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(71) Applicant: MERCK PATENT GMBH [DE/DE]; Frankfurter Strasse 250, 64293 Darmstadt (DE).

(72) Inventors: VOGES, Frank; Weidplatz 2, 67098 Bad Duerkheim (DE). **MUJICA-FERNAUD, Teresa**; Heinrichstrasse 119, 64283 Darmstadt (DE). **MONTENEGRO, Elvira**; Horazweg 5, 69469 Weinheim (DE). **ANÉMIAN, Rémi, Manouk**; Copious 2-101, 1st Floor, Hannam-dong, Yongsan-gu, Seoul 657-169 (KR).

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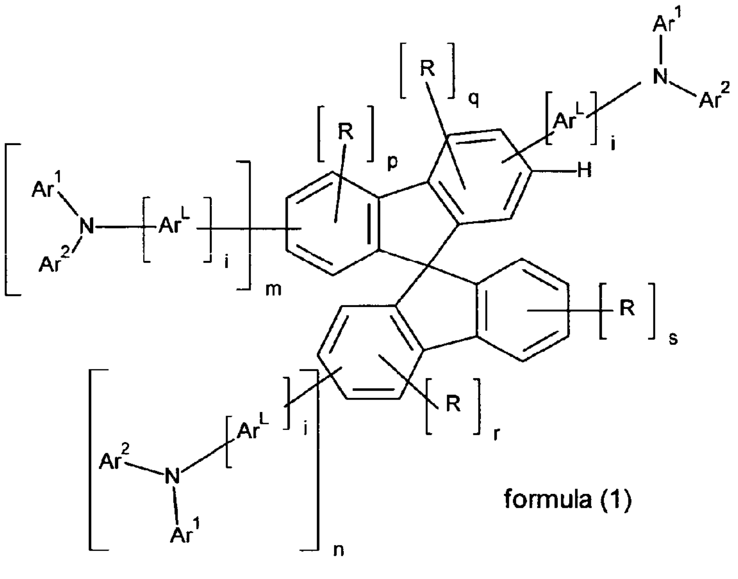

formula (1)

(57) Abstract: The present invention relates to compounds of the formula (1) which are suitable for use in electronic devices, in particular organic electroluminescent devices, and to electronic devices which comprise these compounds.

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Materials for organic electroluminescent devices

The present invention relates to materials for use in electronic devices, in particular in organic electroluminescent devices, and to electronic devices comprising these materials.

The structure of organic electroluminescent devices (OLEDs) in which organic semiconductors are employed as functional materials is described, for example, in US 4,539,507, US 5,151,629, EP 0676461 and WO 98/27136. The emitting materials employed here are increasingly organometallic complexes which exhibit phosphorescence instead of fluorescence (M. A. Baldo *et al.*, *Appl. Phys. Lett.* **1999**, *75*, 4-6).

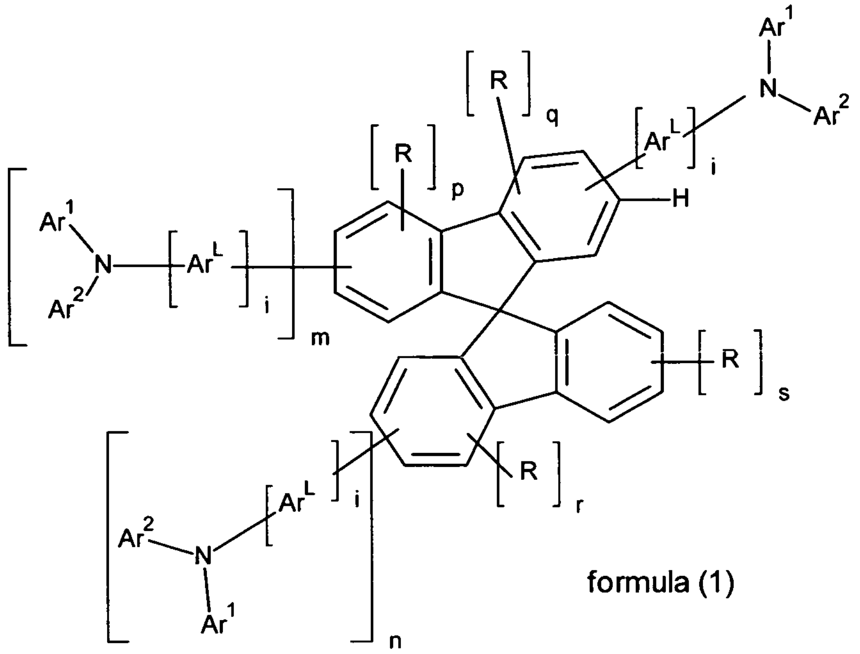
In accordance with the prior art, the hole-transport materials used in the hole-transport layer or in the hole-injection layer are, in particular, triarylamine derivatives which frequently contain at least two triarylamino groups or at least one triarylamino group and at least one carbazole group. These compounds are frequently derived from diarylamino-substituted triphenylamines (TPA type), from diarylamino-substituted biphenyl derivatives (TAD type) or combinations of these base compounds. Furthermore, for example, use is made of spirobifluorene derivatives which are substituted by one to four diarylamino groups (for example in accordance with EP 676461, US 7,714,145, EP2814906). In the case of these compounds, there is still a need for improvement both in the case of fluorescent and in the case of phosphorescent OLEDs, in particular with respect to efficiency, lifetime and operating voltage on use in an organic electroluminescent device.

At the same time, it is important that the compounds processed by vacuum evaporation exhibit a high temperature stability, in order to obtain OLEDs with reproducible properties. The compounds used in OLEDs should also

exhibit a low crystallinity and a high glass transition temperature, in order to obtain OLEDs with a satisfying lifetime.
The object of the present invention is to provide compounds which are suitable for use in a fluorescent or phosphorescent OLED, in particular a phosphorescent OLED, for example as hole-transport material in a hole-transport or exciton-blocking layer or as matrix material in an emitting layer.

It has now been found that certain compounds described below in greater detail achieve this object and result in significant improvements in the organic electroluminescent device, in particular with respect to the lifetime, the efficiency and the operating voltage. This applies to phosphorescent and fluorescent electroluminescent devices, especially on use of the compounds according to the invention as hole-transport material or as matrix material. Furthermore, the compounds described below contain a rigid planar Spiro unit and flexible structure elements in the outer periphery, whereby the flexibility of the molecule center is reduced and the solubility is increased by the substituents, which leads to an easier cleaning and an easier handling of these compounds. Finally, the compounds of the present invention generally have high thermal stability and can therefore be sublimed without decomposition and without a residue. The present invention therefore relates to these compounds and to electronic devices which comprise compounds of this type.

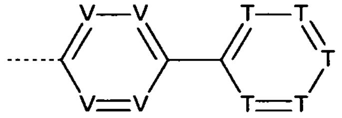
The present invention therefore relates to a compound of the following formula (1):



formula (1)

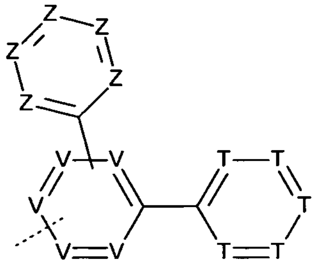
where the following applies to the symbols and indices used:

Ar^1 is a group of formula (Ar1-1),

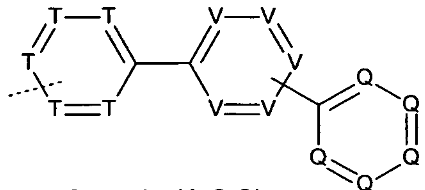


formula (Ar1-1)

Ar^2 is a group of formula (Ar2-1) or (Ar2-2),



formula (Ar2-1)



formula (Ar2-2)

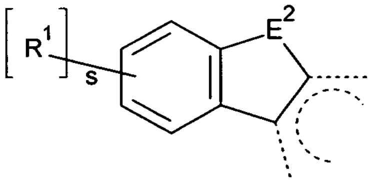
V, Z, T, Q are on each occurrence, identically or differently, N or CR^1, with the proviso that there is a maximum of three N atoms per 6-membered rings;

or V is C and is linked to one adjacent group Z, which is also C, via a bridge E^1;

or V is C and is linked to one adjacent group T, which is also C, via a bridge E^1;

or V is C and is linked to one adjacent group Q, which is also C, via a bridge E^1;

or two adjacent groups V (V-V or V=V), two adjacent groups T (T-T or T=T), two adjacent groups Z (Z-Z or Z=Z) and/or two adjacent groups Q (Q-Q or Q=Q) stand for a group of the formula (E-1),



formula (E-1)

in which the dashed lines indicate respectively the linking to the rest of the 6-membered ring comprising the groups V, the rest of the 6-membered ring comprising the groups T, the rest of the 6-membered ring comprising the groups Z or the rest of the 6-membered ring comprising the groups Q;

E^1, E^2 are identically or differently on each occurrence, a divalent bridge selected from $B(R^0)$, $C(R^0)_2$, $Si(R^0)_2$, C=O, $C=NR^0$, $C=C(R^0)_2$, O, S, S=O, SO_2, $N(R^0)$, $P(R^0)$ and $P(=O)R^0$;

Ar^L is an aromatic or heteroaromatic ring system having 5 to 40 aromatic ring atoms, which may in each case be substituted by one or more radicals R^1;

