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(54) **COMPOUND WITH NOVEL SIX-MEMBERED RING STRUCTURE FOR USE IN ORGANIC ELECTRONIC DEVICES**

VERBINDUNG MIT NEUARTIGER SECHSGLIEDRIGER RINGSTRUKTUR ZUR VERWENDUNG BEI ORGANISCHEN ELEKTRONISCHEN VORRICHTUNGEN

COMPOSÉ AVEC UNE NOUVELLE STRUCTURE D'ANNEAU À SIX ÉLÉMENTS POUR UNE UTILISATION DANS DES DISPOSITIFS ÉLECTRONIQUES ORGANIQUES

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(56) References cited:

**WO-A1-2013/154064 WO-A1-2014/166586
US-A- 2 573 733 US-A1- 2013 291 930
US-B1- 6 511 971**

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Description

Technical Field

[0001] The present invention relates to a novel compound having a six-membered ring structure substituted with electron donor, electron acceptor and sterically demanding groups. Said compound is suited for use in organic electronic devices, particularly in organic electroluminescent devices.

Background

[0002] Organic electronic devices, i.e. electronic devices comprising a layer which is mostly made of an organic material, offer a number of advantages over conventional electronic devices based on inorganic materials. Organic electronic devices allow for example good processability in combination with improved final properties such as flexibility and/or reduced weight. Frequently, such devices are also characterized by extremely low energy consumption. Properties like these are of considerable interest for example for handheld devices, such as tablet-PCs and smart phones.

[0003] A particular example of organic electronic devices are organic electroluminescent devices (OLEDs). The term "organic electroluminescent device" is generally used for an electronic device which comprises at least one organic material that emits light when an electric current is applied. OLEDs in general as well as their structure are for example disclosed in US 4539507, US 5151629, EP 0676461 and WO 98/27136.

[0004] Though progress has been made there remains considerable interest in improving the properties of organic electronic devices, particularly of organic electroluminescent devices, such as for example in terms of life time, efficiency and operating voltage. Important factors in this respect are organic light emitting layers, and particularly the materials comprised therein, as well as organic charge transporting layers.

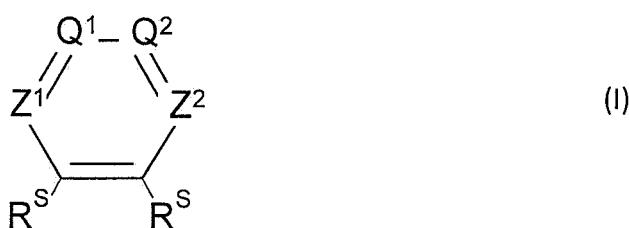
[0005] Emitter materials for OLEDs comprising a benzene core, at least one donor substituent and at least one acceptor substituent are described in the prior art, for example in WO 2013/154064 and in H. Uoyama et al., Nature, Vol. 492, 13 December 2012, pages 234-238

[0006] It is still an object of the present invention to find novel materials having improved properties. Additionally, it is an object of the present invention to further increase the pool of available materials suited for use in organic electronic devices in general and organic electroluminescent devices in particular. Furthermore, it is a particular object of the present invention to increase the pool of materials emitting light of blue color. Further objects of the present invention will become evident from the following description as well as from the examples.

Summary

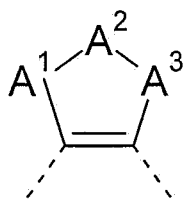
[0007] The present inventors have now surprisingly found that the above objects may be attained either individually or in any combination by the present compound as well as by further aspects of the present application.

[0008] The present application therefore relates to an electronic device comprising a compound of general formula (I)

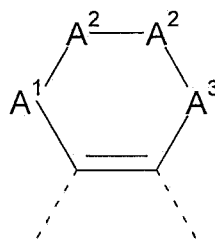


wherein Q¹ and Q² are independently of each other selected from the group consisting of N, CR^A, CR^D, and CR^S; Z¹ and Z² are independently of each other selected from the group consisting of N, CR^A and CR^D; R^A is a group with -M-effect; R^D is a group with +M-effect; and where

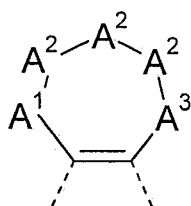
R^S is a sterically demanding group, wherein two groups CR^S together form a five-, six- or seven-membered ring of one of the following formulae (II-A) to (II-G),



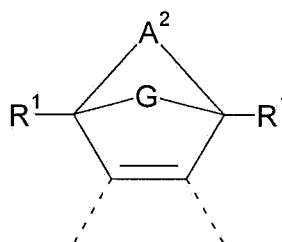
(II-A)



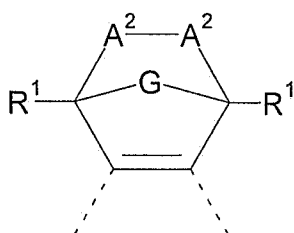
(II-B)



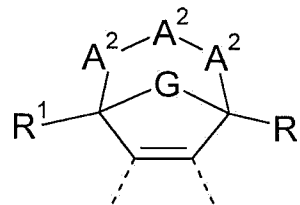
(II-C)



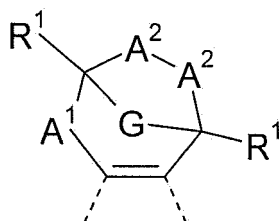
(II-D)



(II-E)



(II-F)



(II-G)

wherein

the dashed lines in formulae (II-A) to (II-G) indicate the corresponding bonding positions to the six-membered ring structure of formula (I), the dashed lines representing the bonds of the six-membered ring structure of formula (I);

G is selected from the group consisting of substituted or unsubstituted alkanediyl with 1, 2 or 3 C-atoms, -CR²=CR²- or a substituted or unsubstituted ortho-linked arylene- or heteroarylene-group with 5 to 14 aromatic ring atoms, which may be substituted with one or more of groups R²;

A¹ and A³ are at each occurrence independently selected from the group consisting of C(R³)₂, O, S, NR³ and C(=O);

A² is at each occurrence independently selected from the group consisting of C(R¹)₂, O, S, NR³ and C(=O), and in case two groups A² are adjacent to each other, A²-A² may also be selected from the group consisting of ortho-linked arylene- or heteroarylene-group with 5 to 14 aromatic ring atoms, each of which may independently of the other be substituted with R² as defined above.

R^1 is at each occurrence independently selected from the group consisting of H, D, F, Cl, Br, I, $B(OR^2)_2$, CHO, $C(=O)R^2$, $CR^2=C(R^2)_2$, CN, $C(=O)OR^2$, $C(=O)N(R^2)_2$, $Si(R^2)_3$, $N(R^2)_2$, NO_2 , $P(=O)(R^2)_2$, OSO_2R^2 , OR^2 , $S(=O)R^2$, $S(=O)_2R^2$, OH, SH, linear alkyl-, alkoxy- or thioalkyl-group with 1 to 20 C-atoms or a branched or cyclic alkyl-, alkoxy- or thioalkyl-group with 3 to 20 C-atoms or an alkenyl- or alkynyl-group with 2 to 20 C-atoms, wherein these groups may be substituted with one or more of groups R^2 and wherein one or more CH_2 -Gruppen in these groups may be replaced by $-R^2C=CR^2-$, $-C\equiv C-$, $Si(R^2)_2$, $C=O$, $C=S$, $C=NR^2$, $-C(=O)O-$, $-C(=O)NR^2$, NR^2 , $P(=O)(R^2)$, $-O-$, $-S-$, SO or SO_2 , and wherein one or more H-atoms in these groups may be replaced by D, F, Cl, Br, I, CN or NO_2 , or an aromatic or heteroaromatic ring system with 5 to 60 aromatic ring atoms, which can be substituted with one or more groups R^2 , or an aryloxy- or heteroaryloxy-group with 5 to 60 aromatic ring atoms, which can be substituted with one or more groups R^2 , or an aralkyl- or heteroaralkyl-group with 5 to 60 aromatic ring atoms, which can be substituted with one or more groups R^2 , wherein two or more groups R^2 may be linked with each other and form an aliphatic or aromatic or heteroaromatic ring;

R^2 is at each occurrence independently selected from the group consisting of H, D, F, alkyl having from 1 to 20 C-atoms, aromatic groups having from 1 to 20 aromatic carbon atoms and heteroaromatic groups having from 1 to 20 aromatic ring atoms, wherein the aromatic groups and the heteroaromatic groups may be substituted with an alkyl having from 1 to 20 carbon atoms; and

R^3 is at each occurrence independently selected from the group consisting of F, linear alkyl- or alkoxy-group with 1 to 20 C-atoms, a branched or cyclic alkyl- or alkoxy-group with 3 to 20 C-atoms, each of which may be substituted with one or more of groups R^2 , wherein one or more non-adjacent CH_2 -groups may be replaced by $R^2C=CR^2$, $C\equiv C$, $Si(R^2)_2$, $C=O$, NR^2 , O, S or $CONR^2$, and wherein one or more H-atom may be replaced with D or F, or an aromatic or heteroaromatic ring system with 5 to 24 aromatic ring atoms, each of which may each be substituted with one or more of groups R^2 , or an aryloxy- or heteroaryloxy-group with 5 to 24 aromatic ring atoms, which can be substituted with one or more groups R^2 , or an aralkyl- or heteroaralkyl-group with 5 to 24 aromatic ring atoms, which can be substituted with one or more groups R^2 , wherein two R^2 bound to the same carbon atom may form an aliphatic or aromatic ring system and thus a spiro system; or R^3 can form together with a neighboring group R^1 or R^2 an aliphatic ring system,

provided that in A^1 - A^2 - A^3 no two heteroatoms are adjacent; and with the provision that the compound of general formula (I) comprises at least one group CR^A and at least one group CR^D .

[0009] The present application also provides for a compound of general formula (I) as detailed below.

[0010] In addition, the present application provides for a formulation comprising a solvent and said compound.

[0011] Further, the present application provides for a method for producing an electronic device, said process comprising the steps of

(a) providing said compound or an oligomer, polymer or dendrimer comprising such compound; and

(b) depositing said compound or said oligomer, polymer or dendrimer on a supporting layer

[0012] In addition, the present application provides for organic electronic devices, particularly for organic electroluminescent devices, comprising said compound.

Detailed Description

DEFINITIONS

[0013] For the purposes of the present application the terms "organic light emitting device" and "organic electroluminescent device" are used interchangeably.

[0014] For the purposes of the present application the terms "group" and "substituent" are used synonymously.

[0015] For the purposes of the present application the term "substituted" is meant to denote a substituent R^2 as defined in the present application.

[0016] In the formulae of the present application a double bond may be used to denote an aromatic bond in an aromatic or heteroaromatic ring system.

[0017] The mesomeric effect, in the present application denoted as "M-effect", is attributed to a substituent or group due to overlap of its p- or π -orbitals with the p- or π -orbitals of the rest of the molecular entity. Delocalization is thereby introduced or extended, and electronic charge may flow to or from the substituent. See International Union of Pure and Applied Chemistry, Compendium of Chemical Technology, Gold Book, Version 2.3.2, 2012-08-19. Groups with a +M-

effect ("positive M-effect") donate electron density to the mesomeric system. Groups with a -M-effect ("negative M-effect") accept electron density from the mesomeric system.

[0018] In the present application R^1 is at each occurrence independently selected from the group consisting of H, D, F, Cl, Br, I, $B(OR^2)_2$, CHO, $C(=O)R^2$, $CR^2=C(R^2)_2$, CN, $C(=O)OR^2$, $C(=O)N(R^2)_2$, $Si(R^2)_3$, $N(R^2)_2$, NO_2 , $P(=O)(R^2)_2$, OSO_2R^2 , OR^2 , $S(=O)R^2$, $S(=O)_2R^2$, OH, SH, linear alkyl-, alkoxy- or thioalkyl-group with 1 to 20 C-atoms or a branched or cyclic alkyl-, alkoxy- or thioalkyl-group with 3 to 20 C-atoms or an alkenyl- or alkynyl-group with 2 to 20 C-atoms, wherein these groups may be substituted with one or more of groups R^2 and wherein one or more CH_2 -groups in these groups may be replaced by $-R^2C=CR^2-$, $-C\equiv C-$, $Si(R^2)_2$, $C=O$, $C=S$, $C=NR^2$, $-C(=O)O-$, $-C(=O)NR^2-$, NR^2 , $P(=O)(R^2)$, $-O-$, $-S-$, SO or SO_2 , and wherein one or more H-atoms in these groups may be replaced by D, F, Cl, Br, I, CN or NO_2 , or an aromatic or heteroaromatic ring system with 5 to 60 aromatic ring atoms, which can be substituted with one or more groups R^2 , or an aryloxy- or heteroaryloxy-group with 5 to 60 aromatic ring atoms, which can be substituted with one or more groups R^2 , or an aralkyl- or heteroaralkyl-group with 5 to 60 aromatic ring atoms, which can be substituted with one or more groups R^2 , wherein two or more groups R^2 may be linked with each other and form an aliphatic or aromatic or heteroaromatic ring.

[0019] In the present application R^2 is at each occurrence independently selected from the group consisting of H, D, F, alkyl having from 1 to 20 C-atoms, aromatic groups having from 1 to 20 aromatic carbon atoms and heteroaromatic groups having from 1 to 20 aromatic ring atoms, wherein the aromatic groups and the heteroaromatic groups may be substituted with an alkyl having from 1 to 20 carbon atoms. For R^2 preferred exemplary alkyls having from 1 to 20 C-atoms may be selected from the group consisting of methyl, ethyl, n-propyl, i-propyl, n-butyl, i-butyl, s-butyl, t-butyl, 2-methylbutyl, n-pentyl, s-pentyl, cyclopentyl, neo-pentyl, n-hexyl, cyclohexyl, neo-hexyl, n-heptyl, cycloheptyl, n-octyl, cyclooctyl, and 2-ethylhexyl. For R^2 preferred exemplary aromatic groups having from 1 to 20 aromatic carbon atoms and heteroaromatic groups having from 1 to 20 aromatic ring atoms may be selected from the group consisting of benzene, naphthalene, anthracene, benzanthracene, phenanthrene, benzphenanthrene, pyrene, chrysene, perylene, fluoranthene, naphthacene, pentacene, benzpyrene, biphenyl, biphenylene, terphenyl, terphenylene, quaterphenyl, fluorene, spirobifluorene, dihydrophenanthrene, dihydropyrene, tetrahydropyrene, cis- oder trans-indenofluorene, truxene, isotruxene, spirotruxene, spiroisotruxene, furane, benzofurane, isobenzofurane, dibenzofurane, thiophene, benzothiophene, isobenzothiophene, dibenzothiophene, pyrrole, indole, isoindole, carbazole, indolocarbazole, indenocarbazole, pyridine, chinoline, isochinoline, acridine, phenanthridine, benzo-5,6-chinoline, benzo-6,7-chinoline, benzo-7,8-chinoline, phenothiazine, phenoxazine, pyrazole, indazole, imidazole, benzimidazole, naphthimidazole, phenanthrimidazole, pyrimidazole, pyrazinimidazole, chinoxalinimidazole, oxazole, benzoxazole, naphthoxazole, anthroxazole, phenanthroxazole, isoxazole, 1,2-thiazole, 1,3-thiazole, benzothiazole, pyridazine, benzopyridazine, pyrimidine, benzpyrimidine, chinoxaline, 1,5-diazaanthracene, 2,7-diazapyrene, 2,3-diazapyrene, 1,6-diazapyrene, 1,8-diazapyrene, 4,5-diazapyrene, 4,5,9,10-tetraazaperylene, pyrazine, phenazine, phenoxazine, phenothiazine, fluorubin, naphthyridine, azacarbazole, benzocarboline, phenanthroline, 1,2,3-triazole, 1,2,4-triazole, benzotriazole, 1,2,3-oxadiazole, 1,2,4-oxadiazole, 1,2,5-oxadiazole, 1,3,4-oxadiazole, 1,2,3-thiadiazole, 1,2,4-thiadiazole, 1,2,5-thiadiazole, 1,3,4-thiadiazole, 1,3,5-triazine, 1,2,4-triazine, 1,2,3-triazine, tetrazole, 1,2,4,5-tetrazine, 1,2,3,4-tetrazine, 1,2,3,5-tetrazine, purine, pteridine, indolizine, benzothiadiazole as well as their alkyl substituted derivatives, with the alkyl having from 1 to 20 C-atoms.

[0020] In the present application R^3 is at each occurrence independently selected from the group consisting of F, linear alkyl- or alkoxy-group with 1 to 20 C-atoms, a branched or cyclic alkyl- or alkoxy-group with 3 to 20 C-atoms, each of which may be substituted with one or more of groups R^2 , wherein one or more non-adjacent CH_2 -groups may be replaced by $R^2C=CR^2$, $C\equiv C$, $Si(R^2)_2$, $C=O$, NR^2 , O, S or $CONR^2$, and wherein one or more H-atom may be replaced with D or F, or an aromatic or heteroaromatic ring system with 5 to 24 aromatic ring atoms, each of which may each be substituted with one or more of groups R^2 , or an aryloxy- or heteroaryloxy-group with 5 to 24 aromatic ring atoms, which can be substituted with one or more groups R^2 , or an aralkyl- or heteroaralkyl-group with 5 to 24 aromatic ring atoms, which can be substituted with one or more groups R^2 , wherein two R^2 bound to the same carbon atom may form an aliphatic or aromatic ring system and thus a spiro system; or R^3 can form together with a neighboring group R^1 or R^2 an aliphatic ring system.

[0021] For the purposes of the present invention linear, branched or cyclic alkyl-, alkenyl- and alkynyl-groups may preferably be selected from the group consisting of methyl, ethyl, n-propyl, i-propyl, n-butyl, i-butyl, s-butyl, t-butyl, 2-methylbutyl, n-pentyl, s-pentyl, cyclopentyl, neo-pentyl, n-hexyl, cyclohexyl, neo-hexyl, n-heptyl, cycloheptyl, n-octyl, cyclooctyl, 2-ethylhexyl, trifluoromethyl, pentafluoroethyl, 2,2,2-trifluoroethyl, ethenyl, propenyl, butenyl, pentenyl, cyclopentenyl, hexenyl, cyclohexenyl, heptenyl, cycloheptenyl, octenyl, cyclooctenyl, ethinyl, propinyl, butinyl, pentinyl, hexinyl, octinyl, and the respective substituted derivatives, wherein they may be substituted with one or more of groups R^2 and wherein one or more CH_2 -groups in these groups may be replaced by $-R^2C=CR^2-$, $-C\equiv C-$, $Si(R^2)_2$, $C=O$, $C=S$, $C=NR^2$, $-C(=O)O-$, $-C(=O)NR^2-$, NR^2 , $P(=O)(R^2)$, $-O-$, $-S-$, SO or SO_2 , and wherein one or more H-atoms in these groups may be replaced by D, F, Cl, Br, I, CN or NO_2 .

[0022] For the purposes of the present invention, linear or branched alkoxy- and thioalkyl-, alkenyl- and alkynyl-groups may preferably be selected from the group consisting of methoxy, trifluoromethoxy, ethoxy, n-propoxy, i-propoxy, n-

butoxy, i-butoxy, s-butoxy, t-butoxy, n-pentoxy, s-pentoxy, 2-methylbutoxy, n-hexoxy, cyclohexyloxy, n-heptoxy, cycloheptyloxy, n-octyloxy, cyclooctyloxy, 2-ethylhexyloxy, pentafluoroethoxy, 2,2,2-trifluoroethoxy, methylthio, ethylthio, n-propylthio, i-propylthio, n-butylthio, i-butylthio, s-butylthio, t-butylthio, n-pentylthio, s-pentylthio, n-hexylthio, cyclohexylthio, n-heptylthio, cycloheptylthio, n-octylthio, cyclooctylthio, 2-ethylhexylthio, trifluoromethylthio, pentafluoroethylthio, 2,2,2-trifluorethylthio, ethenylthio, propenylthio, butenylthio, pentenylthio, cyclopentenylthio, hexenylthio, cyclohexenylthio, heptenylthio, cycloheptenylthio, octenylthio, cyclooctenylthio, ethinylthio, propinylthio, butinylthio, pentinylthio, hexinylthio, heptinylthio, octinylthio, and the respective substituted derivatives, wherein they may be substituted with one or more of groups R^2 and wherein one or more CH_2 -groups in these groups may be replaced by $-R^2C=CR^2$ -, $-C\equiv C$ -, $Si(R^2)_2$ -, $C=O$ -, $C=S$ -, $C=NR^2$ -, $-C(=O)O$ -, $-C(=O)NR^2$ -, NR^2 -, $P(=O)(R^2)$ -, $-O$ -, $-S$ -, SO or SO_2 -, and wherein one or more H-atoms in these groups may be replaced by D, F, Cl, Br, I, CN or NO_2 .

[0023] For the purposes of the present invention an aromatic ring system preferably has from 6 to 60 aromatic ring atoms, most preferably from 6 to 30 aromatic ring atoms. For the purposes of the present invention a heteroaromatic ring system preferably has from 5 to 60 aromatic ring atoms, most preferably from 5 to 30 aromatic ring atoms, at least one of which is a heteroatom. Suitable heteroatoms may be selected from the group consisting of N, O and S. The terms "aromatic ring system" and "heteroaromatic ring system" as used herein may also denote a system in which several aryl- or heteroaryl-groups are connected by non-aromatic units. Preferably such non-aromatic units comprise at most 10 % of the atoms comprised in the aromatic or heteroaromatic ring system, which are different from H and D. Examples of suitable non-aromatic units may be selected from the group consisting of sp^3 -hybridized atoms with the atom selected from the group consisting of C, Si, N and O, sp^2 -hybridized C-atom, sp^2 -hybridized N-atom, and sp -hybridized C-atom. For the purposes of the present application systems such as for example 9,9'-spirobifluorene, 9,9'-diarylfuorene, triarylamine, diarylether, stilbene as well as systems, in which two or more aryl groups are connected for example by means of a linear or cyclic alkyl-, alkenyl- or alkynyl-group of a silyl-group, are to be considered as aromatic rings systems. Furthermore for the purposes of the present application systems, in which one or more aryl- or heteroaryl-groups are connected by means of one or more single bonds, such as for example biphenyl, terphenyl or diphenyltriazine, are to be considered as aromatic or heteroaromatic systems.

[0024] Examples of suitable aromatic or heteroaromatic ring systems, which may optionally be substituted as defined above and optionally being linked at any position on the aromatic or heteroaromatic ring as defined in the present application, are preferably selected from the group consisting of benzene, naphthalene, anthracene, benzanthracene, phenanthrene, benzphenanthrene, pyrene, chrysene, perylene, fluoranthene, naphthacene, pentacene, benzpyrene, biphenyl, biphenylene, terphenyl, terphenylene, quaterphenyl, fluorene, spirobifluorene, dihydrophenanthrene, dihydropyrene, tetrahydropyrene, cis- oder trans-indenofluorene, truxene, isotruxene, spirotruxene, spiroisotruxene, furane, benzofurane, isobenzofurane, dibenzofurane, thiophene, benzothiophene, isobenzothiophene, dibenzothiophene, pyrrole, indole, isoindole, carbazole, indolocarbazole, indenocarbazole, pyridine, chinoline, isochinoline, acridine, phenanthridine, benzo-5,6-chinoline, benzo-6,7-chinoline, benzo-7,8-chinoline, phenothiazine, phenoxazine, pyrazole, indazole, imidazole, benzimidazole, naphthimidazole, phenanthrimidazole, pyridimidazole, pyrazinimidazole, chinoxalinimidazole, oxazole, benzoxazole, naphthoxazole, anthroxazole, phenanthroxazole, isoxazole, 1,2-thiazole, 1,3-thiazole, benzothiazole, pyridazine, benzopyridazine, pyrimidine, benzpyrimidine, chinoxaline, 1,5-diazaanthracene, 2,7-diazapyrene, 2,3-diazapyrene, 1,6-diazapyrene, 1,8-diazapyrene, 4,5-diazapyrene, 4,5,9,10-tetraazaperylene, pyrazine, phenazine, phenoxazine, phenothiazine, fluorubin, naphthyridine, azacarbazole, benzocarboline, phenanthroline, 1,2,3-triazole, 1,2,4-triazole, benzotriazole, 1,2,3-oxadiazole, 1,2,4-oxadiazole, 1,2,5-oxadiazole, 1,3,4-oxadiazole, 1,2,3-thiadiazole, 1,2,4-thiadiazole, 1,2,5-thiadiazole, 1,3,4-thiadiazole, 1,3,5-triazine, 1,2,4-triazine, 1,2,3-triazine, tetrazole, 1,2,4,5-tetrazine, 1,2,3,4-tetrazine, 1,2,3,5-tetrazine, purine, pteridine, indolizine, benzothiadiazole and any combination as well as derivatives thereof.

[0025] Examples of aryl and heteroaryl groups, said groups optionally being substituted as defined above and optionally being linked at any position on the aromatic or heteroaromatic ring as defined in the present application, are preferably selected from the group consisting of benzene, naphthalene, anthracene, phenanthrene, pyrene, dihydropyrene, chrysene, perylene, fluoranthene, benzanthracene, benzphenanthrene, tetracene, pentacene, benzpyrene, furane, benzofurane, isobenzofurane, dibenzofurane, thiophene, benzothiophene, isobenzothiophene, dibenzothiophene, pyrrole, indole, isoindole, carbazole, pyridine, chinoline, isochinoline, acridine, phenanthridine, benzo-5,6-chinoline, benzo-6,7-chinoline, benzo-7,8-chinoline, phenothiazine, phenoxazine, pyrazole, indazole, imidazole, benzimidazole, naphthimidazole, phenanthrimidazole, pyridimidazole, pyrazinimidazole, chinoxalinimidazole, oxazole, benzoxazole, naphthoxazole, anthroxazole, phenanthroxazole, isoxazole, 1,2-thiazole, 1,3-thiazole, benzothiazole, pyridazine, benzopyridazine, pyrimidine, benzpyrimidine, chinoxaline, pyrazine, phenazine, naphthyridine, azacarbazole, benzocarboline, phenanthroline, 1,2,3-triazole, 1,2,4-triazole, benzotriazole, 1,2,3-oxadiazole, 1,2,4-oxadiazole, 1,2,5-oxadiazole, 1,3,4-oxadiazole, 1,2,3-thiadiazole, 1,2,4-thiadiazole, 1,2,5-thiadiazole, 1,3,4-thiadiazole, 1,3,5-triazine, 1,2,4-triazine, 1,2,3-triazine, tetrazole, 1,2,4,5-tetrazine, 1,2,3,4-tetrazine, 1,2,3,5-tetrazine, purine, pteridine, indolizine and benzothiadiazole.

[0026] For the purposes of the present application the terms "aryloxy-group" and heteroaryloxy-group" are used to denote aryl- and heteroaryl-groups, respectively, as defined above, which are covalently bound via a divalent (ether-

type) O-atom.

[0027] For the purposes of the present application, the terms "aralkyl-group" and "heteroaralkyl-group" are used to denote aryl- and heteroaryl-groups, respectively, wherein the aryl- or heteroaryl-group is substituted with an alkyl-group having from 1 to 20 C-atoms, wherein in the alkyl-group any H- or D-atom or any CH₂-group may be substituted with the above mentioned groups, and wherein the alkyl-group is used to bond the aryl- or heteroaryl-group to the remainder of the compound.

ELECTRONIC DEVICE COMPRISING A COMPOUND OF FORMULA (I)

[0028] Stated in a general way, the compounds of formula (I) are characterized by a six-membered ring structure, which is substituted with electron donor, electron acceptor and sterically demanding groups as defined herein.

[0029] Similar compounds have recently been disclosed by H. Uoyama et al., Nature, Vol. 492, 13 December 2012, pages 234-238.

[0030] The compound of formula (I) can be represented as follows



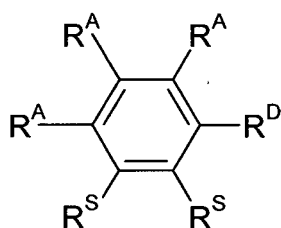
wherein groups Q¹, Q², Z¹, Z² and R^S are as defined below with the provision that the compound of formula (I) comprises at least one group CR^A and at least one group CR^D as defined below.

[0031] Groups Q¹ and Q² are independently of each other selected from the group consisting of N, CR^A, CR^D and CR^S. More preferably they are independently of each other selected from the group consisting of N, CR^A, and CR^D. Most preferably they are independently of each other CR^A or CR^D.

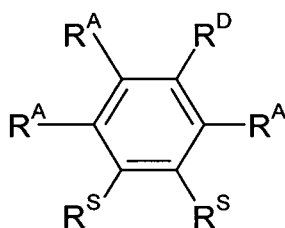
[0032] Groups Z¹ and Z² are independently of each other selected from the group consisting of N, CR^A and CR^D. Most preferably, they are independently of each other CR^A or CR^D.

[0033] Group R^A is a group with a -M-effect. **Group R^D** is a group with a +M-effect. Such groups are well known to the skilled person and can be found in any common textbook on organic chemistry. The groups R^A are at each occurrence - if more than one such group is present - chosen independently of each other. Also, the groups R^D are at each occurrence - if more than one such group is present - chosen independently of each other.

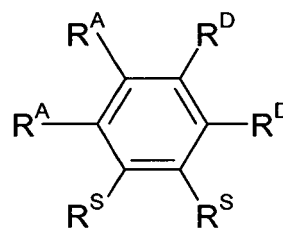
[0034] Examples of compounds of formula (I) are illustrated by the following formulae (I-a) to (I-h)



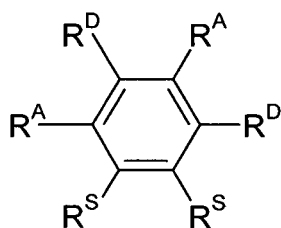
(I-a)



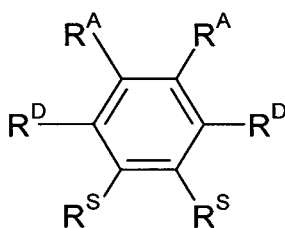
(I-b)



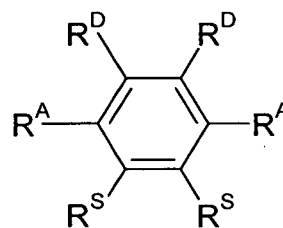
(I-c)



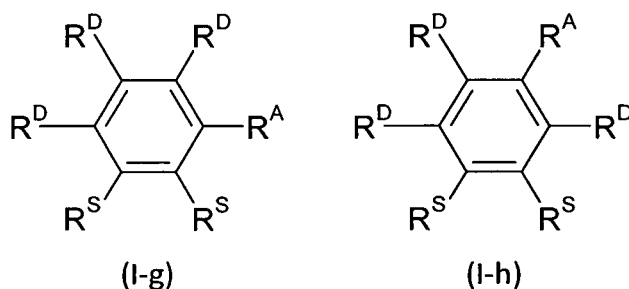
(I-d)



(I-e)



(I-f)



with R^A , R^D and R^S as defined herein. Formula (I-e) is particularly well suited.

[0035] Preferably the compound of formula (I) comprises at least two groups R^A as defined herein. More preferably the compound of formula (I) comprises at least two identical groups R^A . Most preferably the compound of formula (I) comprises two identical groups R^A .

[0036] Preferably the compound of formula (I) comprises at least two groups R^D as defined herein. More preferably the compound of formula (I) comprises at least two identical groups R^D . Most preferably the compound of formula (I) comprises two identical groups R^D .

GROUP R^A

[0037] Preferred examples of groups R^A may be selected from the group consisting of fluoroalkyl, F, BR^1_2 , $B(OR^1)_2$, CHO, $C(=O)R^1$, CN, $C(=O)OR^1$, $C(=O)N(R^1)_2$, $CR^1=C(CN)_2$, N_3 , NO_2 , $P(=O)(R^1)_2$, $S(=O)R^1$, $S(=O)_2R^1$, heteroaryl, heteroaryl substituted with one or more electron withdrawing groups and aryl substituted with one or more electron withdrawing groups, wherein the electron withdrawing groups are selected from the group consisting of fluoroalkyl, F, $B(OR^1)_2$, CHO, $C(=O)R^1$, CN, $C(=O)OR^1$, $C(=O)N(R^1)_2$, NO_2 , $P(=O)(R^1)_2$, $S(=O)R^1$, and $S(=O)_2R^1$, with R^1 as defined above.

[0038] More preferably, at each occurrence R^A is independently selected from the group consisting of fluoroalkyl, F, $C(=O)R^1$, CN, heteroaryl, heteroaryl substituted with one or more electron withdrawing groups and aryl substituted with one or more electron withdrawing groups, wherein the electron withdrawing groups are selected from the group consisting of fluoroalkyl, F, $C(=O)R^1$, and CN, with R^1 as defined above.

[0039] Even more preferably at each occurrence R^A is independently selected from the group consisting of fluoroalkyl, F, CN, heteroaryl, heteroaryl substituted with one or more electron withdrawing groups and aryl substituted with one or more electron withdrawing groups, wherein the electron withdrawing groups are selected from the group consisting of fluoroalkyl, F, CN.

[0040] Still even more preferably at each occurrence R^A is independently selected from the group consisting of F and CN.

[0041] Most preferably R^A is CN.

GROUP R^D

[0042] Preferred examples of groups R^D may be selected from the group consisting of groups of general formula (N-a)



wherein m is 0 or 1, Ar^1 is a substituted or unsubstituted aromatic or heteroaromatic ring system with 5 to 30 aromatic ring atoms, and R^1 is as defined above. If m is 0 then no group Ar^1 is present in the group of formula (N-a).

[0043] Other preferred examples of group R^D may be selected from the group consisting of groups of general formula (N-b)



wherein m and Ar^1 are as defined above, and Ar^2 is a substituted or unsubstituted aromatic or heteroaromatic ring system with 5 to 30 aromatic carbon atoms, wherein the two groups Ar^2 may be linked by a group Y, so that together with the N-atom of the NAr^2_2 -group a ring is formed.

[0044] Suitable linking groups Y may for example be selected from the group consisting of a single bond, BR^1 , $C(R^1)_2$, $Si(R^1)_2$, NR^1 , PR^1 , $P(=O)R^1$, $P(=S)R^1$, O, S, $S=O$ and $S(=O)_2$.

[0045] Preferably said linking group Y may be selected from the group consisting of a single bond, BR^1 , $C(R^1)_2$, $Si(R^1)_2$,

NR¹, P(=O)R¹, O, S, and S(=O)₂.

[0046] More preferably said linking group Y may be selected from the group consisting of a single bond, BR¹, C(R¹)₂, NR¹, P(=O)R¹, O, and S(=O)₂.

[0047] Even more preferably said linking group Y may be selected from the group consisting of a single bond, C(R¹)₂, NR¹, and O, or alternatively from the group consisting of a single bond, NR¹, and O.

[0048] Still even more preferably said linking group Y may be selected from the group consisting of a single bond, and O.

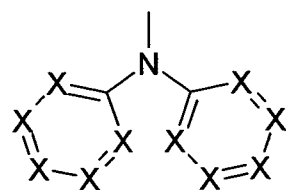
[0049] Most preferably said linking group Y is a single bond.

[0050] R¹ and R² are as defined above.

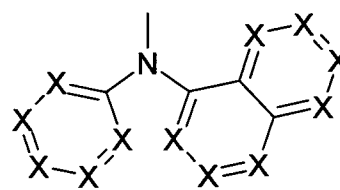
[0051] At each occurrence said linking group Y may be the same or different. Preferably it is the same at each occurrence.

[0052] Particularly suited are groups of formula (N-b), wherein group -NAr²₂ is selected from the group consisting of aromatic amines, heteroaromatic amines, carbazoles, azacarbazoles, annealed carbazoles, annealed azacarbazoles, 5,10-dihydro-phenazaboranes, 9,10-dihydroacridines, 9,10-dihydro-10-sila-acridines, 9,10-dihydro-phenazine, 10-hydro-phenoxazine, and 10-hydro-phentiazine, all of which may be substituted or unsubstituted.

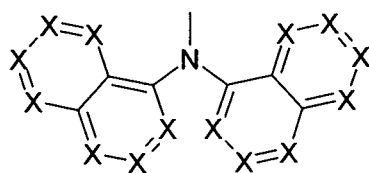
[0053] Examples of suitable aromatic amines are illustrated by the following formulae (N-1) to (N-6)



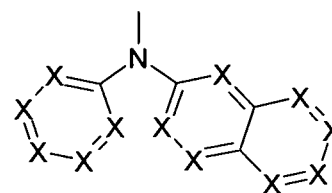
(N-1)



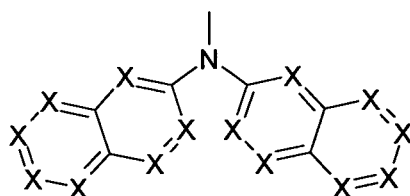
(N-2)



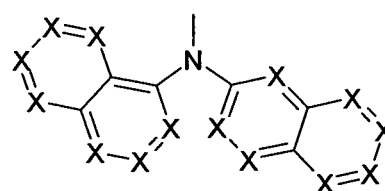
(N-3)



(N-4)

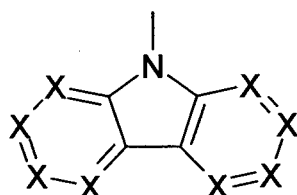


(N-5)

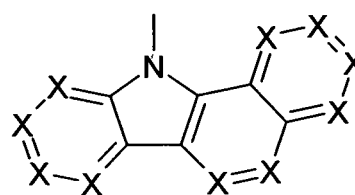


(N-6)

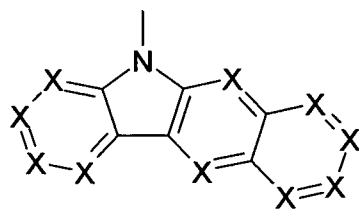
[0054] Suitable examples of carbazoles and azacarbazoles and respective annealed derivatives are illustrated by the following formulae (N-7) to (N-17):



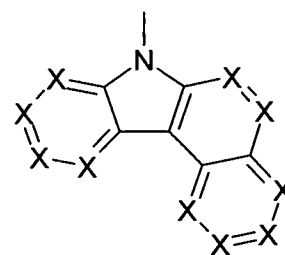
(N-7)



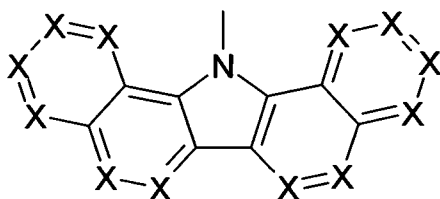
(N-8)



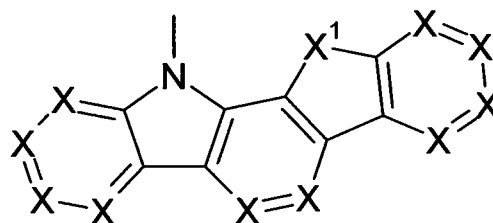
(N-9)



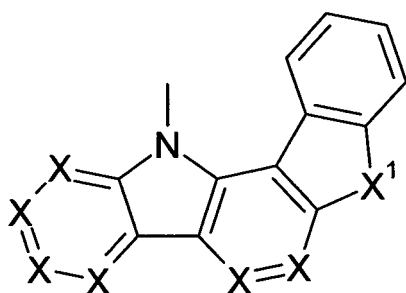
(N-10)



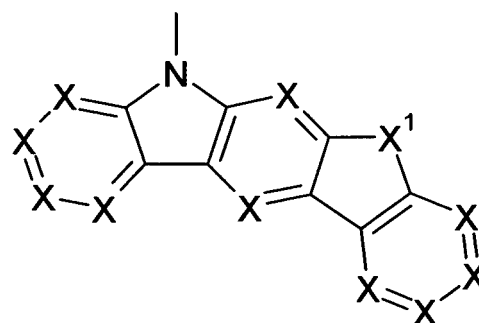
(N-11)



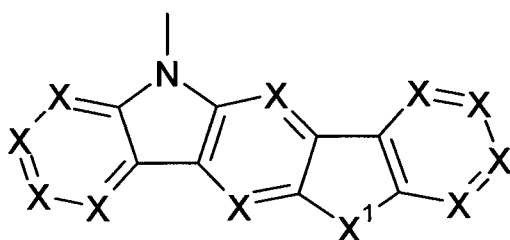
(N-12)



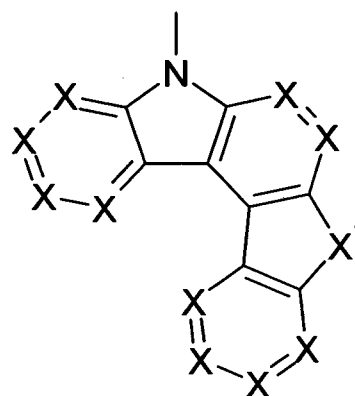
(N-13)



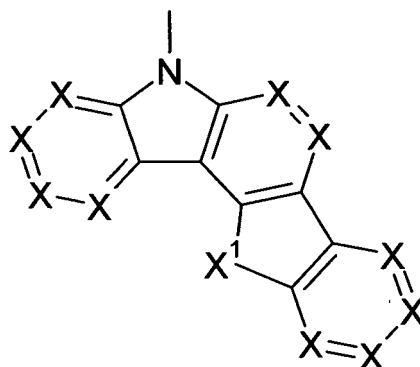
(N-14)



(N-15)

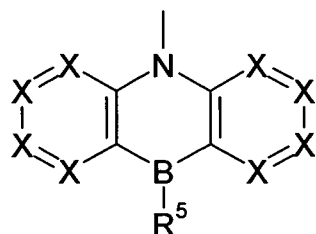


(N-16)

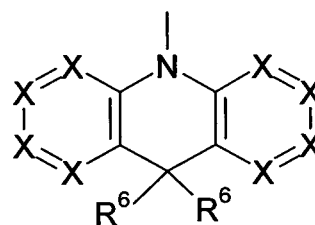


(N-17)

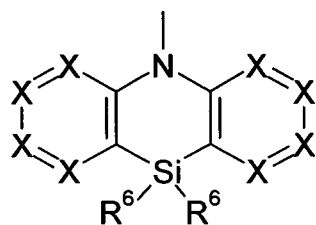
[0055] Suitable examples of 5,10-dihydro-phenazaboranes, 9,10-dihydroacridines, 9,10-dihydro-10-sila-acridines, 9,10-dihydro-phenazine, 10-hydro-phenoxazine, and 10-hydro-phentiazine are illustrated by the following formulae (N-18) to (N-23):



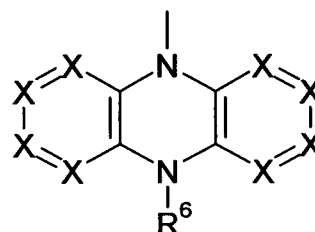
(N-18)



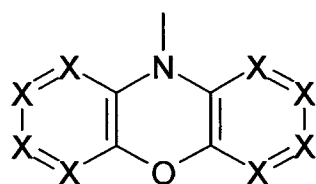
(N-19)



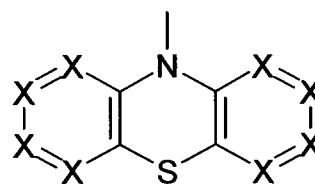
(N-20)



(N-21)



(N-22)



(N-23)

[0056] In above formulae (N-1) to (N-23)

X is N or CR⁴ with R⁴ being as defined above for R²;

X¹ is BR², CR¹₂, NR², O or S; preferably CR¹₂, NR², O or S; most preferably CR¹₂ or NR², with R² as defined above;

R⁵ is unsubstituted aryl, unsubstituted hetaryl, substituted aryl or substituted hetaryl, which - if substituted - are preferably substituted in the 2- and 6-positions with alkyl, aryl or CN; and

R^6 is alkyl, unsubstituted aryl, unsubstituted hetaryl, substituted aryl or substituted hetaryl, which optionally may be linked by a group Y as defined above.

GROUP R^S

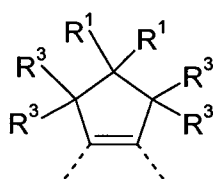
[0057] Group R^S is a sterically demanding group. In the present application the term "sterically demanding" is used to denote a group requiring a substantial spatial volume and essentially blocking physical access from the side of the molecule where such groups R^S are located.

[0058] According to the invention, two adjacent groups C- R^S together form a five-, six- or seven-membered ring as illustrated above by the formulae (II-A) to (II-G).

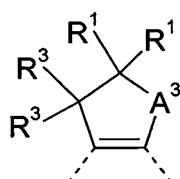
[0059] Formulae (II-A), (II-B), (II-D) and (II-E) are preferred. Formulae (II-A) and (II-B) are most preferred.

[0060] It is noted that the five-, six- or seven-membered rings of formulae (II-A) to (II-G) are annealed to the six-membered ring structure of formula (I) such that the dashed lines in formulae (II-A) to (II-G) indicate the bonding to the six-membered ring structure of formula (I), the dashed lines representing the bonds of the six-membered ring structure of formula (I).

