g



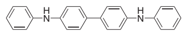
Copper phthalocyanine polymer, 60% dye content

52,762-9 1 g, 5 g



N,N'-Diphenylbenzidine, 97%

D20,520-6 10 g, 50 g



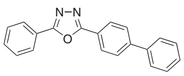
Semiconducting Small Molecules
Hole Transport Materials

Electron Transport Materials (ETM)

ETMs find utility in OLEDs as hole-blocking materials and when co-polymerized with fluorenes as efficient electron transport materials.

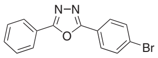
2-(4-Biphenylyl)-5-phenyl-1,3,4-oxadiazole, (PBD), 99%

25,785-0 — 5 g, 25 g



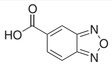
2-(4-Bromophenyl)-5-phenyl-1,3,4-oxadiazole, 96%

55,364-6 — 1 g, 5 g



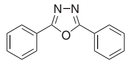
2,1,3-Benzoxadiazole-5-carboxylic acid, 97%

55,661-0 — 500 mg



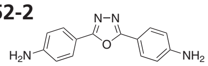
2,5-Diphenyl-1,3,4-oxadiazole, 97%

D21,021-8 — 1 g, 5 g



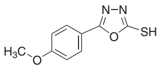
2,5-Bis(4-aminophenyl)-1,3,4-oxadiazole

33,352-2 — 250 mg, 1 g



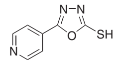
5-(4-Methoxyphenyl)-1,3,4-oxadiazole-2-thiol, 97%

54,896-0 — 25 g



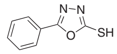
5-(4-Pyridyl)-1,3,4-oxadiazole-2-thiol, 97%

43,856-1 — 1 g, 10 g



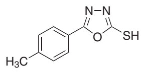
5-Phenyl-1,3,4-oxadiazole-2-thiol, 97%

39,180-8 — 5 g, 25 g



5-(4-Methylphenyl)-1,3,4-oxadiazole-2-thiol, 97%

54,895-2 — 5 g, 25 g

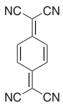


Hole Injection Materials*

The TCN family of molecules are some of the best known electron accepting molecules used in charge transfer superconductors. They are also used as a barrier between ITO and HTMs to enhance charge injection, improving device efficiency.

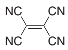
7,7,8,8-Tetracyanoquinodimethane, (TCNQ), 98%

15,763-5 — 1 g, 5 g, 10 g



Tetracyanoethylene, (TCNE), 98%

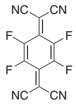
T,880-9



1 g	14.20
5 g	48.40
10 g	85.00
25 g	149.30

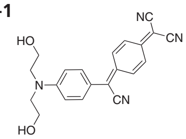
2,3,5,6-Tetrafluoro-7,7,8,8-tetracyanoquinodimethane (TCNQF4), 97%

37,677-9 — 5 mg, 25 mg



2-[4-((Bis(2-hydroxyethyl)aminophenyl)-cyanomethylene)-2,5-cyclohexadien-1-yldiene]malononitrile

57,210-1 — 5 mg, 25 mg

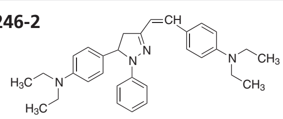


*(PEDOT:PSS is listed on page 1) Electron acceptors for superconducting materials in the Additional CT Materials table below.

Additional Photosensitizing and CT Materials

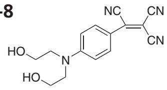
(Diethylamino)phenyldihydrophenylpyrazol-yl-ethenyl-N,N-diethylaniline

46,246-2 — 1 g



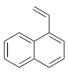
[4-[Bis(2-hydroxyethyl)amino]phenyl]-1,1,2-ethylenetricarbonitrile

57,212-8 — 50 mg, 250 mg



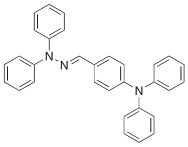
1-Vinylnaphthalene, 95%

53,058-1 — 1 g, 5 g



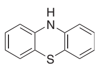
4-(Diphenylamino)benzaldehyde diphenylhydrazone, 97%

46,244-6 — 1 g



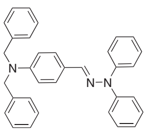
Phenothiazine, 98+%

P1,483-1 — 25 g, 500 g, 1kg



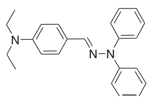
4-(Dibenzylamino)benzaldehyde diphenylhydrazone, 97%

54,836-7 — 1 g



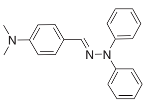
4-(Diethylamino)benzaldehyde diphenylhydrazone, 97%