R, R^0, R^1 are selected on each occurrence, identically or differently, from the group consisting of H, D, F, Cl, Br, I, CHO, CN, $C(=O)Ar^3$, $P(=O)(Ar^3)_2$, $S(=O)Ar^3$, $S(=O)_2Ar^3$, NO_2, $Si(R^2)_3$, $B(OR^2)_2$, OSO_2R^2, a straight-chain alkyl, alkoxy or thioalkyl group having 1 to 40 C atoms or a branched or cyclic alkyl, alkoxy or thioalkyl group having 3 to 40 C atoms, each of which may be substituted by one or more radicals R^2, where in each case one or more non-adjacent CH_2 groups may be replaced by $R^2C=CR^2$, C≡C, $Si(R^2)_2$, $Ge(R^2)_2$, $Sn(R^2)_2$, C=O, C=S, C=Se, $P(=O)(R^2)$, SO, SO_2, O, S or $CONR^2$ and where one or more H atoms may be replaced by D, F, Cl, Br, I, CN or NO_2, an aromatic or heteroaromatic ring system having 5 to 60 aromatic ring atoms, which may in each case be substituted by one or more radicals R^2, an aryloxy group having 5 to 40 aromatic ring atoms, which may be substituted by one or more radicals R^2, where two adjacent substituents R, two adjacent substituents R^0 and/or two adjacent substituents R^1, may optionally form a mono- or polycyclic, aliphatic ring system or aromatic ring system, which may be substituted by one or more radicals R^2;

R^2 is selected on each occurrence, identically or differently, from the group consisting of H, D, F, Cl, Br, I, CHO, CN, $C(=O)Ar^3$, $P(=O)(Ar^3)_2$, $S(=O)Ar^3$, $S(=O)_2Ar^3$, NO_2, $Si(R^3)_3$, $B(OR^3)_2$, OSO_2R^3, a straight-chain alkyl, alkoxy or thioalkyl group having 1 to 40 C atoms or a branched or cyclic alkyl, alkoxy or thioalkyl group having 3 to 40 C atoms, each of which may be substituted by one or more radicals R^3, where in each case one or more non-adjacent CH_2 groups may be replaced by $R^3C=CR^3$, C≡C, $Si(R^3)_2$, $Ge(R^3)_2$, $Sn(R^3)_2$, C=O, C=S, C=Se, $P(=O)(R^3)$, SO, SO_2, O, S or $CONR^3$ and where one or more H atoms may be replaced by D, F, Cl, Br, I, CN or NO_2, an aromatic or heteroaromatic ring system having 5 to 60 aromatic ring atoms, which may in each case be substituted by one or more radicals R^3, an aryloxy group having 5 to 60 aromatic ring atoms, which may be substituted by one or more radicals R^3, where two adjacent substituents R^2 may optionally form a mono- or polycyclic, aliphatic ring system or aromatic ring system, which may be substituted by one or more radicals R^3;

R^3 is selected on each occurrence, identically or differently, from the group consisting of H, D, F, Cl, Br, I, CN, a straight-chain alkyl, alkoxy or thioalkyl group having 1 to 20 C atoms or a branched or cyclic alkyl, alkoxy or thioalkyl group having 3 to 20 C atoms, where in each case one or more non-adjacent CH_2 groups may be replaced by SO, SO_2, O, S and where one or more H atoms may be replaced by D, F, Cl, Br or I, an aromatic or heteroaromatic ring system having 5 to 24 C atoms;

Ar^3 is an aromatic or heteroaromatic ring system having 5 to 24 aromatic ring atoms, more preferably having 5 to 18 aromatic ring atoms, which may in each case also be substituted by one or more radicals R^3;

i is on each occurrence, identically or differently, 0 or 1;

m, n are, identically or differently, 0 or 1;

s, p, r are, identically or differently, 0, 1, 2, 3 or 4; where $r + n \leq 4$ and $p + m \leq 4$;

q is 0, 1 or 2.

For the purposes of the present application, the following definitions of chemical groups apply:

An aryl group in the sense of this invention contains 6 to 60 aromatic ring atoms; a heteroaryl group in the sense of this invention contains 5 to 60 aromatic ring atoms, at least one of which is a heteroatom. The hetero atoms are preferably selected from N, O and S. This represents the basic definition. If other preferences are indicated in the description of the present invention, for example with respect to the number of aromatic ring atoms or the heteroatoms present, these apply.

An aryl group or heteroaryl group here is taken to mean either a simple aromatic ring, i.e. benzene, or a simple heteroaromatic ring, for example pyridine, pyrimidine or thiophene, or a condensed (annellated) aromatic or heteroaromatic polycycle, for example naphthalene, phenanthrene, quino line or carbazole. A condensed (annellated) aromatic or heteroaromatic polycycle in the sense of the present application consists of two or more simple aromatic or heteroaromatic rings condensed with one another.

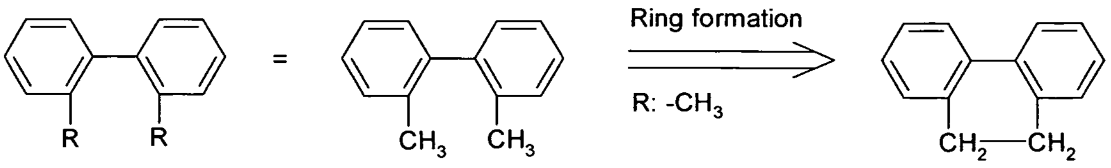
An aryl or heteroaryl group, which may in each case be substituted by the above-mentioned radicals and which may be linked to the aromatic or heteroaromatic ring system via any desired positions, is taken to mean, in particular, groups derived from benzene, naphthalene, anthracene, phenanthrene, pyrene, dihydropyrene, chrysene, perylene, fluoranthene, benzanthracene, benzophenanthrene, tetracene, pentacene, benzopyrene, furan, benzofuran, isobenzofuran, dibenzofuran, thiophene, benzothiophene, isobenzothiophene, dibenzothiophene, pyrrole, indole, isoindole, carbazole, pyridine, quinoline, isoquinoline, acridine, phenanthridine, benzo-5,6-quinoline, benzo-6,7-quinoline, benzo-7,8-quinoline, phenothiazine, phenoxazine, pyrazole, indazole, imidazole, benzimidazole, naphthimidazole, phenanthrimidazole, pyridimidazole, pyrazinimidazole, quinoxalinimidazole, oxazole, benzoxazole, naphthoxazole, anthroxazole, phenanthroxazole, isoxazole, 1,2-thiazole, 1,3-thiazole, benzothiazole, pyridazine, benzopyridazine, pyrimidine, benzopyrimidine, quinoxaline, 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.

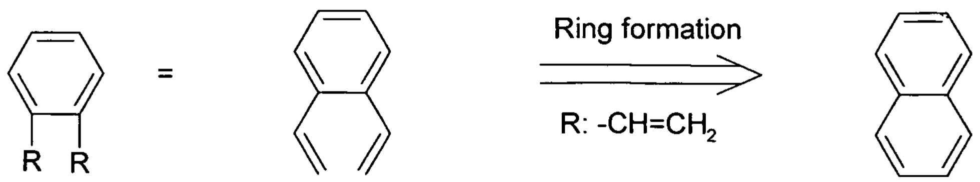
An aryloxy group in accordance with the definition of the present invention is taken to mean an aryl group, as defined above, which is bonded via an oxygen atom. An analogous definition applies to heteroaryloxy groups. An aromatic ring system in the sense of this invention contains 6 to 60 C atoms in the ring system. A heteroaromatic ring system in the sense of this invention contains 5 to 60 aromatic ring atoms, at least one of which is a heteroatom. The heteroatoms are preferably selected from N, O and/or S. An aromatic or heteroaromatic ring system in the sense of this invention is intended to be taken to mean a system which does not necessarily contain only aryl or heteroaryl groups, but instead in which, in addition, a plurality of aryl or heteroaryl groups may be connected by a non-aromatic unit (preferably less than 10% of the atoms other than H), such as, for example, an sp^3-hybridised C, Si, N or O atom, an sp^2-hybridised C or N atom or an sp-hybridised C atom. Thus, for example, systems such as 9,9'-spirobifluorene, 9,9'-diarylfluorene, triarylamine, diaryl ether, stilbene, etc., are also intended to be taken to be aromatic ring systems in the sense of this invention, as are systems in which two or more aryl groups are connected, for example, by a linear or cyclic alkyl, alkenyl or alkynyl group or by a silyl group. Furthermore, systems in which two or more aryl or heteroaryl groups are linked to one another via single bonds are also taken to be aromatic or heteroaromatic ring systems in the sense of this invention, such as, for example, systems such as biphenyl, terphenyl or diphenyltriazine.

An aromatic or heteroaromatic ring system having 5 - 60 aromatic ring atoms, which may in each case also be substituted by radicals as defined above and which may be linked to the aromatic or heteroaromatic group via any desired positions, is taken to mean, in particular, groups derived from benzene, naphthalene, anthracene, benzanthracene, phenanthrene, benzophenanthrene, pyrene, chrysene, perylene, fluoranthene, naphthacene, pentacene, benzopyrene, biphenyl, biphenylene, terphenyl, terphenylene, quaterphenyl, fluorene, spirobifluorene, dihydrophenanthrene, dihydropyrene, tetrahydropyrene, cis- or trans-indenofluorene, truxene, isotruxene, spirotruxene, spiroisotruxene, furan, benzofuran, isobenzofuran, dibenzofuran, thiophene, benzothiophene, isobenzothiophene, dibenzothiophene, pyrrole, indole, isoindole, carbazole, indolocarbazole, indenocarbazole, pyridine, quinoline, isoquinoline, acridine, phenanthridine, benzo-5,6-quinoline, benzo-6,7-quinoline, benzo-7,8-quinoline, phenothiazine, phenoxazine, pyrazole, indazole, imidazole, benzimidazole, naphthimidazole, phenanthrimidazole, pyridimidazole, pyrazinimidazole, quinoxalinimidazole, oxazole, benzoxazole, naphthoxazole, anthroxazole, phenanthroxazole, isoxazole, 1,2-thiazole, 1,3-thiazole, benzothiazole, pyridazine, benzopyridazine, pyrimidine, benzopyrimidine, quinoxaline, 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 and benzothiadiazole, or combinations of these groups.