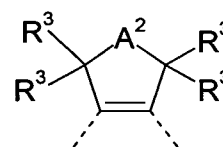
[0061] Preferred examples of formula (II-A) may be selected from the following formulae (II-A-a) to (II-A-e)



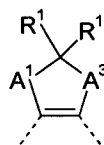
(II-A-a)



(II-A-b)



(II-A-c)



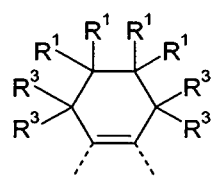
(II-A-d)



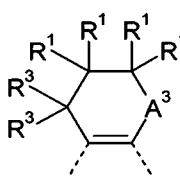
(II-A-e)

with R^1 and R^3 as defined above, and A^1 , A^2 and A^3 are independently of each other selected from the group consisting of O and NR^3 .

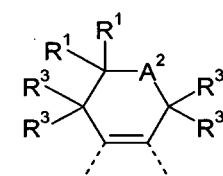
[0062] Preferred examples of formula (II-B) may be selected from the following formulae (II-B-a) to (II-B-f)



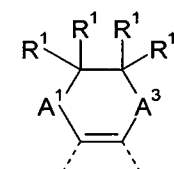
(II-B-a)



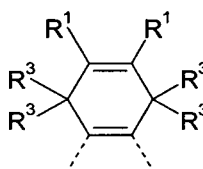
(II-B-b)



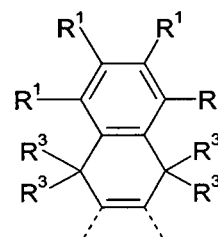
(II-B-c)



(II-B-d)



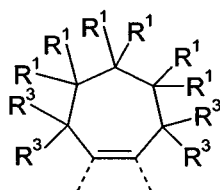
(II-B-e)



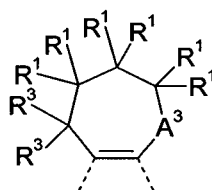
(II-B-f)

with R^1 and R^3 as defined above, and A^1 , A^2 and A^3 are independently of each other selected from the group consisting of O and NR^3 .

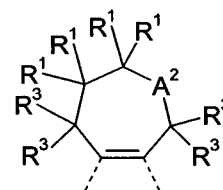
[0063] Preferred examples of formula (II-C) may be selected from the following formulae (II-C-a) to (II-C-e)



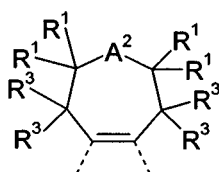
(II-C-a)



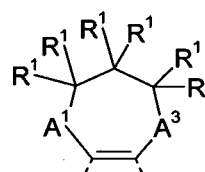
(II-C-b)



(II-C-c)



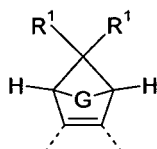
(II-C-d)



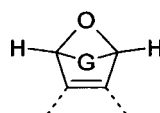
(II-C-e)

with R^1 and R^3 as defined above, and A^1 , A^2 and A^3 are independently of each other selected from the group consisting of O and NR^3 .

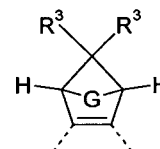
[0064] Preferred examples of formula (II-D) are those, wherein R^1 is selected from the group consisting of H, D, F and CH_3 . Furthermore, A^2 is preferably $C(R^1)_2$ or O and most preferably $C(R^1)_2$. Preferred examples of formula (II-D) may be selected from the following formulae (II-D-a) to (II-D-c)



(II-D-a)



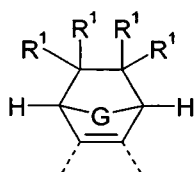
(II-D-b)



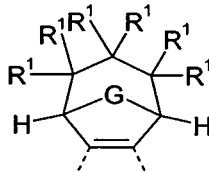
(II-D-c)

with R^1 , R^3 and G as defined above.

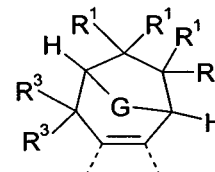
[0065] Preferred examples of formulae (II-E), (II-F) and (II-G) are those, wherein R^1 is selected from the group consisting of H, D, F and CH_3 . Preferred A^2 is $C(R^1)_2$. Thus, particularly preferred examples of formulae (II-E), (II-F) and (II-G) may be selected from the following formulae (II-E-a), (II-F-a) and (II-G-a)



(II-E-a)



(II-F-a)



(II-G-a)

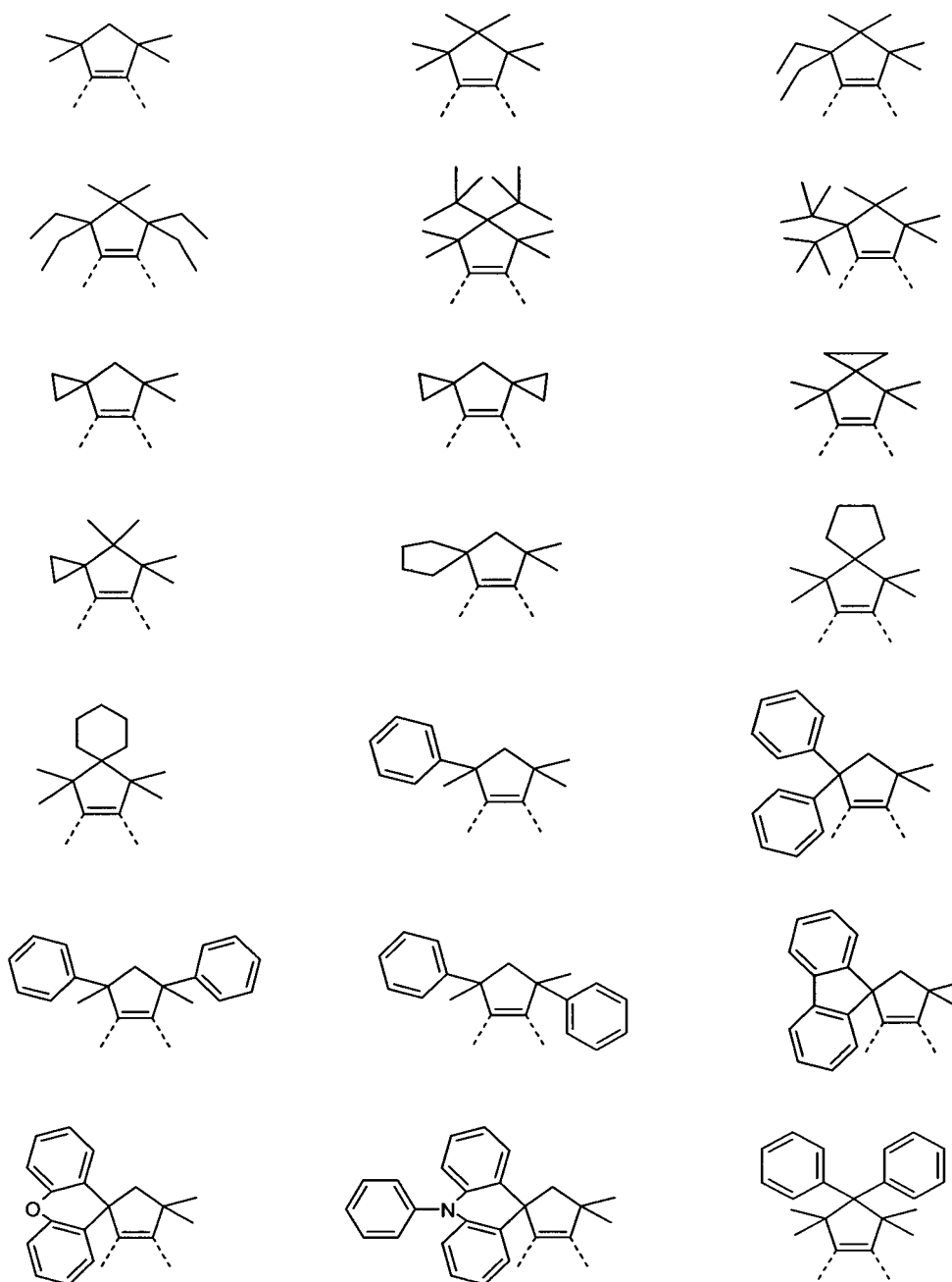
wherein R^1 , R^3 and G are as defined above.

[0066] Furthermore, it is preferred that G in formulae (II-C), (II-D), (II-F), (II-G), (II-D-a), (II-D-b), (II-D-c), (II-E-a), (II-F-a) and (II-G-a) is an ethanediyl of formula $-C(R^7)_2-C(R^7)_2-$, wherein R^7 may at each occurrence be independently selected from the group consisting of H, alkyl having from 1 to 4 C-atoms, and ortho-arylene having from 6 to 10 C-atoms, said ortho-arylene may be substituted with alkyl having from 1 to 4 C-atoms or phenyl. It is, however, preferred that R^7 is H.

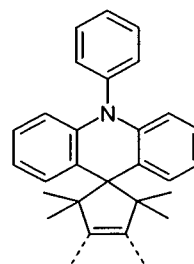
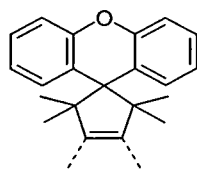
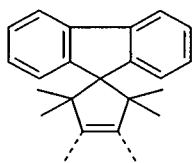
[0067] With regards to formulae (II-A) to (II-G) and their respective examples R^3 is preferably at each occurrence independently selected from the group consisting of F, linear alkyl having from 1 to 10 C-atoms, branched or cyclic alkyl having from 3 to 20 C-atoms, and aromatic and heteroaromatic ring systems having from 5 to 14 aromatic ring atoms, wherein two groups R^3 on the same C-atom may form an aliphatic or aromatic ring system, thus forming a spiro system and wherein two groups R^3 on adjacent C-atoms may form an aliphatic ring system. In each of these groups one or more H-atom may be replaced by one selected from the group consisting of D, F and alkyl having from 1 to 10 C-atoms.

[0068] With regards to formulae (II-A) to (II-G) and their respective examples R^3 is most preferably at each occurrence independently selected from the group consisting of F, linear alkyl having from 1 to 3 C-atoms, with methyl being preferred, and aromatic or heteroaromatic ring systems having from 5 to 12 ring atoms, wherein two groups R^3 on the same C-atom may form an aliphatic or aromatic ring system, thus forming a spiro system and wherein two groups R^3 on adjacent C-atoms may form an aliphatic ring system. In each of these groups one or more H-atom may be replaced by one selected from the group consisting of D, F and alkyl having from 1 to 10 C-atoms

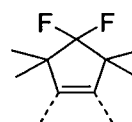
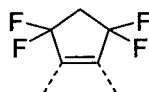
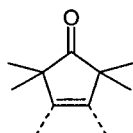
[0069] Particularly preferred examples of formula (II-A) may be selected from the following groups:



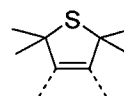
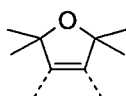
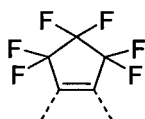
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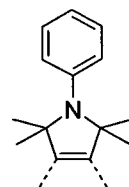
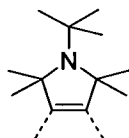
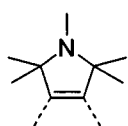
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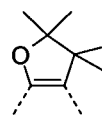
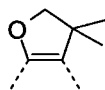
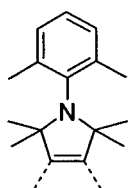


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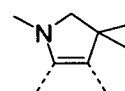
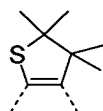
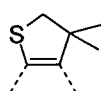


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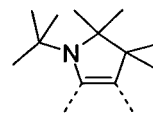
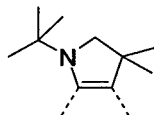
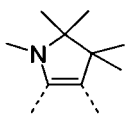
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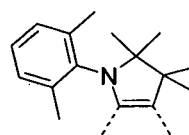
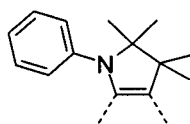
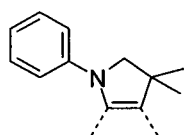
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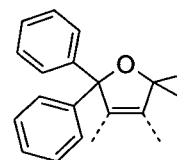
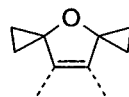
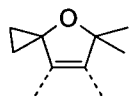
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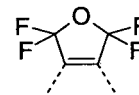
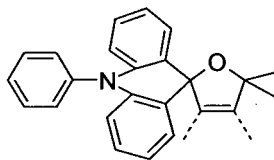
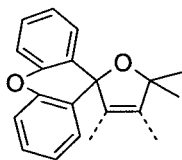
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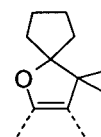
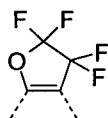
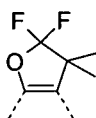
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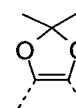
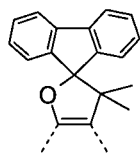
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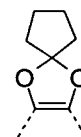
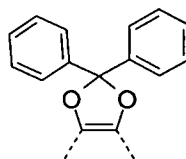
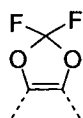
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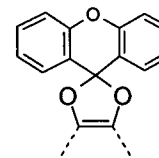
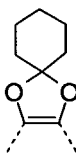
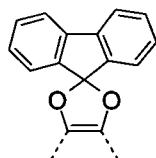
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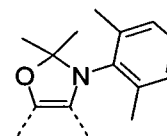
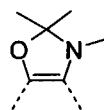
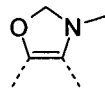
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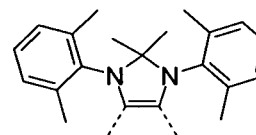
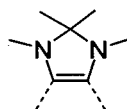
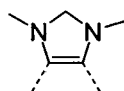
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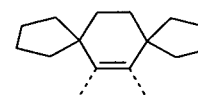
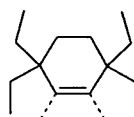
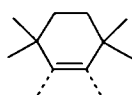
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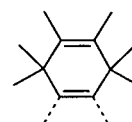
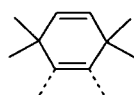
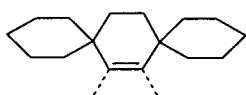


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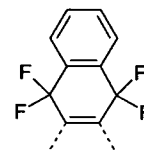
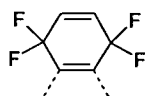
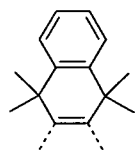
[0070] Particularly preferred examples of formula (II-B) may be selected from the following groups:

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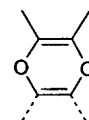




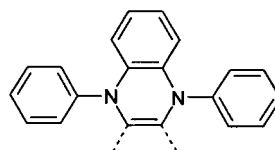
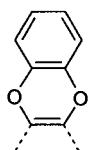
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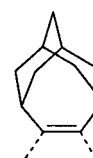
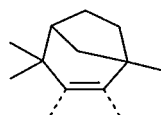
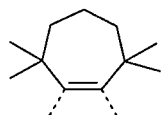
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[0071] Particularly preferred examples of formula (II-C), (II-F) and (II-G) may be selected from the following groups:

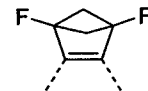
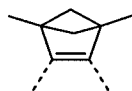
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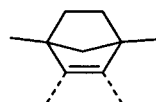
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[0072] Particularly preferred examples of formula (II-D) may be selected from the following groups:

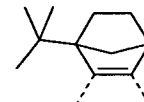
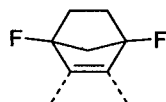
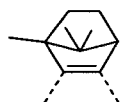
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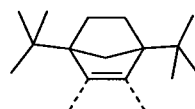
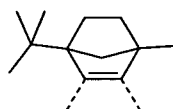
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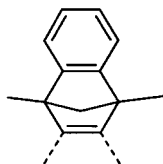


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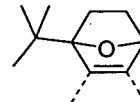
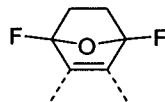
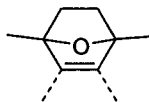


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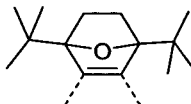
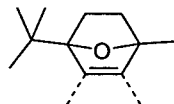
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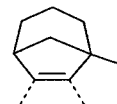
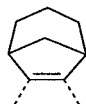
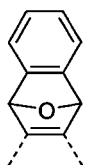
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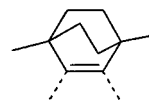
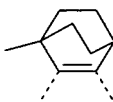
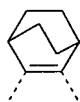
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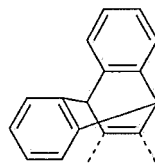
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[0073] Particularly preferred examples of formula (II-E) may be selected from the following groups:

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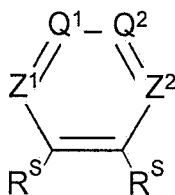


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[0074] Particularly the use of such annealed bicyclic structures can lead to chiral groups. For reasons of solubility it may be preferred to use of blend of enantiomers, rather than the pure isomers.

[0075] The present application also provides for a compound of general formula (I),

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(I)

wherein

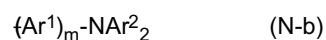
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Q^1 and Q^2 are independently of each other selected from the group consisting of N, CR^A , CR^D , and CR^S ;

Z^1 and Z^2 are independently of each other selected from the group consisting of N, CR^A and CR^D ;

R^A is a group with -M-effect;

R^D is a group with +M-effect being selected from the group consisting of compounds



wherein

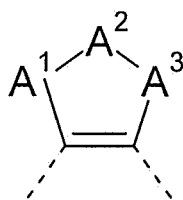
Ar^1 and m are as defined above;

Ar^2 is a substituted or unsubstituted aromatic or heteroaromatic ring system with 5 to 30 aromatic carbon atoms, wherein the two groups Ar^2 may be linked by a group Y , so that together with the N-atom of the NAr^2_2 -group, irrespective of any N-atoms that might be present in Ar^2 , a ring is formed;

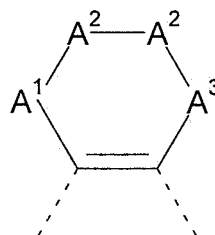
Y is selected from the group consisting of a single bond, BR^1 , $C(R^1)_2$, $Si(R^1)_2$, NR^1 , PR^1 , $P(=O)R^1$, $P(=S)R^1$, O, S, S=O and $S(=O)_2$; and

wherein

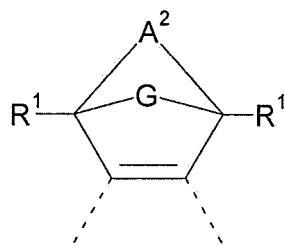
R^S is a sterically demanding group, wherein two groups CR^S together form a five-, six- or seven-membered ring of one of the following formulae (II-A) to (II-G),



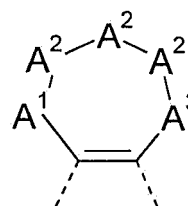
(II-A)



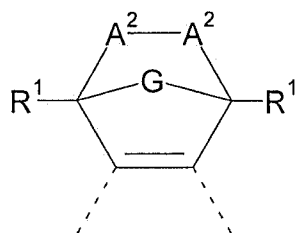
(II-B)



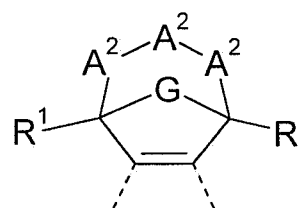
(II-C)



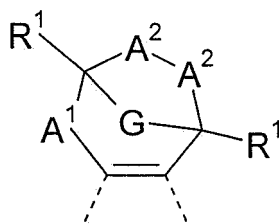
(II-D)



(II-E)



(II-F)



(II-G)

wherein

G is selected from the group consisting of substituted or unsubstituted alkanediyl with 1, 2 or 3 C-atoms, $-\text{CR}^2=\text{CR}^2-$ or a substituted or unsubstituted ortho-linked arylene- or heteroarylene-group with 5 to 14 aromatic ring atoms, which may be substituted with one or more of groups R^2 ;

A^1 and A^3 are at each occurrence independently selected from the group consisting of $\text{C}(\text{R}^3)_2$, O, S, NR^3 and $\text{C}(=\text{O})$;

A^2 is at each occurrence independently selected from the group consisting of $\text{C}(\text{R}^1)_2$, O, S, NR^3 and $\text{C}(=\text{O})$, and in case two groups A^2 are adjacent to each other, A^2-A^2 may also be selected from the group consisting of ortho-linked arylene- or heteroarylene-group with 5 to 14 aromatic ring atoms, each of which may independently of the other be substituted with R^2 as defined above;

R^1 is at each occurrence independently selected from the group consisting of H, D, F, Cl, Br, I, $\text{B}(\text{OR}^2)_2$, CHO, $\text{C}(=\text{O})\text{R}^2$, $\text{CR}^2=\text{C}(\text{R}^2)_2$, CN, $\text{C}(=\text{O})\text{OR}^2$, $\text{C}(=\text{O})\text{N}(\text{R}^2)_2$, $\text{Si}(\text{R}^2)_3$, $\text{N}(\text{R}^2)_2$, NO_2 , $\text{P}(=\text{O})(\text{R}^2)_2$, OSO_2R^2 , OR^2 , $\text{S}(=\text{O})\text{R}^2$, $\text{S}(=\text{O})_2\text{R}^2$, OH, SH, linear alkyl-, alkoxy- or thioalkyl-group with 1 to 20 C-atoms or a branched or cyclic alkyl-, alkoxy- or thioalkyl-group with 3 to 20 C-atoms or a alkenyl- or alkynyl-group with 2 to 20 C-atoms, wherein these groups may be substituted with one or more of groups R^2 and wherein one or more CH_2 -Gruppen in these groups may be replaced by $-\text{R}^2\text{C}=\text{CR}^2-$, $-\text{C}\equiv\text{C}-$, $\text{Si}(\text{R}^2)_2$, $\text{C}=\text{O}$, $\text{C}=\text{S}$, $\text{C}=\text{NR}^2$, $-\text{C}(=\text{O})\text{O}-$, $-\text{C}(=\text{O})\text{NR}^2-$, NR^2 , $\text{P}(=\text{O})(\text{R}^2)$, $-\text{O}-$, $-\text{S}-$, SO or SO_2 , and wherein one or more H-atoms in these groups may be replaced by D, F, Cl, Br, I, CN or NO_2 , or an aromatic or heteroaromatic ring system with 5 to 60 aromatic ring atoms, which can be substituted with one or more groups R^2 , or an aryloxy- or heteroaryloxy-group with 5 to 60 aromatic ring atoms, which can be substituted with one or more groups R^2 , or an aralkyl- or heteroaralkyl-group with 5 to 60 aromatic ring atoms, which can be substituted with one or more groups R^2 , wherein two or more groups R^2 may be linked with each other and form an aliphatic or aromatic or heteroaromatic ring;

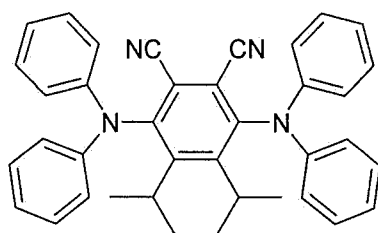
R^2 is at each occurrence independently selected from the group consisting of H, D, F, alkyl having from 1 to 20 C-atoms, aromatic groups having from 1 to 20 aromatic carbon atoms and heteroaromatic groups having from 1 to 20 aromatic ring atoms, wherein the aromatic groups and the heteroaromatic groups may be substituted with an alkyl having from 1 to 20 carbon atoms; and

□

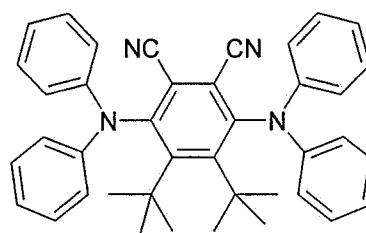
R^3 is at each occurrence independently selected from the group consisting of F, linear alkyl- or alkoxy-group with 1 to 20 C-atoms, a branched or cyclic alkyl- or alkoxy-group with 3 to 20 C-atoms, each of which may be substituted with one or more of groups R^2 , wherein one or more non-adjacent CH_2 -groups may be replaced by $\text{R}^2\text{C}=\text{CR}^2$, $\text{C}\equiv\text{C}$, $\text{Si}(\text{R}^2)_2$, $\text{C}=\text{O}$, NR^2 , O, S or CONR^2 , and wherein one or more H-atom may be replaced with D or F, or an aromatic or heteroaromatic ring system with 5 to 24 aromatic ring atoms, each of which may each be substituted with one or more of groups R^2 , or an aryloxy- or heteroaryloxy-group with 5 to 24 aromatic ring atoms, which can be substituted with one or more groups R^2 , or an aralkyl- or heteroaralkyl-group with 5 to 24 aromatic ring atoms, which can be substituted with one or more groups R^2 , wherein two R^2 bound to the same carbon atom may form an aliphatic or aromatic ring system and thus a spiro system; or R^3 can form together with a neighboring group R^1 or R^2 an aliphatic ring system,

[0076] provided that in $\text{A}^1-\text{A}^2-\text{A}^3$ no two heteroatoms are adjacent; and with the provision that the compound of general formula (I) comprises at least one group CRA and at least one group CR^D .

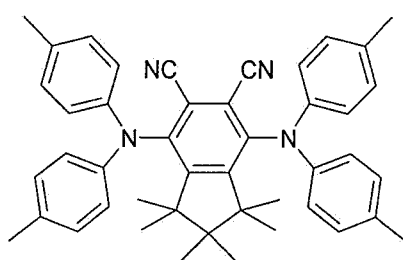
[0077] Particularly suitable examples of compounds of general formula (I) are illustrated by the following formulae (I-3) - (I-48), (I-51) - (I-106), (I-109) - (I-138), (I-141)-(I-168), (I-171) - (I-198), (I-201) - (I-228), (I-231) - (I-252), (I-255) - (I-276), (I-279) - (I-300) and (I-303) - (I-314). The compounds represented by the other formulae are for illustrative purpose only.



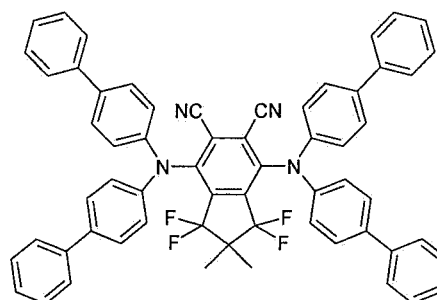
(I-1)



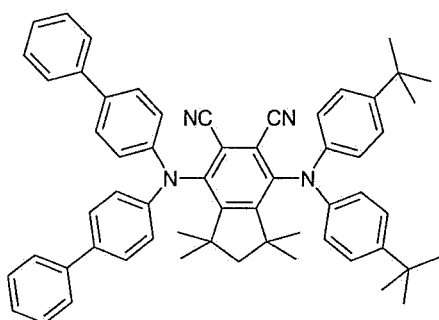
(I-2)



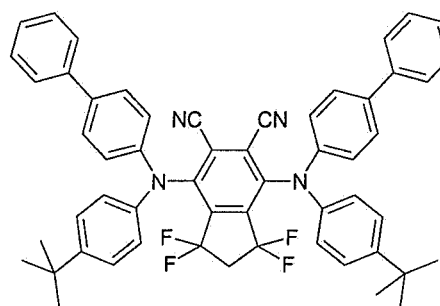
(I-3)



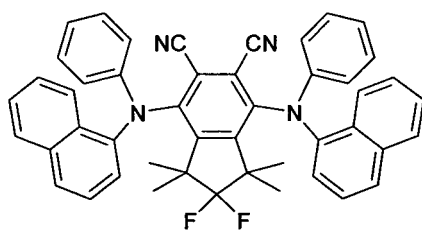
(I-4)



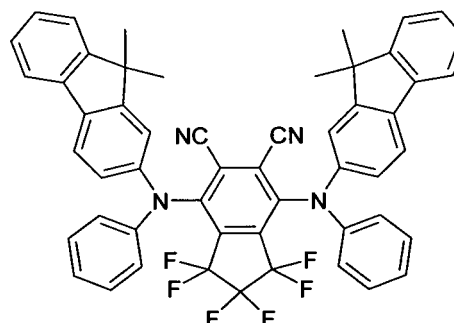
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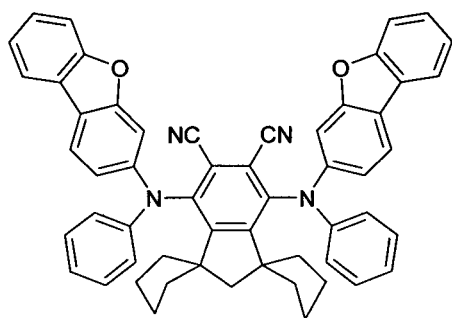
(I-6)



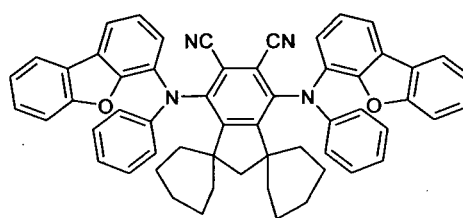
(I-7)



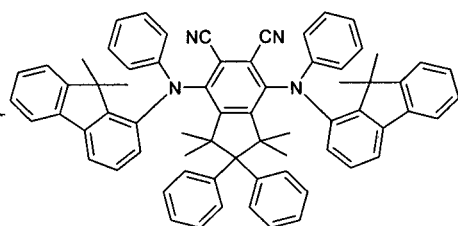
(I-8)



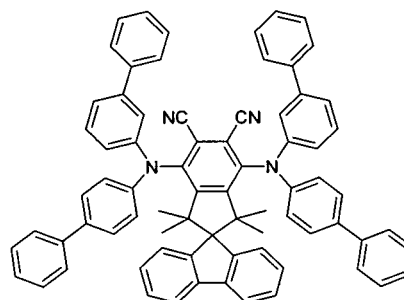
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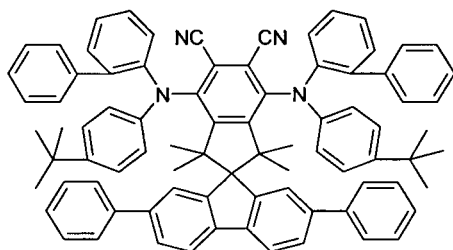
(I-10)



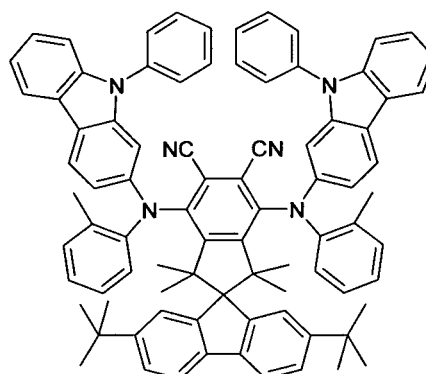
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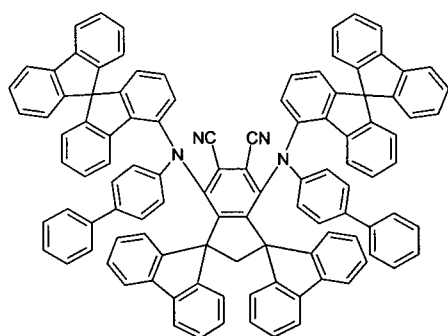
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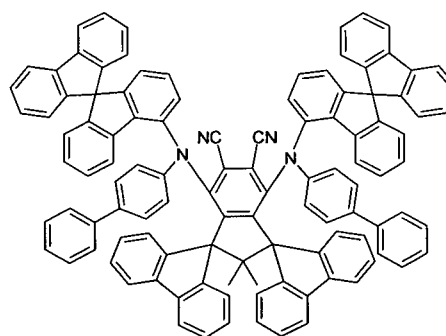
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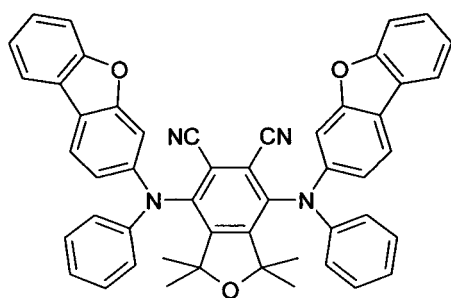
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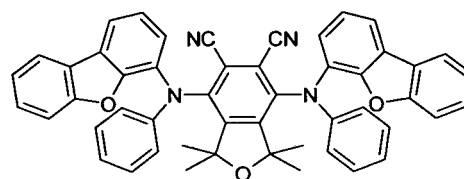
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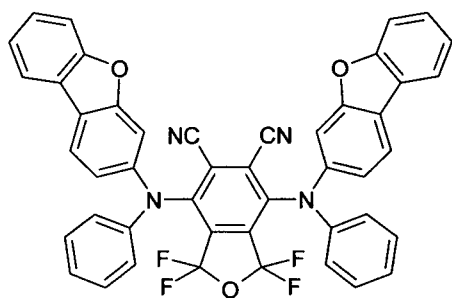
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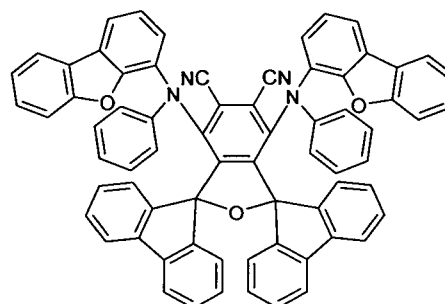
(I-17)



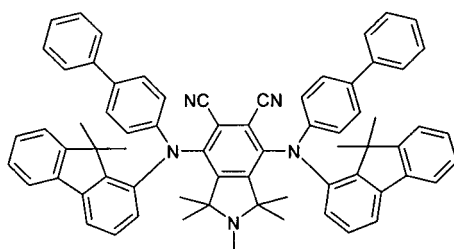
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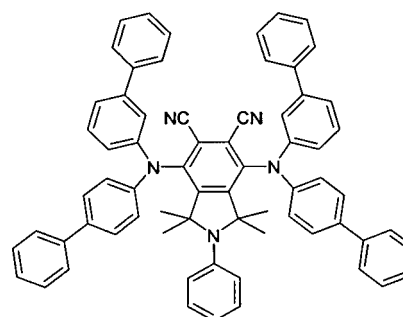
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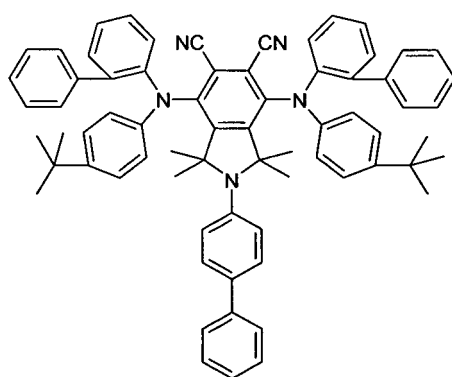
(I-20)



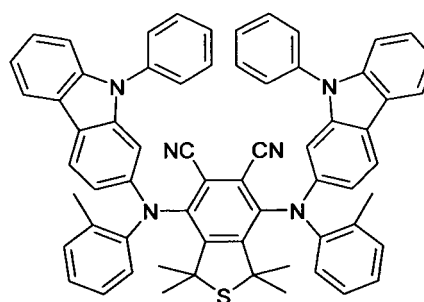
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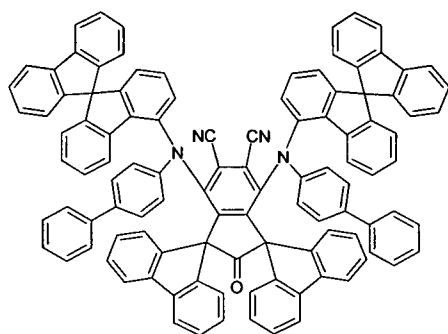
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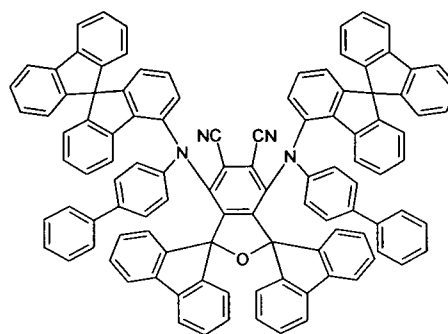
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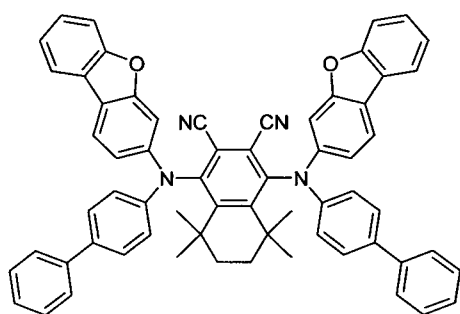
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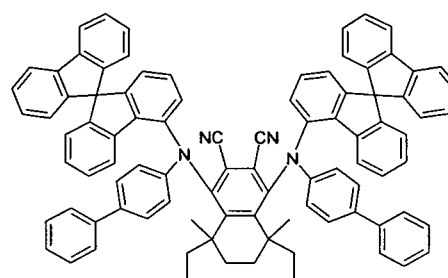
(I-25)



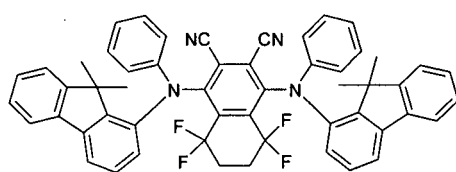
(I-26)



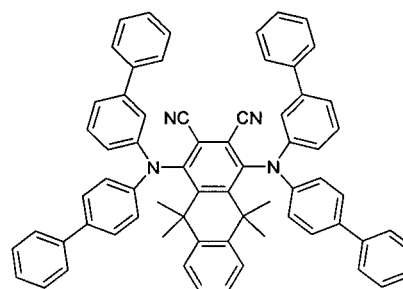
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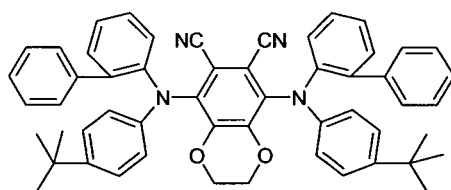
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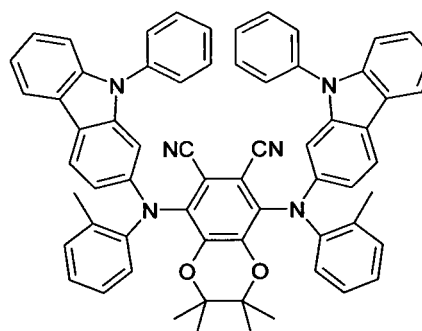
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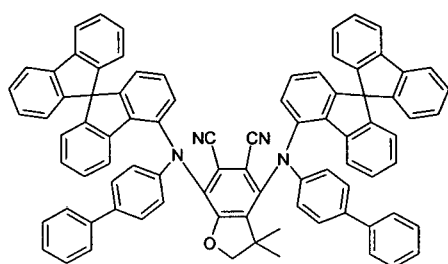
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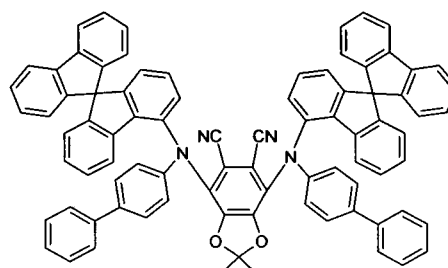
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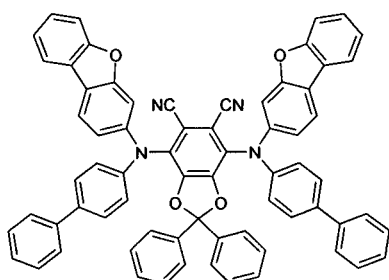
(I-32)



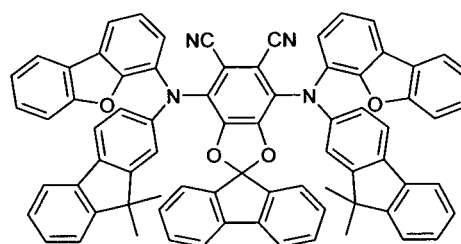
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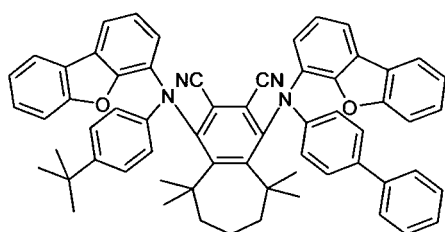
(I-34)



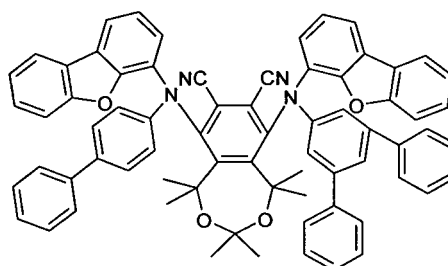
(I-35)



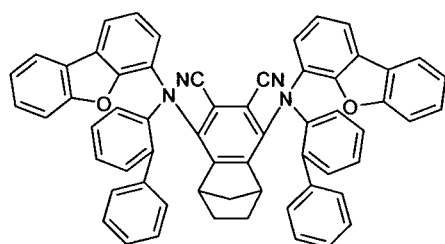
(I-36)



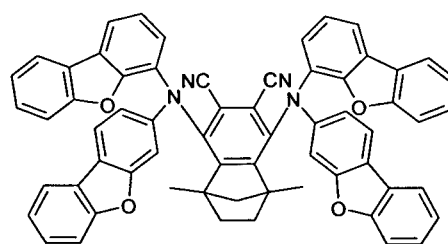
(I-37)



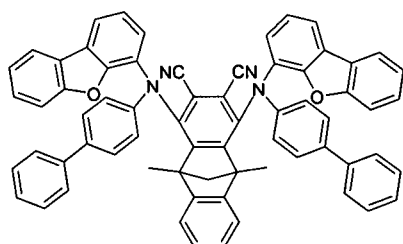
(I-38)



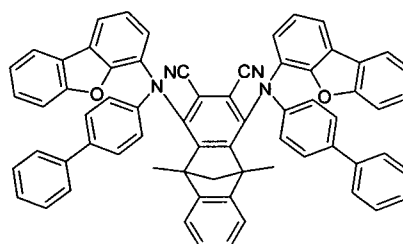
(I-39)



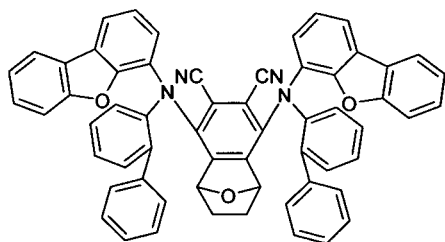
(I-40)



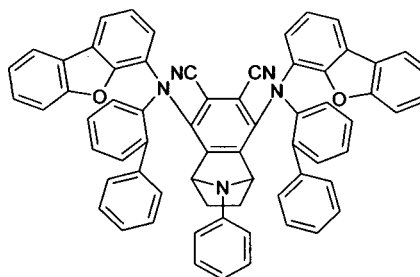
(I-41)



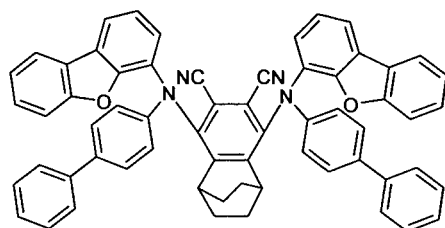
(I-42)



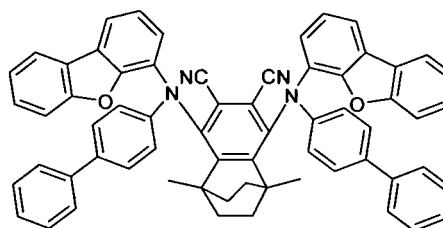
(I-43)



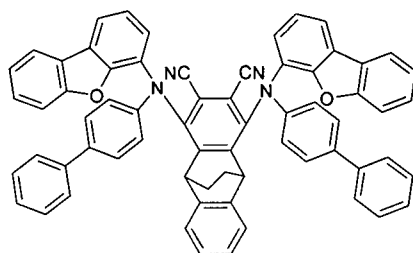
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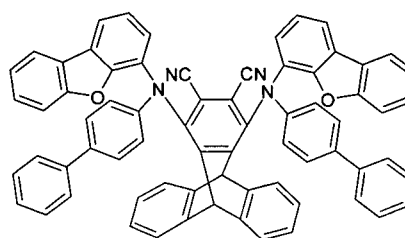
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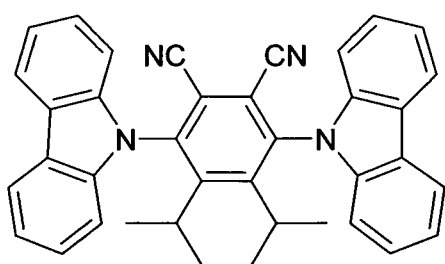
(I-46)



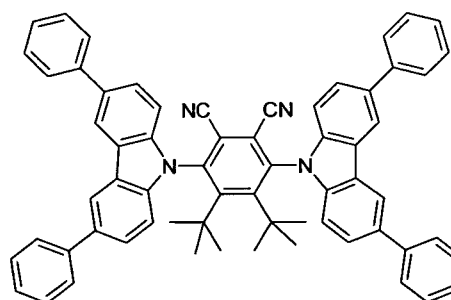
(I-47)