46,243-8 — 1 g, 25 g



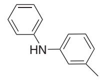
4-(Dimethylamino)benzaldehyde diphenylhydrazone, 97%

46,241-1 — 1 g



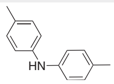
3-Methyldiphenylamine, 98%

18,351-2 — 10 g, 50 g



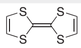
Di-p-tolylamine, 97%

46,108-3 — 5 g, 25 g



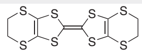
Tetrathiafulvalene, (TTF), 97%

18,318-0 — 100 mg, 250 mg, 1 g



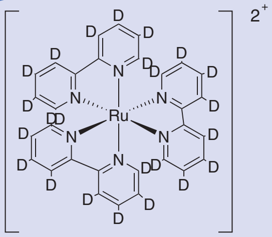
Bis(ethylenedithio)tetrathiafulvalene (BEDT-TTF), 98%

36,202-6 — 100 mg, 500 mg



Electron Transport Materials, Hole Injection Materials, Photosensitizing & CT Materials

NEW



Tris(2,2'-bipyridyl-d$_8$)ruthenium(II) hexafluorophosphate, 99%

Deuteration of the bipyridine ligand improves the emission lifetime and quantum efficiency of the triplet emission by reducing energy losses through C-H bond vibrations. The quantum efficiencies are 20% greater than the undeuterated analog.[16] Sigma-Aldrich presents our newest technology for OLED and sensor applications.

65,240-7 100 mg, 500 mg

MW: $C_{30}D_{24}F_{12}N_6P_2Ru$
mp: >300°C
lmax: 455nm

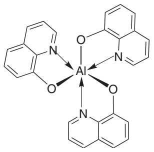
Light-Emitting Metal Complexes

Metal complexes are the key electron transport and emission materials for OLEDs Europium complexes (red), Alq$_3$ (green) and LiBq$_4$(blue) provide the complete spectrum of emission colors. The triplet emitting ruthenium complexes are also used in sensor applications. Have a complex in mind, but can't find it? Contact matsci@sial.com, we welcome your product suggestions.

8-hydroxyquinoline, aluminum salt, ALq$_3$, 99.995%

44,456-1 1 g, 5 g

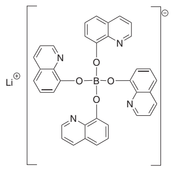
CAS NO: 2085-33-8
MF: $C_{27}H_{18}AlN_3O_3$
FW: 459.44
mp: 408-410 °C
Application: Electroluminescent Green Emitter
λ max (Emis): 511 nm (ITO Film)



Lithium tetra(8-hydroxyquinolinato)boron, 98%

53,892-2 100 mg

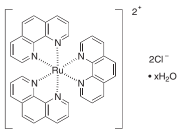
CAS NO: 322727-85-5
MF: $C_{36}H_{24}BN_4O_4Li$
FW: 594.4
mp: 240-241 °C
Application: Electroluminescent Blue Emitter
λ max (Emis): 512 nm (THF)



Dichlortris(1,10-phenanthroline) ruthenium(II) hydrate, 98%

34,371-4 1 g, 5 g

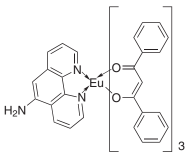
CAS NO: 304695-79-2
MF: $C_{36}H_{24}Cl_2N_6Ru$
FW: 712.61
Application: Triplet Emitter



Tris(dibenzoylmethane)mono (5-aminophenanthroline) europium(III)

53,897-3 100 mg

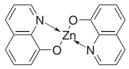
CAS NO: 352546-68-0
MF: $C_{57}H_{43}EuN_3O_6$
FW: 1017.95
mp: 163-168 °C
Application: Triplet Red Emitter
λ max (Emis): 612 nm (H_2O)



8-Hydroxyquinoline, zinc salt , Znq$_2$, 99%

47,175-5 5 g, 25 g

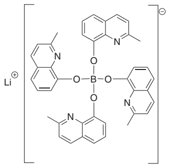
CAS NO: 13978-85-3
MF: $C_{18}H_{12}N_2O_2Zn$
FW: 353.7
mp: 354-356 °C
Application: Electroluminescent Yellow Emitter
λ max (Emis): 544 nm (in THF)



Lithium tetra(2-methyl-8-hydroxyquinolinato) boron, 98%

53,891-4 100 mg

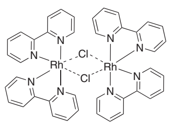
CAS NO: 338949-42-1
MF: $C_{40}H_{32}BN_4O_4Li$
FW: 650.5
mp: 224-225 °C
Application: Electroluminescent Blue Emitter
λ max (Emis): 504 nm (THF)