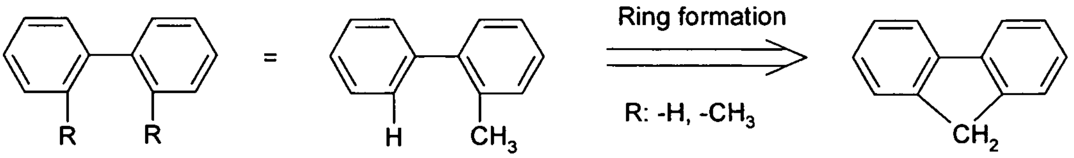
For the purposes of the present invention, a straight-chain alkyl group having 1 to 40 C atoms or a branched or cyclic alkyl group having 3 to 40 C atoms or an alkenyl or alkynyl group having 2 to 40 C atoms, in which, in addition, individual H atoms or CH_2 groups may be substituted by the groups mentioned above under the definition of the radicals, is preferably taken to mean the radicals methyl, ethyl, n-propyl, i-propyl, n-butyl, i-butyl, s-butyl, t-butyl, 2-methylbutyl, n-pentyl, s-pentyl, cyclopentyl, neopentyl, n-hexyl, cyclohexyl, neohexyl, 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, ethynyl, propynyl, butynyl, pentynyl, hexynyl or octynyl. An alkoxy or thioalkyl group having 1 to 40 C atoms is preferably taken to mean 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-trifluoroethylthio, ethenylthio, propenylthio, butenylthio, pentenylthio, cyclopentenylthio, hexenylthio, cyclohexenylthio, heptenylthio, cycloheptenylthio, octenylthio, cyclooctenylthio, ethynylthio, propynylthio, butynylthio, pentynylthio, hexynylthio, heptynylthio or octynylthio.

The formulation that two radicals may form a ring with one another is, for the purposes of the present application, intended to be taken to mean, inter alia, that the two radicals are linked to one another by a chemical bond. This is illustrated by the following schemes:





Furthermore, however, the above-mentioned formulation is also intended to be taken to mean that, in the case where one of the two radicals represents hydrogen, the second radical is bonded at the position to which the hydrogen atom was bonded, with formation of a ring. This is illustrated by the following scheme:

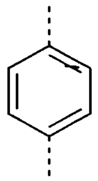


In accordance with a preferred embodiment, m + n = 1. More preferably, m + n = 0.

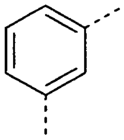
The group Ar^L is, identically or differently on each occurrence, selected from aromatic or heteroaromatic ring systems having 5 to 40, preferably 5 to 30, more preferably 5 to 14 aromatic ring atoms, which may in each case also be substituted by one or more radicals R^1.

More preferably, Ar^L is selected from benzene, biphenyl, fluorene, dibenzofurane, dibenzothiophene, carbazole, which may in each case be substituted by one or more radicals R^1. Very more preferably, Ar^L is selected from benzene, which may be substituted by one or more radicals R^1 but is preferably not substituted.

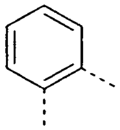
Suitable groups Ar^L are for example the groups of formulae (Ar^L-1) to (Ar^L-37) below:



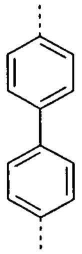
(Ar^L-1)



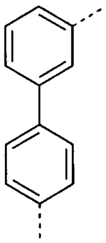
(Ar^L-2)



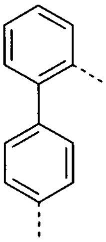
(Ar^L-3)



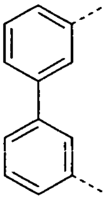
(Ar^L-4)



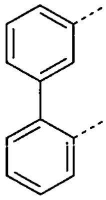
(Ar^L-5)



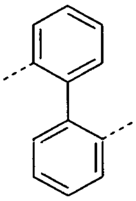
(Ar^L-6)



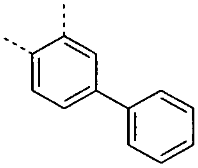
(Ar^L-7)



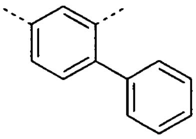
(Ar^L-8)



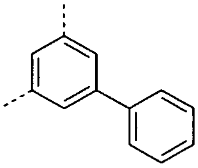
(Ar^L-9)



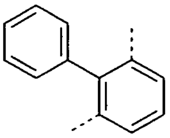
(Ar^L-10)



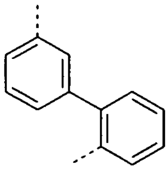
(Ar^L-11)



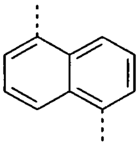
(Ar^L-12)



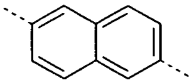
(Ar^L-13)



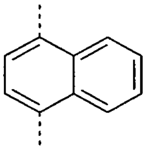
(Ar^L-14)



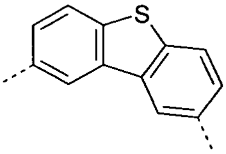
(Ar^L-15)



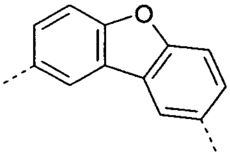
(Ar^L-16)



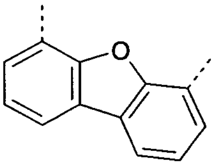
(Ar^L-17)



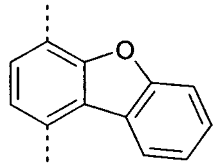
(Ar^L-18)



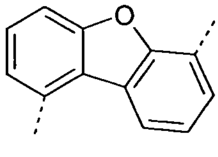
(Ar^L-19)



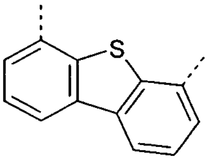
(Ar^L-20)



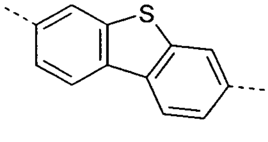
(Ar^L-21)



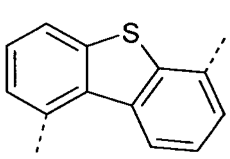
(Ar^L-22)



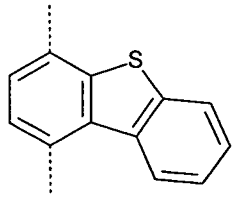
(Ar^L-23)



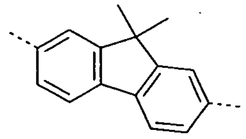
(Ar^L-24)



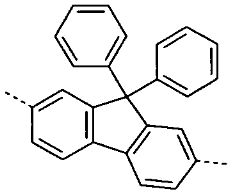
(Ar^{L}-25)



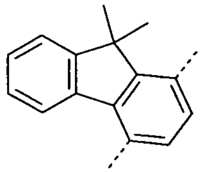
(Ar^{L}-26)



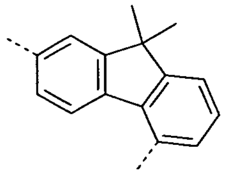
(Ar^{L}-27)



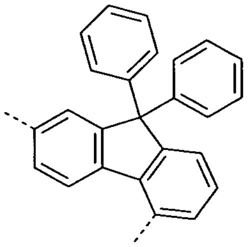
(Ar^{L}-28)



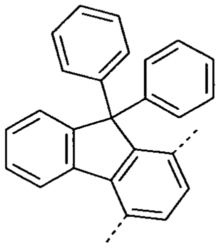
(Ar^{L}-29)



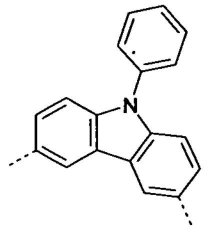
(Ar^{L}-30)



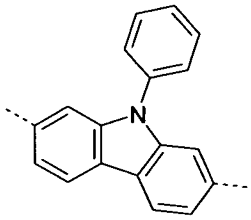
(Ar^{L}-31)



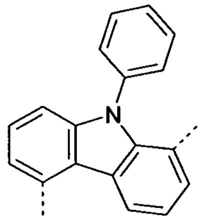
(Ar^{L}-32)



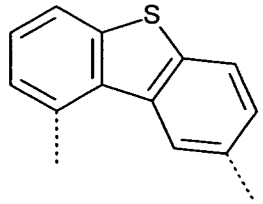
(Ar^{L}-33)



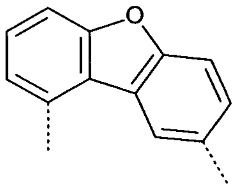
(Ar^{L}-34)



(Ar^{L}-35)



(ArL-36)



(ArL-37)

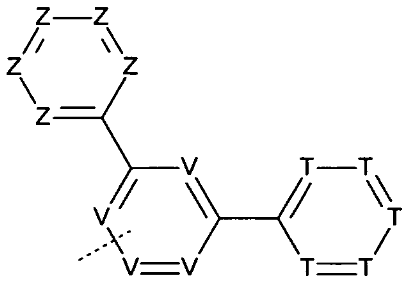
where the dashed bonds indicate the bonds to the spirobifluorene and to the amine, and where the groups (Ar^{L}-1) to (Ar^{L}-37) may be substituted at each free position by a group R^{1} but are preferably unsubstituted.

Among the groups of formulae (ArL-1) to (ArL-37), the groups (Ar^{L}-1) (Ar^{L}-2) and (Ar^{L}-3) are preferred.

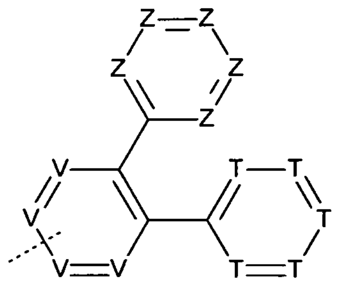
In accordance with a preferred embodiment, the index i is equal to 0 so that the group –NAr^{1}Ar^2 is directly bonded to the spirobifluorene skeleton.

In accordance with a preferred embodiment, Ar^3 is an aryl having 6 to 18 C atoms or an heteroaryl having 5 to 18 aromatic ring atoms, which may in each case also be substituted by one or more radicals R^4.