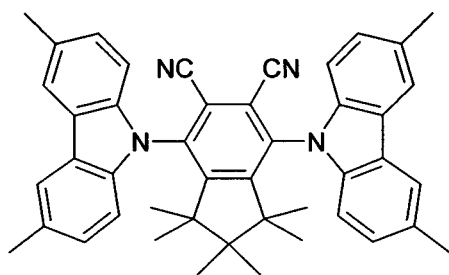
(I-48)



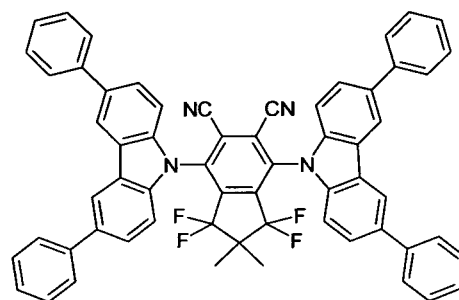
(I-49)



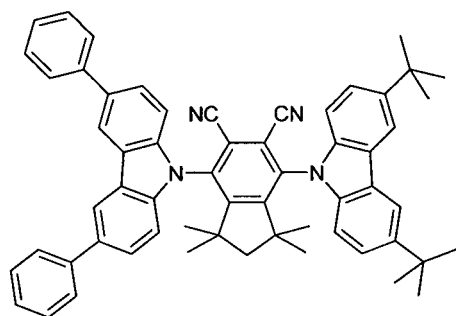
(I-50)



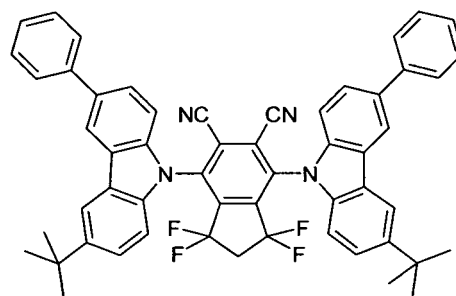
(I-51)



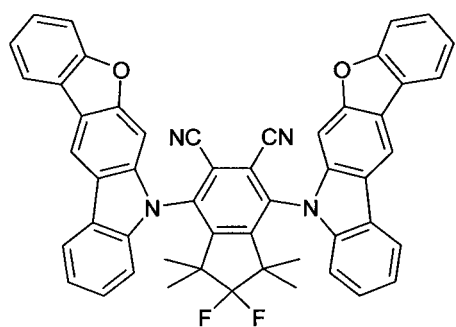
(I-52)



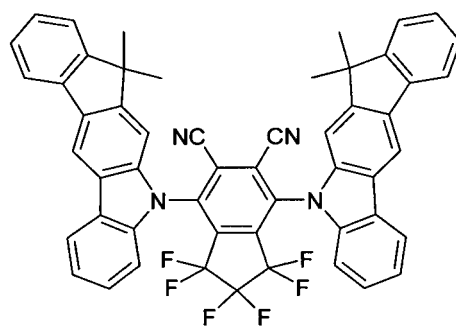
(I-53)



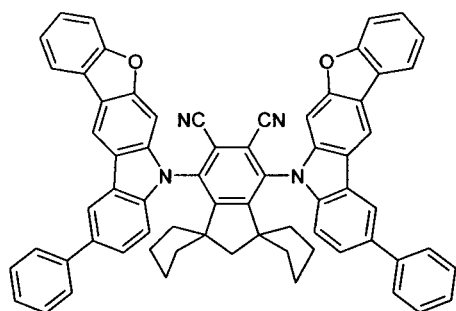
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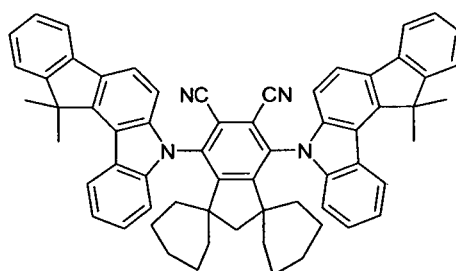
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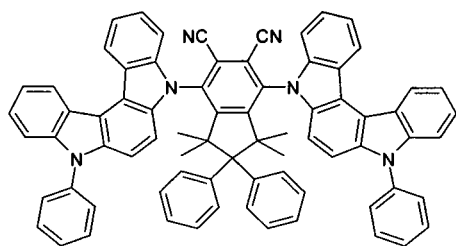
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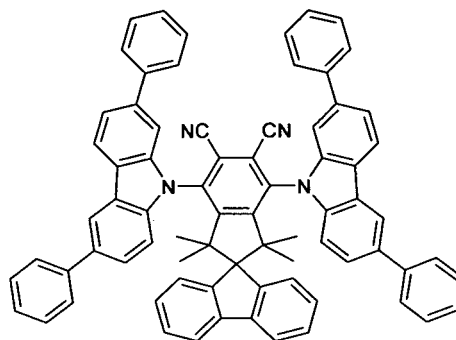
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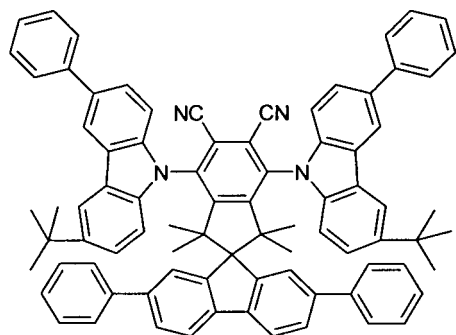
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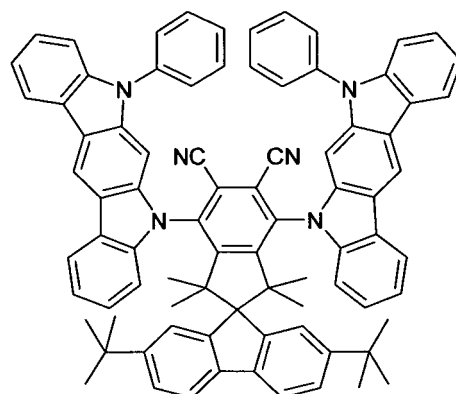
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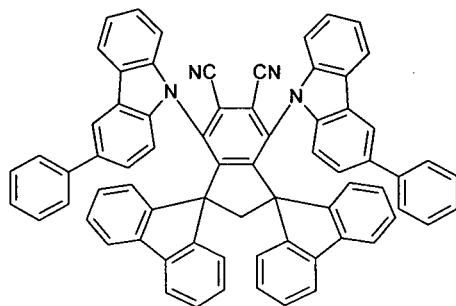
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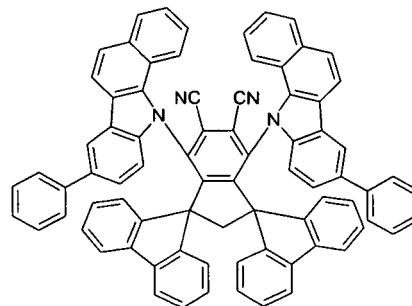
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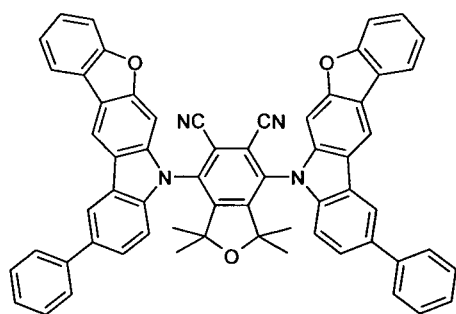
(I-62)



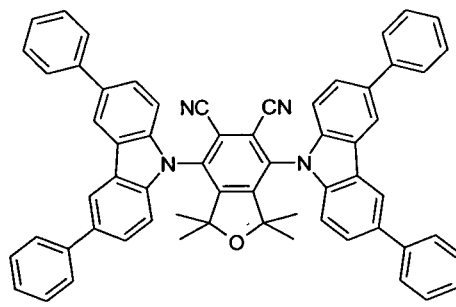
(I-63)



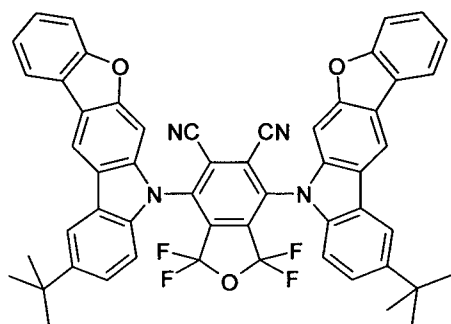
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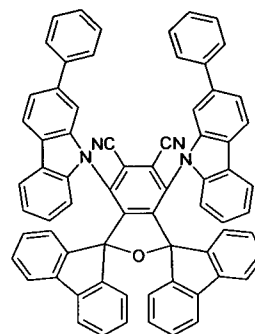
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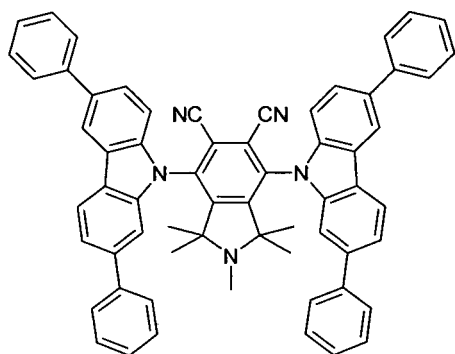
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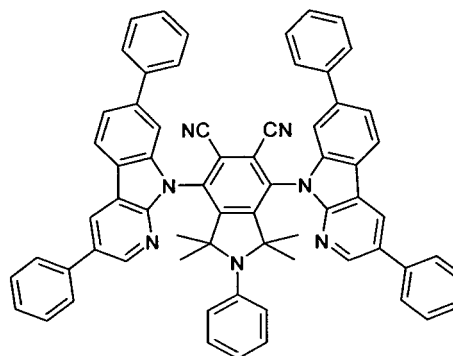
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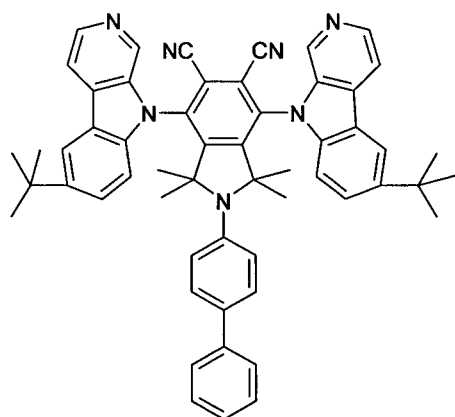
(I-68)



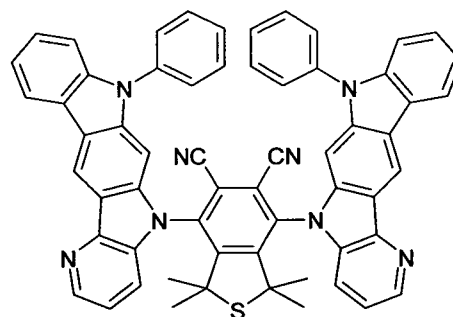
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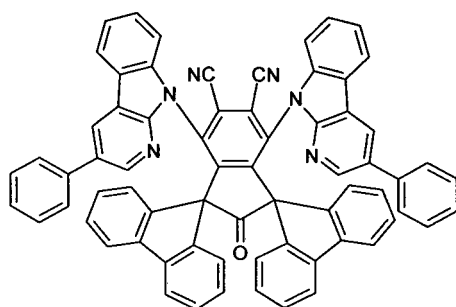
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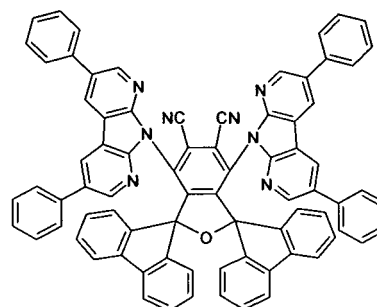
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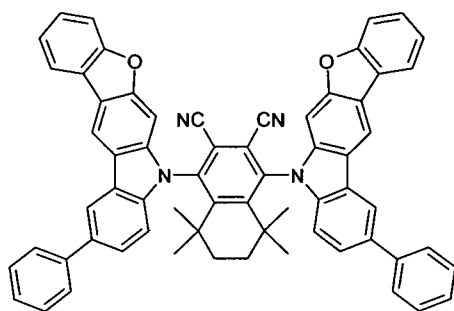
(I-72)



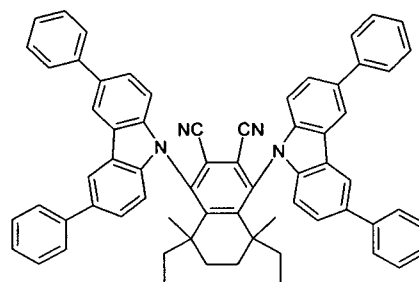
(I-73)



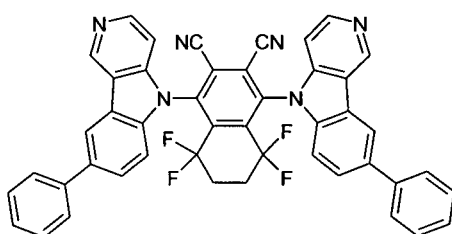
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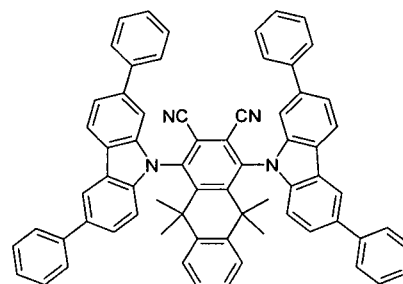
(I-75)



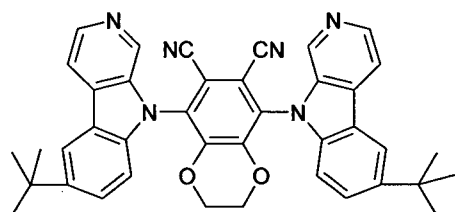
(I-76)



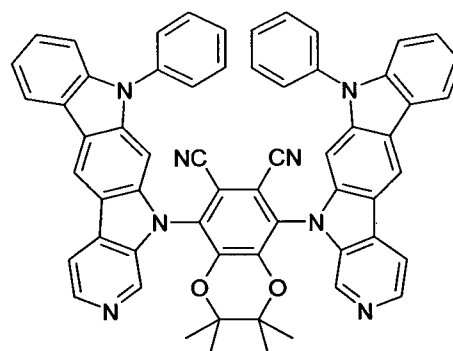
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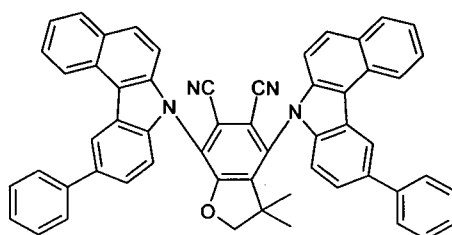
(I-78)



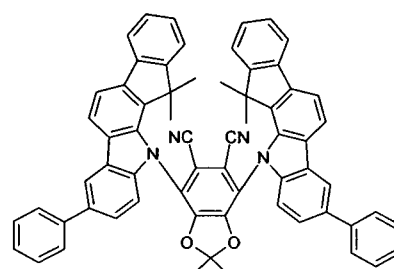
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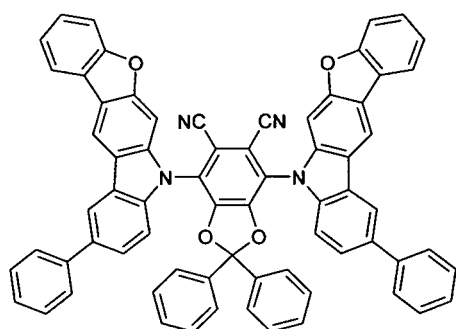
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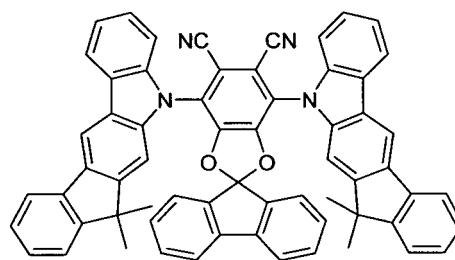
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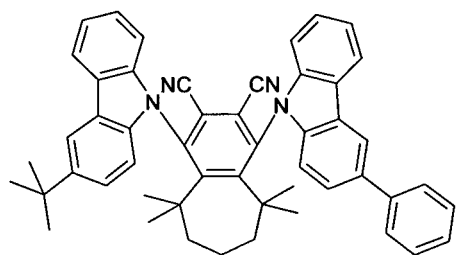
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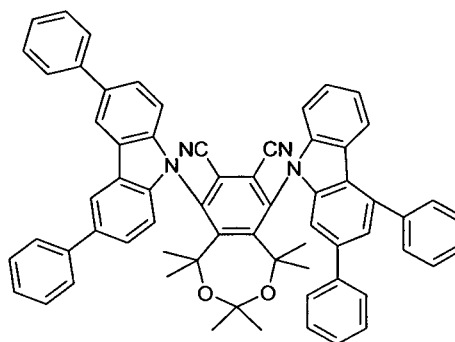
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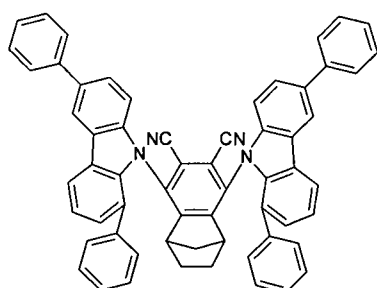
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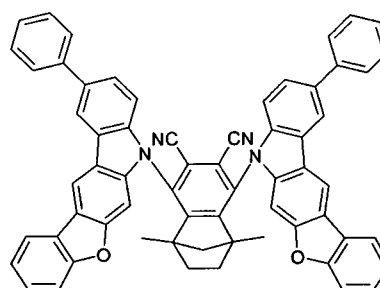
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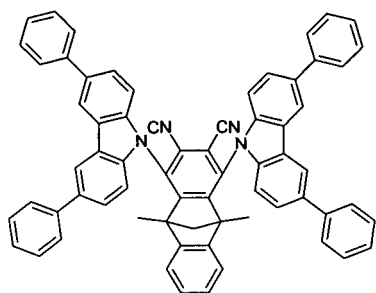
(I-86)



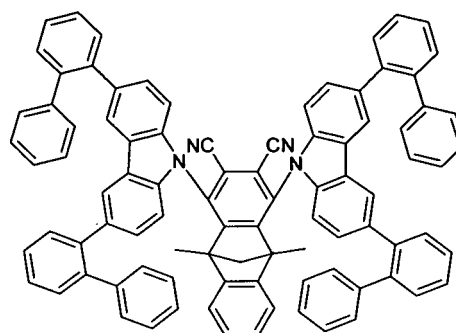
(I-87)



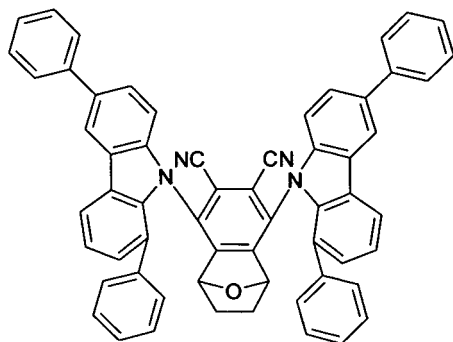
(I-88)



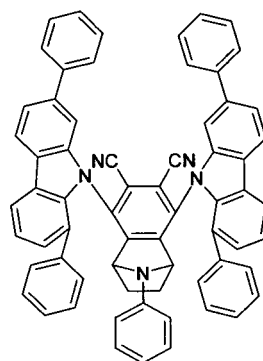
(I-89)



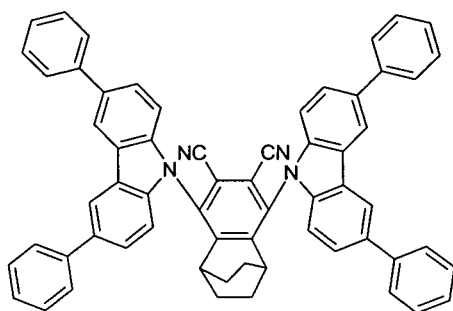
(I-90)



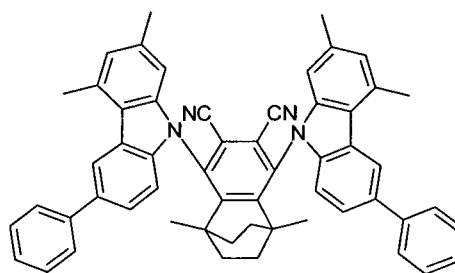
(I-91)



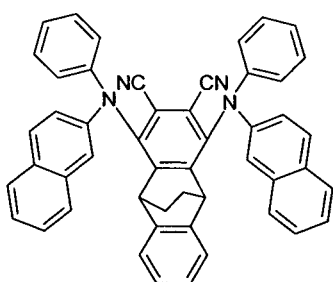
(I-92)



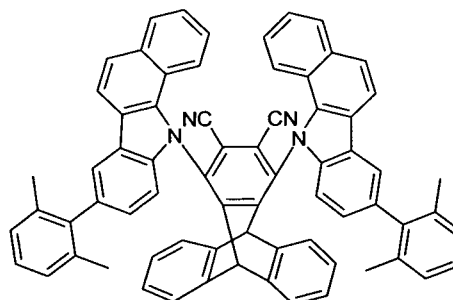
(I-93)



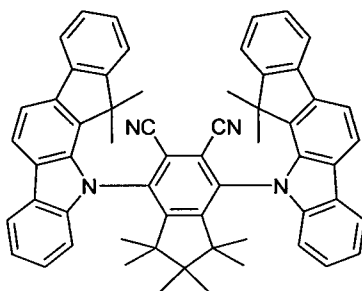
(I-94)



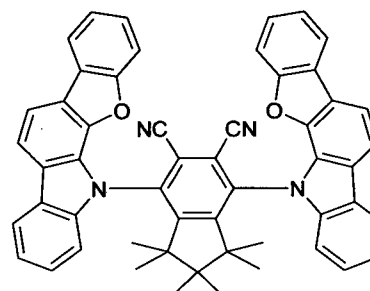
(I-95)



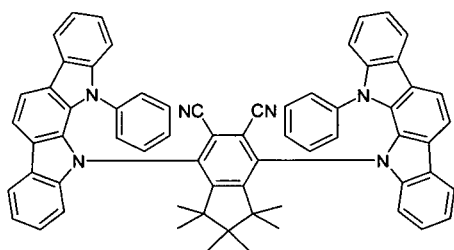
(I-96)



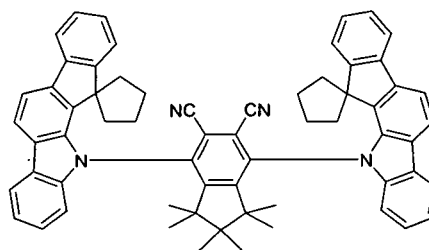
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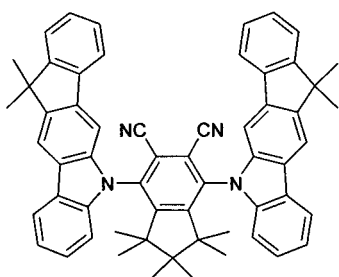
(I-98)



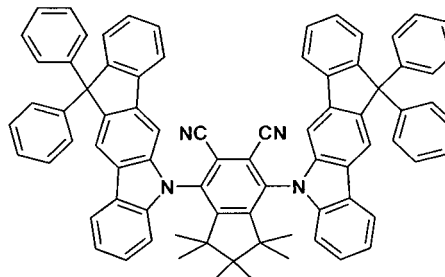
(I-99)



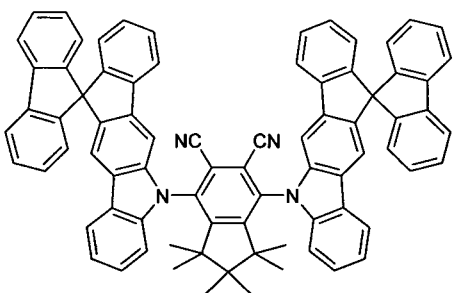
(I-100)



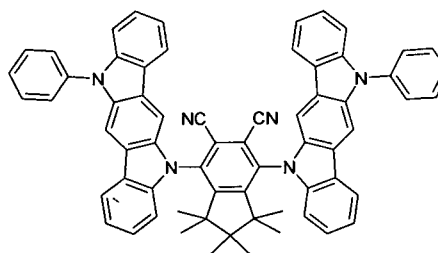
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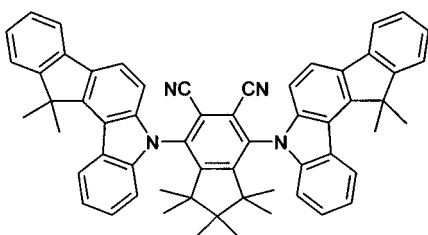
(I-102)



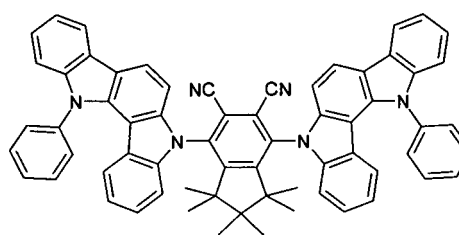
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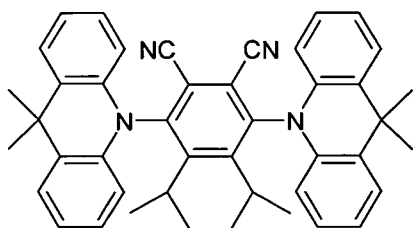
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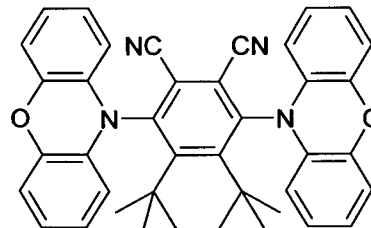
(I-105)



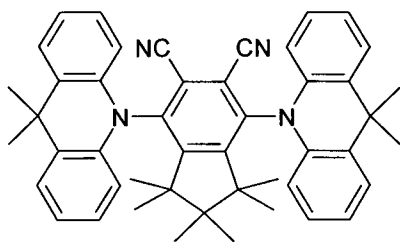
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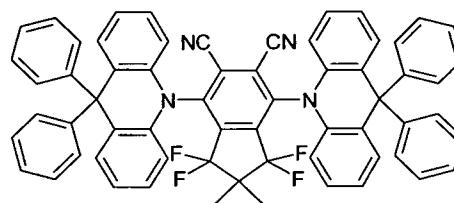
(I-107)



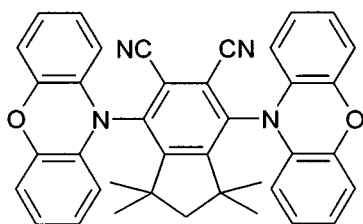
(I-108)



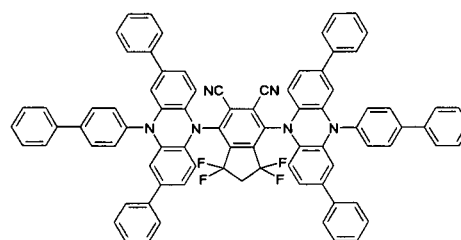
(I-109)



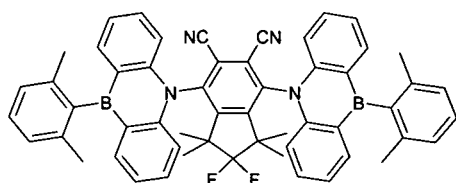
(I-110)



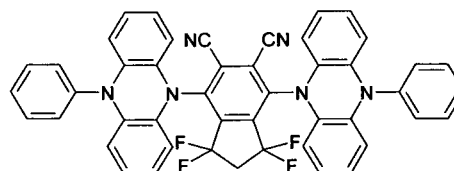
(I-111)



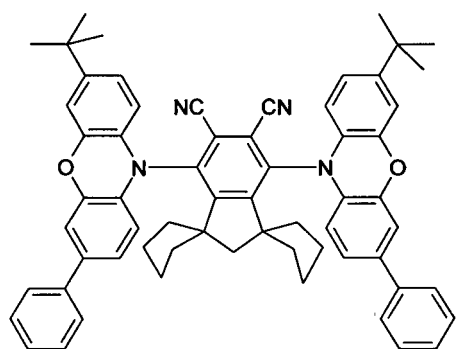
(I-112)



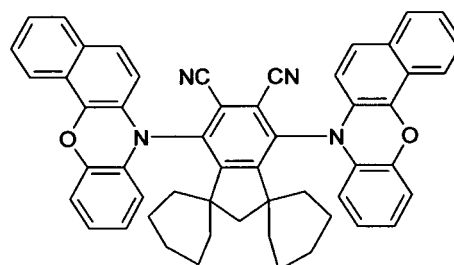
(I-113)



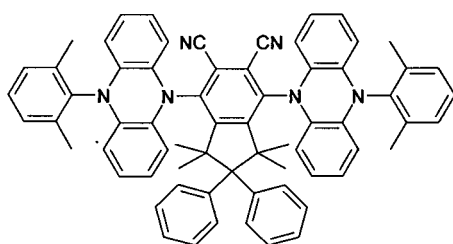
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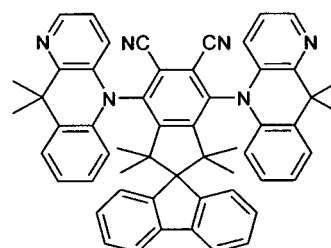
(I-115)



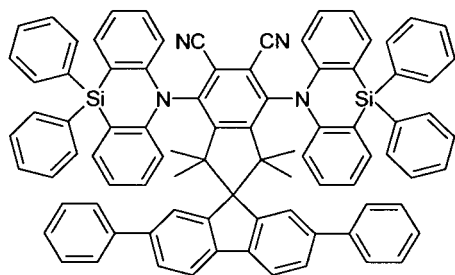
(I-116)



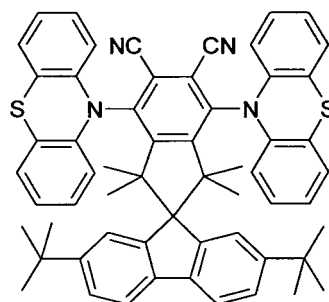
(I-117)



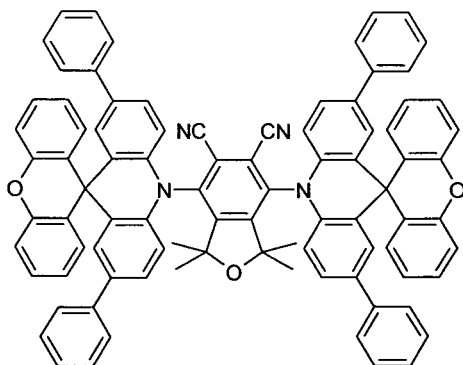
(I-118)



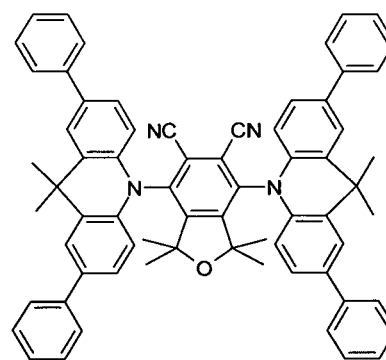
(I-119)



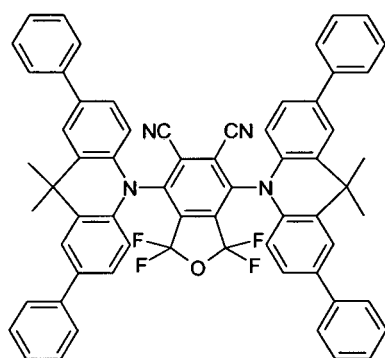
(I-120)



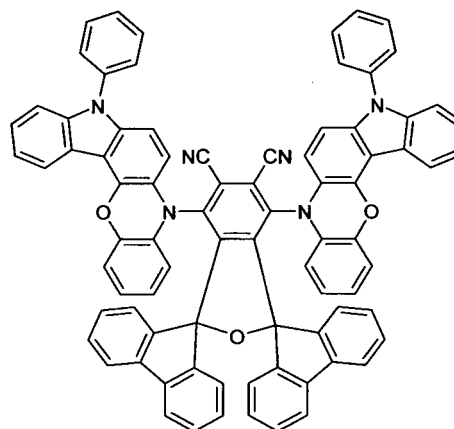
(I-121)



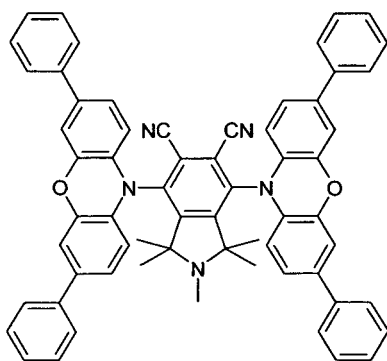
(I-122)



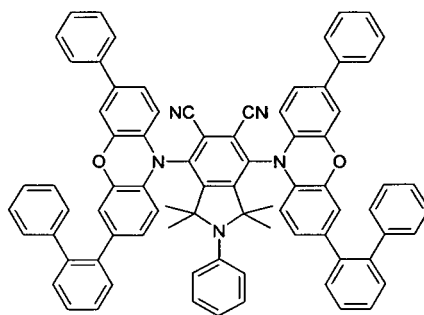
(I-123)



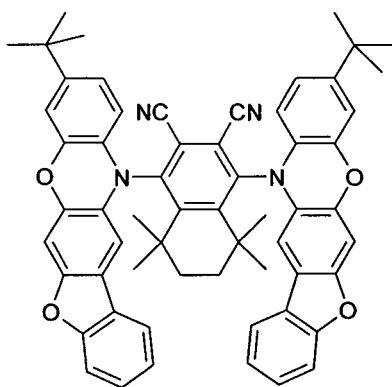
(I-124)



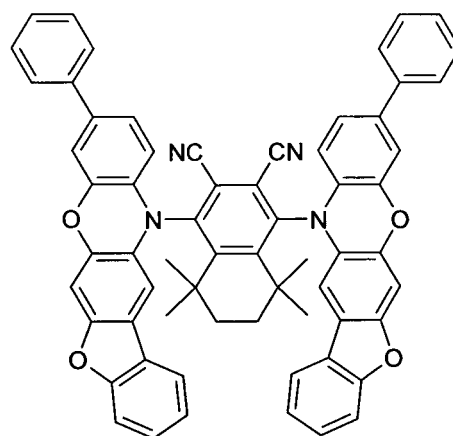
(I-125)



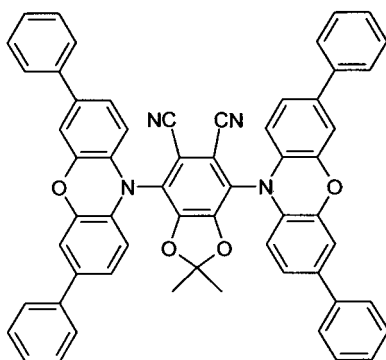
(I-126)



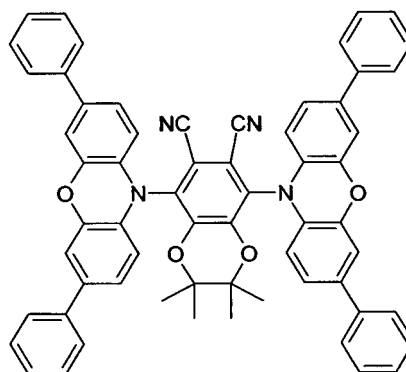
(I-127)



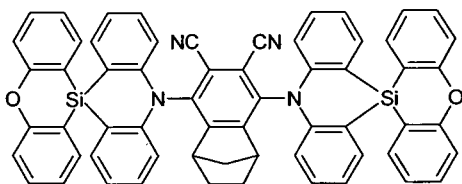
(I-128)



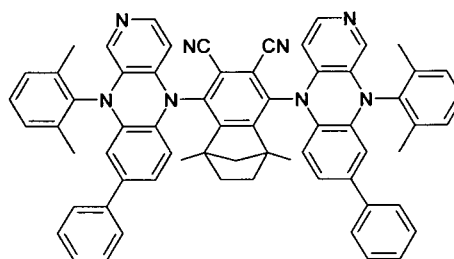
(I-129)



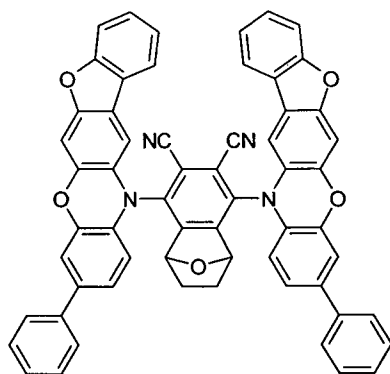
(I-130)



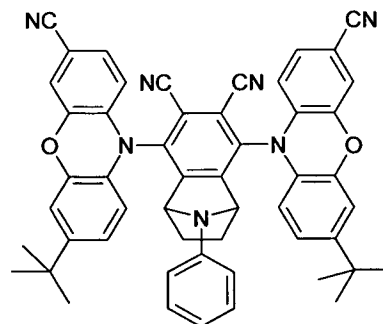
(I-131)



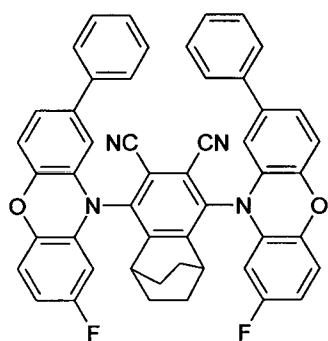
(I-132)



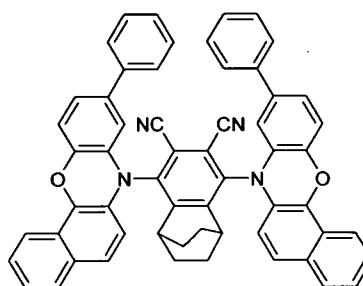
(I-133)



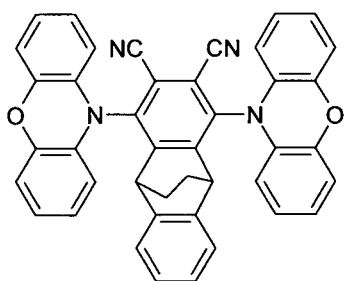
(I-134)



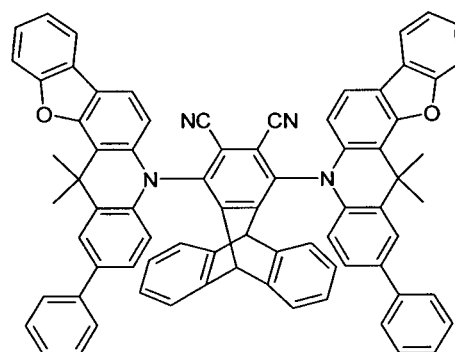
(I-135)



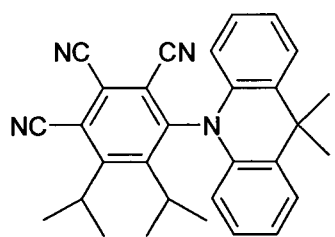
(I-136)



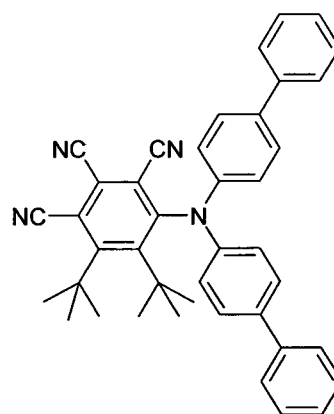
(I-137)



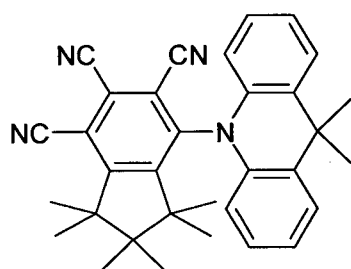
(I-138)



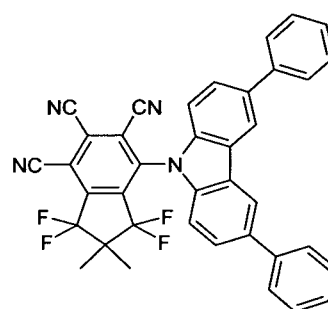
(I-139)



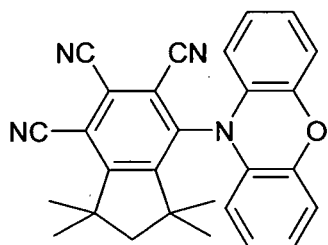
(I-140)



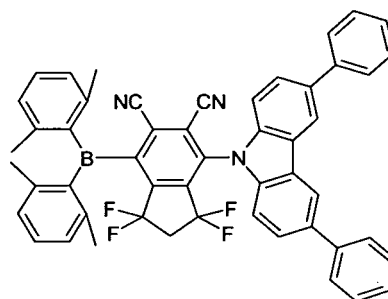
(I-141)



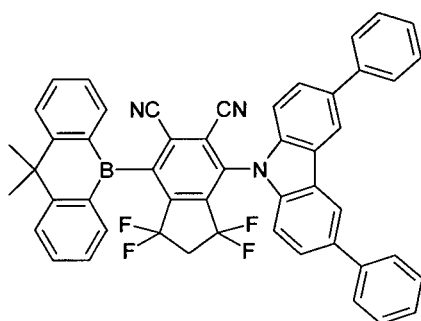
(I-142)



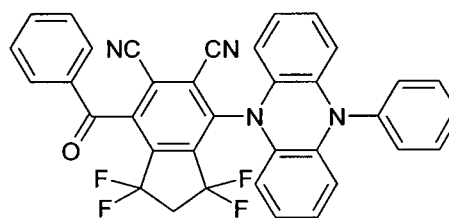
(I-143)



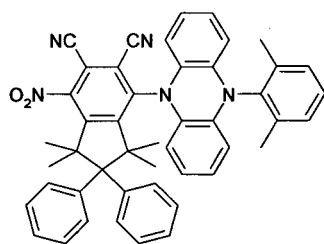
(I-144)



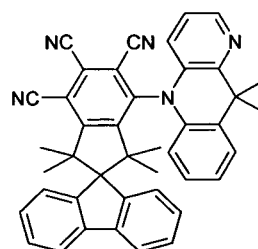
(I-145)



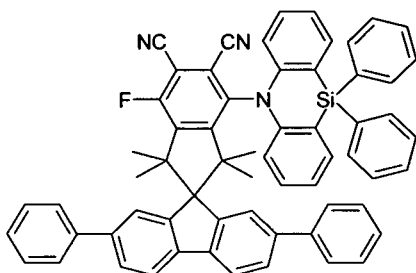
(I-146)



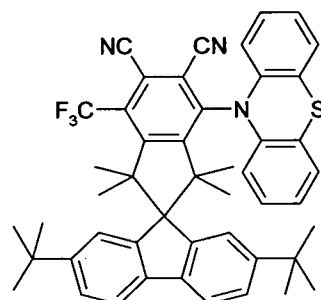
(I-147)



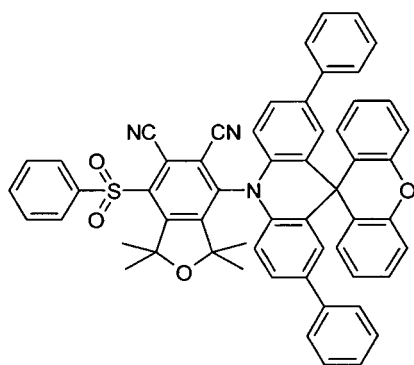
(I-148)



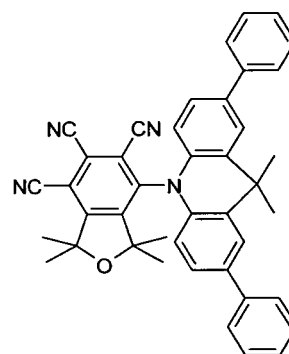
(I-149)



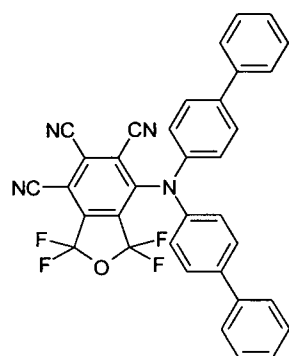
(I-150)



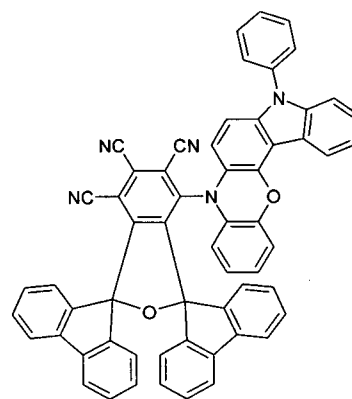
(I-151)