Chlorobis(2-phenylpyridine)rhodium(III)

41,907-9 250 mg, 1 g

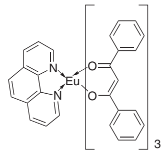
CAS NO: 33915-80-9
MF: $C_{44}H_{32}Cl_2N_4Rh_2$
FW: 893.49
mp: 270 dec.
Application: Triplet Emitter



Tris(dibenzoylmethane)mono(phenanthroline) europium(III)

53,896-5 100 mg

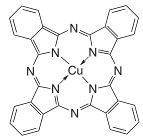
CAS NO: 17904-83-5
MF: $C_{57}H_{41}EuN_2O_6$
FW: 1001.93
mp: 172-173 °C
Application: Triplet Red Emitter
λ max (Emis): 608 nm (THF)



Copper(II) pthalocyanine, 99% (dye content) Sublimation Grade

54,668-2 200 mg, 2 g

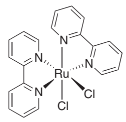
CAS NO: 147-14-8
MF: $C_{32}H_{16}CuN_8$
FW: 576.07



Cis-bis(2,2'-bipyridine)dichlororuthenium(II) hydrate

28,812-8 500 mg, 5 g

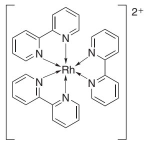
CAS NO: 98014-14-3
MF: $C_{20}H_{16}Cl_2N_4Ru$
FW: 484.36
Application: Triplet Emitter



Tris(2,2'-bipyridyl)dichlororuthenium(II) hexa hydrate, 99.95%

54,498-1 250 mg, 1 g

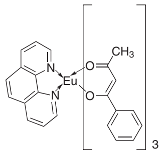
CAS NO: 50525-27-4
MF: $C_{30}H_{36}Cl_2N_6O_6Ru$
FW: 748.63
mp: >300 °C
Application: Triplet Emitter



Tris(benzoylacetonato)mono(phenanthroline) europium(III)

53,895-7 100 mg

CAS NO: 18130-95-5
MF: $C_{42}H_{35}EuN_2O_6$
FW: 818.7
mp: 191-192 °C
Application: Triplet Red Emitter
λ max (Emis): 611 nm (THF)



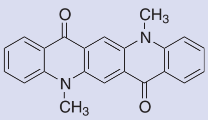
Using Alq$_3$? Improve your efficiency.

Alq$_3$ is the choice electron transport material and green emission layer material for OLED applications because of its stability, processability and fluorescence properties.[17] Alq$_3$ performance can be improved by employing dopants like DMQA or BCP to improve luminous and power efficiency, and emission lifetime.

5,12-Dihydro-5,12-dimethylquino[2,3-b]acridine-7,14-dione (DMQA)

55,758-7 100 mg, 500 mg

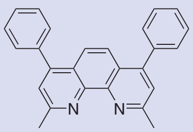
CAS NO: 19205-19-7
MF: $C_{22}H_{16}N_2O_2$
FW: 340.37
mp: 285.8°C (dec)



2,9-Dimethyl-4,7-diphenyl-1,10-phenanthroline, 96% (Bathocuproine or BCP)

14,091-0 500 mg, 1 G

CAS NO: 4733-39-5
MF: $C_{26}H_{20}N_2$
FW: 360.46
mp: 279-283°C (dec)



Spin-Coating Equipment

These compatible, easy-to-use devices provide a convenient step-by-step method for processing metalorganic polymer solutions. The dispenser releases accurately measured amounts onto the precision spin-coater. The hot plate and UV curer are then used to bake or cure your thin film or coating. This simple system can be used to deposit metal oxide thin films, polymer coatings, and metal organic thin films. 220V equipment is CE compliant and supplied with a U.S. plug.

Precision Spin-Coater

A two-stage spin process allows dispensing at low speeds and homogenizing the coating at high speeds. Dim.: 8 ½W x 8 ½H x 10in.D.

Specifications

Vacuum:	>2.1CFM
Speed stability:	<1%
Stage 1:	500-2,500rpm 2-18 seconds
Stage 2:	1,000-8,000rpm 3-60 seconds

Volts	Cat. No.
115V	**Z55,156-2**
220V	**Z55,158-9**

Compact Hot Plate

The portable design is convenient to be used in conjunction with the spin-coater. Has digital display and internal thermocouple. Plate dim: 6 x 6in.