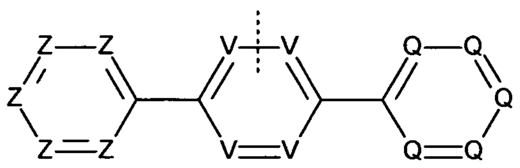
In accordance with a preferred embodiment, the group Ar^2 is selected from the groups of formulae (Ar2-3) to (Ar2-6),



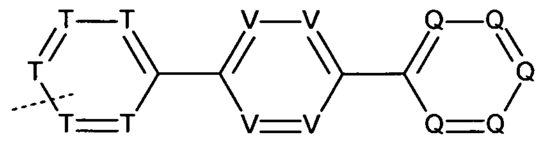
formula (Ar2-3)



formula (Ar2-4)



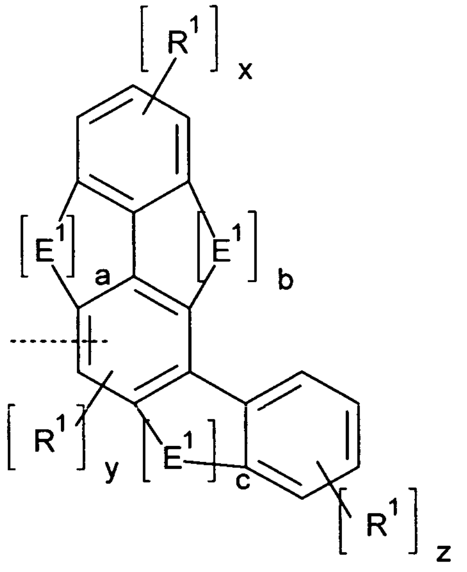
formula (Ar2-5)



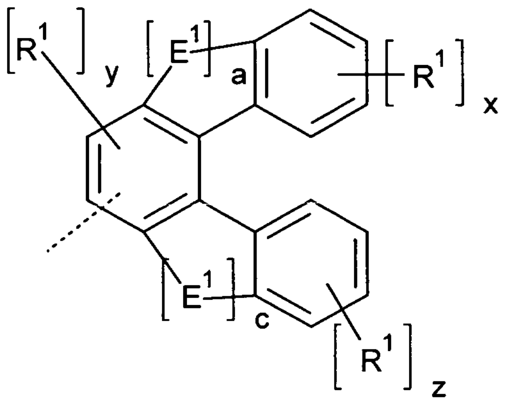
formula (Ar2-6)

where the symbols Z, V, T and Q have the same meaning as defined above.

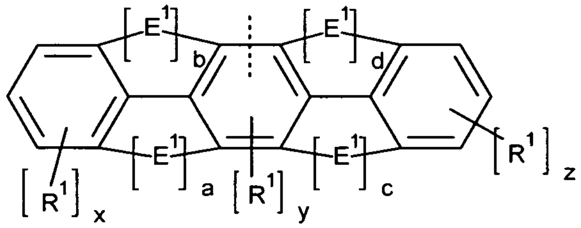
More preferably, the group Ar^2 is selected from the groups of formulae (Ar2-7) to (Ar2-10),



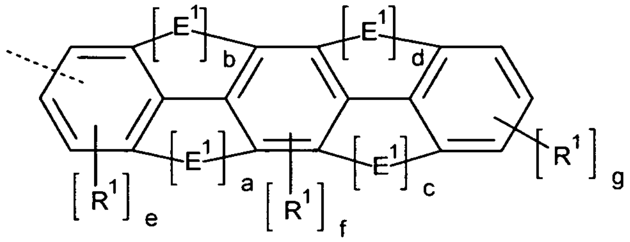
formula (Ar2-7)



formula (Ar2-8)



formula (Ar2-9)



formula (Ar2-10)

where the symbols E^1, R^1 have the same meaning as above, and where a, b, c, d are identically or differently, 0 or 1;

x, z, g are identically or differently, 0, 1, 2, 3, 4 or 5; where $a + b + x \leq 5$ and $z + c \leq 5$ in formulae (Ar2-7), $a + x \leq 5$ and $z + c \leq 5$ in formula (Ar2-8), $a + b + x \leq 5$ and $z + c + d \leq 5$ in formula (Ar2-9) and $g + c + d \leq 5$ in formula (Ar2-10);

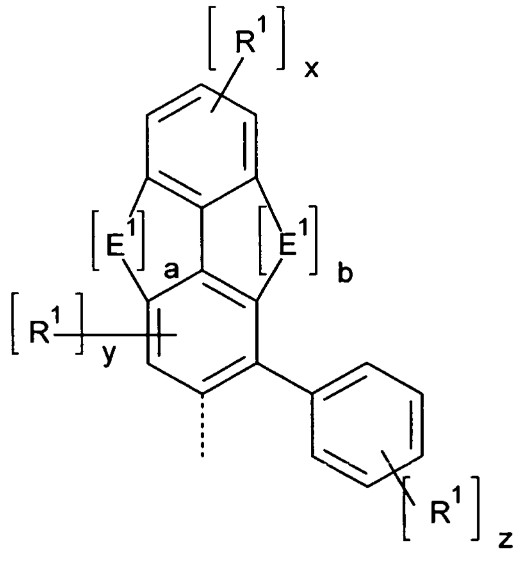
y is 0, 1, 2 or 3; where $y + a + b + c \leq 3$ in formulae (Ar2-7), $y + a + c \leq 3$ in formula (Ar2-8) and $y + a + b + c + d \leq 3$ in formula (Ar2-9);

e, f are identically or differently, 0, 1, 2, 3 or 4; where $e + a + b \leq 4$ and $f + a + b + c + d \leq 4$.

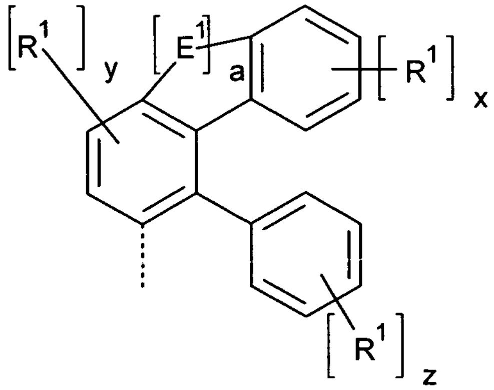
More preferably, $a + b \leq 1$ in formulae (Ar2-7), (Ar2-9) and (Ar2-10) and $c + d \leq 1$ in formulae (Ar2-9) and (Ar2-10).

It is particularly preferred that $a + b \leq 1$ and $c = 0$ in formula (Ar2-6) and $a + b \leq 1$ and $c = d = 0$ in formulae (Ar2-9) and (Ar2-10).

Among the groups of formulae (Ar2-7) to (Ar2-10), the groups (Ar2-7) and (Ar2-8) are preferred. More particularly, the groups (Ar2-7a) and (Ar2-8a) as depicted below are preferred:



formula (Ar2-7a)



formula (Ar2-8a)

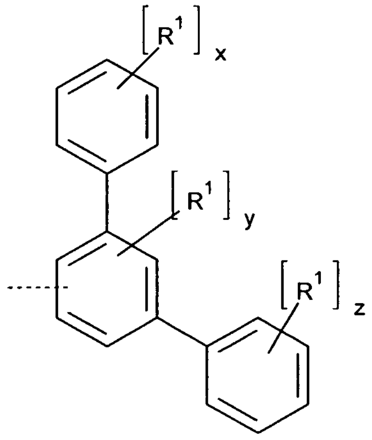
where the symbols R^1 and E^1 have the same meaning as above, and where:

a, b are 0 or 1, and where $a + b \leq 1$;

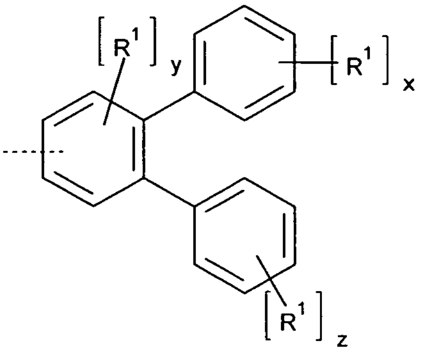
x, z are identically or differently, 0, 1, 2, 3, 4 or 5; where $a + b + x \leq 5$;

y is 0, 1, 2 or 3; where $y + a + b \leq 3$;

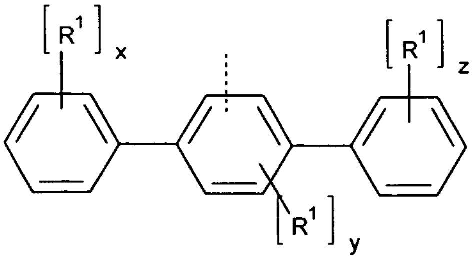
It is very particularly preferred that the group Ar^2 is selected from the group of formulae (Ar2-7-1) to (Ar2-10-1),



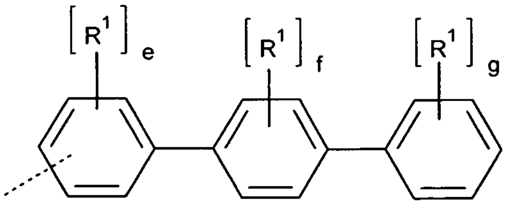
formula (Ar2-7-1)



formula (Ar2-8-1)



formula (Ar2-9-1)



formula (Ar2-10-1)

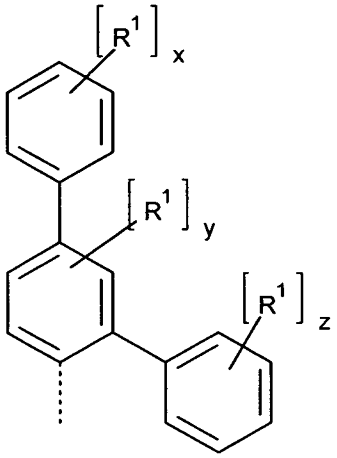
where the symbol R^1 has the same meaning as above, and

x, z, g are 0, 1, 2, 3, 4 or 5;

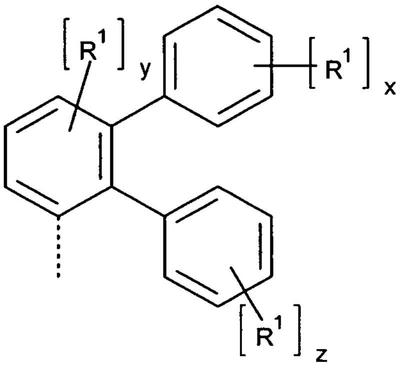
y is 0, 1, 2 or 3; and

e, f are 0, 1, 2, 3 or 4.