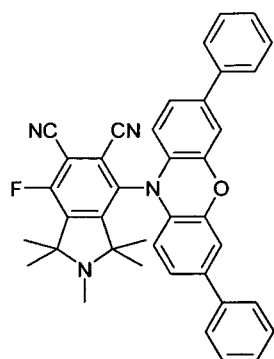
(I-152)



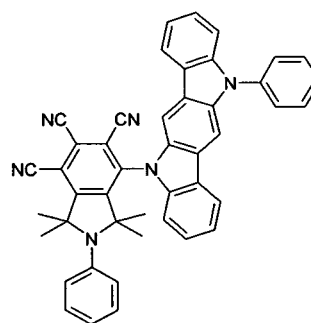
(I-153)



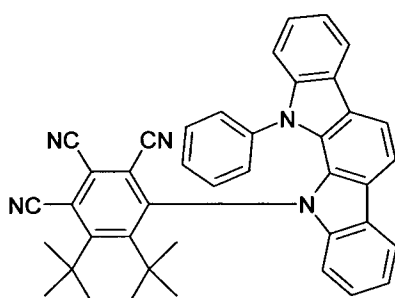
(I-154)



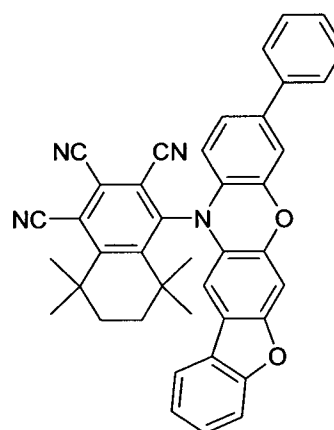
(I-155)



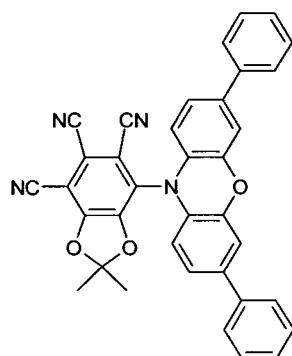
(I-156)



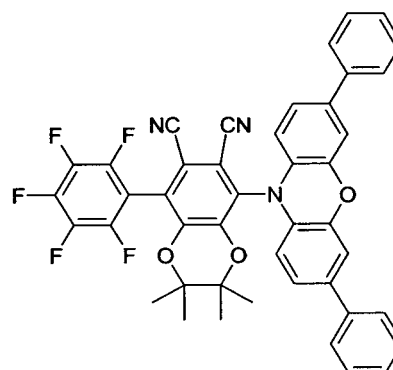
(I-157)



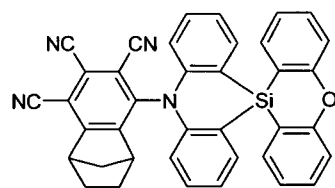
(I-158)



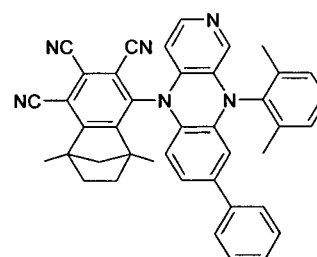
(I-159)



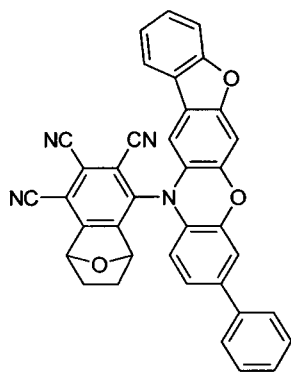
(I-160)



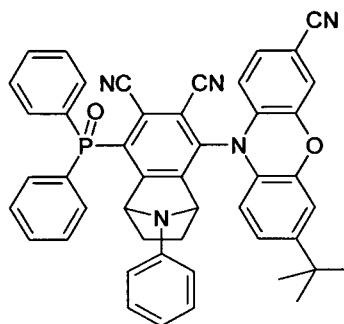
(I-161)



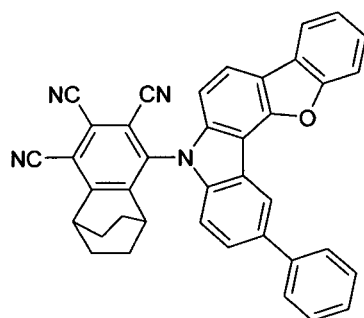
(I-162)



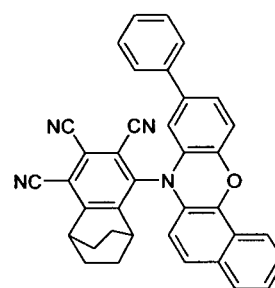
(I-163)



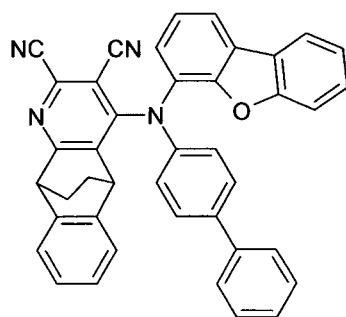
(I-164)



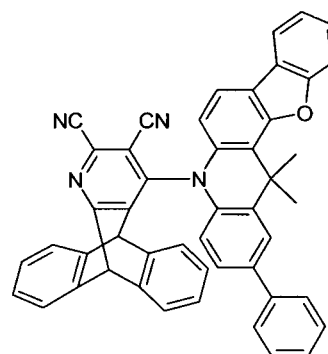
(I-165)



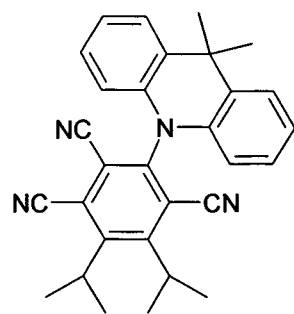
(I-166)



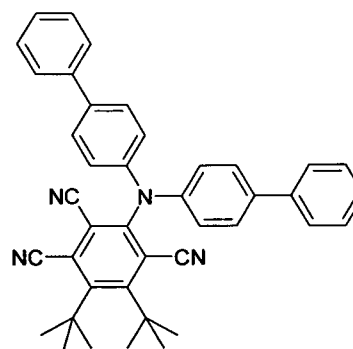
(I-167)



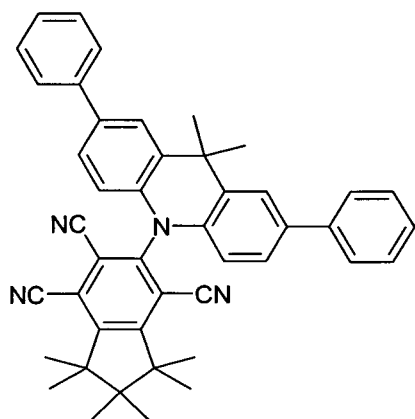
(I-168)



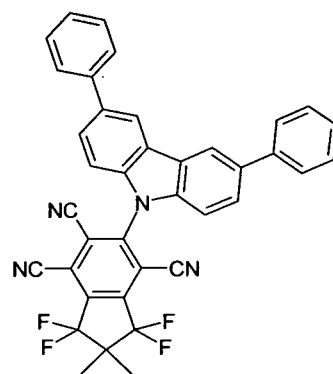
(I-169)



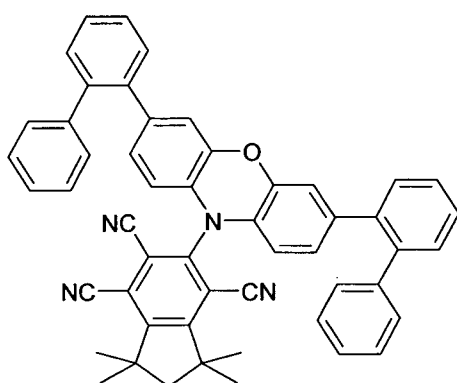
(I-170)



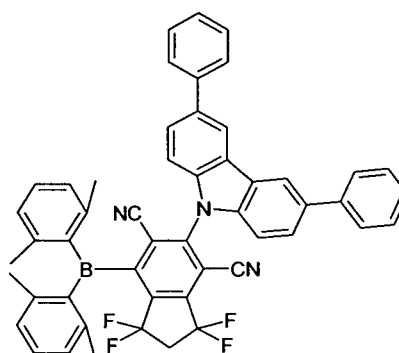
(I-171)



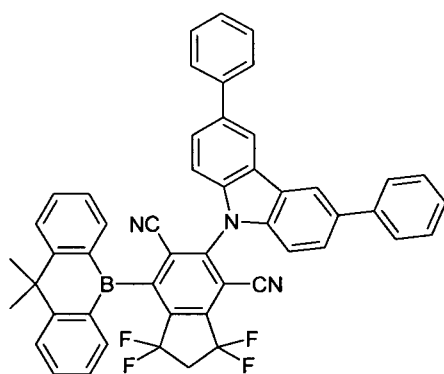
(I-172)



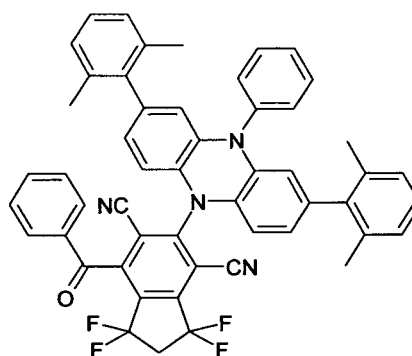
(I-173)



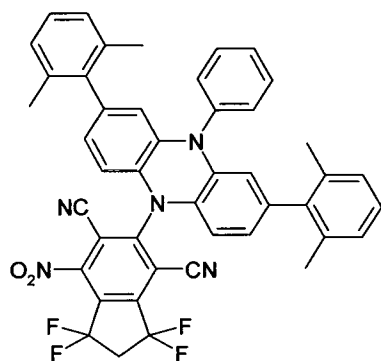
(I-174)



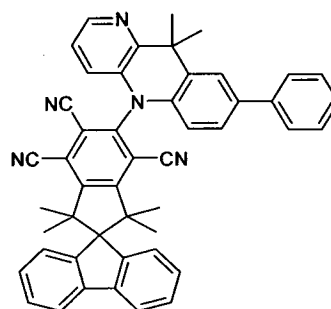
(I-175)



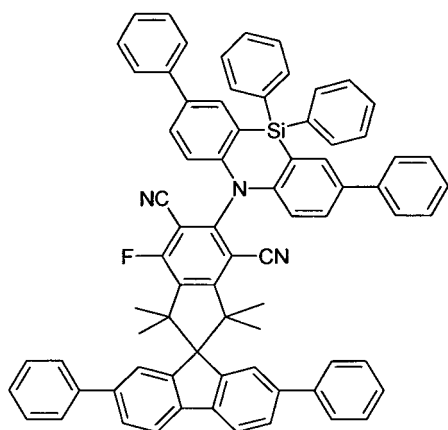
(I-176)



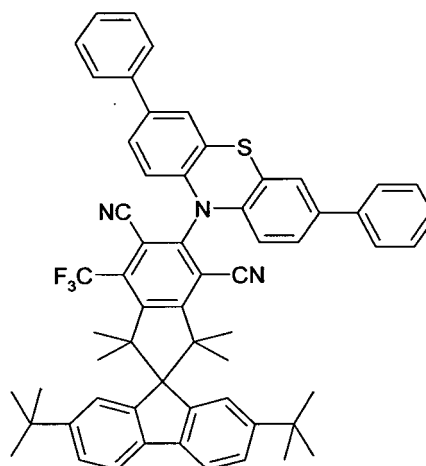
(I-177)



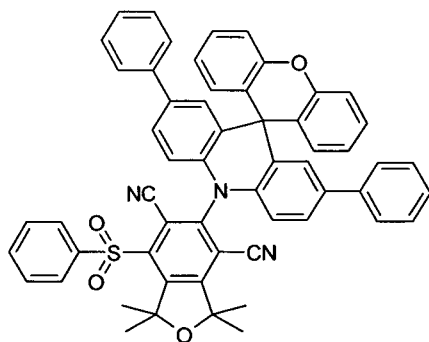
(I-178)



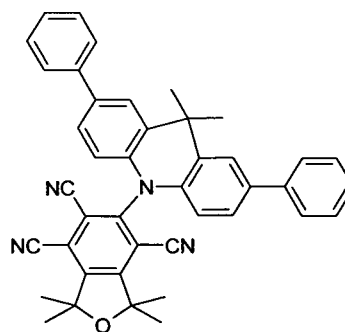
(I-179)



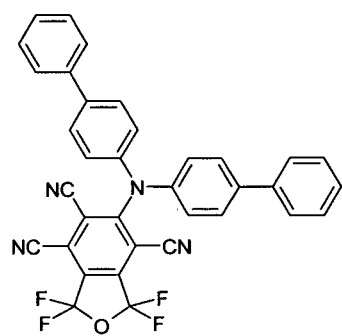
(I-180)



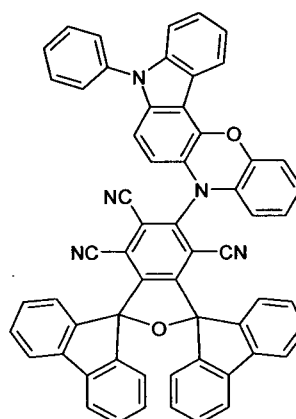
(I-181)



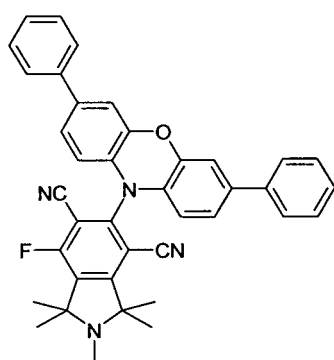
(I-182)



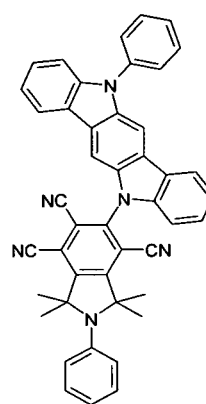
(I-183)



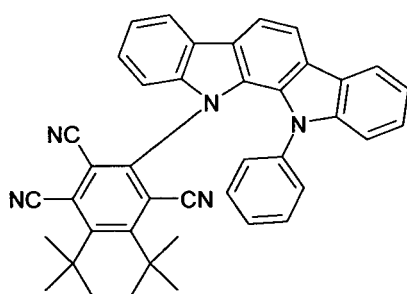
(I-184)



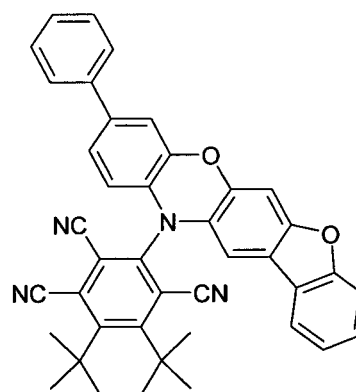
(I-185)



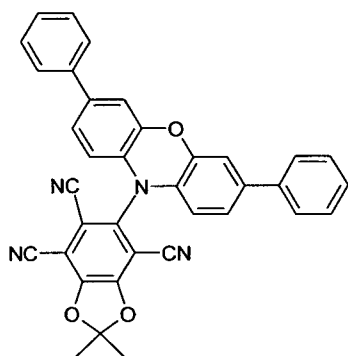
(I-186)



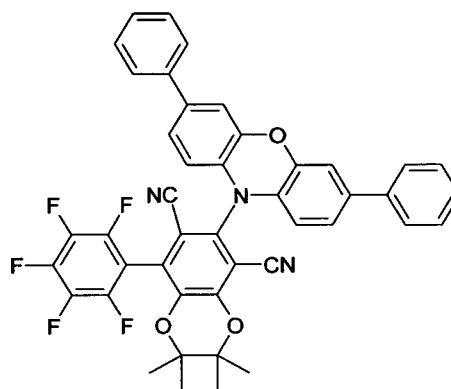
(I-187)



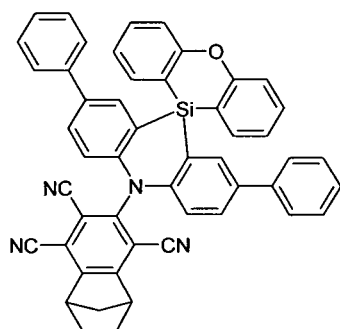
(I-188)



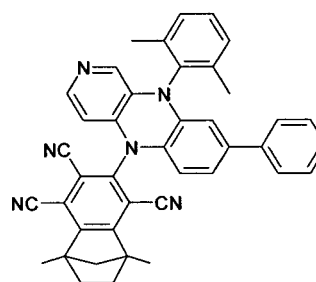
(I-189)



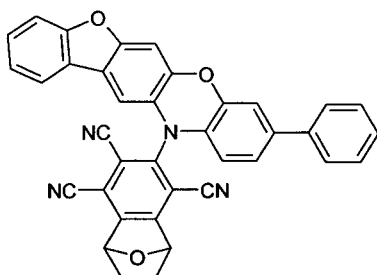
(I-190)



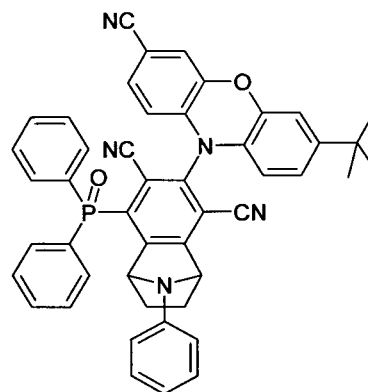
(I-191)



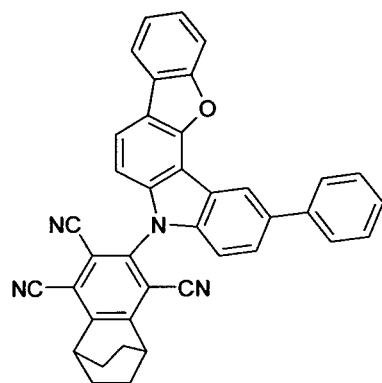
(I-192)



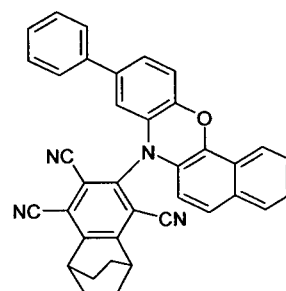
(I-193)



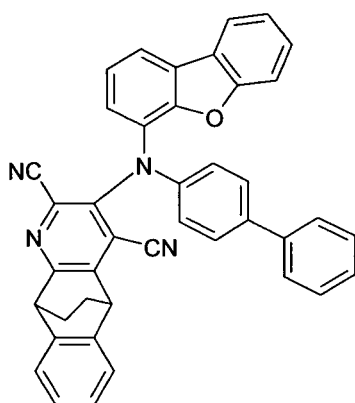
(I-194)



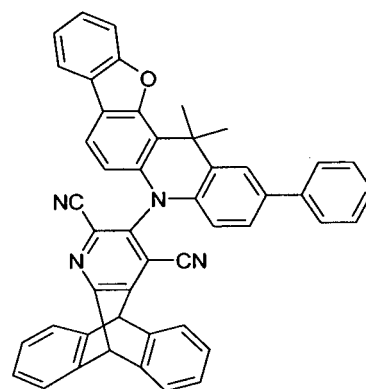
(I-195)



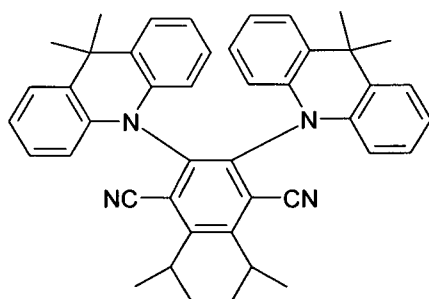
(I-196)



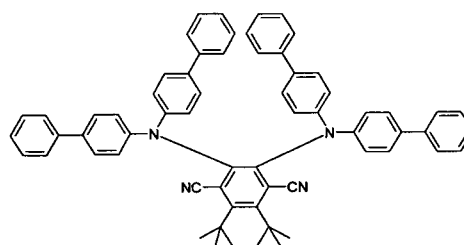
(I-197)



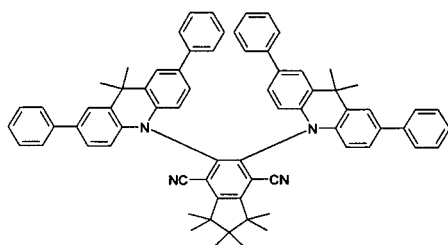
(I-198)



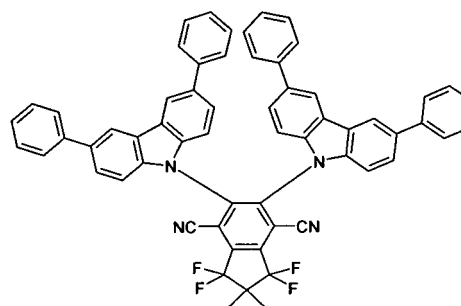
(I-199)



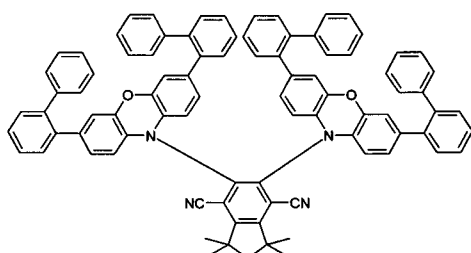
(I-200)



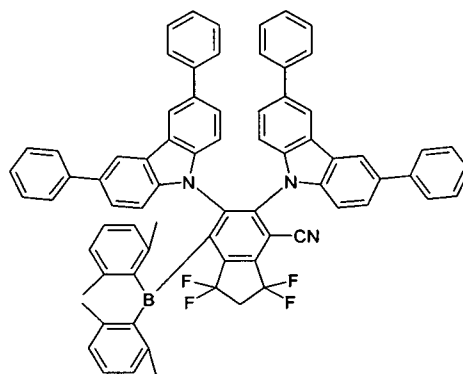
(I-201)



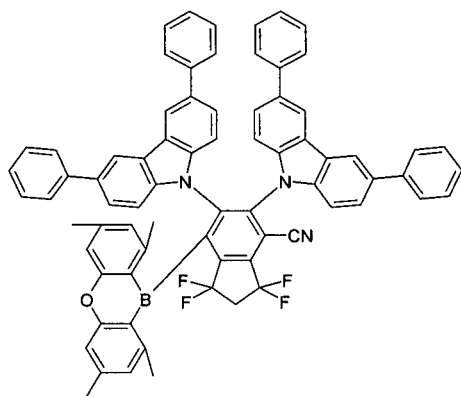
(I-202)



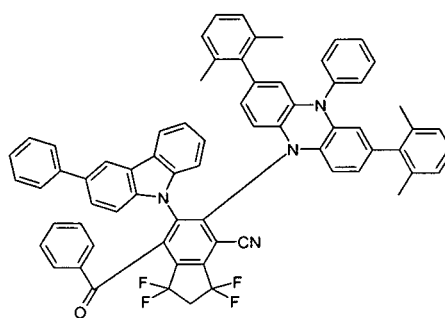
(I-203)



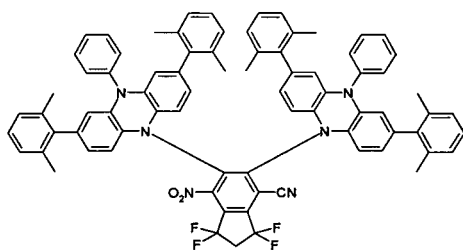
(I-204)



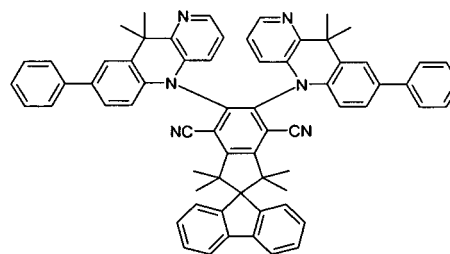
(I-205)



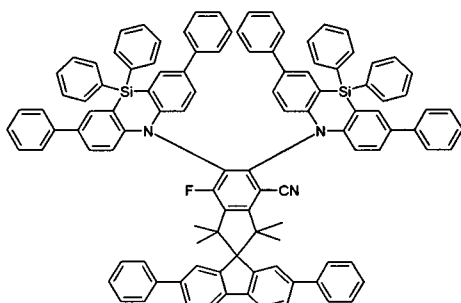
(I-206)



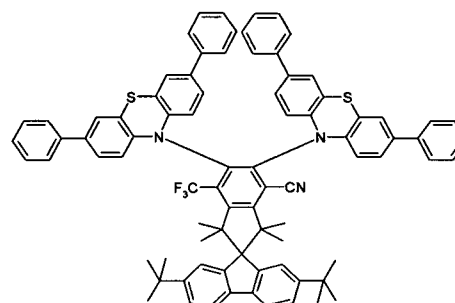
(I-207)



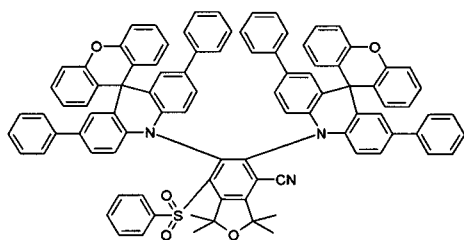
(I-208)



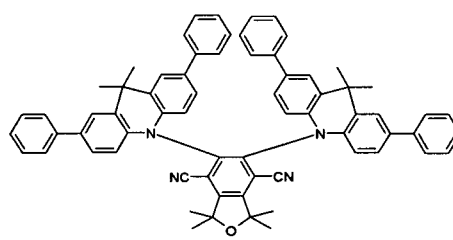
(I-209)



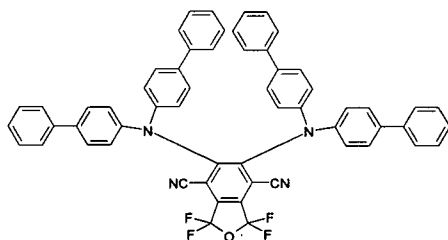
(I-210)



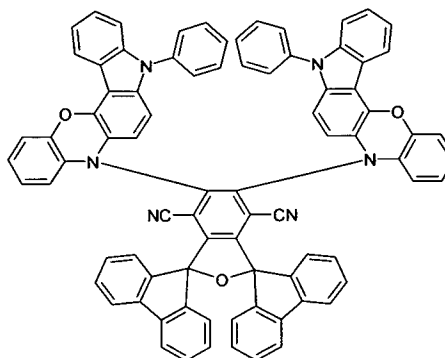
(I-211)



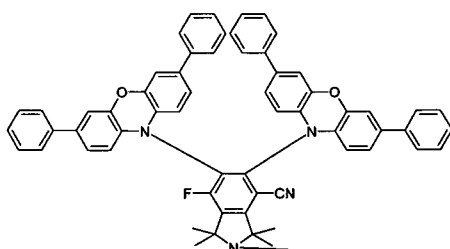
(I-212)



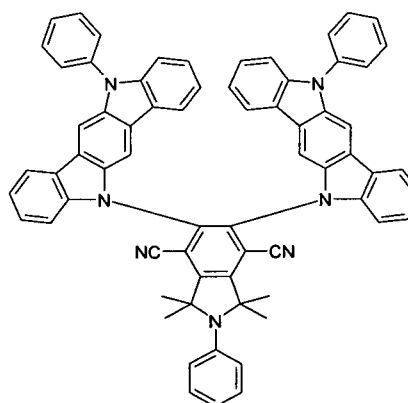
(I-213)



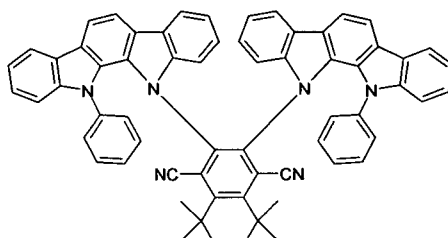
(I-214)



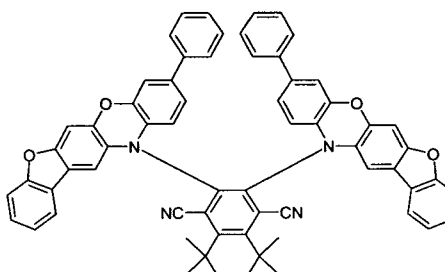
(I-215)



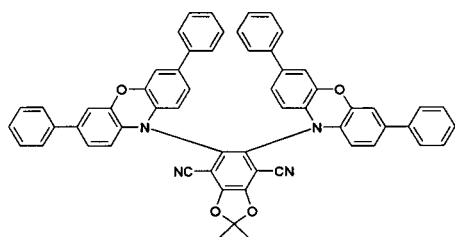
(I-216)



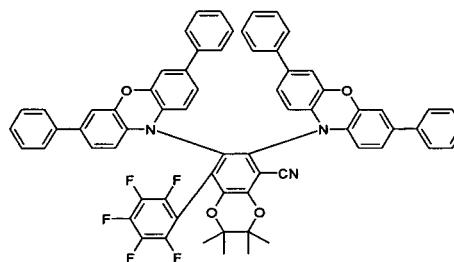
(I-217)



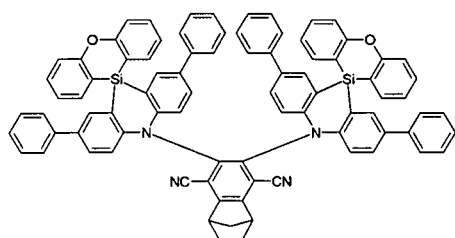
(I-218)



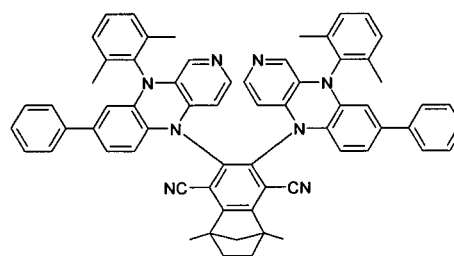
(I-219)



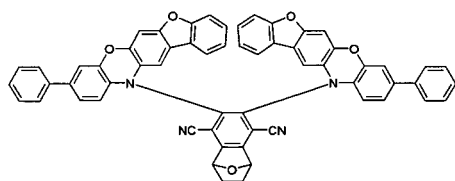
(I-220)



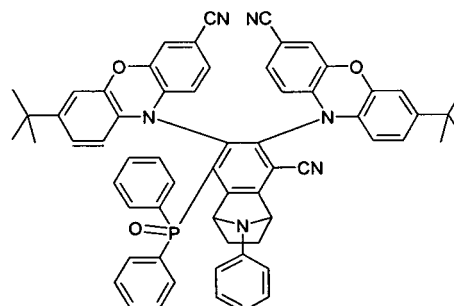
(I-221)



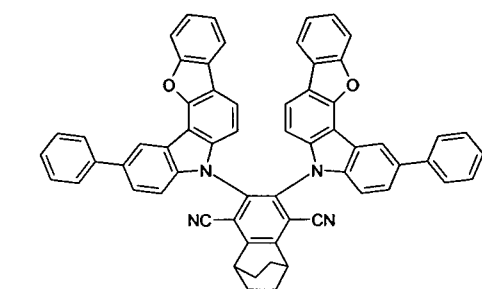
(I-222)



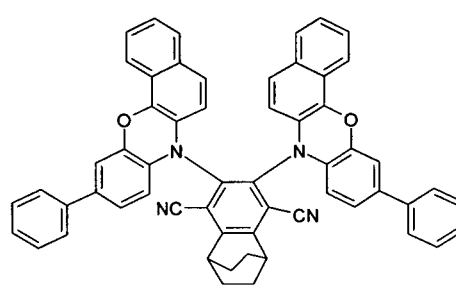
(I-223)



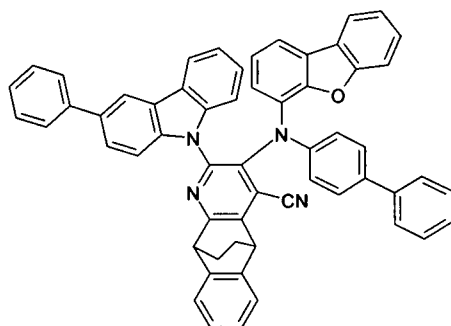
(I-224)



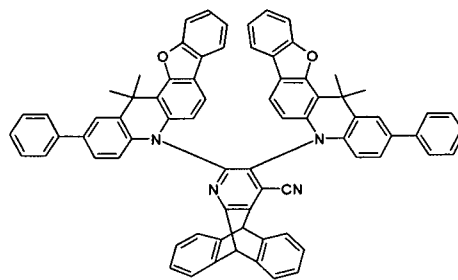
(I-225)



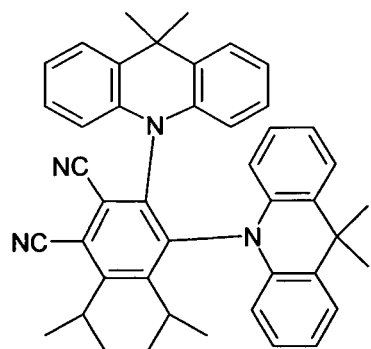
(I-226)



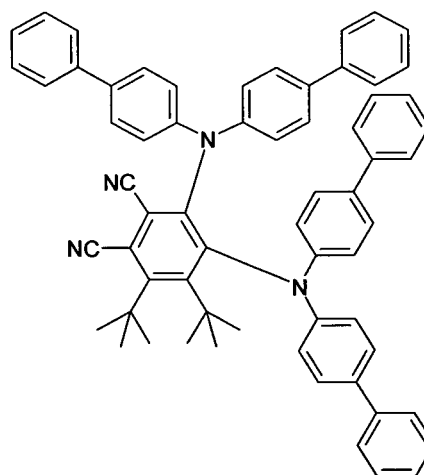
(I-227)



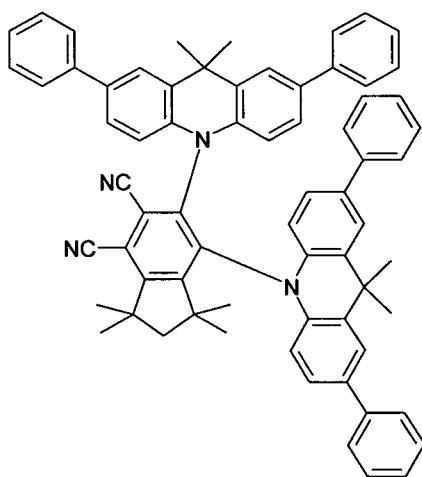
(I-228)



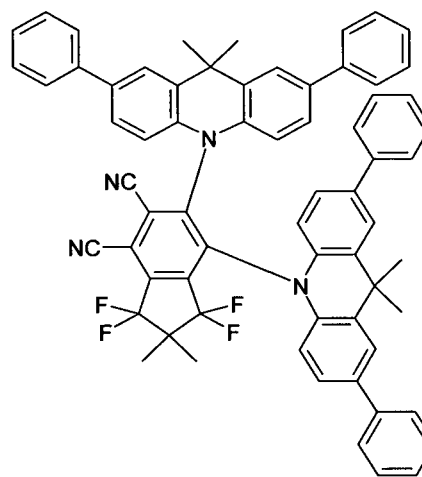
(I-229)



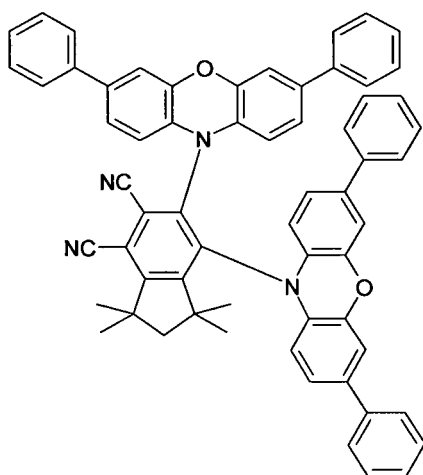
(I-230)



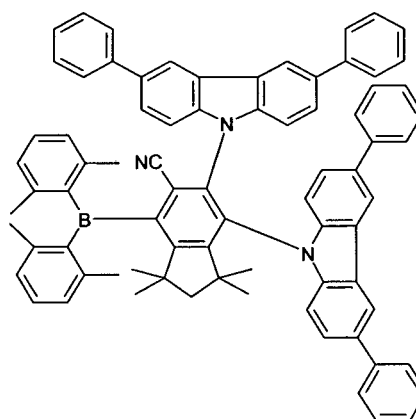
(I-231)



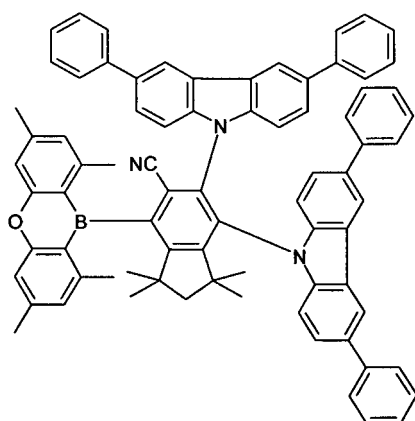
(I-232)



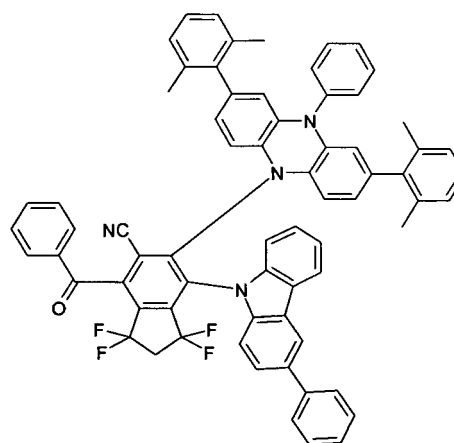
(I-233)



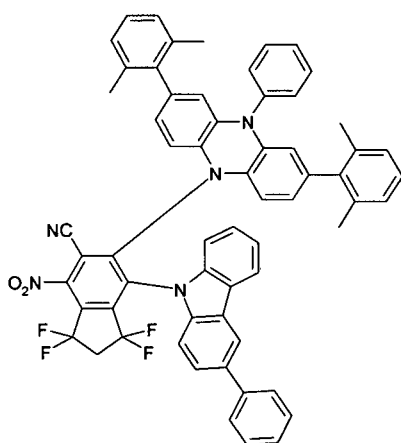
(I-234)



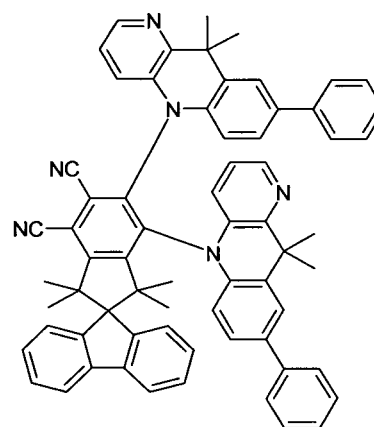
(I-235)



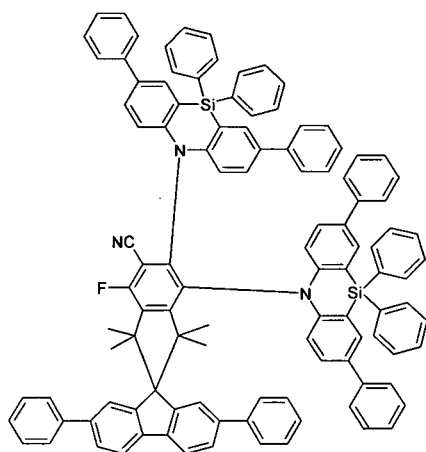
(I-236)



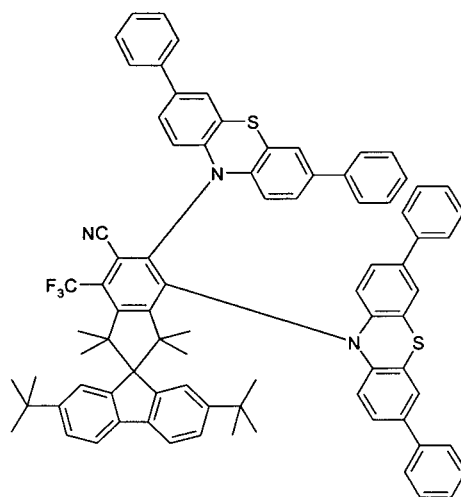
(I-237)



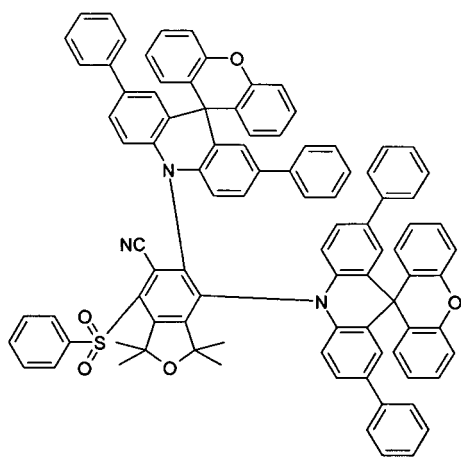
(I-238)



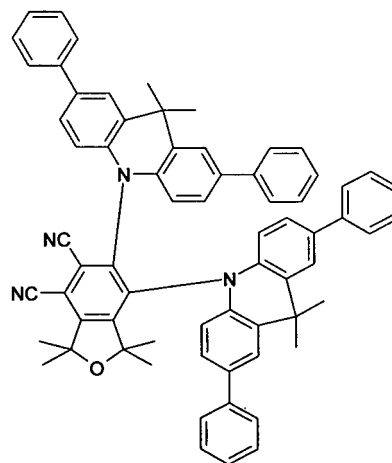
(I-239)



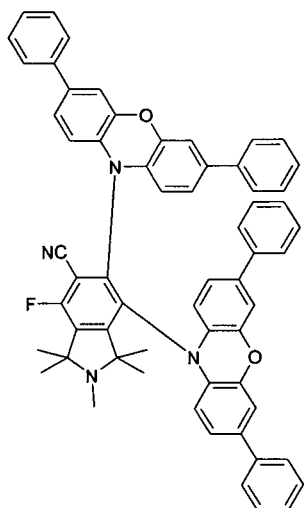
(I-240)



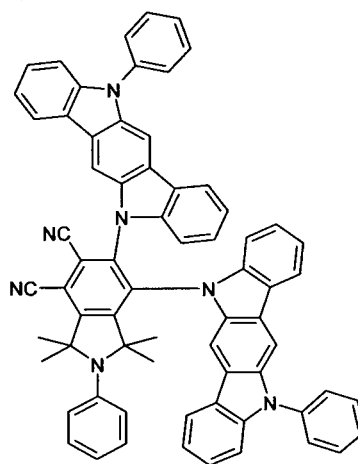
(I-241)



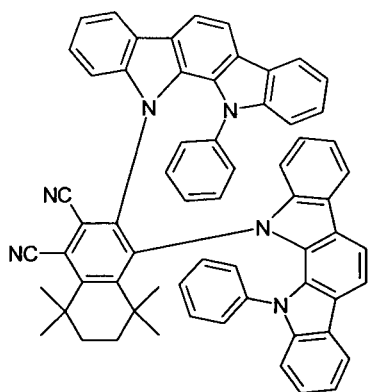
(I-242)



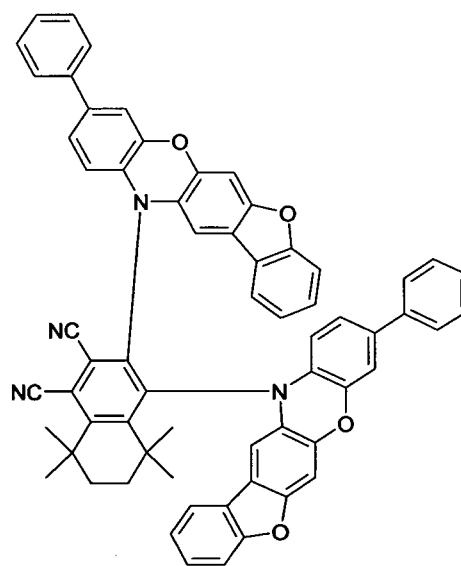
(I-243)



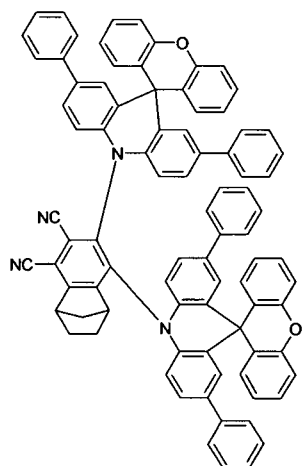
(I-244)



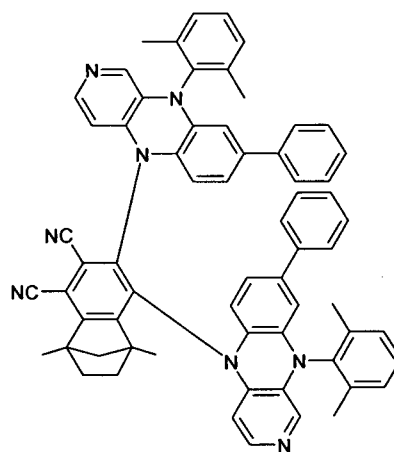
(I-245)