Specifications

Temp. Resolution:	1°C
Temp. Range:	120-660°F

Volts	Cat. No.
110V	**Z55,159-7**
220V	**Z55,160-0**

UV Curer

2 tubes. Dim.: 8 ¼ x 9 ½ in.

Specifications

UV Wavelength:	254nm
Power output:	4 watts/tube
Turn plate:	6rpm

Volts	Cat. No.
110V	**Z55,161-9**
220V	**Z55,162-7**

Dispenser

Dim.: 8 ¼ x 9 ½ x 4in.

Specifications

Air:	80-100psi
Air port:	Quick-connect

Volts	Cat. No.
110V	**Z55,163-5**
220V	**Z55,164-3**

Accessories

Vacuum pump	**Z55,167-8**
Environmental control chamber	**Z55,171-6**

Type CG vacuum chucks

Diam.	Cat. No.
1in.	**Z55,168-6**
1 ½ in.	**Z55,169-4**
2in.	**Z55,170-8**

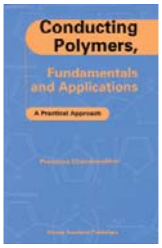
OLED Substrates

Indium Tin Oxide Coated Substrates

Catalog #	Substrate Type	Surface Resistance (sq Ω)	Dimensions[4]	Passivation Layer (Å, SiO_2)	ITO Thickness (Å)	Optical Transmittance (%)
57,827-4	Glass[1] slide	8-12	25 X 75 X 1.1 mm	200-300	1200-1600	>83
63,691-6	Glass[1] slide	15-25	25 X 75 X 1.1 mm	200-300	600-1000	>78
63,690-8	Glass[1] slide	30-60	25 X 75 X 1.1 mm	200-300	300-600	>84
57,635-2	Glass[1] slide	70-100	25 X 75 X 1.1 mm	200-300	150-300	>87
57,636-0	Aluminosilicate[2] glass slide	5-15	25 X 75 X 1.1 mm	none	1200-1600	>85
63,693-2	PET[3] slide	8-12	25 X 75 X 1.1 mm	none	1200-1600	>74
63,692-4	PET[3] slide	60-100	25 X 75 X 1.1 mm	none	150-300	>76
63,931-1	PET[3] sheet	40-45	1 ft X 1 ft X 5 mil	none	1200	>86
63,930-3	PET[3] sheet	50-70	1 ft X 1 ft X 5 mil	none	1000	>79
63,928-1	PET[3] sheet	90-110	1 ft X 1 ft X 5 mil	none	750	>77

1) Typical composition of slide is 72.6% SiO_2, 0.8% B_2O_3, 1.7% Al_2O_3, 4.6% CaO, 3.6% MgO, and 15.2% Na_2O
2) Typical composition of slide is 55.0% SiO_2, 7.0% B_2O_3, 10.4% Al_2O_3, 21.0% CaO, and 1.0% Na_2O
3) PET = poly(ethylene terephthalate)
4) 5 mil = 0.125 mm

Books

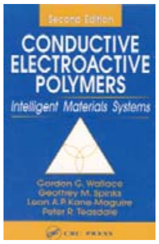


Conducting Polymers, Fundamentals and Applications: A Practical Approach

P. Chandrasekhar, Kluwer Academic Publishing, 1999, 760pp., Hardcover

Conducting polymers is utilizing the unique electronic properties of a class of easily synthesized, primarily organic materials with the predominant property of high and controllable conductivity and subsidiary properties emanating from this conductivity and the associated causative electronic structure. This book deals with the practical fundamentals and applications of conducting polymers.

Z42,253-3



Conductive Electroactive Polymers: Intelligent Materials Systems, 2nd ed.

G. G. Wallace, G. M. Spinks, L. A. P. Kane-McGuire, and P. R. Teasdale, CRC Press, 2002, 248pp., Hardcover

This book provides a thorough, up-to-date introduction to conductive electroactive polymers. The authors discuss the parameters that affect the formation of important CEPs, including polypyrroles, polyanilines, and polythiophenes. They show how to use these parameters to manipulate the properties of the polymers, and they clarify the chemical and energy parameters that determine the structure and its properties. New in this edition are more details on polythiphene and polyaniline systems, an update on progress in polypyrroles, and reports on recent advances in CEP processing techniques and device fabrication.\

Z55,218-6

Handbook of Luminescence, Display, Materials, and Devices, 3-volume set

H. S. Nalwa, American Scientific Publishers, 2003, 1200pp., Hardcover

This book provides coverage on various aspects of organic and inorganic luminescent materials and devices. Includes organic light emitting diodes (OLEDs) and inorganic display devices including materials synthetic strategies, processing and fabrication methods, screening methods, and much more.

Z54,768-9

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