Among the groups of formulae (Ar2-7-1) to (Ar2-10-1), the groups (Ar2-7-1) and (Ar2-8-1) are preferred. More particularly, the groups (Ar2-7a-1) and (Ar2-8a-1) as depicted below are preferred:

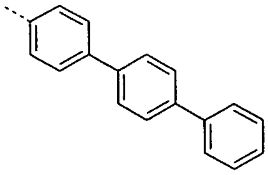
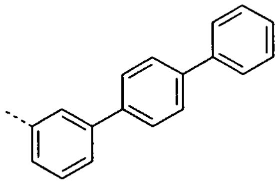
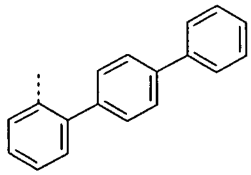
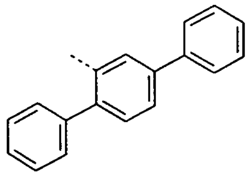
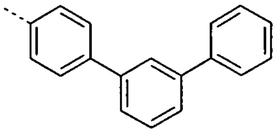
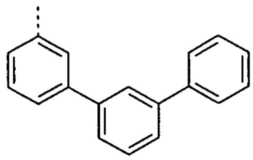
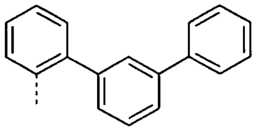
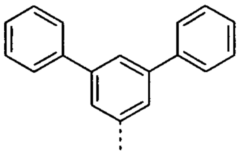
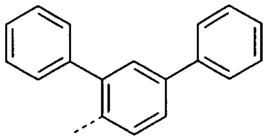
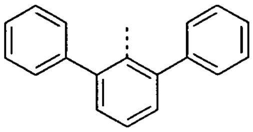
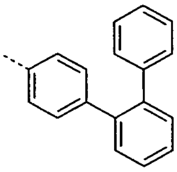
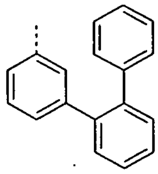
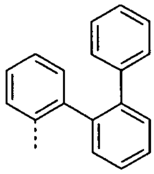
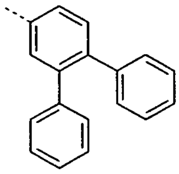
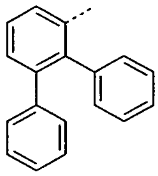
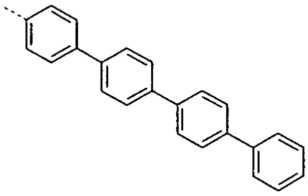
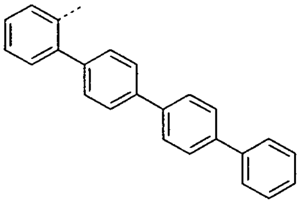
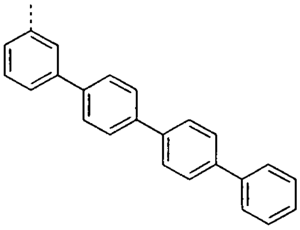


formula (Ar2-7a-1)



formula (Ar2-8a-1)

Suitable groups Ar^2 are for example the groups (Ar2-13) to (Ar2-469) as depicted below:

		
Ar2-13	Ar2-14	Ar2-15
		
Ar2-16	Ar2-17	Ar2-18
		
Ar2-19	Ar2-20	Ar2-21
		
Ar2-22	Ar2-23	Ar2-24
		
Ar2-25	Ar2-26	Ar2-27
		
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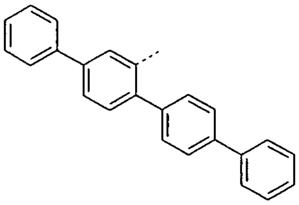	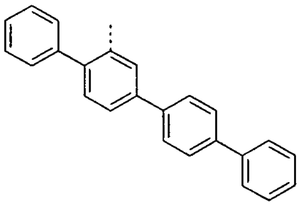	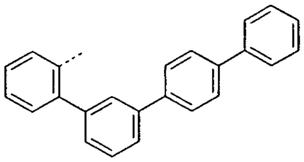
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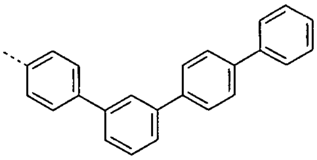	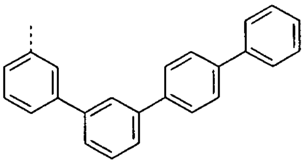	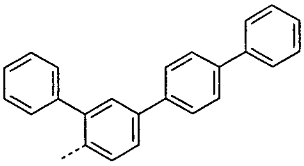
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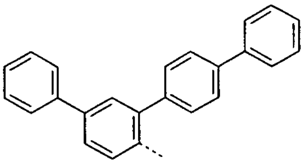	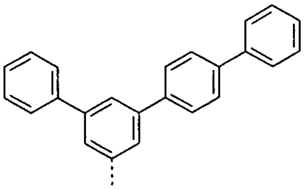	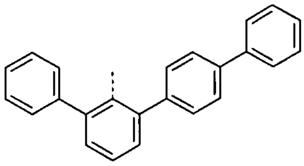
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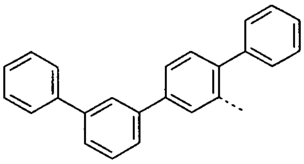	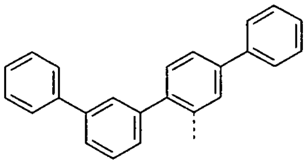	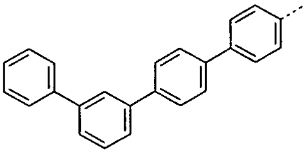
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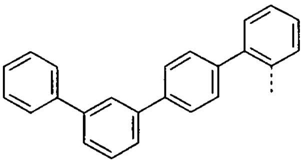	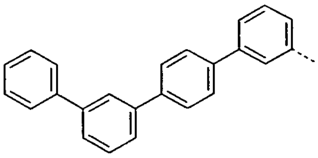	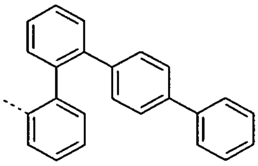
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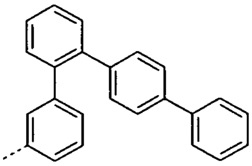	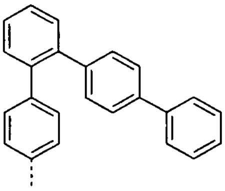	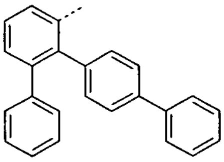
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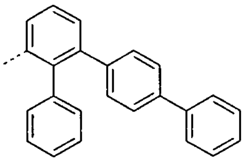	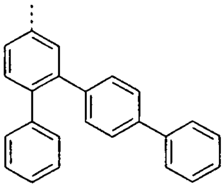	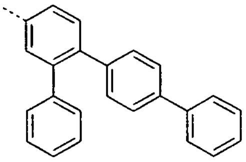
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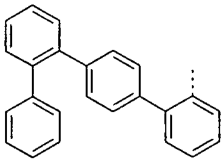	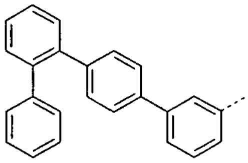	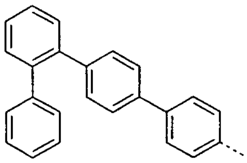
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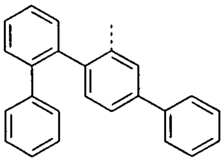	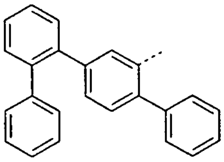	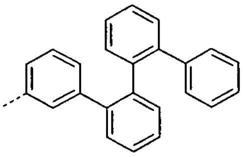
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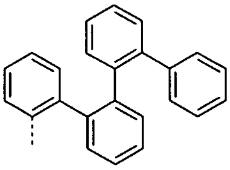	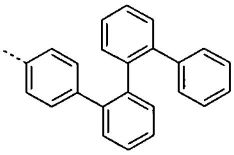	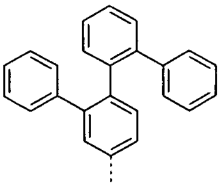
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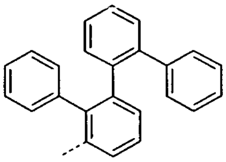	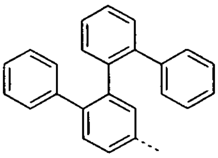	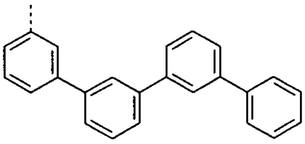
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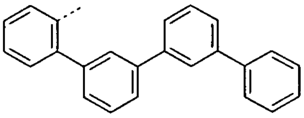	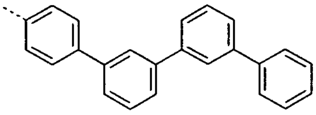	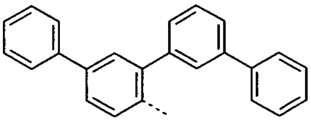
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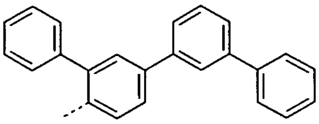	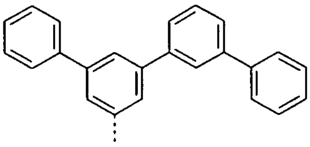	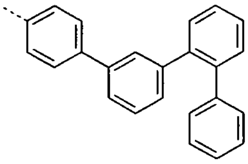
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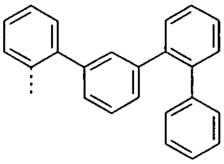	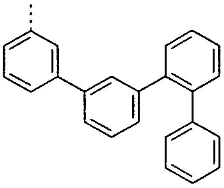	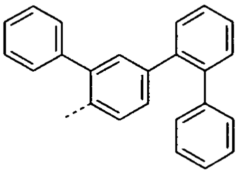
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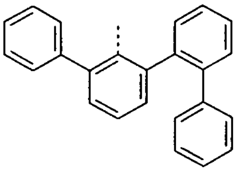	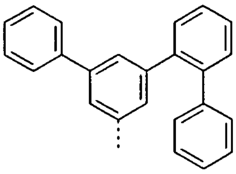	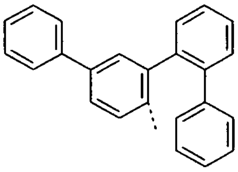
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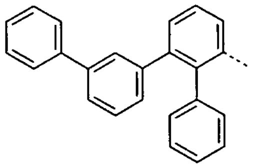	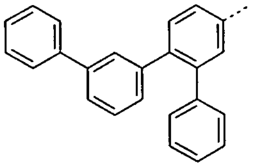	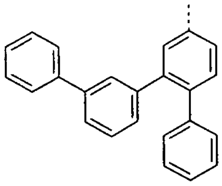
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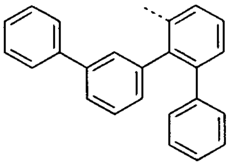	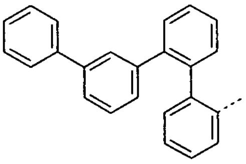	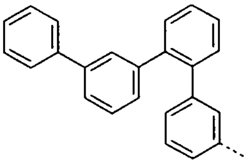
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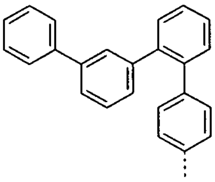	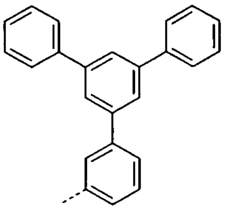	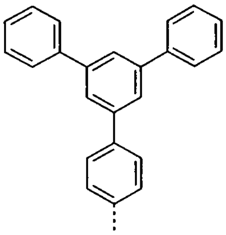
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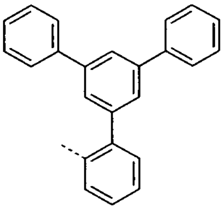	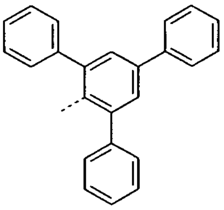	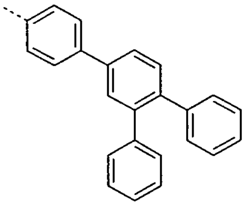
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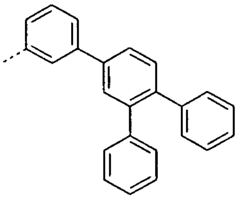	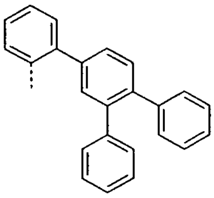	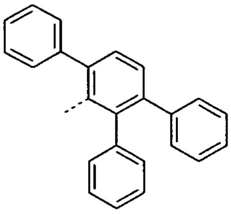
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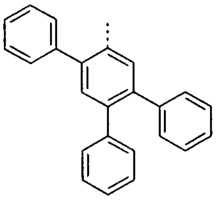	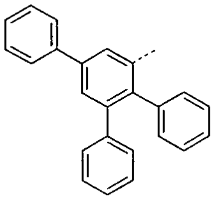	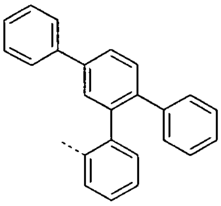
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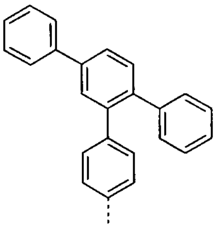	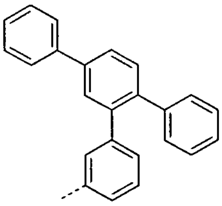	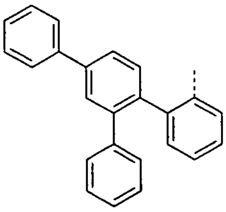
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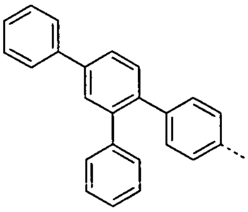	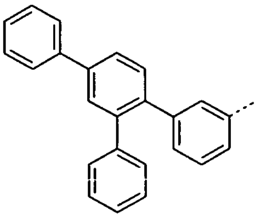	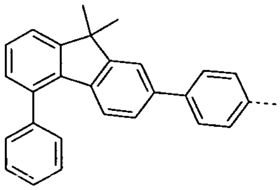
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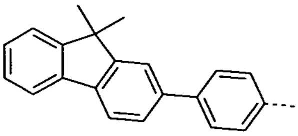	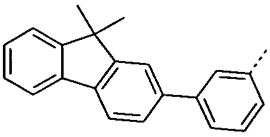	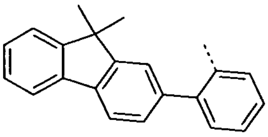
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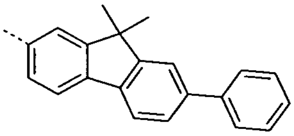	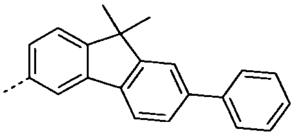	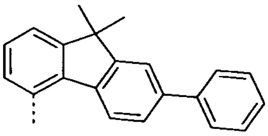
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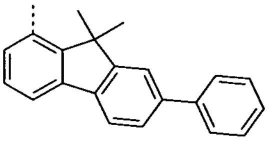	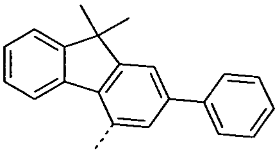	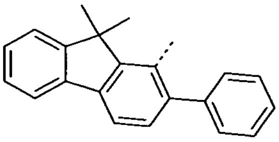
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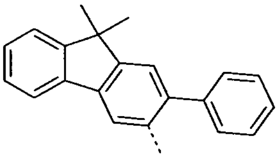	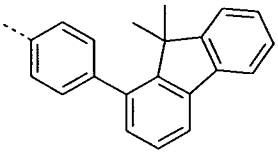	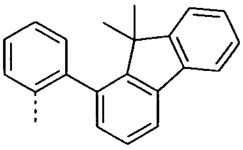
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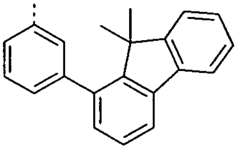	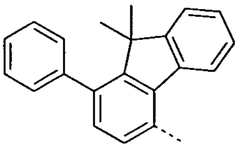	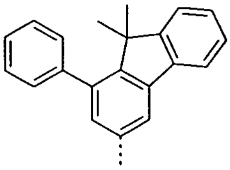
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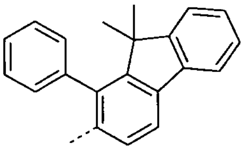	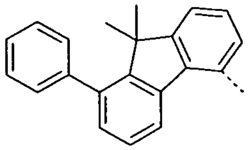	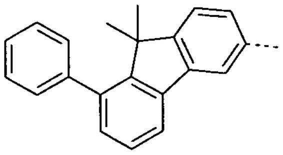
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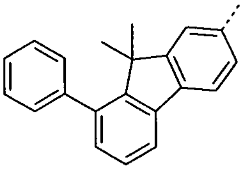	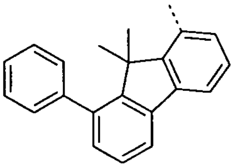	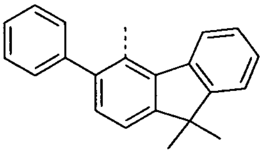
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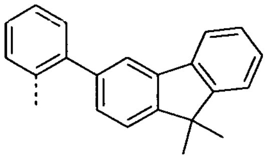	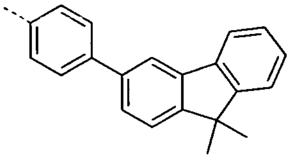	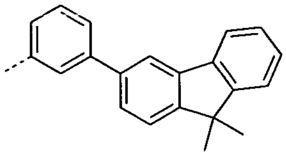
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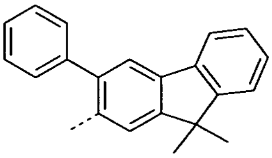
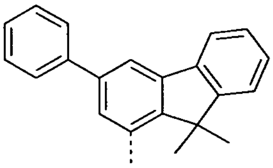
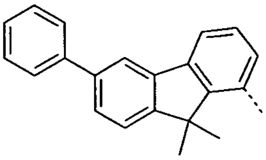
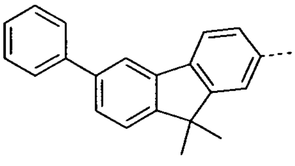
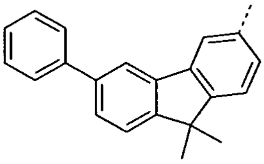
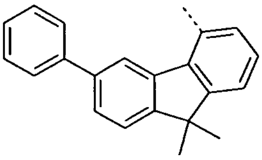
		