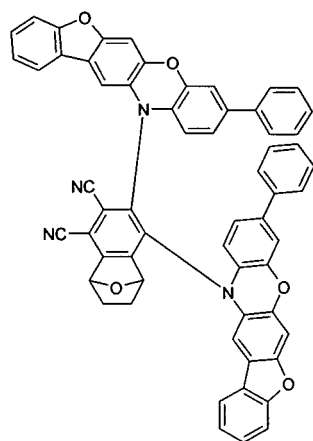
(I-246)



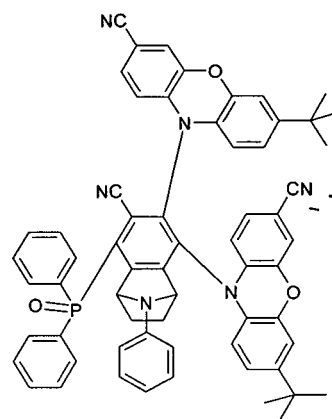
(I-247)



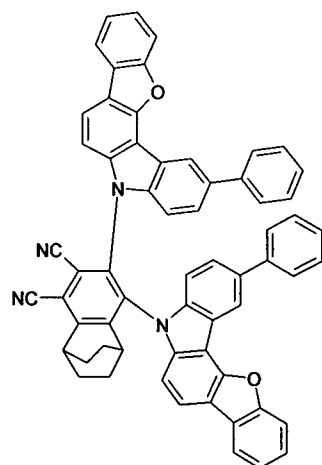
(I-248)



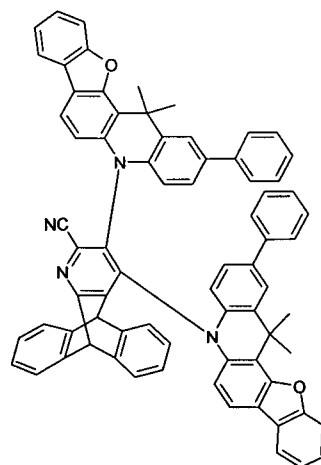
(I-249)



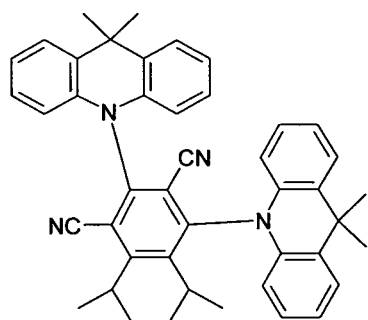
(I-250)



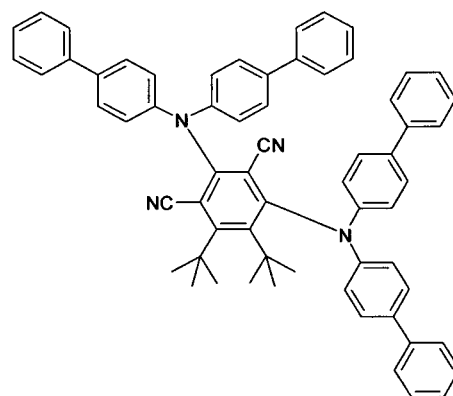
(I-251)



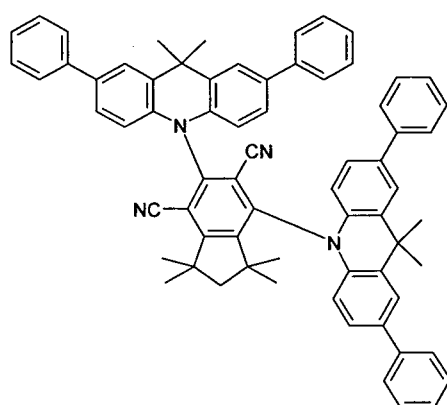
(I-252)



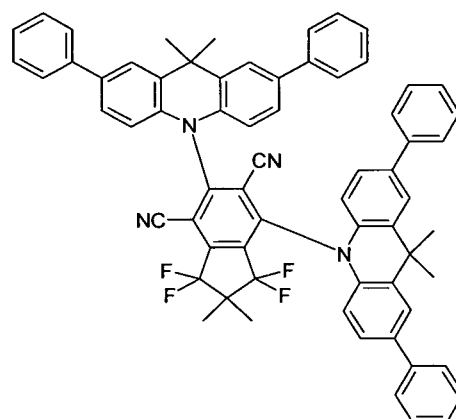
(I-253)



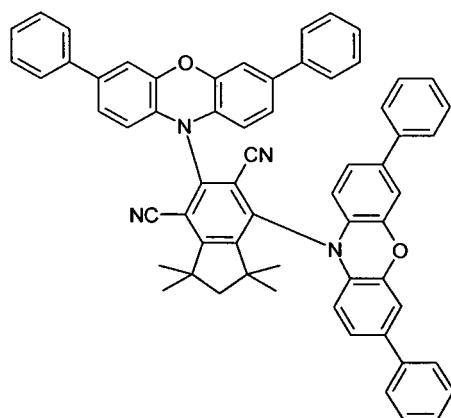
(I-254)



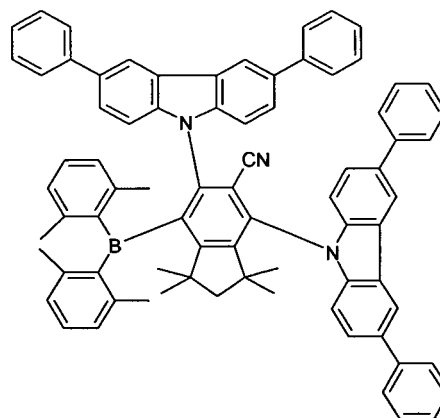
(I-255)



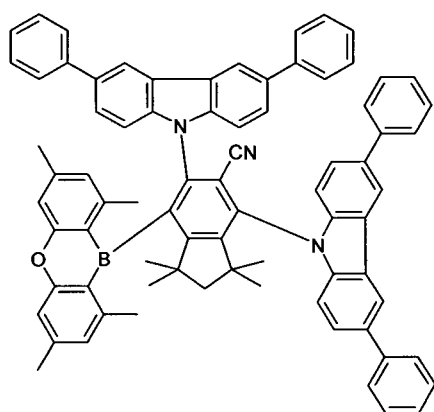
(I-256)



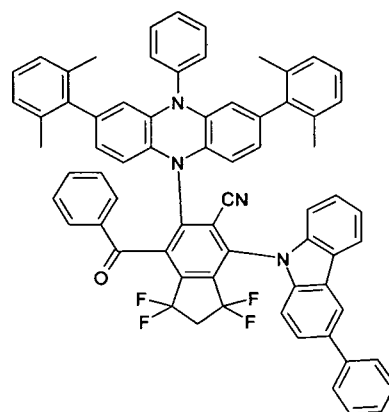
(I-257)



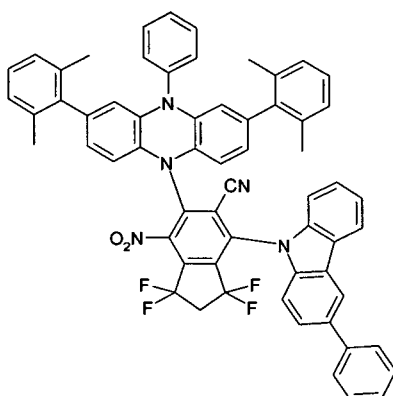
(I-258)



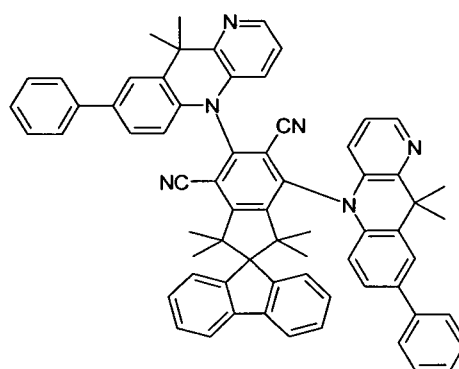
(I-259)



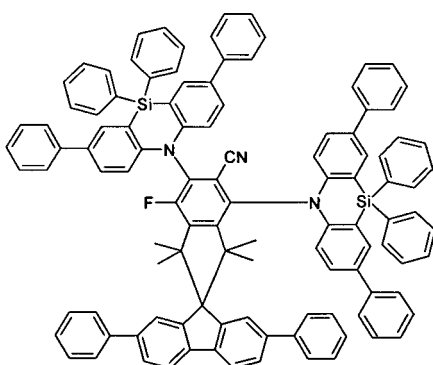
(I-260)



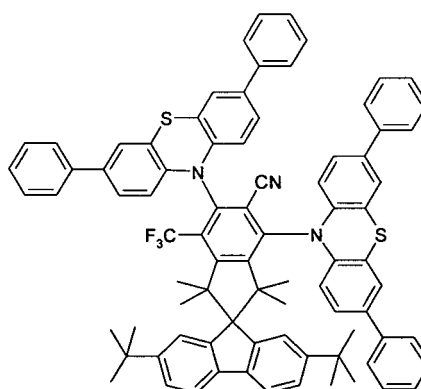
(I-261)



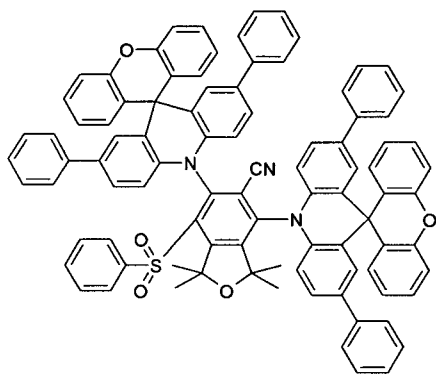
(I-262)



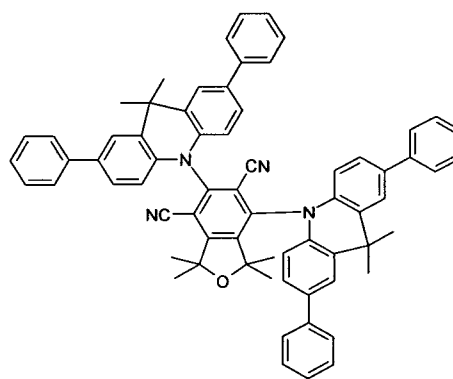
(I-263)



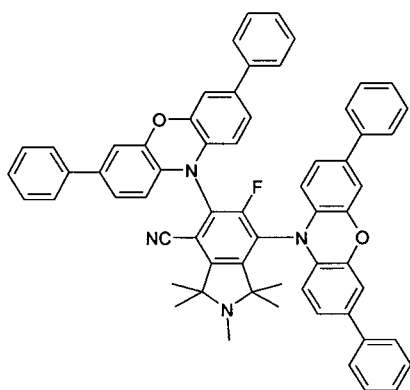
(I-264)



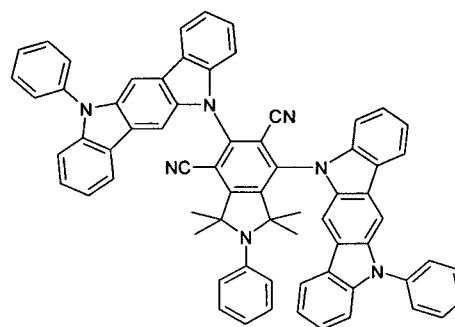
(I-265)



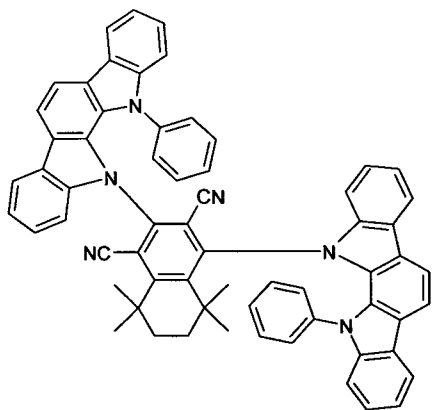
(I-266)



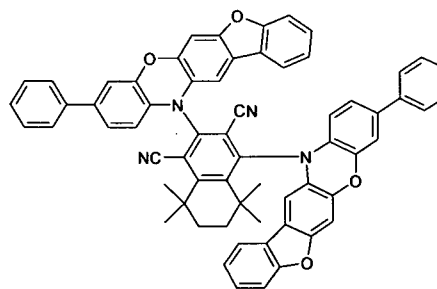
(I-267)



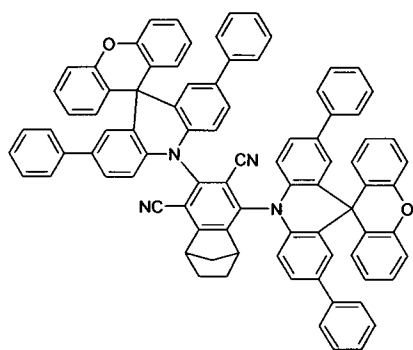
(I-268)



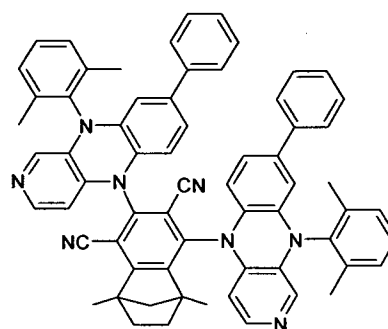
(I-269)



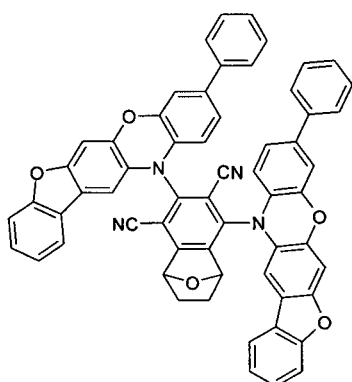
(I-270)



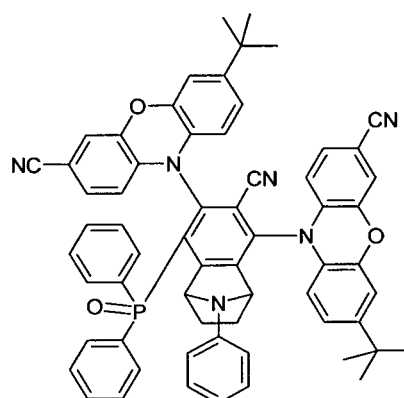
(I-271)



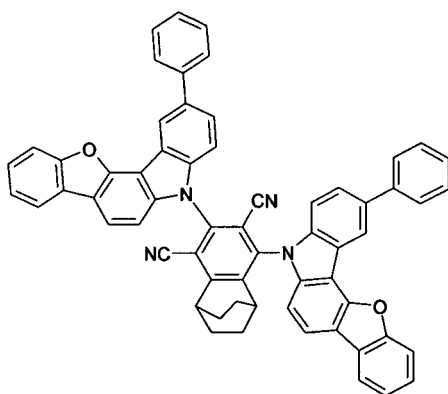
(I-272)



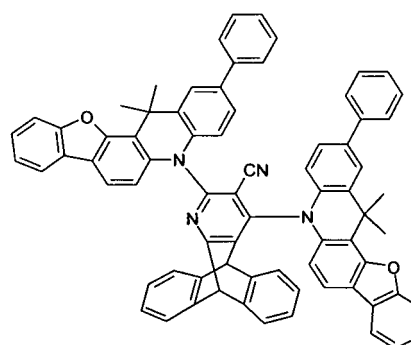
(I-273)



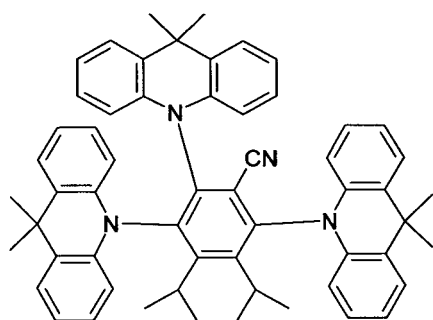
(I-274)



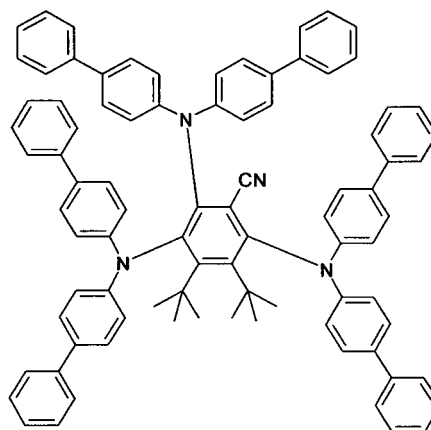
(I-275)



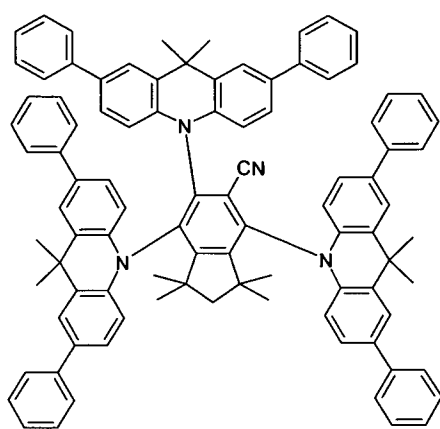
(I-276)



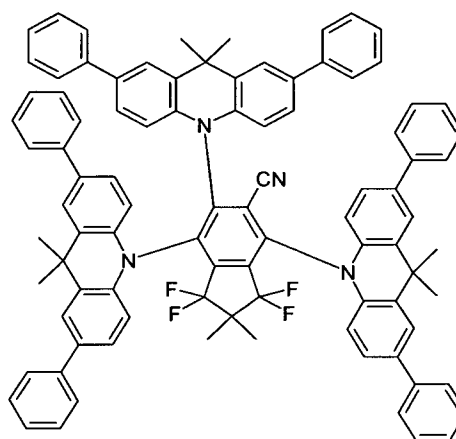
(I-277)



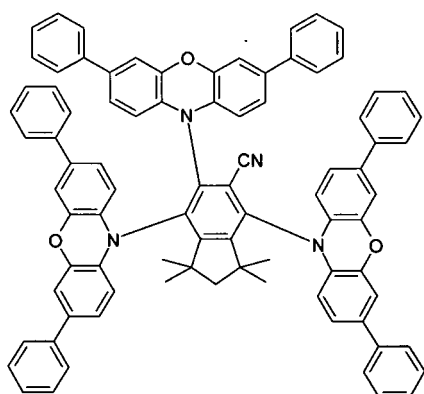
(I-278)



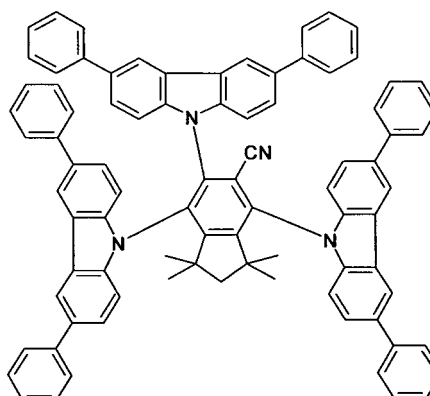
(I-279)



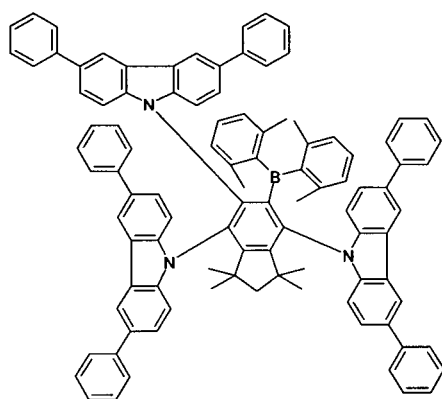
(I-280)



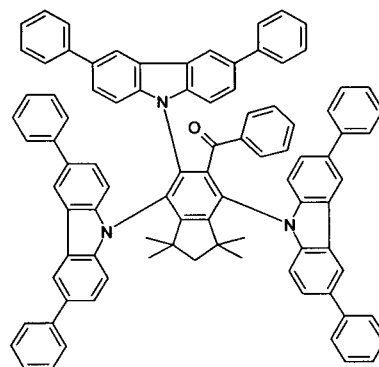
(I-281)



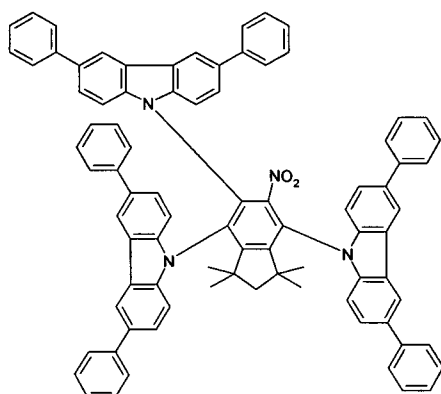
(I-282)



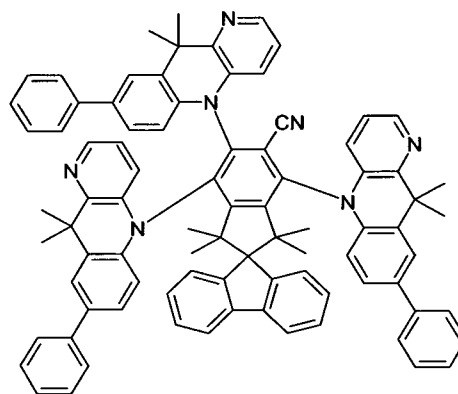
(I-283)



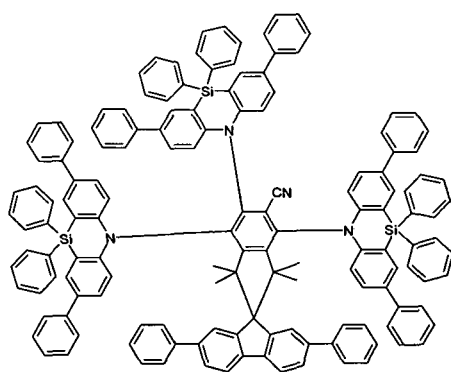
(I-284)



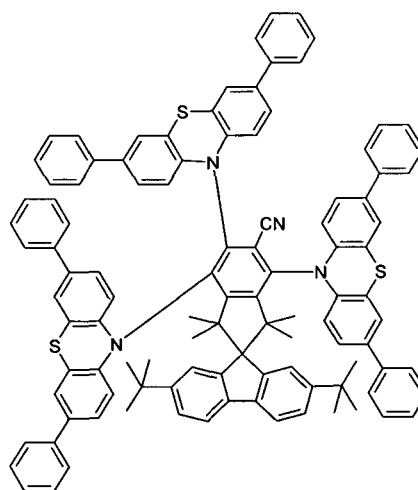
(I-285)



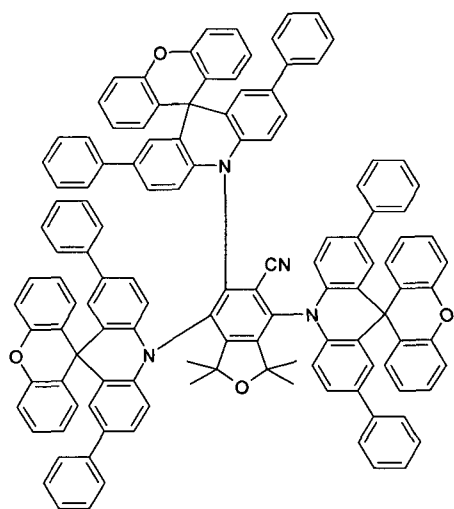
(I-286)



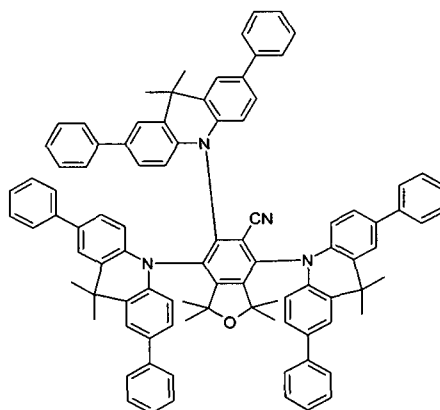
(I-287)



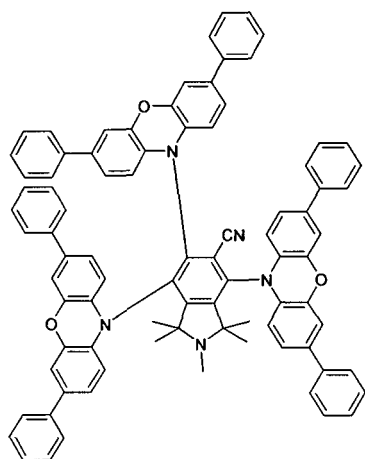
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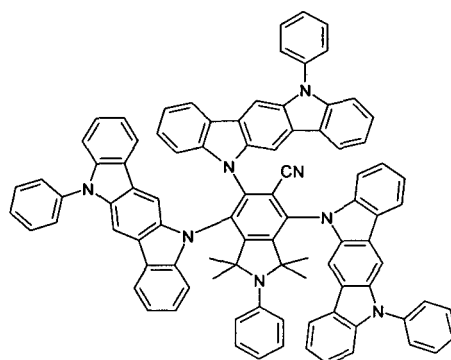
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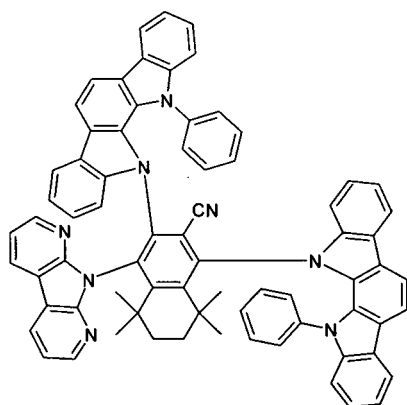
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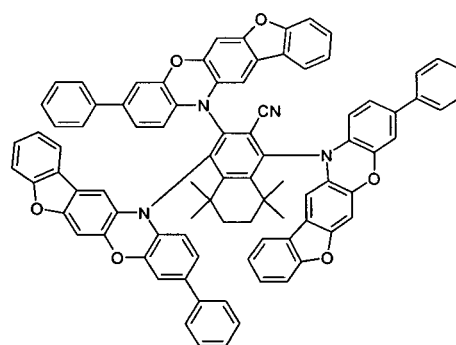
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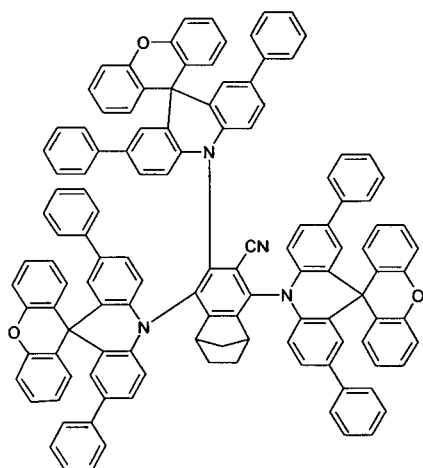
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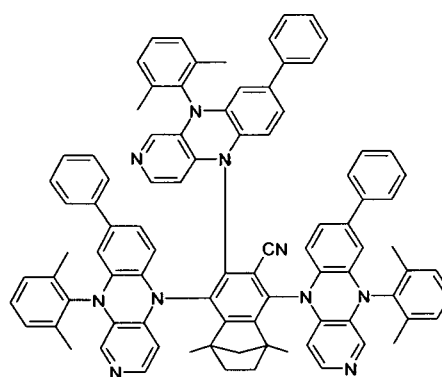
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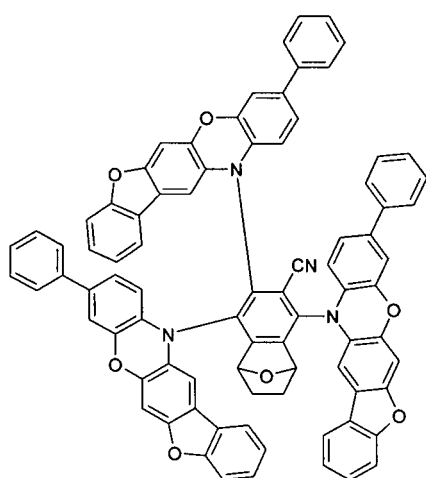
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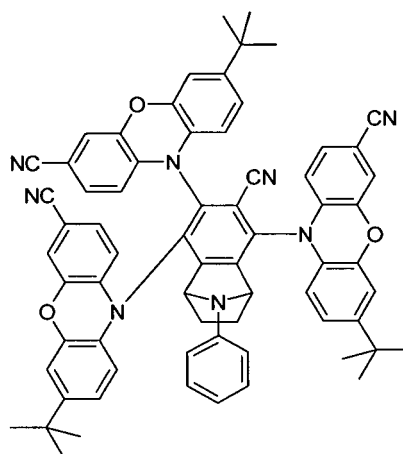
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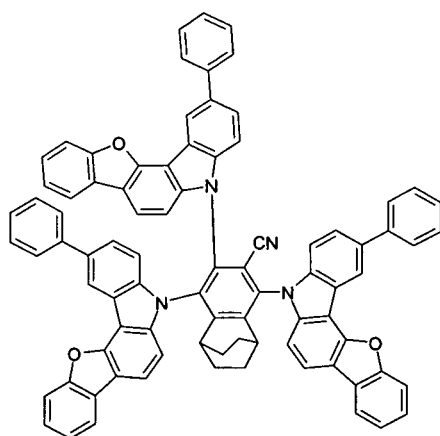
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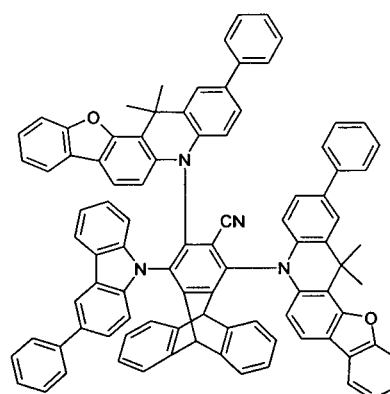
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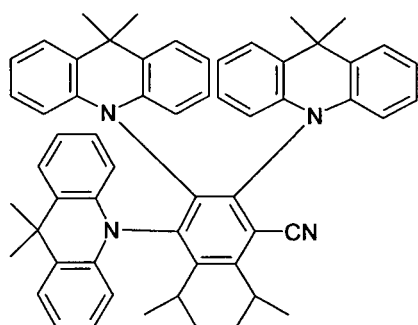
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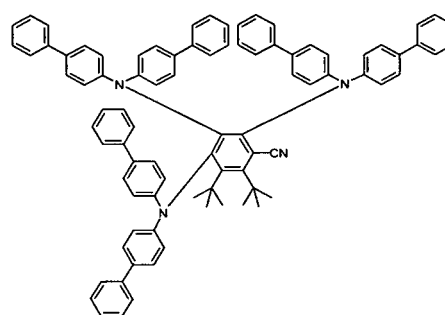
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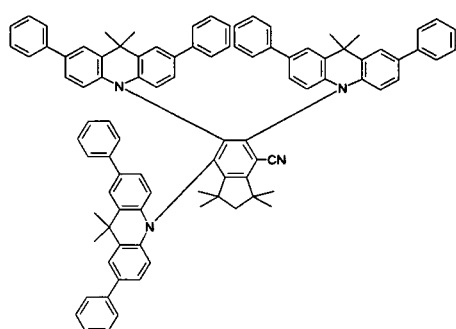
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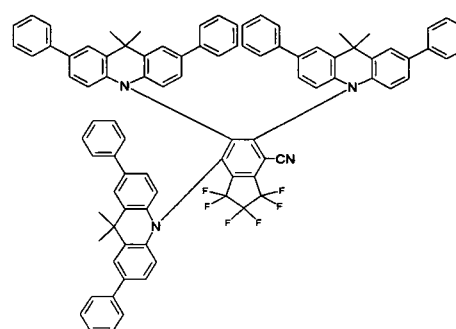
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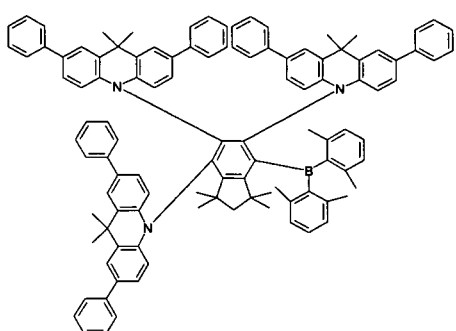
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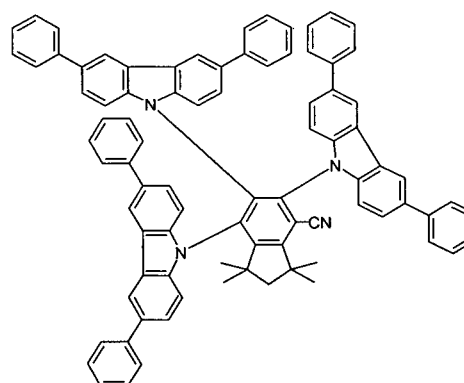
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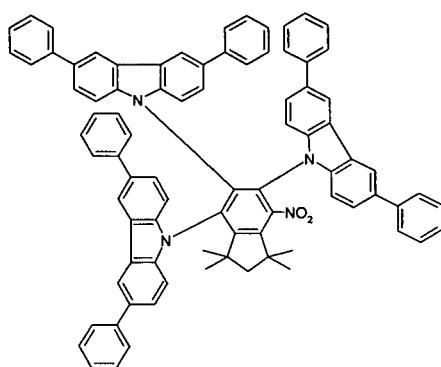
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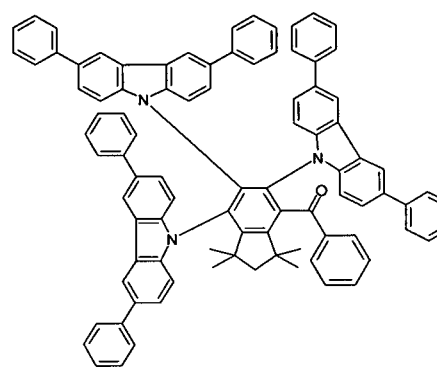
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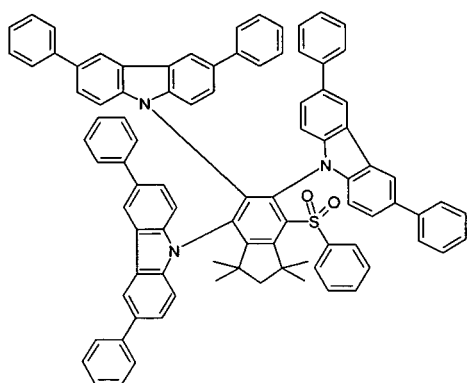
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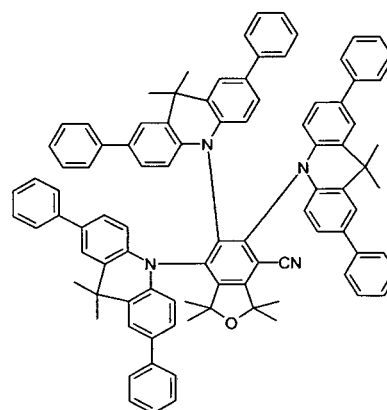
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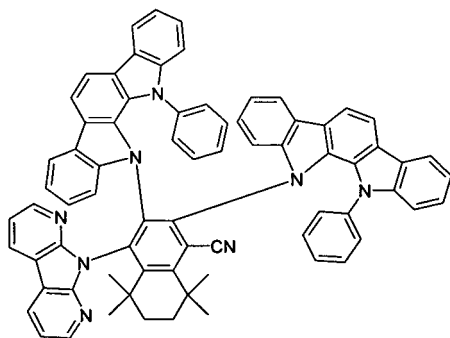
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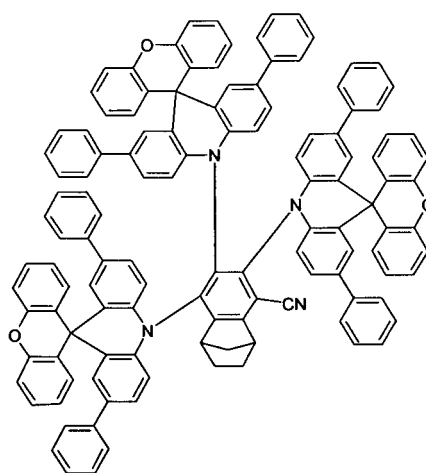
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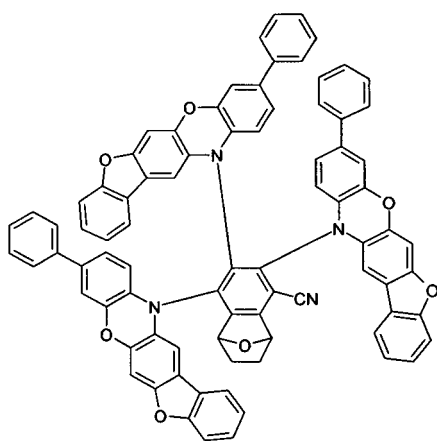
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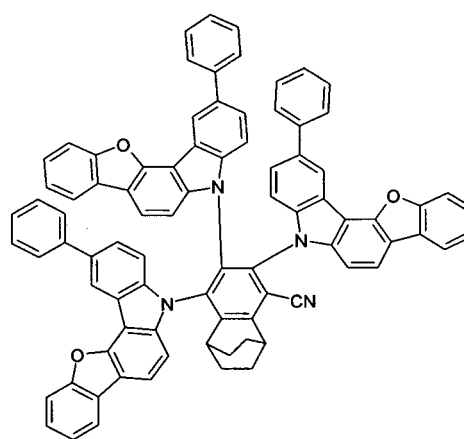
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(I-312)



(I-313)



(I-314)

OLIGOMERS, POLYMERS, DENDRIMERS

[0078] The compounds of general formula (I), particularly such compounds comprising reactive groups, may be used as monomers for the production of the respective oligomers, polymers or dendrimers. The present invention therefore also provides for oligomers, polymers and dendrimers comprising the compound of general formula (I).

[0079] Exemplary reactive groups may - independently of each other if more than one such group is present - be

selected from the group consisting of Cl, Br, I, boronic acid, esters of boronic acid, amines, alkenyl with terminal C-C-double bond, alkynyl with terminal C-C-triple bond, oxirane, oextane, groups capable of undergoing a cycloaddition, particularly a 1,3-dipolar cycloaddition (such as for example dienes or azides), derivatives of carbonic acids, alcohols and silanes. Such reactive groups may be comprised in the compounds of general formula (I) for example in groups R^A, R^D and R^S and/or also directly on a ring carbon atom, as for example in any one or more of groups Q¹, Q², Z¹ and Z². Depending upon the position of the reactive group(s) in the compound of formula (I), compound (I) may eventually be located in the main chain and/or in a side chain of the oligomer, polymer or dendrimer.

[0080] For the purposes of the present application an oligomer is understood to comprise at least 3 repeating units, and a polymer is understood to comprise at least 10 repeating units, such repeating units comprising at least one compound of general formula (I). It is noted that the above definitions in respect to the compound of formula (I) also apply here.

[0081] The oligomers, polymers and dendrimers of the present invention may be conjugated, partially conjugated or not conjugated. They may also be linear, branched or dendritic. In a linear structure the repeating units may either consist of a suitable compound of formula (I) or may be linked by means of a bivalent group, such as for example a substituted or unsubstituted alkylene group, a heteroatom or a bivalent aromatic or heteroaromatic group. In branched or dendritic structures three or even more suitable compounds of general formula (I) may be linked by means of a tri- or even higher-valent group, for example by means of a trivalent or higher-valent aromatic or heteroaromatic group, so as to form a branched or dendritic oligomer or polymer.

[0082] The present oligomers or polymers may be either homopolymerized or copolymerized in presence of at least one further monomer, in the following referred to as "comonomer". Suitable comonomers may be selected from the list consisting of fluorenes (for example those disclosed in EP 842208 or WO 00/22026), spirobifluorenes (for example those disclosed in EP 707020, EP 894107 or WO 06/061181), para-phenylenes (for example those disclosed in WO 1992/18552), carbazoles (for example those disclosed in WO 04/070772 or WO 2004/113468), thiophenes (for example those disclosed in EP 1028136), dihydro-phenanthrenes (for example those disclosed in WO 2005/014689 or WO 2007/006383), cis- and trans-indenofluorenes (for example those disclosed in WO 2004/041901 or WO 2004/113412), ketones (for example those disclosed in WO 2005/040302), phenanthrenes (for example those disclosed in WO 2005/104264 or WO 2007/017066) and blends of any one or more of these.

[0083] The present oligomers, polymers and dendrimers may comprise further components such as for example emitting compounds, of which vinyltriarylamines (for example those disclosed in WO 2007/068325) or metal complexes (for example those disclosed in WO 2006/003000), and/or charge transporting components, particularly those comprising triarylamines.

[0084] The present oligomers, polymers and dendrimers may generally be produced by well known polymerization methods. As particularly well suited polymerization methods leading to the formation of C-C or C-N bonds the following may be mentioned:

- (A) SUZUKI-polymerization;
- (B) YAMAMOTO-polymerization;
- (C) STILLE-polymerization; and
- (D) HARTWIG-BUCHWALD-polymerization.

[0085] These methods including the respective polymerization conditions are well known to the skilled person and are also described in detail in the literature, for example in WO 2003/048225, WO 2004/037887 and WO 2004/037887.

[0086] Hence, the present application also provides for a method to produce the above oligomers, and polymers by polymerization according to a method selected from the group consisting of Suzuki-polymerization, Yamamoto-polymerization, Stille-polymerization, and Hartwig-Buchwald-polymerization. The respective dendrimers may be produced according to these methods or similar methods. Suitable methods for producing such dendrimers are for example disclosed in Jean M.J. Frechet, Craig J. Hawker, "Hyperbranched polyphenylene and hyperbranched polyesters: new soluble, three-dimensional, reactive polymers", *Reactive & Functional Polymers* (1995), 26(1-3), 127-36; H.M. Janssen, E.W. Meijer, "The synthesis and characterization of dendritic molecules", *Materials Science and Technology* (1999), 20 (Synthesis of Polymers), 403-458; Donald A. Tomalia, "Dendrimer molecules", *Scientific American* (1995), 272(5), 62-6; WO 2002/067343 A1; and WO 2005/026144 A1.

[0087] The compounds and polymers according to the present invention can also be used in mixtures or polymer blends, for example together with monomeric compounds or together with other polymers having charge-transport, semiconducting, electrically conducting, photoconducting and/or light emitting semiconducting properties, or for example with polymers having hole blocking or electron blocking properties for use as interlayers or charge blocking layers in OLED devices. Thus, another aspect of the invention relates to a polymer blend comprising one or more polymers according to the present invention and one or more further polymers having one or more of the above-mentioned properties. These blends can be prepared by conventional methods that are described in prior art and known to the

skilled person. Typically the polymers are mixed with each other or dissolved in suitable solvents and the solutions combined.

FORMULATION

[0088] Another aspect of the invention relates to a formulation comprising one or more compounds of formula (I), oligomers, polymers, dendrimers or polymer blends as described above and below and one or more organic solvents. Such formulation may be a solution, a suspension or an emulsion. The manufacture of such formulations is well known and for example disclosed in WO 2002/072714, WO 2003/019694 and the literature cited therein.

[0089] Suitable organic solvents may for example be selected from the group consisting of toluene, anisol, o-xylene, m-xylene, p-xylene, methylbenzoate, mesitylene, tetraline, 1,2-dimethoxybenzene (commonly known as "veratrole"), tetrahydrofurane (commonly abbreviated as "THF"), methyl-tetrahydrofurane, tetrahydropyrane (oxane), chlorobenzene, dioxane, phenoxytoluene, particularly 3-phenoxytoluene, (-)-fenchone, 1,2,3,5-tetramethylbenzene, 1,2,4,5-tetramethylbenzene, 1-methylnaphthalene, 2-methylbenzothiazole, 2-phenoxyethanol, 2-pyrrolidinone, 3-methylanisol, 4-methylanisol, 3,4-dimethylanisol, 3,5-dimethylanisol, acetophenone, α -terpineol, benzothiazole, butylbenzoate, cumene, cyclohexanol, cyclohexanone, cyclohexylbenzene, decalin, dodecylbenzene, ethylbenzoate, indane, N-methyl-2-pyrrolidone (commonly abbreviated as "NMP"), p-cymene, ethyl phenyl ether, 1,4-diisopropylbenzene, dibenzylether, diethyleneglycolbutyl-methylether, triethyleneglycolbutylmethylether, diethyleneglycoldibutylether, triethyleneglycoldimethylether, diethyleneglycolmonobutylether, tripropyleneglycoldimethylether, tetraethyleneglycoldimethylether, 2-isopropyl-naphthalene, pentylbenzene, hexylbenzene, heptylbenzene, octylbenzene, 1,1-bis(3,4-dimethylphenyl)ethane and blends of any of these.

ORGANIC ELECTRONIC DEVICES

[0090] The compound, oligomer, polymer and dendrimer of the present invention can be used as active material in an organic electronic device. The term "active material" is used herein to denote for example charge injection materials, charge transport materials, charge blocking materials, emitting materials or matrix materials.

[0091] Preferably such organic electronic device comprises an anode, a cathode and an active layer, said active layer comprising said active material. Organic electronic devices of the present invention include, without limitation, optical, electrooptical, electronic, electroluminescent and photoluminescent devices. Examples thereof include, without limitation, organic field effect transistors (OFETs), organic thin film transistors (OTFTs), organic light emitting diodes (OLEDs), organic light emitting transistors (OLETs), organic photovoltaic devices (OPVs), organic photodetectors (OPDs), organic solar cells, laser diodes, Schottky diodes, photoconductors, and photodiodes. Preferably, the present devices are selected from the group consisting of organic light emitting diodes, and organic light emitting transistors. Most preferably the present devices are organic light emitting diodes.

[0092] In addition to the anode, cathode and active layer, the present organic electronic device may optionally comprise at least one further layer selected from the group consisting of electron transport layer, hole transport layer, hole injection layer, electron injection layer, exciton blocking layer, interlayers, and charge generation layer. The presence (or absence) of such further layers depends upon the type of organic device and the respective final use.

[0093] Because the present compound, oligomer, polymer or dendrimer show particularly advantageous properties when used as light emitting material in organic electroluminescent devices, it is preferred to use these as light emitting materials in light emitting layers of such devices.

[0094] If the organic electronic device of the present invention is an organic electroluminescent device it comprises an anode, a cathode and a light emitting layer. Optionally, in addition to these it may comprise one or more further layers selected from the group consisting of hole injection layer, hole transport layer, hole blocking layer, electron injection layer, electron transport layer, electron blocking layer, charge generation layer, exciton blocking layer, organic p/n-transition layer and inorganic p/n-transition layer. It may also be possible that one or more hole transport layers comprise a p-dopant. Exemplary p-dopants are metal oxides and (per)fluorinated electron-deficient aromatics. Examples of suitable metal oxides are - without limitation - MoO_3 and WO_3 . It is also possible that - independent of any doping of a hole transport layer - one or more electron transport layers are doped with a n-dopant. Optionally, interlayers may be present between two light emitting layers - if such are present, which for example have an exciton blocking function and/or direct the charge equilibrium in the organic electroluminescent device.

[0095] The present organic electronic devices may also have more than one light emitting layer. In such a case it is preferred that the different light emitting layers have different emission maxima between 380 nm and 750 nm, thereby allowing the emission of light of different colors, and resulting for example in the emission of white light. Particularly preferred in this respect are organic electronic devices comprising three light emitting layers, wherein preferably at least one of these comprises the compound, oligomer, polymer or dendrimer of the present application and the three light emitting layers emit in the blue, green, and orange or red. For a description of the basic structure of such a device it is

for example referred to WO 2005/011013. It is noted that instead of several different light emitting compounds it is also possible to use one compound that emits in a broad range of wavelength and in sum emits white light.

[0096] In a preferred aspect of the present invention the compound of general formula (I) is used as emitter in or more light emitting layers.

[0097] If used as an emitter in a light emitting layer, the compound of formula (I) is preferably used in combination with one or more matrix materials. The mixture comprising compound of formula (I) and a matrix material preferably comprises between 0.1 vol% and 99 vol%, preferably between 1 vol% and 90 vol%, even more preferably between 3 and 40 vol%, and most preferably between 5 vol% and 15 vol% of the compound of formula (I), relative to the total volume of the mixture.

[0098] As matrix materials any suitable materials known to the skilled person may be used, preferably such materials wherein the triplet-level of the matrix material is higher than the triplet-level of the emitter.

[0099] Suitable matrix materials used herein may be selected from the following: ketones, phosphinioxides, sulfoxides, sulfones, triarylaminos, carbazol-derivatives, indolocarbazole-derivatives, indenocarbazole-derivatives, azacarbazoles, bipolar matrix materials, silanes, azaboroles, boronic acid esters, diazasilole-derivatives, triazine-derivatives, zinc-complexes, dibenzofurane-derivatives and bridged carbazole-derivatives. Suitable examples of sulfoxides and sulfones are for example disclosed in WO 2004/013080, WO 2004/093207, WO 2006/005627 or WO 2010/006680. Suitable derivatives of carbazoles are for example CBP (N,N-Bis-carbazolylbiphenyl), m-CBP or the ones disclosed in WO 2005/039246, US 2005/0069729, JP 2004/288381, EP 1205527, WO 2008/086851 and US 2009/0134784. Suitable derivatives of indolocarbazole are for example the ones disclosed in WO 2007/063754 or WO 2008/056746. Suitable examples of derivatives of indenocarbazole are for example the ones disclosed in WO 2010/136109 or WO 2011/000455. Suitable examples of azacarbazoles are for example disclosed in EP 1617710, EP 1617711, EP 1731584, or JP 2005/347160. Suitable examples of bipolar matrix materials are for example disclosed in WO 2007/137725. Suitable examples of silanes are for example disclosed in WO 2005/111172. Suitable examples of azaboroles or boronic acid esters are for example disclosed in WO 2006/117052. Suitable derivatives of diazasiloles are for example disclosed in WO 2010/054729. Suitable derivatives of diazaphospholes are for example disclosed in WO 2010/054730. Suitable derivatives of triazine are for example disclosed in WO 2010/015306, WO 2007/063754 or WO 2008/056746. Suitable zinc-complexes are for example disclosed in EP 652273 or WO 2009/062578. Suitable derivatives of dibenzofuranes are for example disclosed in WO 2009/148015. Suitable examples of bridged derivatives of carbazole are for example disclosed in US 2009/0136779, WO 2010/050778, WO 2011/042107 or WO 2011/088877.

[0100] Alternatively the compound, oligomer, polymer or dendrimer of the present application may be present in any of the other layers present in the organic electronic device, such as for example in the electron transport layer.

[0101] Preferably, the sequence of layers is as follows:

- anode,
- optional hole injection layer,
- optional one or more hole transport layer,
- light emitting layer,
- optional electron transport layer,
- optional electron injection layer, and
- cathode.

It is noted that any layer indicated as "optional" may either be present or absent, depending upon the intended use and/or desired properties of the resulting device.

[0102] The anode is generally formed of an electrically conductive material. Exemplary electrically conductive materials include electrically conductive metals, electrically conductive alloys, electrically conductive polymers, and electrically conductive metal oxides. Exemplary electrically conductive metals include gold, silver, copper, aluminum, nickel, palladium, platinum, and titanium. Exemplary electrically conductive alloys include stainless steel (e.g., 302 stainless steel, 316 stainless steel), alloys of gold, alloys of silver, alloys of copper, alloys of aluminum, alloys of nickel, alloys of palladium, alloys of platinum, and alloys of titanium. Exemplary electrically conducting polymers include polythiophenes (e.g., doped poly(3,4-ethylenedioxythiophene)), polyanilines (e.g., doped polyanilines), polypyrroles (e.g., doped polypyrroles). Exemplary electrically conducting metal oxides include indium tin oxide, indium zinc oxide, fluorinated tin oxide, tin oxide and zinc oxide. It is preferred that the anode is formed of a material with high work function, for example with a work function of at least 4.5 eV versus vacuum. In some embodiments, blends or combinations of electrically conductive materials are used. In some embodiment, it may be advantageous to form the anode of transparent material, such as for example indium tin oxide or indium zinc oxide. Alternatively the anode may comprise more than one layer, for example it may comprise an inner layer of indium tin oxide and an outer layer of tungsten oxide, molybdenum oxide or vanadium oxide.

[0103] The cathode is generally formed of an electrically conductive material, preferably one with a low work function.

Exemplary materials suitable are metals such as earth alkaline metal, main group metals or lanthanide. Particular examples of such metals are Ca, Ba, Mg, Al, In, Yb, Sm and Eu as well as alloys thereof. It is also possible to use alloys of silver and an alkaline metal or alkaline earth metal, such as for example an alloy of silver and magnesium. The cathode may also be formed of more than one layer, in which case metals or alloys having a higher work function may be present.

Examples of such metals or alloys having a higher work function are Ag, Al, Ca/Ag alloy, Mg/Ag alloy and Ba/Ag alloy.

[0104] In some embodiments the cathode may also comprise a layer of material having a high dielectric constant. Examples of suitable materials are metal fluorides, oxides or carbonates with the metal selected from the alkaline and alkaline earth metals. Specific examples of such materials are LiF, Li₂O, BaF₂, MgO, NaF, CsF, Cs₂CO₃ or CaF₂. Lithium chinolate may also be used.

[0105] Further suitable materials for a charge transport layer, for example for a hole transport layer or an electron transport layer, are for example disclosed in Y. Shirota et al., Chemical Reviews 2007, 107(4), 953-1010. Suitable examples are aluminum complexes, zirconium complexes, benzimidazole, triazine, pyridine, pyrimidine, pyrazine, chinoxaline, chinoline, oxadiazole, aromatic ketones, lactame, borane, diazaphosphole, phosphin oxide and their derivatives as for example disclosed in JP 2000/053957, WO 2003/060956, WO 2004/028217, WO 2004/080975 or WO 2010/072300.

[0106] Preferred examples of hole transport materials, which may be used in a hole transport, hole injection or electron blocking layer, are derivatives of indenofluorene amine (e.g. disclosed in WO 06/122630 or WO 06/100896), amines (e.g. the amines disclosed in EP 1661888 or those disclosed in WO 95/09147), derivatives of hexaazatriphenylene (e.g. disclosed in WO 01/049806), derivatives of amines with annealed aryls (e.g. as disclosed in US 5,061,569), monobenzoindenofluorenamines (for example as disclosed in WO 08/006449), dibenzoindenofluorenamines (for example as disclosed in WO 07/140847), spirobifluorene-amines (for example as disclosed in WO 2012/034627), fluorene-amines, spiro-dibenzopyrane-amines and derivatives of acridine.

[0107] In order to avoid or reduce the damaging effects of water and air the organic electronic device of the present invention is subsequently enclosed and sealed.

[0108] The present compound, oligomers, polymers or dendrimers as defined above, or alternatively their respective formulations as defined above, may be used in the production of organic electronic devices, particularly organic light emitting diodes (OLEDs). In particular, they are useful in the production of the light emitting layer of an organic light emitting diode.

[0109] The organic electronic device of the present invention may be produced by any suitable method. For example, one or more layer comprised in such organic electronic device may be deposited by sublimation, by organic vapor phase deposition (OPVD), by carrier gas sublimation, by organic vapor jet printing, by spin-coating or by any printing method, such as for example screen-printing, inkjet printing, flexographic printing, or light induced thermal imaging.

[0110] Hence, the present invention also provides for a method for producing the present electronic devices, said method comprising the steps of

- (a) providing the compound, polymer, oligomer or dendrimer of the present invention; and
(b) depositing said compound, polymer, oligomer or dendrimer on a supporting layer.

[0111] The present organic electronic devices may for example be used in displays, light sources in lighting appliances as well as for example in medical and cosmetic appliances.

[0112] It is believed that the compounds, oligomers, polymers and dendrimers of the present invention are to have particularly advantageous properties in organic light emitting devices because of the reduced energy difference between S1-level and T1-level, which have been confirmed by calculations. Without wishing to be bound by theory it is believed that this is the result of the particular arrangement of substituents on the six-membered ring of the compound of the present invention. Calculations furthermore indicate that the compounds of the present invention will emit in the blue region and as such are particularly desirable for use in organic light emitting compounds.

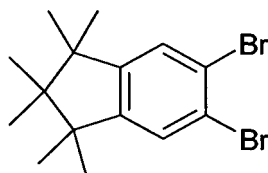
Examples

[0113] The following syntheses are, if not indicated otherwise, performed in dried solvents under an inert atmosphere. Solvents and reagents may be purchased for example from Sigma-ALDRICH or ABCR.

[0114] The following abbreviations are used: "THF" for tetrahydrofuran; "DMF" for dimethylformamide; "FEP" for fluorinated ethylene propylene; "DCM" for dichloromethane (CH_2Cl_2); "NMR" for nuclear magnetic resonance.

Example S1 - Synthesis of 5,6-dibromo-1,1,2,2,3,3-hexamethylindane (S1)

[0115]



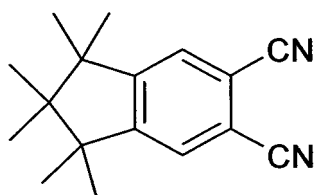
[0116] To a solution of 101.2 g (500 mmol) 1,1,2,2,3,3-hexamethyl-indane (CAS-no. 91324-94-6) in 2000 ml dichloromethane 1.3 g water-free iron(III) chloride are added. Then a mixture of 64.0 ml (1.25 mol) bromine and 300 ml dichloromethane is added in the absence of light in such a way that the temperature does not exceed 25°C, if necessary by cooling with a cold water bath. After stirring the reaction mixture for 16 hours at room temperature 500 ml of a saturated aqueous solution of sodium sulfite are slowly added, followed by separation of the aqueous phase. The organic phase is successively washed three times with 1000 ml water each, dried over sodium sulfate, and filtered through a short column of silica gel. Subsequently the solvent is evaporated. The obtained solid is re-crystallized from ca. 100 ml ethanol.

[0117] The following compounds S2 to S5 may be synthesized accordingly:

Ex.	Starting material	Product
S2	 (CAS no. 577-55-9)	 S2
S3	 (CAS no. 4834-33-7)	 S3
S4	 (CAS no. 113710-83-1)	 S4
S5	 (CAS no. 4175-52-4)	 S5

Example S6 - Synthesis of 5,6-dicyano-1,1,2,2,3,3-hexamethylindane (S6)

[0118]

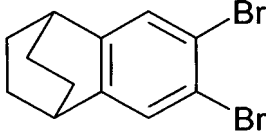
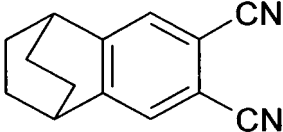


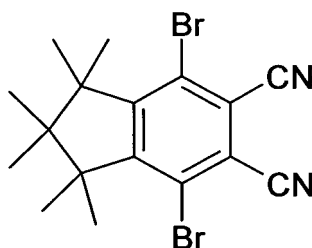
[0119] The synthesis may be conducted according to T. Schareina et al., Chem. Eur. J., 2007, 13, 6249. In an autoclave a mixture of 36.0 g (100 mmol) 5,6-bromo-1,1,2,2,3,3-hexamethylindane (S1), 18.4 g (50 mmol) $K_4[Fe(CN)_6]$ (water-free, CAS no. 13943-58-3), 1.9 g (10 mmol) copper(I) iodide, 26.4 ml (200 mmol) 1-butyl-imidazole and 200 ml toluene is heated to 110°C for 20 h. After cooling to room temperature the reaction mixture is diluted with 300 ml toluene. The organic phases are successively washed three times with 300 ml water each, dried over magnesium sulfate and filtered through Celite. Following the removal of the toluene in vacuum, the residue is re-crystallized twice from dimethylformamide/ethanol.

[0120] The following compounds S7 to S11 may be synthesized accordingly:

Ex.	Starting material	Product
S7	S2	S7 (purified by chromatography)
S8	S3	S8 (CAS no. 137818-51-0)
S9	S4	S9
S10	(CAS no. 42810-32-2)	S10 (CAS no. 52477-73-3)

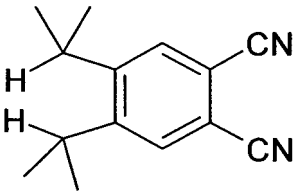
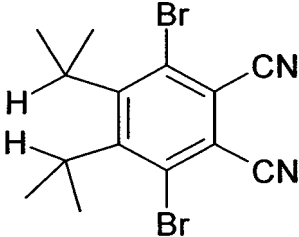
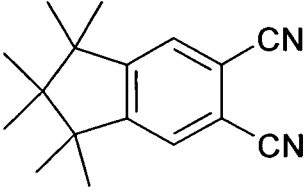
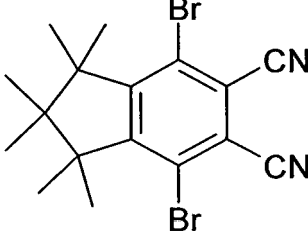
(continued)

Ex.	Starting material	Product
S11	 S5	 S11

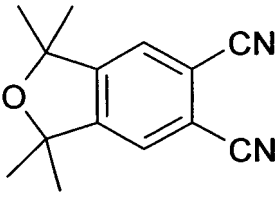
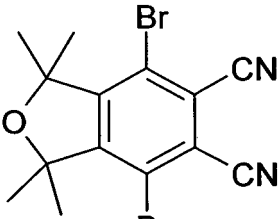
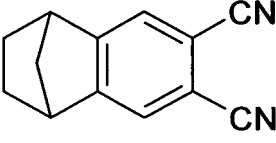
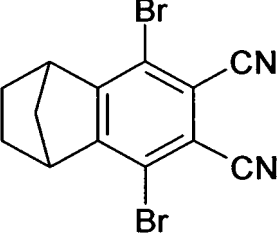
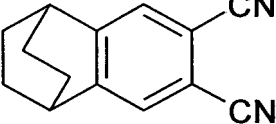
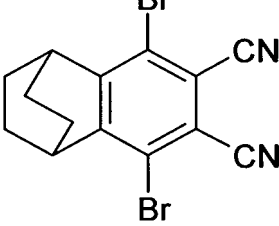
Example S12 - Synthesis of 4,7-dibromo-5,6-dicyano-1,1,2,2,3,3-hexamethyl-indane (S12)**[0121]**

[0122] The synthesis may be conducted according to B. Du et al., J. Org. Chem., 2013, 78, 2786. A mixture of 12.6 g (50 mmol) 5,6-dicyano-1,1,2,2,3,3-hexamethylindane (S6), 21.4 g (120 mmol) N-bromosuccinimide, 1.1 g (5 mmol) palladium(II) acetate, 951 mg (5 mmol) p-toluenesulfonic acid monohydrate and 300 ml 1,2-dichloroethane is stirred at 80°C for 30 h. After cooling to room temperature the reaction mixture is successively washed three times with 300 ml each of 5 wt% aqueous solution of ammonia, then once with saturated sodium chloride solution, dried over magnesium sulfate and filtered over Celite. After removal of the solvent under vacuum the residue is purified by chromatography on silica gel with ethyl acetate/n-heptane in a 1:1 volume ratio.

[0123] The following compounds S13 to S17 may be synthesized accordingly:

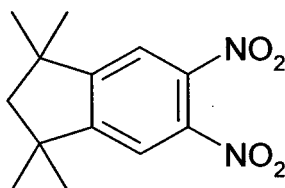
Ex.	Starting material	Product
S13	 S7	 S13
S14	 S8	 S14

(continued)

Ex.	Starting material	Product
S15	 S9	 S15
S16	 S10	 S16
S17	 S11	 S17

Example S18 - Synthesis of 1,1,3,3-tetramethyl-indane-5,6-diamine

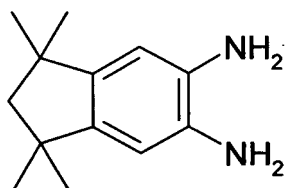
Step A: Synthesis of 5,6-dinitro-1,1,3,3-tetramethyl-indane (S18a)

[0124]

[0125] At 0°C 350 ml nitric acid (100 %) are slowly added to a well-stirred mixture of 87.2 g (500 mmol) 1,1,3,3-tetramethylindane (CAS-no. 4834-33-7) and 350 ml sulfuric acid (95 %) so that the temperature does not exceed +5°C. The reaction mixture is then allowed to slowly warm to room temperature over a period of 2 to 3 h and is subsequently added to a well-stirred mixture of 6 kg ice and 2 kg water. The pH is adjusted to between 8 and 9 by the addition of 40 wt% aqueous sodium hydroxide solution. Subsequently one extracts three times with 1000 ml ethyl acetate each, successively washes the combined organic phases twice with 1000 ml water each, dries over magnesium sulfate, and under vacuum almost completely removes the ethyl acetate until crystallization commences. Crystallization is then completed by the addition of 500 ml heptane. The beige-colored crystals are separated by vacuum filtration and dried in vacuo.

Step B - Synthesis of 1,1,3,3-Tetramethyl-indan-5,6-diamin (S18)

[0126]

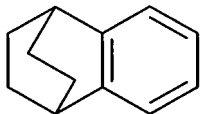
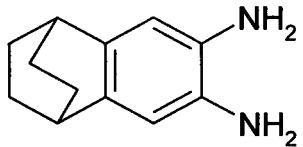


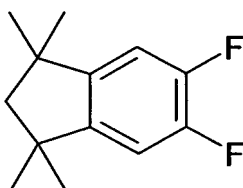
[0127] 126.9 g (480 mmol) 5,6-dinitro-1,1,3,3-tetramethylindane (S18a) in 1200 ml ethanol are hydrogenated in presence of 10 g palladium on carbon as catalyst under 3 bars of hydrogen pressure for a period of 24 h. The reaction mixture is successively filtered twice over a bed of Celite. The ethanol is removed. The obtained brown solid is purified by Kugelrohr distillation at a temperature of about 160°C at a pressure of about 10⁻⁴ mbar.

[0128] The following compounds S19 to S23 may be synthesized accordingly:

Ex.	Starting material	Product
S19	 577-55-9	 S19
S20	 91324-94-6	 S20
S21	 113710-83-1	 S21
S22	 4486-29-7	 124639-03-8 / S22

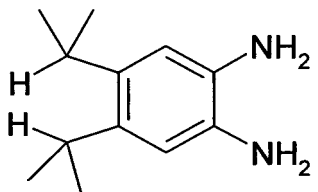
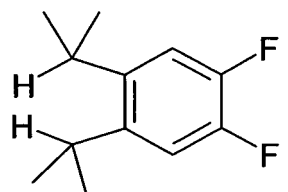
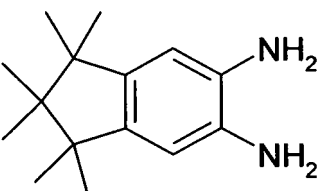
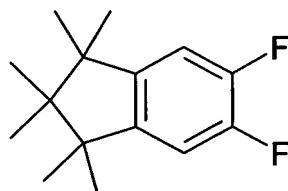
(continued)

Ex.	Starting material	Product
S23	 4175-52-4	 S23

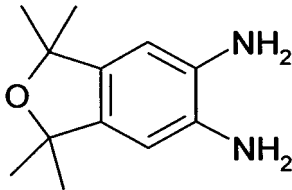
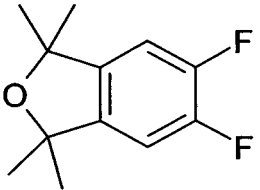
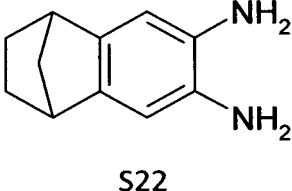
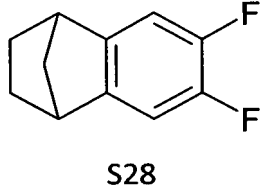
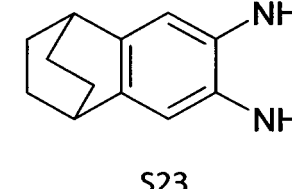
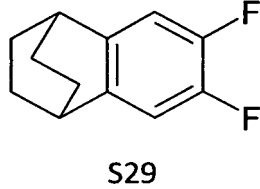
Example S24 - Synthesis of 5,6-difluoro-1,1,3,3-tetramethylindane (S24)**[0129]**

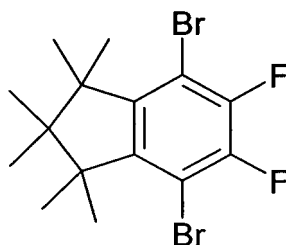
[0130] The synthesis may be conducted according to K. Sasaki et al., J. Fluorine Chem., 1996, 76, 59. In a FEP flask 100 ml of a mixture of HF and pyridine in a 60:40 weight ratio are cooled to 5°C. Then 6.4 g (30 mmol) 1,1,3,3-tetramethylindane-5,6-diamine (S18) and 4.5 g (65 mmol) sodium nitrite are successively added in small portions. The reaction mixture is allowed to warm to 10°C and stirred for 45 min. Subsequently 11.4 g (60 mmol) tin(II) chloride and 18.1g (60 mmol) tetrabutylammonium dihydrogen trifluoride are added. The resulting reaction mixture is then slowly warmed to 100°C (Attention: Foaming and evolution of gas) and is stirred at 100°C for 5 h. After cooling the reaction mixture is poured into 1000 g of ice and water, followed by successive extraction with 300 ml of dichloromethane three times each. The combined organic phases are then washed with 300 ml of a saturated aqueous solution of calcium chloride and dried over magnesium sulfate. After removal of the solvent the product is purified first by chromatography on silica gel with a mixture of n-heptane and DCM in a 9:1 volume ratio and then by Kugelrohr distillation.

[0131] The following compounds S25 to S29 may be synthesized accordingly:

Ex.	Starting material	Product
S25	 S19	 S25
S26	 S20	 S26

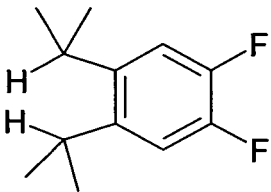
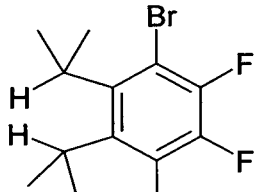
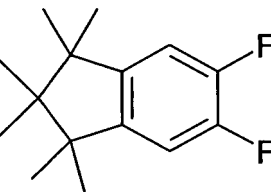
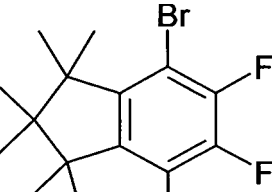
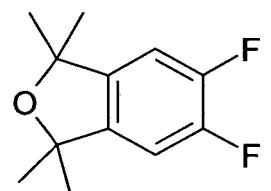
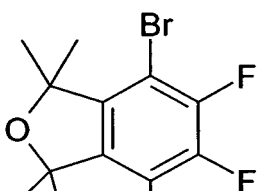
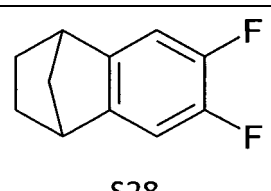
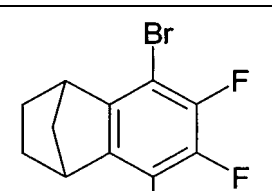
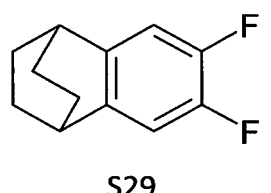
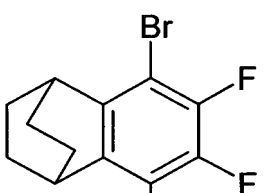
(continued)

Ex.	Starting material	Product
S27	 S21	 S27
S28	 S22 CAS no. 124639-03-8	 S28
S29	 S23	 S29

Example S30 - Synthesis of 4,7-dibromo-5,6-difluoro-1,1,2,2,3,3-hexamethyl-indane**[0132]**

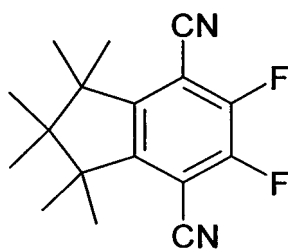
[0133] A freshly prepared solution of 110 mmol lithium diisopropylamide (LDA) in 110 ml THF is added dropwise to a solution of 11.9 g (50 mmol) 5,6-difluoro-1,1,3,3-tetramethylindane in 300 ml THF cooled to -78°C and then stirred for an hour. In the following a solution of 36.5 g (110 mmol) tetrabromomethane in 200 ml THF is added quickly and stirring is continued for 30 min. The reaction mixture is allowed to warm to -20°C and quenched by the addition of 20 ml methanol. The solvent is removed and the residue is purified by chromatography on silica gel with a mixture of n-heptane and DCM in a 9:1 volume ratio.

[0134] The following compounds S31 to S35 may be synthesized accordingly:

Ex.	Starting material	Product
S31	 S25	 S31
S32	 S26	 S32
S33	 S27	 S33
S34	 S28	 S34
S35	 S29	 S35

Example S36 - Synthesis of 4,7-dicyano-5,6-difluoro-1,1,2,2,3,3-hexamethyl-indane

[0135]

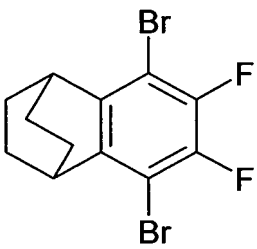
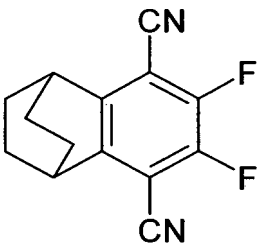


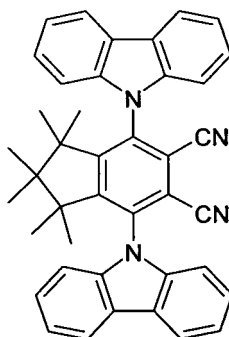
[0136] The synthesis may be conducted in accordance with Example S6, except that instead of 5,6-bromo-1,1,2,3,3-hexamethylindane (S1) 4.0 g (10 mmol) 4,7-dibromo-5,6-difluoro-1,1,2,3,3-hexamethylindane (S30) is used and the respective amounts of the other reactants are adapted in proportion to the amount of S30.

[0137] The following compounds S37 to S41 may be synthesized accordingly:

Ex.	Starting material	Product
S37	S31	S37
S38	S32	S38
S39	S33	S39
S40	S34	S40

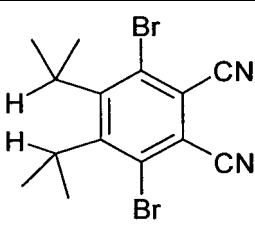
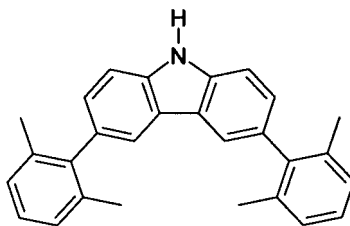
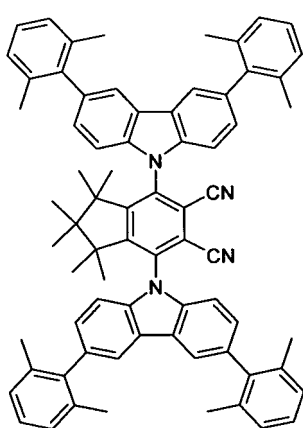
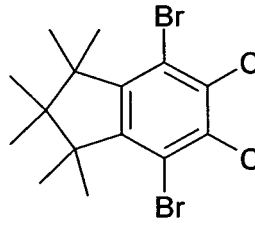
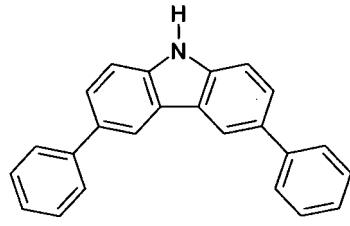
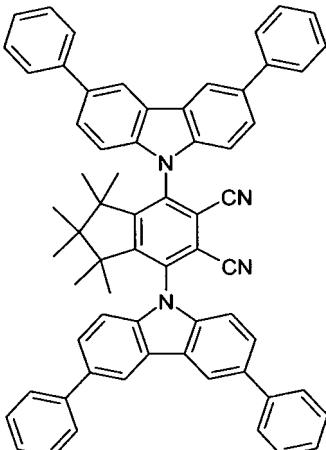
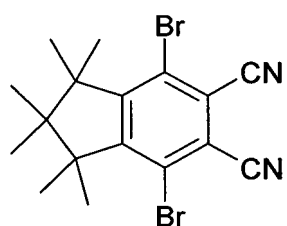
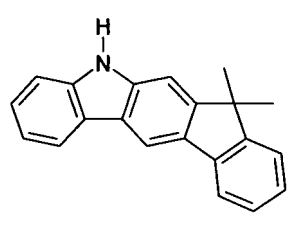
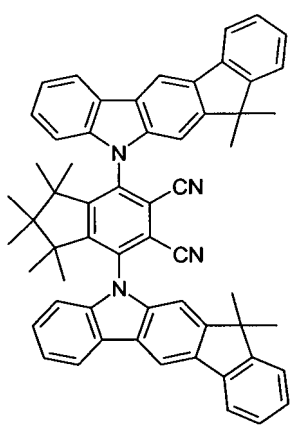
(continued)

Ex.	Starting material	Product
S41	 S35	 S41

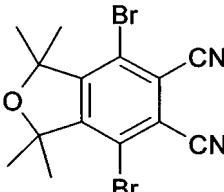
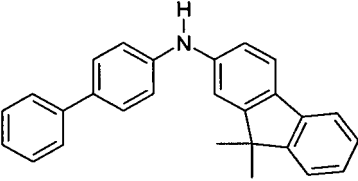
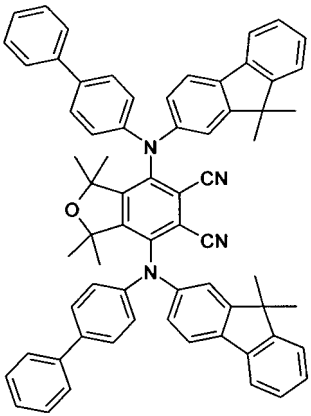
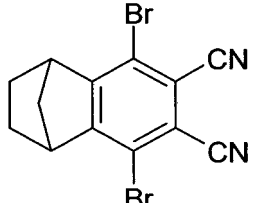
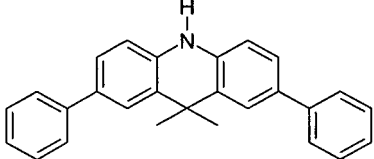
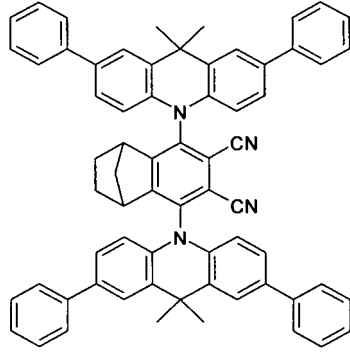
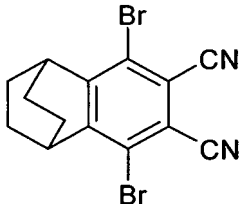
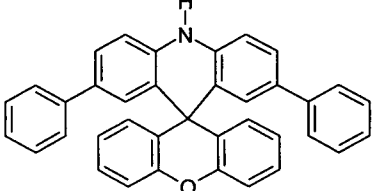
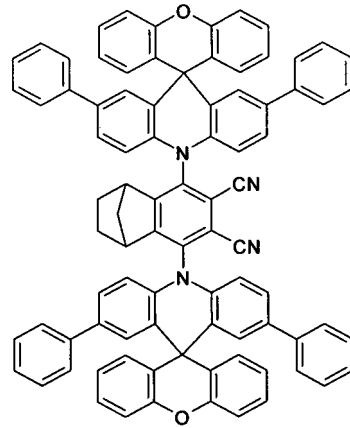
Example B1 - Synthesis of 4,7-bis-N-carbazolyl-5,6-dicyano-1,1,2,2,3,3-hexamethylindane (B1)**[0138]**

[0139] The synthesis may be conducted in accordance with B. Hu et al., Tetrahedron, 2010, 66(38), 7583. A mixture of 20.5 g (50 mmol) 4,7-dibromo-5,6-dicyano-1,1,2,2,3,3-hexamethylindane (S12), 33.4 g (200 mmol) carbazole (CAS no. 86-74-8), 55.3 g (400 mmol) potassium carbonate, 635 mg (10 mmol) copper powder, 26.4 g (100 mmol) 18-crown-6, 100 g glass beads (4 mm diameter) and 500 ml: dimethylformamide are heated to slight reflux under good stirring for 48 h while evolving water is collected in a Dean-Stark trap and removed from time to time. After cooling 500 ml of ethyl acetate are added. Glass beads and salts are removed by vacuum filtration over Celite. The filtrate is successively washed five times with 500 ml water each, once with 500 ml aqueous saturated solution of sodium chloride and dried over magnesium sulfate. After removal of the solvent the residue is successively re-crystallized five times from DMF/ethanol and subsequently purified at a temperature of about 310°C under a pressure of about 10⁻⁵ mbar by three successive fractionated sublimations.

[0140] The following compounds B2 to B7 may be synthesized accordingly:

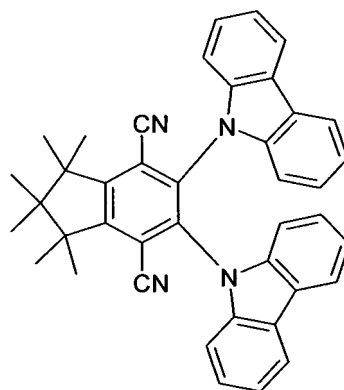
Ex.	Starting materials	Product
B2	 S13  CAS no. 1246891-46-2	 B2
B3	 S14  CAS no. 56525-79-2	 B3
B4	 S15  CAS no. 1257220-47-5	 B4

(continued)

Ex.	Starting materials	Product
B5	 S16  CAS no. 897671-69-1	 B5
B6	 S17  CAS no. 1403980-16-4	 B6
B7	 S18  CAS no. 1443131-19-8	 B7

Example B8 - Synthesis of 4,7-dicyano-5,6-bis-N-carbazolyl-1,1,2,2,3,3-hexa-methylindane (B8)

[0141]

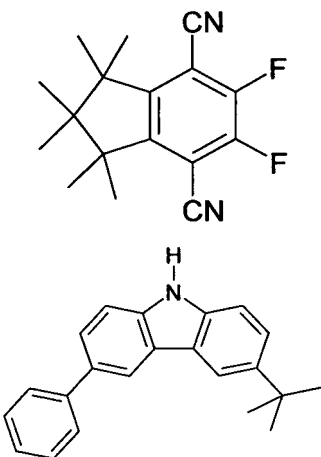
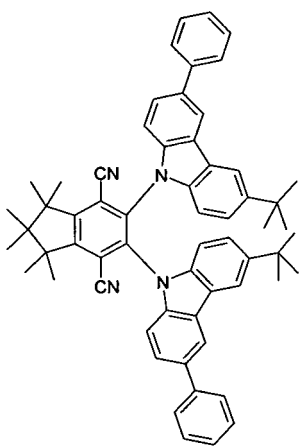
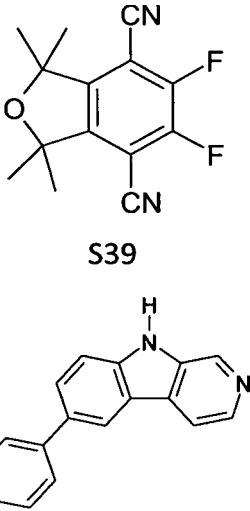
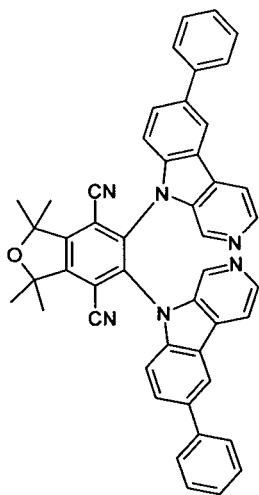


[0142] A suspension of 960 mg (40 mmol) sodium hydride in 50 ml THF is cooled to 0°C. Then 6.7 g (40 mmol) carbazole (CAS no. 86-74-8) is added in portions (Attention: Evolution of hydrogen, foaming). After warming to room temperature the reaction mixture is stirred for one hour, following which a solution of 2.9 g (10 mmol) 4,7-dicyano-5,6-difluoro-1,1,2,2,3,3-hexamethylindane (S36) in 50 ml THF is added slowly. After the exothermic reaction has stopped one continues to stir at 50°C for 16 h, then adds 50 ml ethanol and removes the solvent in vacuo. The residue is dissolved in 300 ml DCM. The organic phase is successively washed three times with 200 ml water each and once with 100 ml of an aqueous saturated sodium chloride solution, dried over magnesium sulfate and then filtered over Celite. After removal of the solvent the residue is re-crystallized five times from DMF/ethanol and is then purified by three successive fractionated sublimations at a temperature of about 320°C at a pressure of about 10⁻⁵ mbar.

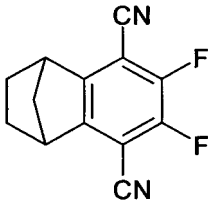
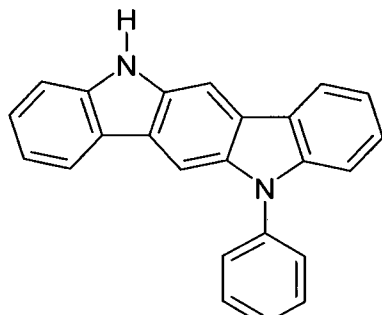
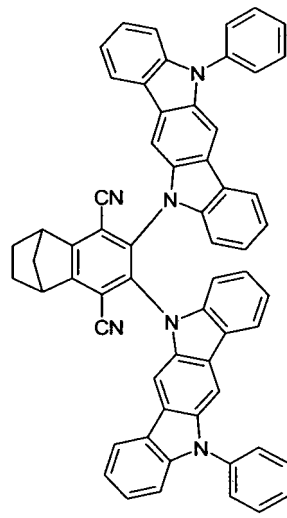
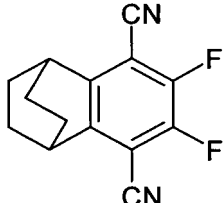
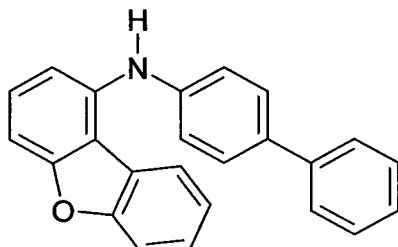
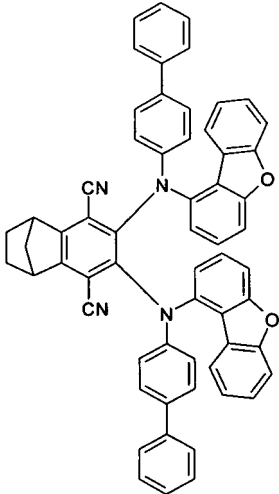
[0143] The following compounds B9 to B13 may be synthesized accordingly. It is noted that compound B9 is not according to the claimed invention.

Ex.	Starting materials	Product
B9	S37 CAS no. 1257220-49-7	B9

(continued)

Ex.	Starting materials	Product
B10	 CAS no. 1335126-51-6	 B10
B11	 S39 CAS no. 99822-95-4	 B11

(continued)

Ex.	Starting materials	Product
B12	 S40  CAS no. 1316311-27-9	 B12
B13	 S41  CAS no. 1318338-47-4	 B13

Example - Production of OLEDs

a) Vacuum-processed devices

[0144] OLEDs according to the invention and OLEDs in accordance with the prior art are produced by a general process in accordance with WO 2004/058911, which is adapted to the circumstances described here (layer-thickness variation, materials used). Glass plates with structured ITO (indium tin oxide, 50 nm) form the substrates to which the OLEDs are applied. The substrates are cleaned by a wet cleaning process (dishwasher, detergent Extran from Merck), then dried for 15 min at 250 °C and treated with an O₂-plasma prior to use.

[0145] The OLEDs have in principle the following layer structure: substrate / hole-transport layer (HTL) / optional electron blocking layer (EBL) / emission layer (EML) / optional hole blocking layer / electron-transport layer (ETL) / optional electron-injection layer (EIL) and finally a cathode. The cathode is formed by an aluminium layer with a thickness of 100 nm.

[0146] Firstly, vacuum-processed OLEDs are described. For this purpose, all materials are applied by thermal vapour deposition in a vacuum chamber. The emission layer here always consists of at least one matrix material (host material) and an emitting dopant (emitter), which is admixed with the matrix material or matrix materials in a certain proportion by volume by co-evaporation. An expression such as matrix M:B (95%:5%) here means that material M is present in the layer in a proportion by volume of 95% and the dopant B is present in the layer in a proportion of 5%. Analogously, the electron-transport layer may also consist of a mixture of two materials. The precise structure of such OLEDs is shown in Table 1. The materials used for the production of such OLEDs are shown in Table 2.