Ar2-124	Ar2-125	Ar2-126
		
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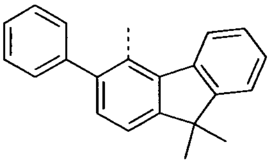	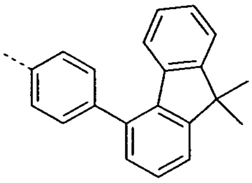	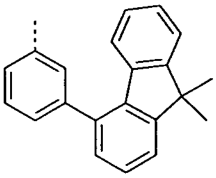
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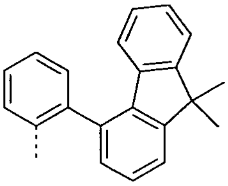	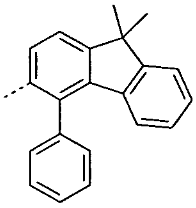	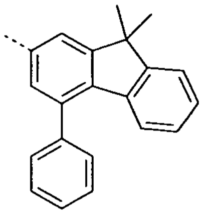
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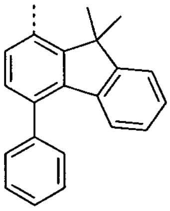	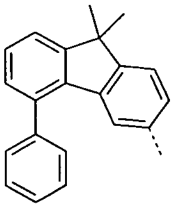	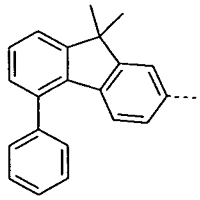
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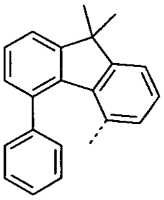	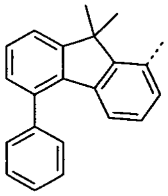	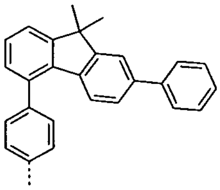
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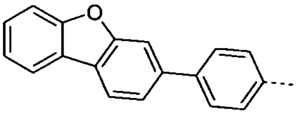	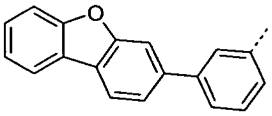	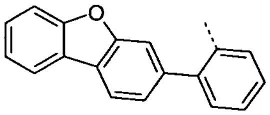
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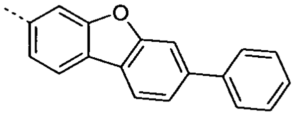	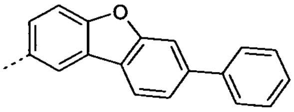	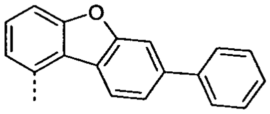
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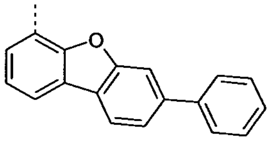	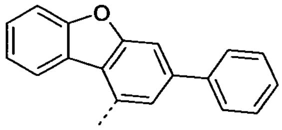	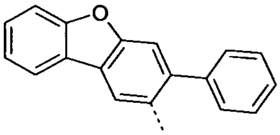
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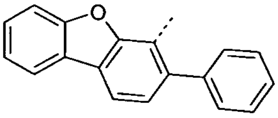	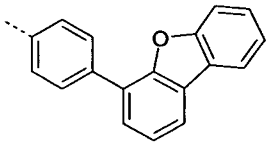	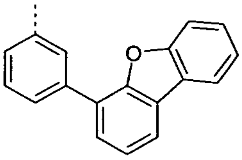
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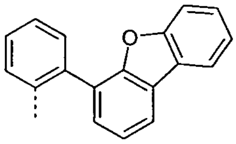	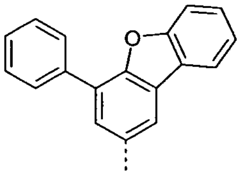	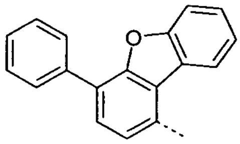
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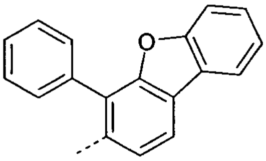	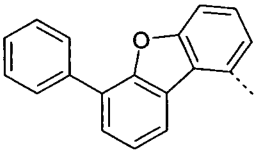	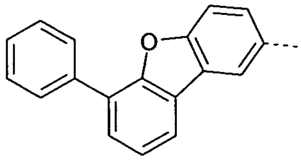
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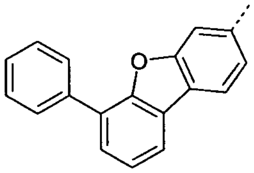	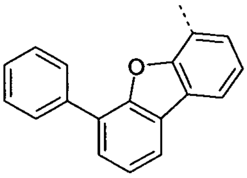	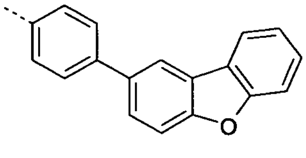
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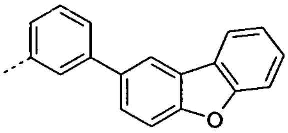	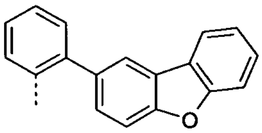	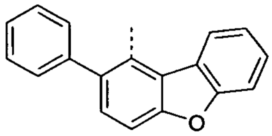
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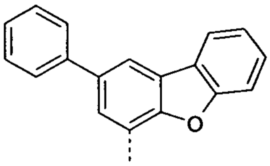	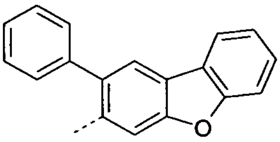	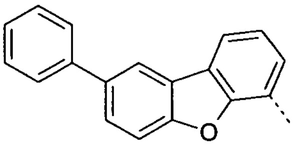
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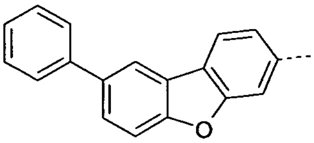	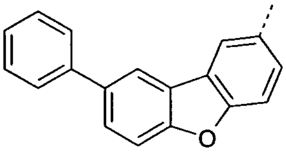	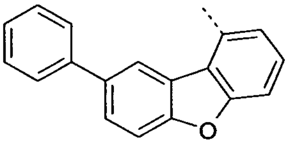
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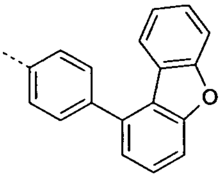	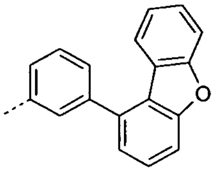	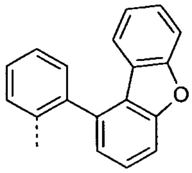
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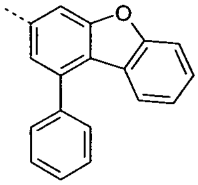	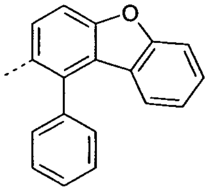	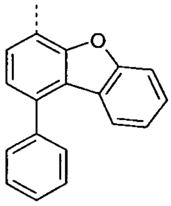
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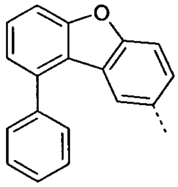	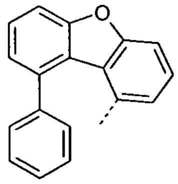	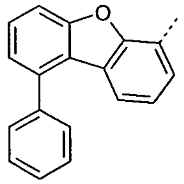
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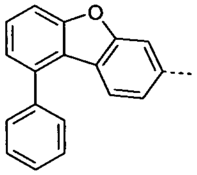	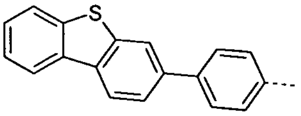	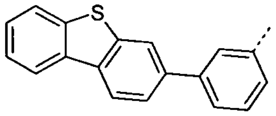
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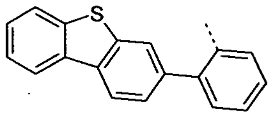	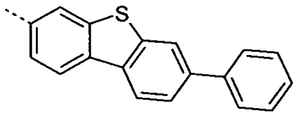	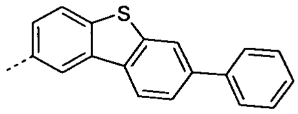
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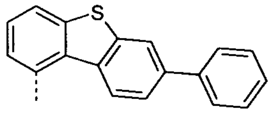	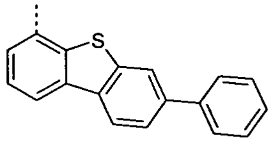	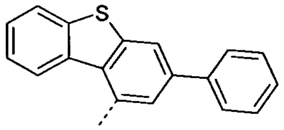