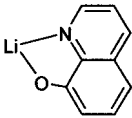
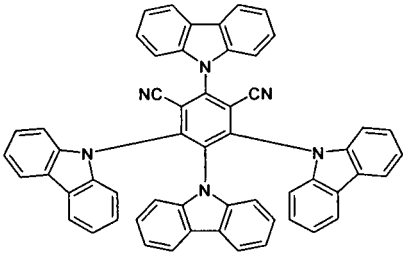
Table 1 - Structure of the OLEDs

Ex.	HTL Thickness	EBL Thickness	EML Thickness	HBL Thickness	ETL Thickness	EIL Thickness
D-Ref reference	HTM 90 nm	---	M1:DR (95%:5%) 20 nm	---	ETM 50 nm	EIM 3 nm
D-B1	HTM 90 nm	EBM 10 nm	M2:M3:B1 (65%:30%: 5%) 20 nm	HBM 10 nm	ETM 50 nm	EIM 3nm
D-B8	HTM 90 nm	---	M1:B8 (95%:5%) 20 nm	---	ETM 50 nm	EIM 3 nm

Table 2 - Structural formulae of the materials

CAS no. 123847-85-8 HTM = NPB	CAS no. 1206465-62-4 EBM
CAS no. 58328-31-7 M1 = CBP	CAS no. 604785-54-8 M2

(continued)

CAS no. 1201800-83-0 M3 / HBM	CAS no. 1233200-52-6 ETM
	
CAS no. 25387-93-3 EIM	CAS no. 1416881-52-1 DR

[0147] The OLEDs are characterised by standard methods. For this purpose, the electroluminescence spectra, the current efficiency (measured in cd/A) and the voltage (measured at 1000 cd/m² in V) are determined from current/voltage/luminance characteristic lines (IUL characteristic lines). For selected experiments, the lifetime is determined. The lifetime is defined as the time after which the luminous density has dropped to a certain proportion from a certain initial luminous density. The expression LT80 means that the lifetime given is the time at which the luminous density has dropped to 80% of the initial luminous density, i.e. from, for example, 1000 cd/m² to 800 cd/m². Depending on the emission colour, different initial luminances were selected. The values for the lifetime can be converted to a figure for other initial luminous densities with the aid of conversion formulae known to the person skilled in the art. The lifetime for an initial luminous density of 1000 cd/m² is a usual figure here.

b) Use of compounds according to the invention as emitter materials in OLEDs

[0148] The compounds according to the invention can be employed, inter alia, as emitter materials (dopants) in the emission layer in OLEDs. The compound DR is used as comparison in accordance with the prior art.

Claims

1. Electronic device comprising a compound of general formula (I)

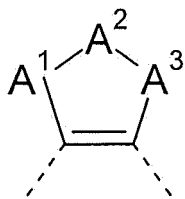


wherein

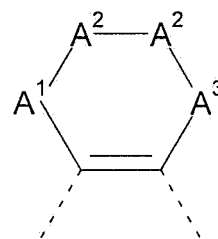
Q¹ and Q² are independently of each other selected from the group consisting of N, CR^A, CR^D, and CR^S;
 Z¹ and Z² are independently of each other selected from the group consisting of N, CR^A and CR^D;
 R^A is a group with -M-effect;
 R^D is a group with +M-effect;

characterized in that,

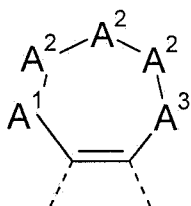
R^S is a sterically demanding group, wherein two groups CR^S together form a five-, six- or seven-membered ring of one of the following formulae (II-A) to (II-G),



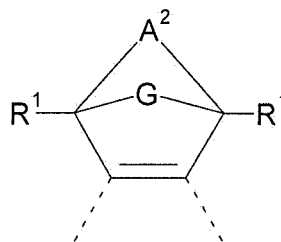
(II-A)



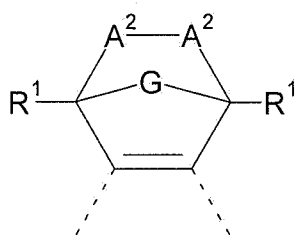
(II-B)



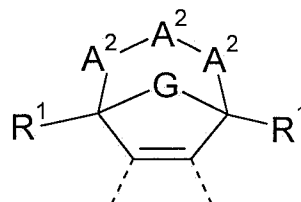
(II-C)



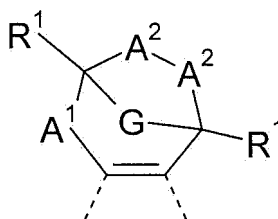
(II-D)



(II-E)



(II-F)



(II-G)

wherein

the dashed lines in formulae (II-A) to (II-G) indicate the corresponding bonding positions to the six-membered ring structure of formula (I), the dashed lines representing the bonds of the six-membered ring structure of formula (I);

G is selected from the group consisting of substituted or unsubstituted alkanediyl with 1, 2 or 3 C-atoms, -CR²=CR²- or a substituted or unsubstituted ortho-linked arylene- or heteroarylene-group with 5 to 14 aromatic ring atoms, which may be substituted with one or more of groups R²;

A¹ and A³ are at each occurrence independently selected from the group consisting of C(R³)₂, O, S, NR³ and C(=O);

A² is at each occurrence independently selected from the group consisting of C(R¹)₂, O, S, NR³ and C(=O), and in case two groups A² are adjacent to each other, A²-A² may also be selected from the group consisting of ortho-linked arylene- or heteroarylene-group with 5 to 14 aromatic ring atoms, each of which may independently of the other be substituted with R²;

R¹ is at each occurrence independently selected from the group consisting of H, D, F, Cl, Br, I, B(OR²)₂, CHO,

$C(=O)R^2$, $CR^2=C(R^2)_2$, CN , $C(=O)OR^2$, $C(=O)N(R^2)_2$, $Si(R^2)_3$, $N(R^2)_2$, NO_2 , $P(=O)(R^2)_2$, OSO_2R^2 , OR^2 , $S(=O)R^2$, $S(=O)_2R^2$, OH , SH , linear alkyl-, alkoxy- or thioalkyl-group with 1 to 20 C-atoms or a branched or cyclic alkyl-, alkoxy- or thioalkyl-group with 3 to 20 C-atoms or an alkenyl- or alkynyl-group with 2 to 20 C-atoms, wherein these groups may be substituted with one or more of groups R^2 and wherein one or more CH_2 -Gruppen in these groups may be replaced by $-R^2C=CR^2-$, $-C\equiv C-$, $Si(R^2)_2$, $C=O$, $C=S$, $C=NR^2$, $-C(=O)O-$, $-C(=O)NR^2-$, NR^2 , $P(=O)(R^2)$, $-O-$, $-S-$, SO or SO_2 , and wherein one or more H-atoms in these groups may be replaced by D, F, Cl, Br, I, CN or NO_2 , or an aromatic or heteroaromatic ring system with 5 to 60 aromatic ring atoms, which can be substituted with one or more groups R^2 , or an aryloxy- or heteroaryloxy-group with 5 to 60 aromatic ring atoms, which can be substituted with one or more groups R^2 , or an aralkyl- or heteroaralkyl-group with 5 to 60 aromatic ring atoms, which can be substituted with one or more groups R^2 , wherein two or more groups R^2 may be linked with each other and form an aliphatic or aromatic or heteroaromatic ring;

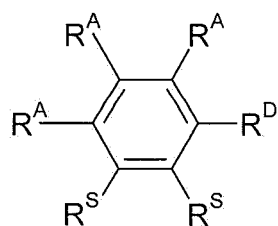
R^2 is at each occurrence independently selected from the group consisting of H, D, F, alkyl having from 1 to 20 C-atoms, aromatic groups having from 1 to 20 aromatic carbon atoms and heteroaromatic groups having from 1 to 20 aromatic ring atoms, wherein the aromatic groups and the heteroaromatic groups may be substituted with an alkyl having from 1 to 20 carbon atoms; and

R^3 is at each occurrence independently selected from the group consisting of F, linear alkyl- or alkoxy-group with 1 to 20 C-atoms, a branched or cyclic alkyl- or alkoxy-group with 3 to 20 C-atoms, each of which may be substituted with one or more of groups R^2 , wherein one or more non-adjacent CH_2 -groups may be replaced by $R^2C=CR^2$, $C\equiv C$, $Si(R^2)_2$, $C=O$, NR^2 , O, S or $CONR^2$, and wherein one or more H-atom may be replaced with D or F, or an aromatic or heteroaromatic ring system with 5 to 24 aromatic ring atoms, each of which may each be substituted with one or more of groups R^2 , or an aryloxy- or heteroaryloxy-group with 5 to 24 aromatic ring atoms, which can be substituted with one or more groups R^2 , or an aralkyl- or heteroaralkyl-group with 5 to 24 aromatic ring atoms, which can be substituted with one or more groups R^2 , wherein two R^2 bound to the same carbon atom may form an aliphatic or aromatic ring system and thus a spiro system; or R^3 can form together with a neighboring group R^1 or R^2 an aliphatic ring system,

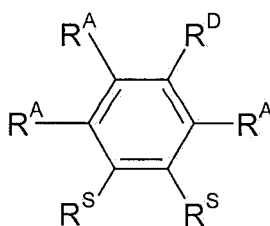
provided that in A^1 - A^2 - A^3 no two heteroatoms are adjacent;

and with the provision that the compound of general formula (I) comprises at least one group CR^A and at least one group CR^D .

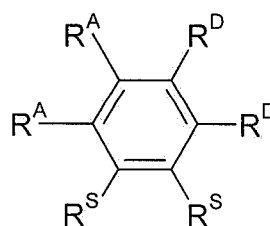
2. The device according to claim 1, wherein Q^1 and Q^2 are independently of each other selected from the group consisting of N, CR^A and CR^D .
3. The device according to claim 1 or claim 2, wherein the compound of formula (I) is selected from the group consisting of formulae (I-a) to (I-h)



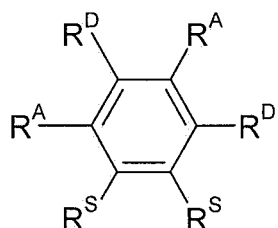
(I-a)



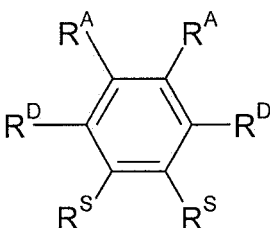
(I-b)



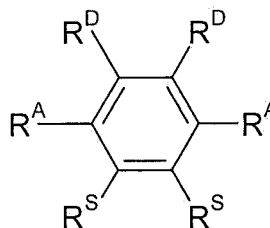
(I-c)



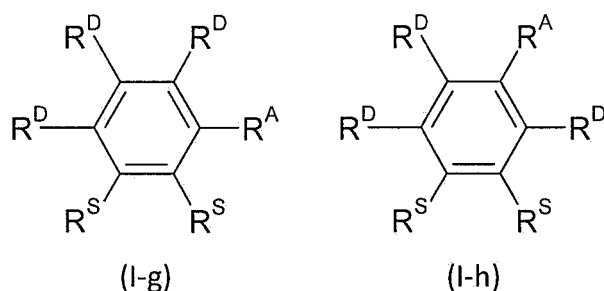
(I-d)



(I-e)



(I-f)



wherein R^A , R^D and R^S are as defined in claim 1.

4. The device according to claim 3, wherein the compound is of formula (I-e).

5. The device according to claim 4, wherein two groups CR^S together form a five or six-membered ring of formula (II-A), (II-B), (II-D) or (II-E).

6. The device according to any one or more of the preceding claims, wherein at each occurrence R^D is independently of each other selected from the group consisting of groups of general formula (N-a)



wherein

Ar^1 is a substituted or unsubstituted aromatic or heteroaromatic ring system with 5 to 30 aromatic ring atoms;
 m is 0 or 1; and
 R^1 is as defined in claim 1.

7. The device according to one or more of the preceding claims, wherein at each occurrence R^D is selected from the group consisting of compounds



wherein

Ar^1 and m are as defined in claim 6;
 Ar^2 is a substituted or unsubstituted aromatic or heteroaromatic ring system with 5 to 30 aromatic carbon atoms, wherein the two groups Ar^2 may be linked by a group Y , so that together with the N -atom of the NAr^{2_2} -group, irrespective of any N -atoms that might be present in Ar^2 , a ring is formed;
 Y is selected from the group consisting of a single bond, BR^1 , $C(R^1)_2$, $Si(R^1)_2$, NR^1 , PR^1 , $P(=O)R^1$, $P(=S)R^1$, O , S , $S=O$ and $S(=O)_2$; and
 R^1 and R^2 are independently of each other as defined in claim 1.

8. The device according to one or more of the preceding claims, wherein at each occurrence R^D is independently of each other selected from the group consisting of groups of general formula (N-b)



wherein

Ar^1 and m are as defined in claim 6; and
 NAr^{2_2} is selected from the group consisting of aromatic amines, heteroaromatic amines, carbazoles, azacarbazoles, annealed carbazoles, annealed azacarbazoles, 5,10-dihydro-phenazaboranes, 9,10-dihydroacridines, 9,10-dihydro-10-sila-acridines, 9,10-dihydro-phneazine, 10-hydro-phenoxazine, and 10-hydro-phentiazine, all of which may be substituted or unsubstituted.

9. The device according to one or more of the preceding claims, said compound comprising at least two identical

groups R^D .

10. The device according to any one or more of the preceding claims, wherein at each occurrence R^A is independently of each other selected from the group consisting of fluoroalkyl, F, BR^1_2 , $B(OR^1)_2$, CHO, $C(=O)R^1$, CN, $C(=O)OR^1$, $C(=O)N(R^1)_2$, $CR^1=C(CN)_2$, N_3 , NO_2 , $P(=O)(R^1)_2$, $S(=O)R^1$, $S(=O)_2R^1$ heteroaryl, heteroaryl substituted with one or more electron withdrawing groups and aryl substituted with one or more electron withdrawing groups, wherein the electron withdrawing groups are selected from the group consisting of fluoroalkyl, F, $B(OR^1)_2$, CHO, $C(=O)R^1$, CN, $C(=O)OR^1$, $C(=O)N(R^1)_2$, NO_2 , $P(=O)(R^1)_2$, $S(=O)R^1$, and $S(=O)_2R^1$, with R^1 as defined in claim 1.

11. The device according to any one or more of the preceding claims, said compound comprising at least two identical R^A .

12. A compound of general formula (I)



wherein

Q^1 and Q^2 are independently of each other selected from the group consisting of N, CR^A , CR^D , and CR^S ;

Z^1 and Z^2 are independently of each other selected from the group consisting of N, CR^A and CR^D ;

R^A is a group with -M-effect;

R^D is a group with +M-effect being selected from the group consisting of compounds



wherein

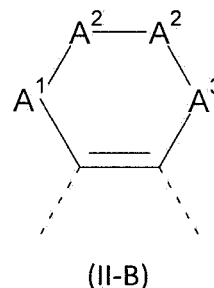
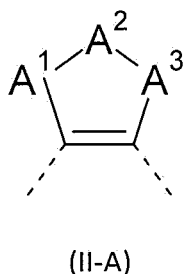
Ar^1 and m are as defined in claim 6;

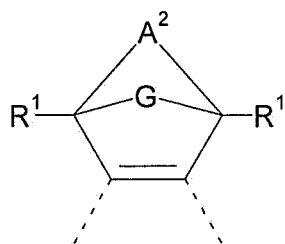
Ar^2 is a substituted or unsubstituted aromatic or heteroaromatic ring system with 5 to 30 aromatic carbon atoms, wherein the two groups Ar^2 may be linked by a group Y, so that together with the N-atom of the NAr^2_2 -group, irrespective of any N-atoms that might be present in Ar^2 , a ring is formed;

Y is selected from the group consisting of a single bond, BR^1 , $C(R^1)_2$, $Si(R^1)_2$, NR^1 , PR^1 , $P(=O)R^1$, $P(=S)R^1$, O, S, S=O and $S(=O)_2$; and

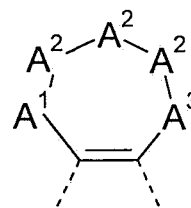
characterized in that,

R^S is a sterically demanding group, wherein two groups CR^S together form a five-, six- or seven-membered ring of one of the following formulae (II-A) to (II-G),

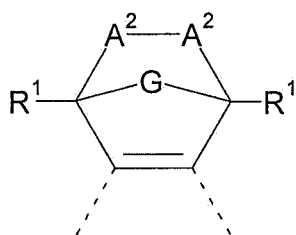




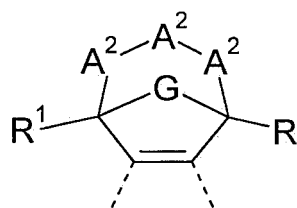
(II-C)



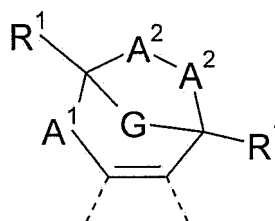
(II-D)



(II-E)



(II-F)



(II-G)

wherein

the dashed lines in formulae (II-A) to (II-G) indicate the corresponding bonding positions to the six-membered ring structure of formula (I), the dashed lines representing the bonds of the six-membered ring structure of formula (I);

G is selected from the group consisting of substituted or unsubstituted alkanediyl with 1, 2 or 3 C-atoms, $-CR^2=CR^2-$ or a substituted or unsubstituted ortho-linked arylene- or heteroarylene-group with 5 to 14 aromatic ring atoms, which may be substituted with one or more of groups R^2 ;

A^1 and A^3 are at each occurrence independently selected from the group consisting of $C(R^3)_2$, O, S, NR^3 and $C(=O)$;

A^2 is at each occurrence independently selected from the group consisting of $C(R^1)_2$, O, S, NR^3 and $C(=O)$, and in case two groups A^2 are adjacent to each other, A^2-A^2 may also be selected from the group consisting of ortho-linked arylene- or heteroarylene-group with 5 to 14 aromatic ring atoms, each of which may independently of the other be substituted with R^2 ;

R^1 is at each occurrence independently selected from the group consisting of H, D, F, Cl, Br, I, $B(OR^2)_2$, CHO, $C(=O)R^2$, $CR^2=C(R^2)_2$, CN, $C(=O)OR^2$, $C(=O)N(R^2)_2$, $Si(R^2)_3$, $N(R^2)_2$, NO_2 , $P(=O)(R^2)_2$, OSO_2R^2 , OR^2 , $S(=O)R^2$, $S(=O)_2R^2$, OH, SH, linear alkyl-, alkoxy- or thioalkyl-group with 1 to 20 C-atoms or a branched or cyclic alkyl-, alkoxy- or thioalkyl-group with 3 to 20 C-atoms or a alkenyl- or alkynyl-group with 2 to 20 C-atoms, wherein these groups may be substituted with one or more of groups R^2 and wherein one or more CH_2 -Gruppen in these groups may be replaced by $-R^2C=CR^2-$, $-C\equiv C-$, $Si(R^2)_2$, $C=O$, $C=S$, $C=NR^2$, $-C(=O)O-$, $-C(=O)NR^2-$, NR^2 , $P(=O)(R^2)$, $-O-$, $-S-$, SO or SO_2 , and wherein one or more H-atoms in these groups may be replaced by D, F, Cl, Br, I, CN or NO_2 , or an aromatic or heteroaromatic ring system with 5 to 60 aromatic ring atoms, which can be substituted with one or more groups R^2 , or an aryloxy- or heteroaryloxy-group with 5 to 60 aromatic ring atoms, which can be substituted with one or more groups R^2 , or an aralkyl- or heteroaralkyl-group with 5 to 60 aromatic ring atoms, which can be substituted with one or more groups

R^2 , wherein two or more groups R^2 may be linked with each other and form an aliphatic or aromatic or heteroaromatic ring;

R^2 is at each occurrence independently selected from the group consisting of H, D, F, alkyl having from 1 to 20 C-atoms, aromatic groups having from 1 to 20 aromatic carbon atoms and heteroaromatic groups having from 1 to 20 aromatic ring atoms, wherein the aromatic groups and the heteroaromatic groups may be substituted with an alkyl having from 1 to 20 carbon atoms; and

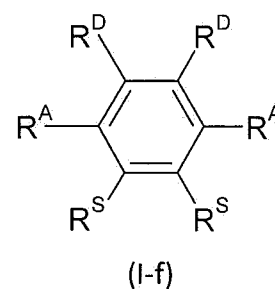
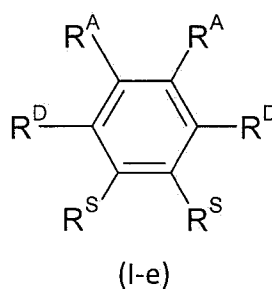
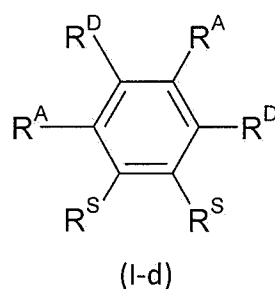
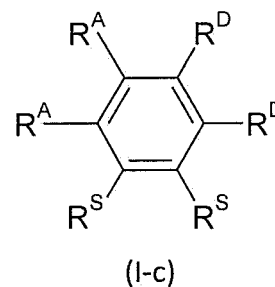
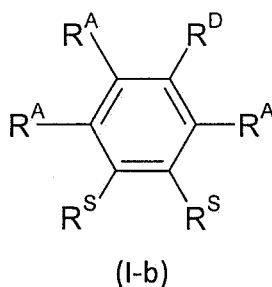
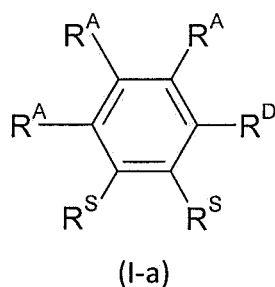
R^3 is at each occurrence independently selected from the group consisting of F, linear alkyl- or alkoxy-group with 1 to 20 C-atoms, a branched or cyclic alkyl- or alkoxy-group with 3 to 20 C-atoms, each of which may be substituted with one or more of groups R^2 , wherein one or more non-adjacent CH_2 -groups may be replaced by $R^2C=CR^2$, $C\equiv C$, $Si(R^2)_2$, $C=O$, NR^2 , O, S or $CONR^2$, and wherein one or more H-atom may be replaced with D or F, or an aromatic or heteroaromatic ring system with 5 to 24 aromatic ring atoms, each of which may each be substituted with one or more of groups R^2 , or an aryloxy- or heteroaryloxy-group with 5 to 24 aromatic ring atoms, which can be substituted with one or more groups R^2 , or an aralkyl- or heteroaralkyl-group with 5 to 24 aromatic ring atoms, which can be substituted with one or more groups R^2 , wherein two R^2 bound to the same carbon atom may form an aliphatic or aromatic ring system and thus a spiro system; or R^3 can form together with a neighboring group R^1 or R^2 an aliphatic ring system,

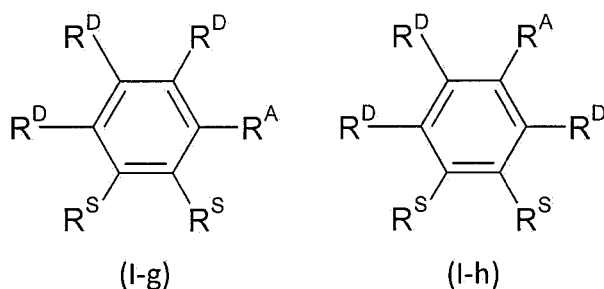
provided that in A^1 - A^2 - A^3 no two heteroatoms are adjacent;

and with the provision that the compound of general formula (I) comprises at least one group CR^A and at least one group CR^D .

13. A compound according to claim 12, wherein Q^1 and Q^2 are independently of each other selected from the group consisting of N, CR^A and CR^D .

14. A compound according to claim 12 or claim 13, wherein the compound of formula (I) is selected from the group consisting of formulae (I-a) to (I-h)



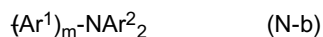


wherein R^A , R^D and R^S are as defined in claim 1.

15. A compound according to claim 14, wherein the compound is of formula (I-e).

16. A compound according to claim 15, wherein two groups CR^S together form a five or six-membered ring of formula (II-A), (II-B), (II-D) or (II-E).

17. A compound according to one or more of claims 12-16, wherein at each occurrence R^D is independently of each other selected from the group consisting of groups of general formula (N-b)



wherein

Ar^1 and m are as defined in claim 6; and

NAr^2_2 is selected from the group consisting of aromatic amines, heteroaromatic amines, carbazoles, azacarbazoles, annealed carbazoles, annealed azacarbazoles, 5,10-dihydro-phenazaboranes, 9,10-dihydroacridines, 9,10-dihydro-10-sila-acridines, 9,10-dihydro-phneazine, 10-hydro-phenoxazine, and 10-hydro-phentiazine, all of which may be substituted or unsubstituted.

18. A compound according to one or more of claims 12-17, said compound comprising at least two identical groups R^D .

19. A compound according to one or more of claims 12-18, wherein at each occurrence R^A is independently of each other selected from the group consisting of fluoroalkyl, F, BR^1_2 , $B(OR^1)_2$, CHO, $C(=O)R^1$, CN, $C(=O)OR^1$, $C(=O)N(R^1)_2$, $CR^1=C(CN)_2$, N_3 , NO_2 , $P(=O)(R^1)_2$, $S(=O)R^1$, $S(=O)_2R^1$, heteroaryl, heteroaryl substituted with one or more electron withdrawing groups and aryl substituted with one or more electron withdrawing groups, wherein the electron withdrawing groups are selected from the group consisting of fluoroalkyl, F, $B(OR^1)_2$, CHO, $C(=O)R^1$, CN, $C(=O)OR^1$, $C(=O)N(R^1)_2$, NO_2 , $P(=O)(R^1)_2$, $S(=O)R^1$, and $S(=O)_2R^1$, with R^1 as defined in claim 1.

20. The compound according to one or more of claims 12-19, said compound comprising at least two identical R^A .

21. A formulation comprising a solvent and a compound of one or more of claims 12 to 20.

22. An electronic device selected from the group consisting of organic integrated circuits (OICs), organic field-effect transistors (OFETs), organic thin-film transistors (OTFTs), organic light-emitting transistors (OLETs), organic photovoltaic cells, organic optical detectors, organic photoreceptors, organic field-quench-devices (OFQDs), organic light-emitting electrochemical cells (OLECs), organic laser diodes (O-Laser) and organic electroluminescence devices (OLEDs), **characterized in that** the electronic devices comprises a compound of any one or more of claims 12 to 20.

23. Electronic device according to claim 22, wherein the electronic device is an organic electroluminescent device, **characterized in that** it comprises an anode, a cathode and at least one organic layer, said organic layer comprising a compound of any one or more of claims 12 to 20 as matrix material in an emitting layer in combination with one or more dopants, or that it is comprised as electron transport material in an electron transport layer, an electron injection layer or a hole blocking layer.

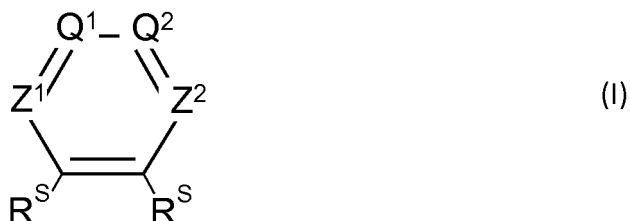
24. Use of a compound of any one or more of claims 12 to 20 in an electronic device.

25. Method of producing the electronic device of claim 22 or claim 23, said method comprising the steps of

- (a) providing a compound of one or more of claims 12 to 20; and
 (b) depositing said compound on a supporting layer.

Patentansprüche

1. Elektronische Vorrichtung enthaltend eine Verbindung der allgemeinen Formel (I)

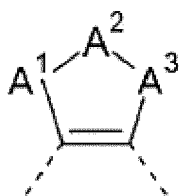


wobei

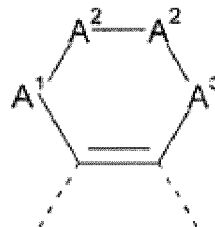
- Q^1 und Q^2 unabhängig voneinander aus der aus N, CR^A , CR^D und CR^S bestehenden Gruppe ausgewählt sind;
 Z^1 und Z^2 unabhängig voneinander aus der aus N, CR^A und CR^D bestehenden Gruppe ausgewählt sind;
 R^A eine Gruppe mit -M-Effekt ist;
 R^D eine Gruppe mit +M-Effekt ist;

dadurch gekennzeichnet, dass

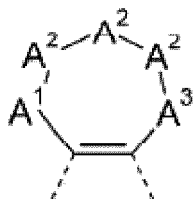
RS eine sterisch anspruchsvolle Gruppe ist, wobei zwei Gruppen CR^S zusammen einen fünf-, sechs- oder siebengliedrigen Ring einer der folgenden Formeln (II-A) bis (II-G)



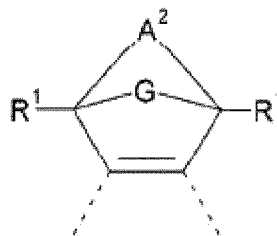
(II-A)



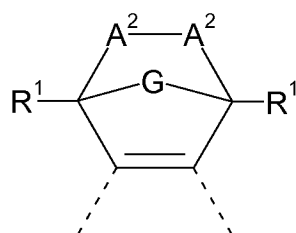
(II-B)



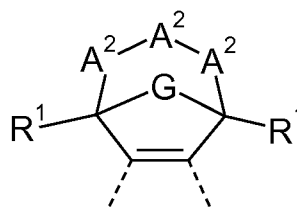
(II-C)



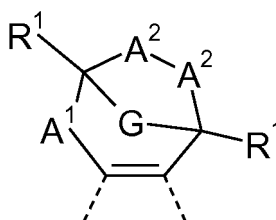
(II-D)



(II-E)



(II-F)



(II-G)

bilden, wobei

die gestrichelten Linien in Formeln (II-A) bis (II-G) die entsprechenden Bindungspositionen zur sechsgliedrigen Ringstruktur der Formel (I) angeben, wo die gestrichelten Linien die Bindungen der sechsgliedrigen Ringstruktur der Formel (I) darstellen;

G aus der Gruppe bestehend aus substituiertem oder unsubstituiertem Alkandiyl mit 1, 2 oder 3 C-Atomen, -CR²=CR²- oder einer substituierten oder unsubstituierten ortho-verknüpften Arylen- oder Heteroarylengruppe mit 5 bis 14 aromatischen Ringatomen, die mit einer oder mehreren der Gruppen R² substituiert sein kann, ausgewählt ist;

A¹ und A³ bei jedem Auftreten unabhängig aus der aus C(R³)₂, O, S, NR³ und C(=O) bestehenden Gruppe ausgewählt sind;

A² bei jedem Auftreten unabhängig aus der aus C(R¹)₂, O, S, NR³ und C(=O) bestehenden Gruppe ausgewählt ist, und, wenn zwei Gruppen A² einander benachbart sind, A²-A² auch aus der Gruppe bestehend aus ortho-verknüpfter Arylen- oder Heteroarylengruppe mit 5 bis 14 aromatischen Ringatomen ausgewählt sein kann, die jeweils unabhängig voneinander mit R² substituiert sein kann;

R¹ bei jedem Auftreten unabhängig aus der Gruppe bestehend aus H, D, F, Cl, Br, I, B(OR²)₂, CHO, C(=O)R², CR²=C(R²)₂, CN, C(=O)OR², C(=O)N(R²)₂, Si(R²)₃, N(R²)₂, NO₂, P(=O)(R²)₂, OSO₂R², OR², S(=O)R², S(=O)₂R², OH, SH, linearer Alkyl-, Alkoxy- oder Thioalkylgruppe mit 1 bis 20 C-Atomen oder einer verzweigten oder cyclischen Alkyl-, Alkoxy- oder Thioalkylgruppe mit 3 bis 20 C-Atomen oder einer Alkenyl- oder Alkynylgruppe mit 2 bis 20 C-Atomen, wobei diese Gruppen mit einer oder mehreren der Gruppen R² substituiert sein können und wobei eine oder mehrere CH₂-Gruppen in diesen Gruppen durch -R²C=CR²-, -C≡C-, Si(R²)₂, C=O, C=S, C=NR², -C(=O)O-, -C(=O)NR²-, NR², P(=O)(R²), -O-, -S-, SO oder SO₂ ersetzt sein können und wobei ein oder mehrere H-Atome in diesen Gruppen durch D, F, Cl, Br, I, CN oder NO₂ ersetzt sein können, oder einem aromatischen oder heteroaromatischen Ringsystem mit 5 bis 60 aromatischen Ringatomen, das mit einer oder mehreren Gruppen R² substituiert sein kann, oder einer Aryloxy- oder Heteroaryloxygruppe mit 5 bis 60 aromatischen Ringatomen, die mit einer oder mehreren Gruppen R² substituiert sein kann, oder einer Aralkyl- oder Heteroaralkylgruppe mit 5 bis 60 aromatischen Ringatomen, die mit einer oder mehreren Gruppen R² substituiert sein kann, wobei zwei oder mehr Gruppen R² miteinander verknüpft sein und einen aliphatischen oder aromatischen oder heteroaromatischen Ring bilden können, ausgewählt ist;

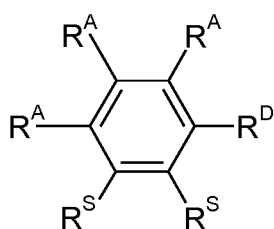
R² bei jedem Auftreten unabhängig aus der Gruppe bestehend aus H, D, F, Alkyl mit 1 bis 20 C-Atomen, aromatischen Gruppen mit 1 bis 20 aromatischen Kohlenstoffatomen und heteroaromatischen Gruppen mit 1 bis 20 aromatischen Ringatomen ausgewählt ist, wobei die aromatischen Gruppen und die heteroaromatischen Gruppen mit einem Alkyl mit 1 bis 20 Kohlenstoffatomen substituiert sein können; und

R³ bei jedem Auftreten unabhängig aus der Gruppe bestehend aus F, linearer Alkyl- oder Alkoxygruppe mit 1 bis 20 C-Atomen, einer verzweigten oder cyclischen Alkyl- oder Alkoxygruppe mit 3 bis 20 C-Atomen, die jeweils mit einer oder mehreren der Gruppen R² substituiert sein kann, wobei eine oder mehrere nicht benachbarte

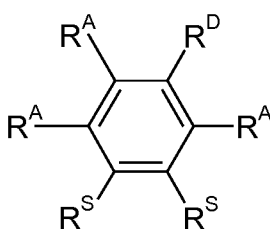
CH₂-Gruppen durch R²C=CR², C≡C, Si(R²)₂, C=O, NR², O, S oder CONR² ersetzt sein können und wobei ein oder mehrere H-Atome mit D oder F ersetzt sein können, oder einem aromatischen oder heteroaromatischen Ringsystem mit 5 bis 24 aromatischen Ringatomen, das jeweils mit einer oder mehreren der Gruppen R² substituiert sein kann, oder einer Aryloxy- oder Heteroaryloxygruppe mit 5 bis 24 aromatischen Ringatomen, die mit einer oder mehreren Gruppen R² substituiert sein kann, oder einer Aralkyl- oder Heteroaralkylgruppe mit 5 bis 24 aromatischen Ringatomen, die mit einer oder mehreren Gruppen R² substituiert sein kann, wobei zwei an dasselbe Kohlenstoffatom gebundene R² ein aliphatisches oder aromatisches Ringsystem und somit ein Spirosystem bilden können, ausgewählt ist; oder R³ zusammen mit einer benachbarten Gruppe R¹ oder R² ein aliphatisches Ringsystem bilden kann,

vorausgesetzt, dass in A¹-A²-A³ keine zwei Heteroatome benachbart sind, und mit der Maßgabe, dass die Verbindung der allgemeinen Formel (I) mindestens eine Gruppe CR^A und mindestens eine Gruppe CR^D enthält.

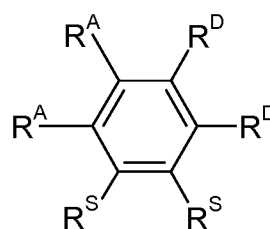
2. Vorrichtung nach Anspruch 1, wobei Q¹ und Q² unabhängig voneinander aus der aus N, CR^A und CR^D bestehenden Gruppe ausgewählt sind.
3. Vorrichtung nach Anspruch 1 oder Anspruch 2, wobei die Verbindung der Formel (I) aus der Gruppe bestehend aus Formeln (I-a) bis (I-h)



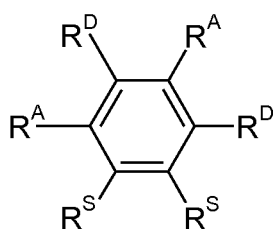
(I-a)



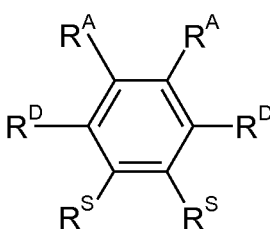
(I-b)



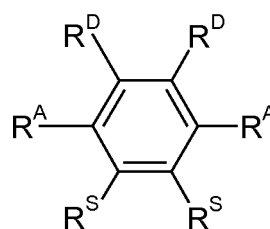
(I-c)



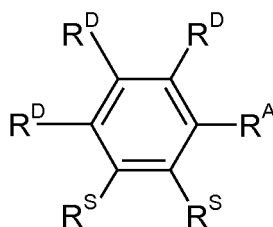
(I-d)



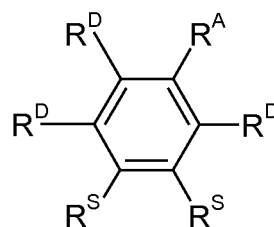
(I-e)



(I-f)



(I-g)



(I-h)

ausgewählt ist, wobei R^A, R^D und R^S wie in Anspruch 1 definiert sind.

4. Vorrichtung nach Anspruch 3, wobei die Verbindung die Formel (I-e) aufweist.
5. Vorrichtung nach Anspruch 4, wobei zwei Gruppen CR^S zusammen einen fünf- oder sechsgliedrigen Ring der

Formel (II-A), (II-B), (II-D) oder (II-E) bilden.

6. Vorrichtung nach einem oder mehreren beliebigen der vorhergehenden Ansprüche, wobei R^D bei jedem Auftreten unabhängig voneinander aus der Gruppe bestehend aus Gruppen der allgemeinen Formel (N-a)



ausgewählt ist, wobei

Ar^1 ein substituiertes oder unsubstituiertes aromatisches oder heteroaromatisches Ringsystem mit 5 bis 30 aromatischen Ringatomen ist;
 m 0 oder 1 ist; und
 R^1 wie in Anspruch 1 definiert ist.

7. Vorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, wobei R^D bei jedem Auftreten aus der Gruppe bestehend aus Verbindungen



ausgewählt ist, wobei

Ar^1 und m wie in Anspruch 6 definiert sind;
 Ar^2 ein substituiertes oder unsubstituiertes aromatisches oder heteroaromatisches Ringsystem mit 5 bis 30 aromatischen Kohlenstoffatomen ist, wobei die beiden Gruppen Ar^2 durch eine Gruppe Y verknüpft sein können, so dass zusammen mit dem N-Atom der NAr^2_2 -Gruppe, unabhängig von eventuell in Ar^2 vorhandenen N-Atomen, ein Ring entsteht;
 Y aus der aus einer Einfachbindung, BR^1 , $C(R^1)_2$, $Si(R^1)_2$, NR^1 , PR^1 , $P(=O)R^1$, $P(=S)R^1$, O, S, $S=O$ und $S(=O)_2$ bestehenden Gruppe ausgewählt ist; und
 R^1 und R^2 unabhängig voneinander wie in Anspruch 1 definiert sind.

8. Vorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, wobei R^D bei jedem Auftreten unabhängig voneinander aus der Gruppe bestehend aus Gruppen der allgemeinen Formel (N-b)



ausgewählt ist, wobei

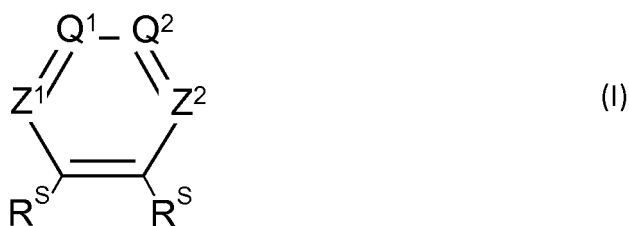
Ar^1 und m wie in Anspruch 6 definiert sind; und
 NAr^2_2 aus der Gruppe bestehend aus aromatischen Amininen, heteroaromatischen Amininen, Carbazolen, Azacarbazolen, anellierten Carbazolen, anellierten Azacarbazolen, 5,10-Dihydro-phenazaboranen, 9,10-Dihydroacridinen, 9,10-Dihydro-10-sila-acridinen, 9,10-Dihydro-phenazin, 10-Hydro-phenoxazin und 10-Hydro-phentiazin ausgewählt ist, die alle substituiert oder unsubstituiert sein können.

9. Vorrichtung nach einem oder mehreren der vorhergehenden Ansprüche, wo die Verbindung mindestens zwei gleiche Gruppen R^D enthält.

10. Vorrichtung nach einem oder mehreren beliebigen der vorhergehenden Ansprüche, wobei R^A bei jedem Auftreten unabhängig voneinander aus der Gruppe bestehend aus Fluoralkyl, F, BR^1_2 , $B(OR^1)_2$, CHO, $C(=O)R^1$, CN, $C(=O)OR^1$, $C(=O)N(R^1)_2$, $CR^1=C(CN)_2$, N_3 , NO_2 , $P(=O)(R^1)_2$, $S(=O)R^1$, $S(=O)_2R^1$, Heteroaryl, mit einer oder mehreren elektronenziehenden Gruppen substituiertes Heteroaryl und mit einer oder mehreren elektronenziehenden Gruppen substituiertes Aryl ausgewählt ist, wobei die elektronenziehenden Gruppen aus der Gruppe bestehend aus Fluoralkyl, F, $B(OR^1)_2$, CHO, $C(=O)R^1$, CN, $C(=O)OR^1$, $C(=O)N(R^1)_2$, NO_2 , $P(=O)(R^1)_2$, $S(=O)R^1$ und $S(=O)_2R^1$ ausgewählt sind, wo R^1 wie in Anspruch 1 definiert ist.

11. Vorrichtung nach einem oder mehreren beliebigen der vorhergehenden Ansprüche, wo die Verbindung mindestens zwei gleiche R^A enthält.

12. Verbindung der allgemeinen Formel (I)



wobei

Q^1 und Q^2 unabhängig voneinander aus der aus N, CR^A , CR^D und CR^S bestehenden Gruppe ausgewählt sind;

Z^1 und Z^2 unabhängig voneinander aus der aus N, CR^A und CR^D bestehenden Gruppe ausgewählt sind;

R^A eine Gruppe mit -M-Effekt ist;

R^D eine Gruppe mit +M-Effekt ist, die aus der Gruppe bestehend aus Verbindungen



ausgewählt ist, wobei

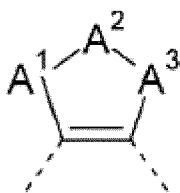
Ar^1 und m wie in Anspruch 6 definiert sind;

Ar^2 ein substituiertes oder unsubstituiertes aromatisches oder heteroaromatisches Ringsystem mit 5 bis 30 aromatischen Kohlenstoffatomen ist, wobei die beiden Gruppen Ar^2 durch eine Gruppe Y verknüpft sein können, so dass zusammen mit dem N-Atom der NAr^2_2 -Gruppe, unabhängig von eventuell in Ar^2 vorhandenen N-Atomen, ein Ring entsteht;

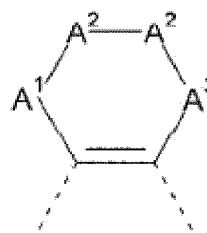
Y aus der aus einer Einfachbindung, BR^1 , $C(R^1)_2$, $Si(R^1)_2$, NR^1 , PR^1 , $P(=O)R^1$, $P(=S)R^1$, O, S, $S=O$ und $S(=O)_2$ bestehenden Gruppe ausgewählt ist;

dadurch gekennzeichnet, dass

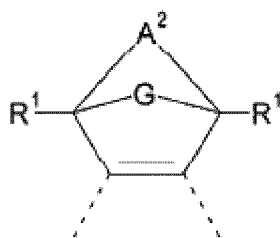
R^S eine sterisch anspruchsvolle Gruppe ist, wobei zwei Gruppen CR^S zusammen einen fünf-, sechs- oder siebengliedrigen Ring einer der folgenden Formeln (II-A) bis (II-G)



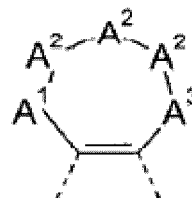
(II-A)



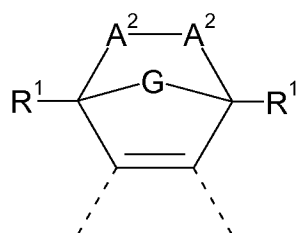
(II-B)



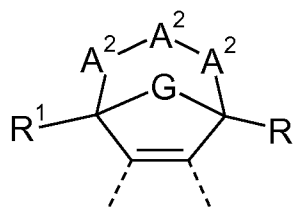
(II-C)



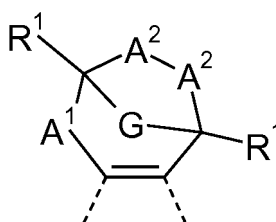
(II-D)



(II-E)



(II-F)



(II-G)

bilden, wobei

die gestrichelten Linien in Formeln (II-A) bis (II-G) die entsprechenden Bindungspositionen zur sechsgliedrigen Ringstruktur der Formel (I) angeben, wo die gestrichelten Linien die Bindungen der sechsgliedrigen Ringstruktur der Formel (I) darstellen;

G aus der Gruppe bestehend aus substituiertem oder unsubstituiertem Alkandiyl mit 1, 2 oder 3 C-Atomen, -CR²=CR²- oder einer substituierten oder unsubstituierten ortho-verknüpften Arylenoder Heteroarylengruppe mit 5 bis 14 aromatischen Ring-atomen, die mit einer oder mehreren der Gruppen R² substituiert sein kann, ausgewählt ist;

A¹ und A³ bei jedem Auftreten unabhängig aus der aus C(R³)₂, O, S, NR³ und C(=O) bestehenden Gruppe ausgewählt sind;

A² bei jedem Auftreten unabhängig aus der aus C(R¹)₂, O, S, NR³ und C(=O) bestehenden Gruppe ausgewählt ist, und, wenn zwei Gruppen A² einander benachbart sind, A²-A² auch aus der Gruppe bestehend aus ortho-verknüpfter Arylen- oder Heteroarylengruppe mit 5 bis 14 aromatischen Ringatomen ausgewählt sein kann, die jeweils unabhängig voneinander mit R² substituiert sein kann;

R¹ bei jedem Auftreten unabhängig aus der Gruppe bestehend aus H, D, F, Cl, Br, I, B(OR²)₂, CHO, C(=O)R², CR²=C(R²)₂, CN, C(=O)OR², C(=O)N(R²)₂, Si(R²)₃, N(R²)₂, NO₂, P(=O)(R²)₂, OSO₂R², OR², S(=O)R², S(=O)₂R², OH, SH, linearer Alkyl-, Alkoxy- oder Thioalkylgruppe mit 1 bis 20 C-Atomen oder einer verzweigten oder cyclischen Alkyl-, Alkoxy- oder Thioalkylgruppe mit 3 bis 20 C-Atomen oder einer Alkenyl- oder Alkynylgruppe mit 2 bis 20 C-Atomen, wobei diese Gruppen mit einer oder mehreren der Gruppen R² substituiert sein können und wobei eine oder mehrere CH₂-Gruppen in diesen Gruppen durch -R²C=CR²-, -C≡C-, Si(R²)₂, C=O, C=S, C=NR², -C(=O)O-, -C(=O)NR²-, NR², P(=O)(R²), -O-, -S-, SO oder SO₂ ersetzt sein können und wobei ein oder mehrere H-Atome in diesen Gruppen durch D, F, Cl, Br, I, CN oder NO₂ ersetzt sein können, oder einem aromatischen oder heteroaromatischen Ringsystem mit 5 bis 60 aromatischen Ring-atomen, das mit einer oder mehreren Gruppen R² substituiert sein kann, oder einer Aryloxy- oder Heteroaryloxygruppe mit 5 bis 60 aromatischen Ringatomen, die mit einer oder mehreren Gruppen R² substituiert sein kann, oder einer Aralkyl- oder Heteroaralkylgruppe mit 5 bis 60 aromatischen Ringatomen, die mit einer oder mehreren Gruppen R² substituiert sein kann, wobei zwei oder mehr Gruppen R² miteinander verknüpft sein und einen aliphatischen oder aromatischen oder heteroaromatischen Ring bilden können, ausgewählt ist;

R² bei jedem Auftreten unabhängig aus der Gruppe bestehend aus H, D, F, Alkyl mit 1 bis 20 C-Atomen, aromatischen Gruppen mit 1 bis 20 aromatischen Kohlenstoffatomen und heteroaromatischen Gruppen mit 1 bis 20 aromatischen Ringatomen ausgewählt ist, wobei die aromatischen Gruppen und die heteroaromatischen Gruppen mit einem Alkyl mit 1 bis 20 Kohlenstoffatomen substituiert sein können; und

R³ bei jedem Auftreten unabhängig aus der Gruppe bestehend aus F, linearer Alkyl- oder Alkoxygruppe mit 1 bis 20 C-Atomen, einer verzweigten oder cyclischen Alkyl- oder Alkoxygruppe mit 3 bis 20 C-Atomen, die jeweils mit einer oder mehreren der Gruppen R² substituiert sein kann, wobei eine oder mehrere nicht benachbarte

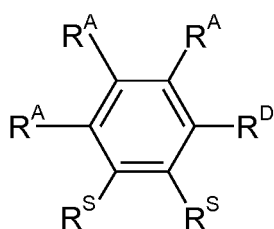
CH₂-Gruppen durch R²C=CR², C≡C, Si(R²)₂, C=O, NR², O, S oder CONR² ersetzt sein können und wobei ein oder mehrere H-Atome mit D oder F ersetzt sein können, oder einem aromatischen oder heteroaromatischen Ringsystem mit 5 bis 24 aromatischen Ringatomen, das jeweils mit einer oder mehreren der Gruppen R² substituiert sein kann, oder einer Aryloxy- oder Heteroaryloxygruppe mit 5 bis 24 aromatischen Ringatomen, die mit einer oder mehreren Gruppen R² substituiert sein kann, oder einer Aralkyl- oder Heteroaralkylgruppe mit 5 bis 24 aromatischen Ringatomen, die mit einer oder mehreren Gruppen R² substituiert sein kann, wobei zwei an dasselbe Kohlenstoffatom gebundene R² ein aliphatisches oder aromatisches Ringsystem und somit ein Spirosystem bilden können, ausgewählt ist; oder R³ zusammen mit einer benachbarten Gruppe R¹ oder R² ein aliphatisches Ringsystem bilden kann,

vorausgesetzt, dass in A¹-A²-A³ keine zwei Heteroatome benachbart sind.

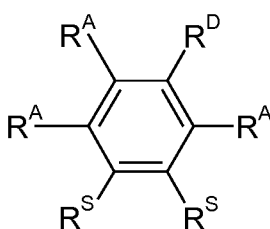
und mit der Maßgabe, dass die Verbindung der allgemeinen Formel (I) mindestens eine Gruppe CR^A und mindestens eine Gruppe CR^D enthält.

13. Verbindung nach Anspruch 12, wobei Q¹ und Q² unabhängig voneinander aus der aus N, CR^A und CR^D bestehenden Gruppe ausgewählt sind.

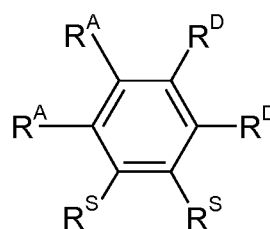
14. Verbindung nach Anspruch 12 oder Anspruch 13, wobei die Verbindung der Formel (I) aus der Gruppe bestehend aus Formeln (I-a) bis (I-h)



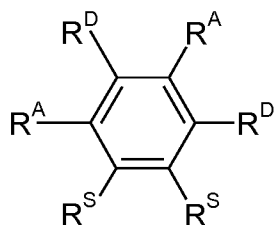
(I-a)



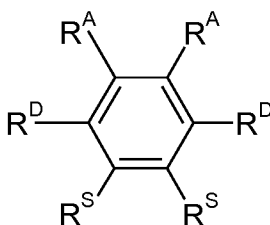
(I-b)



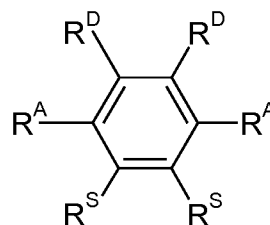
(I-c)



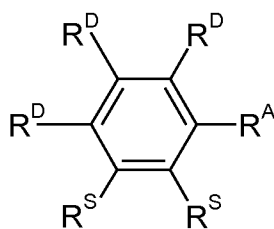
(I-d)



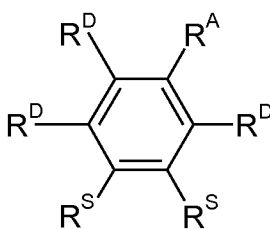
(I-e)



(I-f)



(I-g)



(I-h)

ausgewählt ist, wobei R^A, R^D und R^S wie in Anspruch 1 definiert sind.

15. Verbindung nach Anspruch 14, wobei die Verbindung die Formel (I-e) aufweist.

16. Verbindung nach Anspruch 15, wobei zwei Gruppen CR^S zusammen einen fünf- oder sechsgliedrigen Ring der Formel (II-A), (II-B), (II-D) oder (II-E) bilden.

17. Verbindung nach einem oder mehreren der Ansprüche 12-16, wobei R^D bei jedem Auftreten unabhängig voneinander aus der Gruppe bestehend aus Gruppen der allgemeinen Formel (N-b)



ausgewählt ist, wobei

Ar^1 und m wie in Anspruch 6 definiert sind; und

NAr^2_2 aus der Gruppe bestehend aus aromatischen Aminen, heteroaromatischen Aminen, Carbazolen, Azacarbazolen, anellierten Carbazolen, anellierten Azacarbazolen, 5,10-Dihydro-phenazaboranen, 9,10-Dihydroacridinen, 9,10-Dihydro-10-sila-acridinen, 9,10-Dihydro-phenazin, 10-Hydro-phenoxazin und 10-Hydrophentiazin ausgewählt ist, die alle substituiert oder unsubstituiert sein können.

18. Verbindung nach einem oder mehreren der Ansprüche 12-17, die mindestens zwei gleiche Gruppen R^D enthält.

19. Verbindung nach einem oder mehreren der Ansprüche 12-18, wobei R^A bei jedem Auftreten unabhängig voneinander aus der Gruppe bestehend aus Fluoralkyl, F, BR^1_2 , $B(OR^1)_2$, CHO, $C(=O)R^1$, CN, $C(=O)OR^1$, $C(=O)N(R^1)_2$, $CR^1=C(CN)_2$, N_3 , NO_2 , $P(=O)(R^1)_2$, $S(=O)R^1$, $S(=O)_2R^1$, Heteroaryl, mit einer oder mehreren elektronenziehenden Gruppen substituiertes Heteroaryl und mit einer oder mehreren elektronenziehenden Gruppen substituiertes Aryl ausgewählt ist, wobei die elektronenziehenden Gruppen aus der Gruppe bestehend aus Fluoralkyl, F, $B(OR^1)_2$, CHO, $C(=O)R^1$, CN, $C(=O)OR^1$, $C(=O)N(R^1)_2$, NO_2 , $P(=O)(R^1)_2$, $S(=O)R^1$ und $S(=O)_2R^1$ ausgewählt sind, wo R^1 wie in Anspruch 1 definiert ist.

20. Verbindung nach einem oder mehreren der Ansprüche 12-19, die mindestens zwei gleiche R^A enthält.

21. Formulierung enthaltend ein Lösungsmittel und eine Verbindung nach einem oder mehreren der Ansprüche 12 bis 20.

22. Elektronische Vorrichtung ausgewählt aus der Gruppe bestehend aus organischen integrierten Schaltungen (OICs), organischen Feldeffekttransistoren (OFETs), organischen Dünnschichttransistoren (OTFTs), organischen lichtemittierenden Transistoren (OLETs), organischen photovoltaischen Zellen, organischen optischen Detektoren, organischen Photorezeptoren, organischen Feld-Quench-Devices (OFQDs), organischen lichtemittierenden elektrochemischen Zellen (OLECS), organischen Laserdioden (O-Laser) und organischen Elektrolumineszenzvorrichtungen (OLEDs), **dadurch gekennzeichnet, dass** die elektronische Vorrichtung eine Verbindung eines oder mehrerer beliebigen/r der Ansprüche 12 bis 20 enthält.

23. Elektronische Vorrichtung nach Anspruch 22, wobei es sich bei der elektronischen Vorrichtung um eine organische Elektrolumineszenzvorrichtung handelt, **dadurch gekennzeichnet, dass** sie eine Anode, eine Kathode und mindestens eine organische Schicht enthält, wo die organische Schicht eine Verbindung eines oder mehrerer beliebigen/r der Ansprüche 12 bis 20 als Matrixmaterial in einer emittierenden Schicht in Kombination mit einem oder mehreren Dotierstoffen oder als Elektronentransportmaterial in einer Elektronentransportschicht, einer Elektroneninjektionsschicht oder einer lockblockierenden Schicht enthält.

24. Verwendung einer Verbindung eines oder mehrerer beliebigen/r der Ansprüche 12 bis 20 in einer elektronischen Vorrichtung.

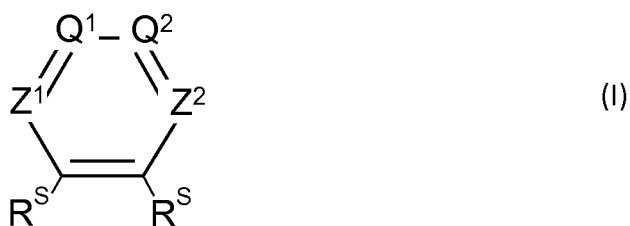
25. Verfahren zur Herstellung der elektronischen Vorrichtung des Anspruchs 22 oder Anspruchs 23, umfassend die Schritte

(a) Bereitstellen einer Verbindung eines oder mehrerer der Ansprüche 12 bis 20; und

(b) Abscheiden der Verbindung auf einer Trägerschicht.

Revendications

1. Dispositif électronique comprenant un composé de la formule générale (I) :



dans laquelle :

Q^1 et Q^2 sont, de manière indépendante l'un de l'autre, sélectionnés parmi le groupe qui est constitué par N, CR^A , CR^D et CR^S ;

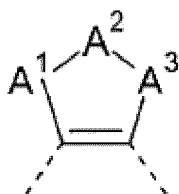
Z^1 et Z^2 sont, de manière indépendante l'un de l'autre, sélectionnés parmi le groupe qui est constitué par N, CR^A et CR^D ;

R^A est un groupe avec effet -M ;

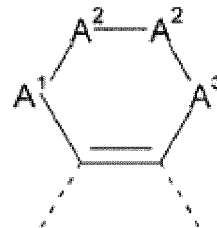
R^D est un groupe avec effet +M ;

caractérisé en ce que :

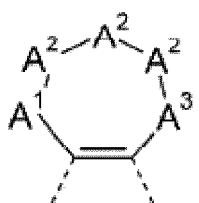
R^S est un groupe stériquement exigeant, dans lequel deux groupes CR^S forment en association un cycle à cinq, six ou sept éléments de l'une des formules (II-A) à (II-G) qui suivent :



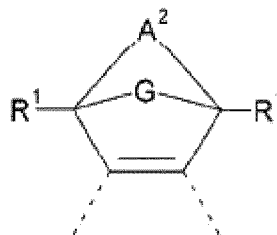
(II-A)



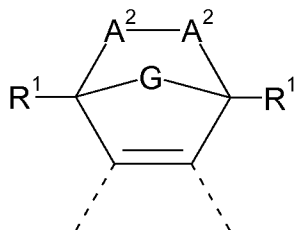
(II-B)



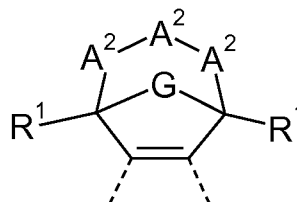
(II-C)



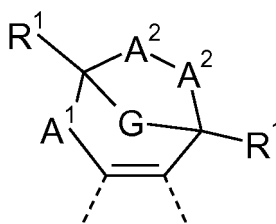
(II-D)



(II-E)



(II-F)



(II-G)

dans lesquelles :

les lignes en pointillés au niveau des formules (II-A) à (II-G) indiquent les positions de liaison correspondantes sur la structure de cycle à six éléments de la formule (I), les lignes en pointillés représentant les liaisons de la structure de cycle à six éléments de la formule (I) ;

G est sélectionné parmi le groupe qui est constitué par alkanediyle substitué ou non substitué qui comporte 1, 2 ou 3 atome(s) de C, $-CR^2=CR^2-$ ou un groupe arylène ou hétéroarylène ortho-lié substitué ou non substitué qui comporte de 5 à 14 atomes de cycle aromatique, lequel peut être substitué par un ou plusieurs groupe(s) R^2 ; A^1 et A^3 sont pour chaque occurrence, de manière indépendante, sélectionnés parmi le groupe qui est constitué par $C(R^3)_2$, O, S, NR^3 et $C(=O)$;

A^2 est pour chaque occurrence, de manière indépendante, sélectionné parmi le groupe qui est constitué par $C(R^1)_2$, O, S, NR^3 et $C(=O)$, et dans le cas où deux groupes A^2 sont adjacents l'un à l'autre, A^2-A^2 peut également être sélectionné parmi le groupe qui est constitué par le groupe arylène ou hétéroarylène ortholié qui comporte de 5 à 14 atomes de cycle aromatique, dont chacun peut, de manière mutuellement indépendante, être substitué par R^2 ;

R^1 est pour chaque occurrence, de manière indépendante, sélectionné parmi le groupe qui est constitué par H, D, F, Cl, Br, I, $B(OR^2)_2$, CHO, $C(=O)R^2$, $CR^2=C(R^2)_2$, CN, $C(=O)OR^2$, $C(=O)N(R^2)_2$, $Si(R^2)_3$, $N(R^2)_2$, NO_2 , $P(=O)(R^2)_2$, OSO_2R^2 , OR^2 , $S(=O)R^2$, $S(=O)_2R^2$, OH, SH, un groupe alkyle, alcoxy ou thioalkyle linéaire qui comporte de 1 à 20 atome(s) de C ou un groupe alkyle, alcoxy ou thioalkyle ramifié ou cyclique qui comporte de 3 à 20 atomes de C ou un groupe alkényle ou alkyne qui comporte de 2 à 20 atomes de C, dans lequel ces groupes peuvent être substitués par un ou plusieurs groupe(s) R^2 et dans lequel un ou plusieurs groupe(s) CH_2 dans ces groupes peut/peuvent être remplacé(s) par $-R^2C=CR^2-$, $-C\equiv C-$, $Si(R^2)_2$, $C=O$, $C=S$, $C=NR^2$, $-C(=O)O-$, $-C(=O)NR^2-$, NR^2 , $P(=O)(R^2)$, $-O-$, $-S-$, SO ou SO_2 , et dans lequel un ou plusieurs atome(s) de H dans ces groupes peut/peuvent être remplacé(s) par D, F, Cl, Br, I, CN ou NO_2 , ou un système de cycle aromatique ou hétéroaromatique qui comporte de 5 à 60 atomes de cycle aromatique, lequel peut être substitué par un ou plusieurs groupe(s) R^2 , ou un groupe aryloxy ou hétéroaryloxy qui comporte de 5 à 60 atomes de cycle aromatique, lequel peut être substitué par un ou plusieurs groupe(s) R^2 , ou un groupe aralkyle ou hétéroaralkyle qui comporte de 5 à 60 atomes de cycle aromatique, lequel peut être substitué par un ou plusieurs groupe(s) R^2 , dans lequel deux groupes R^2 ou plus peuvent être liés l'un à l'autre ou les uns aux autres et peuvent former un cycle aliphatique ou aromatique ou hétéroaromatique ;

R^2 est pour chaque occurrence, de manière indépendante, sélectionné parmi le groupe qui est constitué par H, D, F, alkyle qui comporte de 1 à 20 atome(s) de C, les groupes aromatiques qui comportent de 1 à 20 atome(s) de carbone aromatique et les groupes hétéroaromatiques qui comportent de 1 à 20 atome(s) de cycle aromatique, dans lequel les groupes aromatiques et les groupes hétéroaromatiques peuvent être substitués par un alkyle qui comporte de 1 à 20 atome(s) de carbone ; et

R^3 est pour chaque occurrence, de manière indépendante, sélectionné parmi le groupe qui est constitué par F, un groupe alkyle ou alcoxy linéaire qui comporte de 1 à 20 atome(s) de C, un groupe alkyle ou alcoxy ramifié ou cyclique qui comporte de 3 à 20 atomes de C, dont chacun peut être substitué par un ou plusieurs groupe(s) R^2 , dans lequel un ou plusieurs groupe(s) CH_2 non adjacents peut/peuvent être remplacé(s) par $R^2C=CR^2$, $C\equiv C$, $Si(R^2)_2$, $C=O$, NR^2 , O, S ou $CONR^2$, et dans lequel un ou plusieurs atome(s) de H peut/peuvent être remplacé(s) par D ou F, ou un système de cycle aromatique ou hétéroaromatique qui comporte de 5 à 24 atomes de cycle aromatique, dont chacun peut être substitué par un ou plusieurs groupe(s) R^2 , ou un groupe aryloxy ou hétéroaryloxy qui comporte de 5 à 24 atomes de cycle aromatique, lequel peut être substitué par un ou plusieurs groupe(s) R^2 , ou un groupe aralkyle ou hétéroaralkyle qui comporte de 5 à 24 atomes de cycle aromatique, lequel peut être substitué par un ou plusieurs groupe(s) R^2 , dans lequel deux R^2 qui sont liés sur le même atome de carbone peuvent former un système de cycle aliphatique ou aromatique et par conséquent un système spiro ; ou R^3 peut former, en association avec un groupe voisin R^1 ou R^2 , un système de cycle

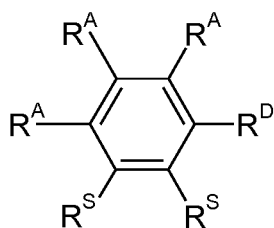
aliphatique ;

étant entendu que dans A¹-A²-A³, deux hétéroatomes ne sont pas adjacents ;

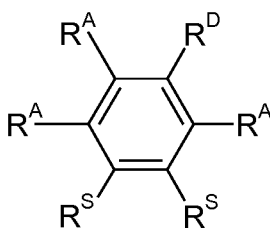
et étant entendu que le composé de la formule générale (I) comprend au moins un groupe CR^A et au moins un groupe CR^D.

2. Dispositif selon la revendication 1, dans lequel Q¹ et Q² sont, de manière indépendante l'un de l'autre, sélectionnés parmi le groupe qui est constitué par N, CR^A et CR^D.

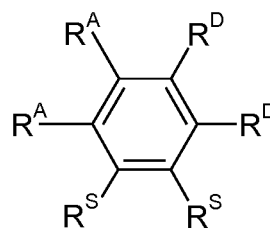
3. Dispositif selon la revendication 1 ou la revendication 2, dans lequel le composé de la formule (I) est sélectionné parmi le groupe qui est constitué par les formules (I-a) à (I-h) :



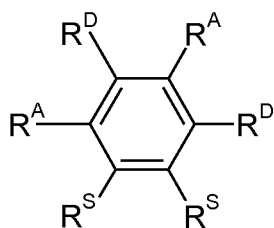
(I-a)



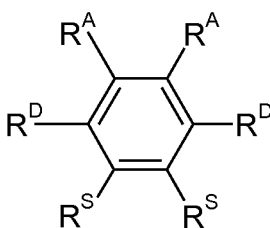
(I-b)



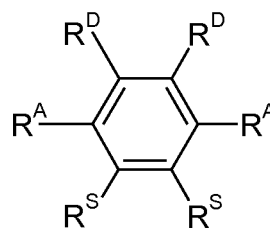
(I-c)



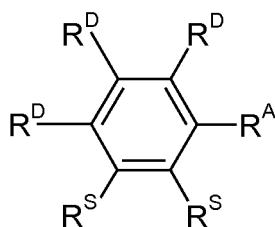
(I-d)



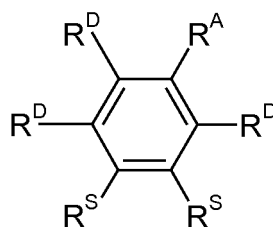
(I-e)



(I-f)



(I-g)



(I-h)

dans lesquelles R^A, R^D et R^S sont tels qu'ils ont été définis selon la revendication 1.

4. Dispositif selon la revendication 3, dans lequel le composé est de la formule (I-e).

5. Dispositif selon la revendication 4, dans lequel deux groupes CR^S forment en association un cycle à cinq ou six éléments de la formule (II-A), (II-B), (II-D) ou (II-E).

6. Dispositif selon l'une quelconque ou plusieurs des revendications qui précèdent, dans lequel, pour chaque occurrence, R^D est sélectionné, de manière mutuellement indépendante, parmi le groupe qui est constitué par les groupes de la formule générale (N-a) :



dans laquelle :

Ar¹ est un système de cycle aromatique ou hétéroaromatique substitué ou non substitué qui comporte de 5 à 30 atomes de cycle aromatique ;
 m est 0 ou 1; et
 R¹ est tel qu'il a été défini selon la revendication 1.

7. Dispositif selon une ou plusieurs des revendications qui précèdent, dans lequel, pour chaque occurrence, R^D est sélectionné parmi le groupe qui est constitué par les composés :



dans lesquels :

Ar¹ et m sont tels qu'ils ont été définis selon la revendication 6 ;
 Ar² est un système de cycle aromatique ou hétéroaromatique substitué ou non substitué qui comporte de 5 à 30 atomes de carbone aromatique, dans lequel les deux groupes Ar² peuvent être liés au moyen d'un groupe Y, de telle sorte qu'en association avec l'atome de N du groupe NAr²₂, indépendamment de quelconques atomes de N qui pourraient être présents dans Ar², un cycle soit formé ;
 Y est sélectionné parmi le groupe qui est constitué par une liaison simple, BR¹, C(R¹)₂, Si(R¹)₂, NR¹, PR¹, P(=O)R¹, P(=S)R¹, O, S, S=O et S(=O)₂; et
 R¹ et R² sont, de manière indépendante l'un de l'autre, tels qu'ils ont été définis selon la revendication 1.

8. Dispositif selon une ou plusieurs des revendications qui précèdent, dans lequel, pour chaque occurrence, R^D est de manière mutuellement indépendante sélectionné parmi le groupe qui est constitué par les groupes de la formule générale (N-b) :



dans laquelle :

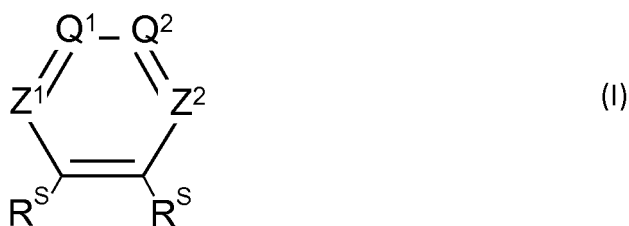
Ar¹ et m sont tels qu'ils ont été définis selon la revendication 6 ; et
 NAr²₂ est sélectionné parmi le groupe qui est constitué par les amines aromatiques, les amines hétéroaromatiques, les carbazoles, les azacarbazoles, les carbazoles soumis à recuit, les azacarbazoles soumis à recuit, les 5,10-dihydro-phénazaboranes, les 9,10-dihydroacridines, les 9,10-dihydro-10-sila-acridines, les 9,10-dihydro-phnéazine, le 10-hydro-phénoxazine, et le 10-hydrophentiazine, dont tous peuvent être substitués ou non substitués.

9. Dispositif selon une ou plusieurs des revendications qui précèdent, ledit composé comprenant au moins deux groupes identiques R^D.

10. Dispositif selon l'une quelconque ou plusieurs des revendications qui précèdent, dans lequel, pour chaque occurrence, R^A est, de manière mutuellement indépendante, sélectionné parmi le groupe qui est constitué par fluoroalkyle, F, BR¹₂, B(OR¹)₂, CHO, C(=O)R¹, CN, C(=O)OR¹, C(=O)N(R¹)₂, CR¹=C(CN)₂, N₃, NO₂, P(=O)(R¹)₂, S(=O)R¹, S(=O)₂R¹, hétéroaryle, hétéroaryle qui est substitué par un ou plusieurs groupe(s) attracteur(s) d'électrons et aryle qui est substitué par un ou plusieurs groupe(s) attracteur(s) d'électrons, dans lequel les groupes attracteurs d'électrons sont sélectionnés parmi le groupe qui est constitué par fluoroalkyle, F, B(OR¹)₂, CHO, C(=O)R¹, CN, C(=O)OR¹, C(=O)N(R¹)₂, NO₂, P(=O)(R¹)₂, S(=O)R¹, et S(=O)₂R¹, R¹ étant tel qu'il a été défini selon la revendication 1.

11. Dispositif selon l'une quelconque ou plusieurs des revendications qui précèdent, ledit composé comprenant au moins deux groupes identiques R^A.

12. Composé de la formule générale (I) :



dans laquelle :

Q^1 et Q^2 sont, de manière indépendante l'un de l'autre, sélectionnés parmi le groupe qui est constitué par N, CR^A , CR^D , et CR^S ;

Z^1 et Z^2 sont, de manière indépendante l'un de l'autre, sélectionnés parmi le groupe qui est constitué par N, CR^A et CR^D ;

R^A est un groupe avec effet -M ;

R^D est un groupe avec effet +M qui est sélectionné parmi le groupe qui est constitué par les composés :



dans lesquels :

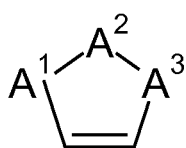
Ar^1 et m sont tels qu'ils ont été définis selon la revendication 6 ;

Ar^2 est un système de cycle aromatique ou hétéroaromatique substitué ou non substitué qui comporte de 5 à 30 atomes de carbone aromatique, dans lequel les deux groupes Ar^2 peuvent être liés par un groupe Y, de telle sorte qu'en association avec l'atome de N du groupe NAr^2_2 , indépendamment de quelconques atomes de N qui pourraient être présents dans Ar^2 , un cycle soit formé ;

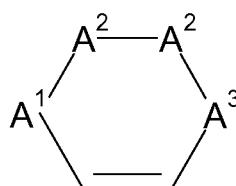
Y est sélectionné parmi le groupe qui est constitué par une liaison simple, BR^1 , $C(R^1)_2$, $Si(R^1)_2$, NR^1 , PR^1 , $P(=O)R^1$, $P(=S)R^1$, O, S, S=O et $S(=O)_2$;

caractérisé en ce que :

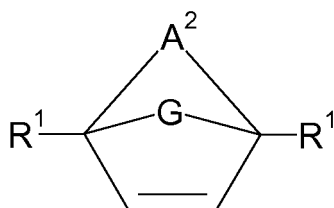
R^S est un groupe stériquement exigeant, dans lequel deux groupes CR^S forment en association un cycle à cinq, six ou sept éléments de l'une des formules (II-A) à (II-G) qui suivent :



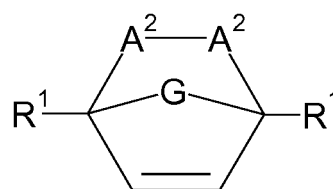
(II-A)



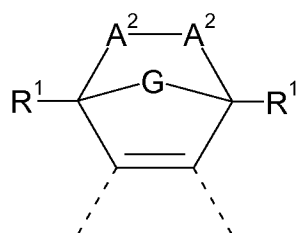
(II-B)



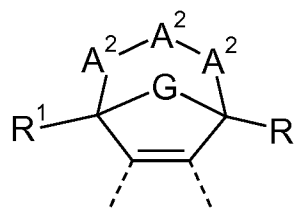
(II-C)



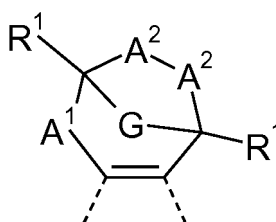
(II-D)



(II-E)



(II-F)



(II-G)

dans lesquelles :

les lignes en pointillés au niveau des formules (II-A) à (II-G) indiquent les positions de liaison correspondantes sur la structure de cycle à six éléments de la formule (I), les lignes en pointillés représentant les liaisons de la structure de cycle à six éléments de la formule (I) ;

G est sélectionné parmi le groupe qui est constitué par alkanediyle substitué ou non substitué qui comporte 1, 2 ou 3 atome(s) de C, $-\text{CR}^2=\text{CR}^2-$ ou un groupe arylène ou hétéroarylène ortho-lié substitué ou non substitué qui comporte de 5 à 14 atomes de cycle aromatique, lequel peut être substitué par un ou plusieurs groupe(s) R^2 ; A^1 et A^3 sont pour chaque occurrence, de manière indépendante, sélectionnés parmi le groupe qui est constitué par $\text{C}(\text{R}^3)_2$, O, S, NR^3 et $\text{C}(=\text{O})$;

A^2 est pour chaque occurrence, de manière indépendante, sélectionné parmi le groupe qui est constitué par $\text{C}(\text{R}^1)_2$, O, S, NR^3 et $\text{C}(=\text{O})$, et dans le cas où deux groupes A^2 sont adjacents l'un à l'autre, A^2-A^2 peut également être sélectionné parmi le groupe qui est constitué par le groupe arylène ou hétéroarylène ortho-lié qui comporte de 5 à 14 atomes de cycle aromatique, dont chacun peut, de manière mutuellement indépendante, être substitué par R^2 ;

R^1 est pour chaque occurrence, de manière indépendante, sélectionné parmi le groupe qui est constitué par H, D, F, Cl, Br, I, $\text{B}(\text{OR}^2)_2$, CHO , $\text{C}(=\text{O})\text{R}^2$, $\text{CR}^2=\text{C}(\text{R}^2)_2$, CN, $\text{C}(=\text{O})\text{OR}^2$, $\text{C}(=\text{O})\text{N}(\text{R}^2)_2$, $\text{Si}(\text{R}^2)_3$, $\text{N}(\text{R}^2)_2$, NO_2 , $\text{P}(=\text{O})(\text{R}^2)_2$, OSO_2R^2 , OR^2 , $\text{S}(=\text{O})\text{R}^2$, $\text{S}(=\text{O})_2\text{R}^2$, OH, SH, un groupe alkyle, alcoxy ou thioalkyle linéaire qui comporte de 1 à 20 atome(s) de C ou un groupe alkyle, alcoxy ou thioalkyle ramifié ou cyclique qui comporte de 3 à 20 atomes de C ou un groupe alkényle ou alkyne qui comporte de 2 à 20 atomes de C, dans lequel ces groupes peuvent être substitués par un ou plusieurs groupe(s) R^2 et dans lequel un ou plusieurs groupe(s) CH_2 dans ces groupes peut/peuvent être remplacé(s) par $-\text{R}^2\text{C}=\text{CR}^2-$, $-\text{C}\equiv\text{C}-$, $\text{Si}(\text{R}^2)_2$, $\text{C}=\text{O}$, $\text{C}=\text{S}$, $\text{C}=\text{NR}^2$, $-\text{C}(=\text{O})\text{O}-$, $-\text{C}(=\text{O})\text{NR}^2-$, NR^2 , $\text{P}(=\text{O})(\text{R}^2)$, $-\text{O}-$, $-\text{S}-$, SO ou SO_2 , et dans lequel un ou plusieurs atome(s) de H dans ces groupes peut/peuvent être remplacé(s) par D, F, Cl, Br, I, CN ou NO_2 , ou un système de cycle aromatique ou hétéroaromatique qui comporte de 5 à 60 atomes de cycle aromatique, lequel peut être substitué par un ou plusieurs groupe(s) R^2 , ou un groupe aryloxy ou hétéroaryloxy qui comporte de 5 à 60 atomes de cycle aromatique, lequel peut être substitué par un ou plusieurs groupe(s) R^2 , ou un groupe aralkyle ou hétéroaralkyle qui comporte de 5 à 60 atomes de cycle aromatique, lequel peut être substitué par un ou plusieurs groupe(s) R^2 , dans lequel deux groupes R^2 ou plus peuvent être liés l'un à l'autre ou les uns aux autres et peuvent former un cycle aliphatique ou aromatique ou hétéroaromatique ;

R^2 est pour chaque occurrence, de manière indépendante, sélectionné parmi le groupe qui est constitué par H, D, F, alkyle qui comporte de 1 à 20 atome(s) de C, les groupes aromatiques qui comportent de 1 à 20 atome(s) de carbone aromatique et les groupes hétéroaromatiques qui comportent de 1 à 20 atome(s) de cycle aromatique, dans lequel les groupes aromatiques et les groupes hétéroaromatiques peuvent être substitués par un alkyle qui comporte de 1 à 20 atome(s) de carbone ; et

R^3 est pour chaque occurrence, de manière indépendante, sélectionné parmi le groupe qui est constitué par

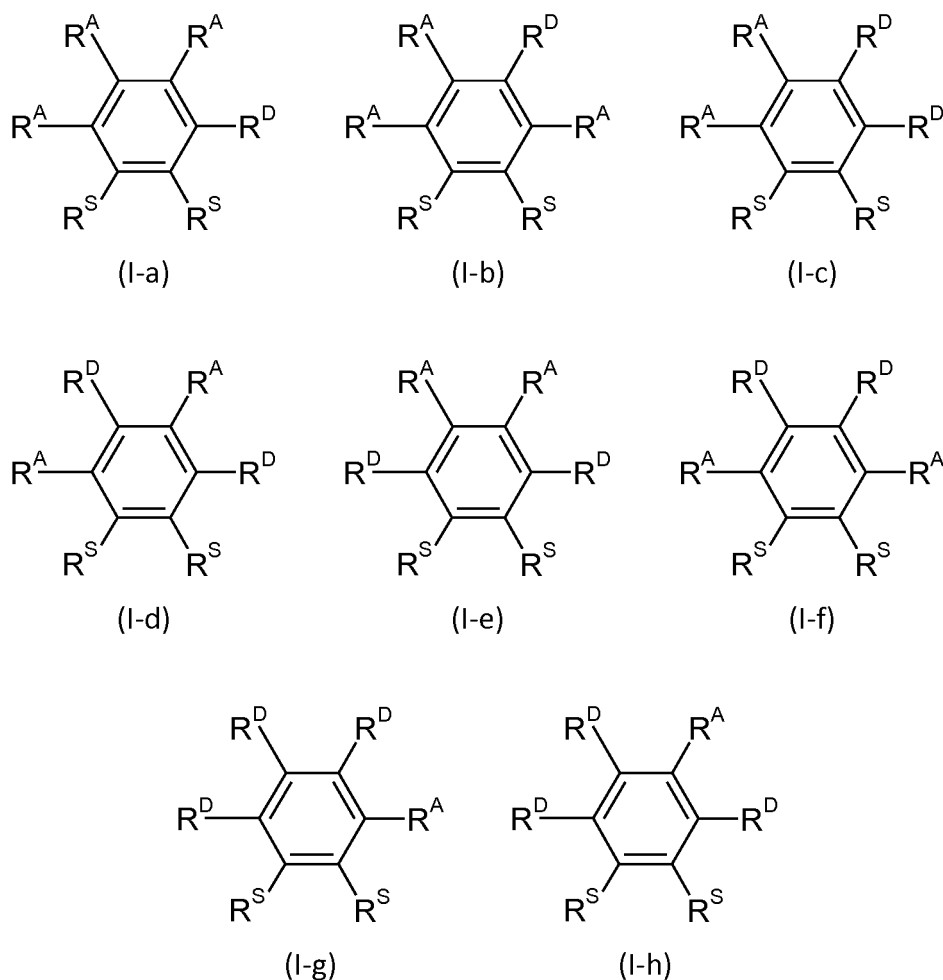
F, un groupe alkyle ou alcoxy linéaire qui comporte de 1 à 20 atome(s) de C, un groupe alkyle ou alcoxy ramifié ou cyclique qui comporte de 3 à 20 atomes de C, dont chacun peut être substitué par un ou plusieurs groupe(s) R^2 , dans lequel un ou plusieurs groupe(s) CH_2 non adjacents peut/peuvent être remplacé(s) par $R^2C=CR^2$, $C\equiv C$, $Si(R^2)_2$, $C=O$, NR^2 , O, S ou $CONR^2$, et dans lequel un ou plusieurs atome(s) de H peut/peuvent être remplacé(s) par D ou F, ou un système de cycle aromatique ou hétéroaromatique qui comporte de 5 à 24 atomes de cycle aromatique, dont chacun peut être substitué par un ou plusieurs groupe(s) R^2 , ou un groupe aryloxy ou hétéroaryloxy qui comporte de 5 à 24 atomes de cycle aromatique, lequel peut être substitué par un ou plusieurs groupe(s) R^2 , ou un groupe aralkyle ou hétéroaralkyle qui comporte de 5 à 24 atomes de cycle aromatique, lequel peut être substitué par un ou plusieurs groupe(s) R^2 , dans lequel deux R^2 qui sont liés sur le même atome de carbone peuvent former un système de cycle aliphatique ou aromatique et par conséquent un système spiro ; ou R^3 peut former, en association avec un groupe voisin R^1 ou R^2 , un système de cycle aliphatique ;

étant entendu que dans $A^1-A^2-A^3$, deux hétéroatomes ne sont pas adjacents ;

et étant entendu que le composé de la formule générale (I) comprend au moins un groupe CR^A et au moins un groupe CR^D .

13. Composé selon la revendication 12, dans lequel Q^1 et Q^2 sont, de manière indépendante l'un de l'autre, sélectionnés parmi le groupe qui est constitué par N, CR^A et CR^D .

14. Composé selon la revendication 12 ou la revendication 13, dans lequel le composé de la formule (I) est sélectionné parmi le groupe qui est constitué par les formules (I-a) à (I-h) :



dans lesquelles R^A , R^D et R^S sont tels qu'ils ont été définis selon la revendication 1.

15. Composé selon la revendication 14, dans lequel le composé est de la formule (I-e).
16. Composé selon la revendication 15, dans lequel deux groupes CR^S forment en association un cycle à cinq ou six éléments de la formule (II-A), (II-B), (II-D) ou (II-E).

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17. Composé selon une ou plusieurs des revendications 12 à 16, dans lequel, pour chaque occurrence, R^D est de manière mutuellement indépendante sélectionné parmi le groupe qui est constitué par les groupes de la formule générale (N-b) :

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dans laquelle :

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Ar¹ et m sont tels qu'ils ont été définis selon la revendication 6 ; et

NAr²₂ est sélectionné parmi le groupe qui est constitué par les amines aromatiques, les amines hétéroaromatiques, les carbazoles, les azacarbazoles, les carbazoles soumis à recuit, les azacarbazoles soumis à recuit, les 5,10-dihydro-phénazaboranes, les 9,10-dihydroacridines, les 9,10-dihydro-10-sila-acridines, les 9,10-dihydro-phnéazine, le 10-hydro-phénoxazine, et le 10-hydro-phéntiazine, dont tous peuvent être substitués ou non substitués.

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18. Composé selon une ou plusieurs des revendications 12 à 17, ledit composé comprenant au moins deux groupes identiques R^D.

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19. Composé selon une ou plusieurs des revendications 12 à 18, dans lequel, pour chaque occurrence, R^A est, de manière mutuellement indépendante, sélectionné parmi le groupe qui est constitué par fluoroalkyle, F, BR¹₂, B(OR¹)₂, CHO, C(=O)R¹, CN, C(=O)OR¹, C(=O)N(R¹)₂, CR¹=C(CN)₂, N₃, NO₂, P(=O)(R¹)₂, S(=O)R¹, S(=O)₂R¹, hétéroaryle, hétéroaryle qui est substitué par un ou plusieurs groupe(s) attracteur(s) d'électrons et aryle qui est substitué par un ou plusieurs groupe(s) attracteur(s) d'électrons, dans lequel les groupes attracteurs d'électrons sont sélectionnés parmi le groupe qui est constitué par fluoroalkyle, F, B(OR¹)₂, CHO, C(=O)R¹, CN, C(=O)OR¹, C(=O)N(R¹)₂, NO₂, P(=O)(R¹)₂, S(=O)R¹, et S(=O)₂R¹, R¹ étant tel qu'il a été défini selon la revendication 1.

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20. Composé selon une ou plusieurs des revendications 12 à 19, ledit composé comprenant au moins deux groupes identiques R^A.

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21. Formulation comprenant un solvant et un composé selon une ou plusieurs des revendications 12 à 20.

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22. Dispositif électronique sélectionné parmi le groupe qui est constitué par les circuits intégrés organiques (OIC), les transistors à effet de champ organiques (OFET), les transistors à film mince organiques (OTFT), les transistors à émission de lumière organiques (OLET), les cellules photovoltaïques organiques, les détecteurs optiques organiques, les photorécepteurs organiques, les dispositifs à extinction de champ organiques (OFQD), les cellules électrochimiques à émission de lumière organiques (OLEC), les diodes laser organiques (O-Laser) et les dispositifs à électroluminescence organiques (OLED), **caractérisé en ce que** le dispositif électronique comprend un composé selon l'une quelconque ou plusieurs des revendications 12 à 20.

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23. Dispositif électronique selon la revendication 22, dans lequel le dispositif électronique est un dispositif électroluminescent organique, **caractérisé en ce qu'il** comprend une anode, une cathode et au moins une couche organique, ladite couche organique comprenant un composé selon l'une quelconque ou plusieurs des revendications 12 à 20 en tant que matériau de matrice dans une couche d'émission en combinaison avec un ou plusieurs dopant(s), ou en tant que matériau de transport d'électrons dans une couche de transport d'électrons, une couche d'injection d'électrons ou une couche de blocage de trous.

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24. Utilisation d'un composé selon l'une quelconque ou plusieurs des revendications 12 à 20 dans un dispositif électronique.

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25. Procédé de fabrication du dispositif électronique selon la revendication 22 ou la revendication 23, ledit procédé comprenant les étapes constituées par :

(a) la fourniture d'un composé selon une ou plusieurs des revendications 12 à 20 ; et

(b) le dépôt dudit composé sur une couche de support.

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专利名称(译)	具有新型六元环结构的化合物，用于有机电子器件		
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摘要(译)

本发明涉及根据式 (I) 的新化合物，其具有被电子给体，电子受体和空间要求基团取代的六元环结构。所述化合物适用于有机电子器件，特别是有机电致发光器件 (OLED)。式 (I) 其中Q1和Q2彼此独立地选自 N，CRA，CRD和CRS; Z1和Z2彼此独立地选自N，CRA和CRD; RA是一组具有-M效应的组; RD是具有+ M效应的组;并且RS是空间要求较高的基团，其中通式 (I) 的化合物包含至少一个基团CRA和至少一个基团CRD。