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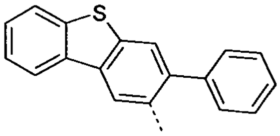	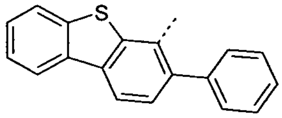	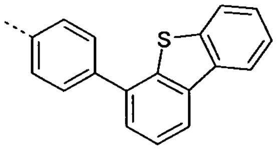
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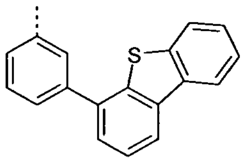	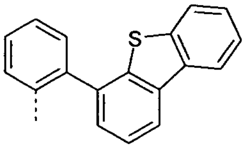	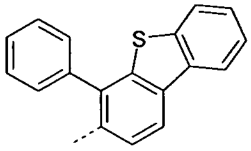
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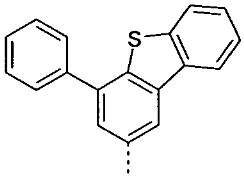	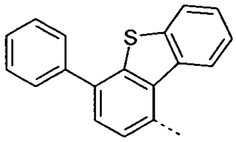	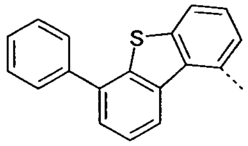
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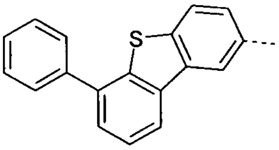	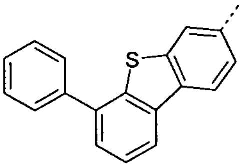	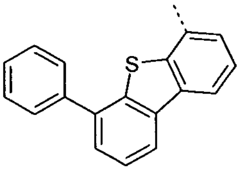
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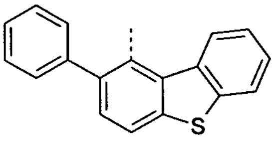	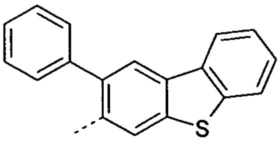	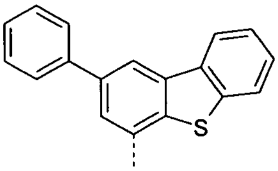
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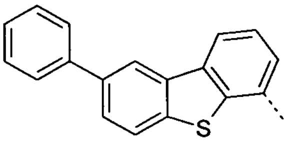	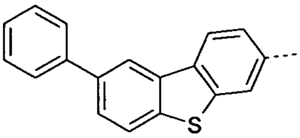	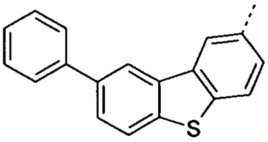
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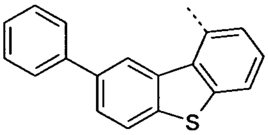	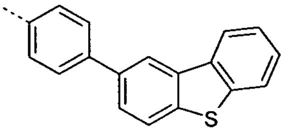	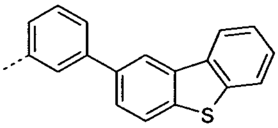
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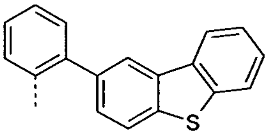	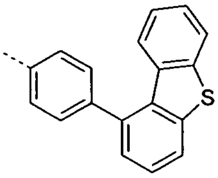	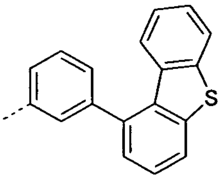
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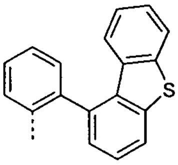	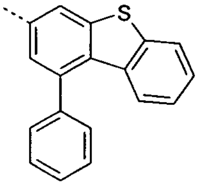	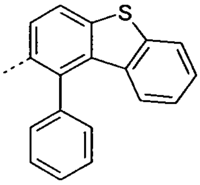
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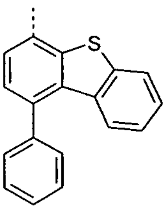	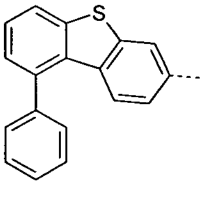	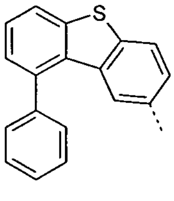
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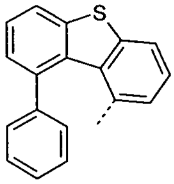	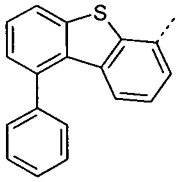	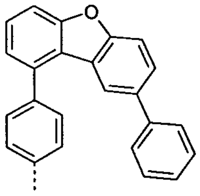
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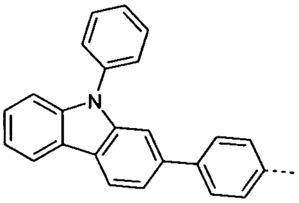	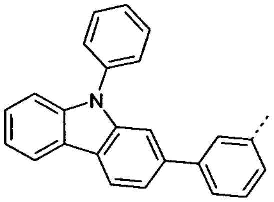	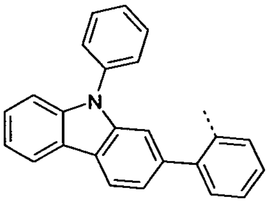
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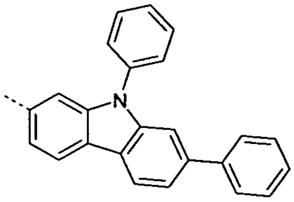	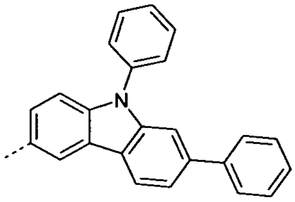	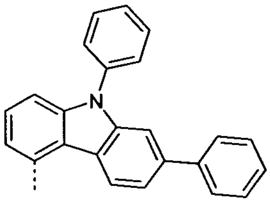
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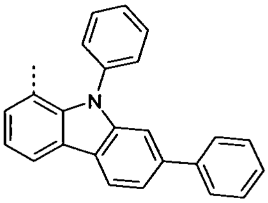	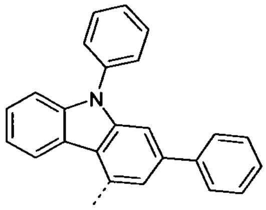	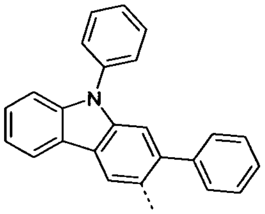
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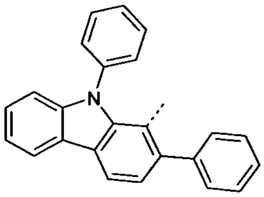	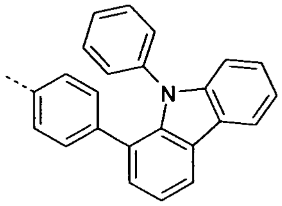	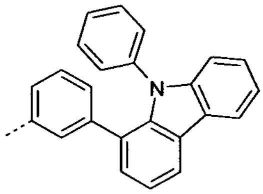
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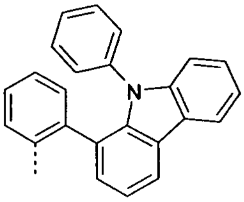	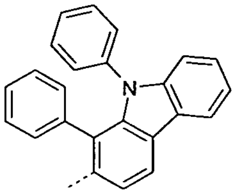	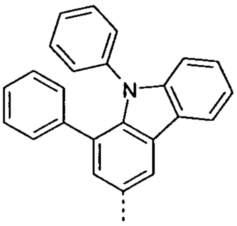
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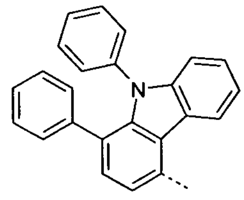	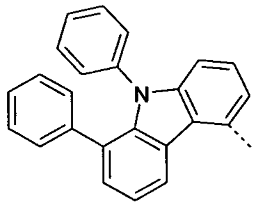	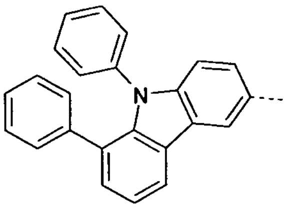
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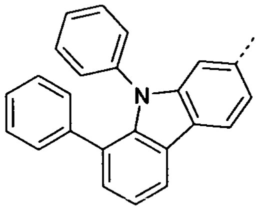	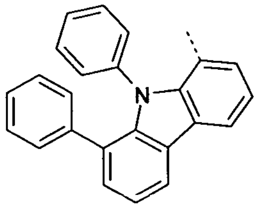	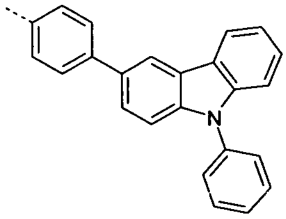
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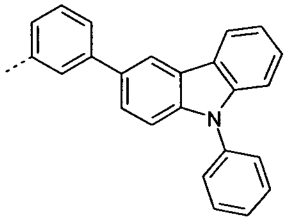	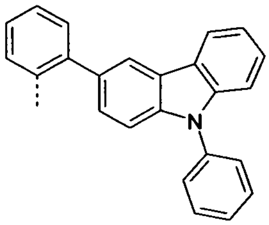	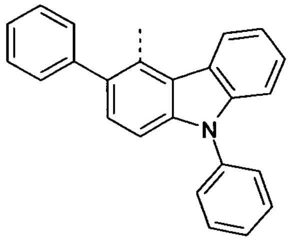
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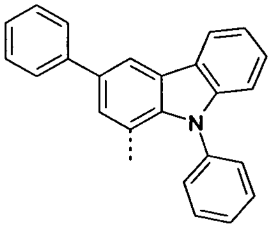	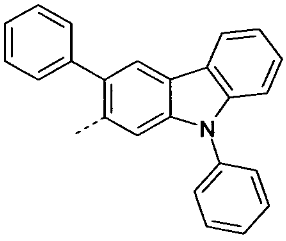	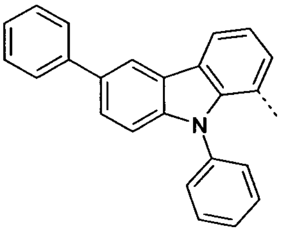
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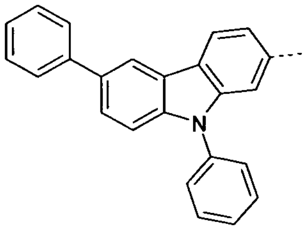	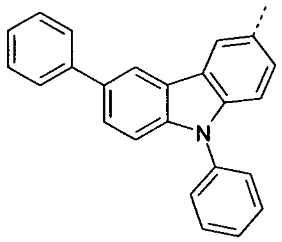	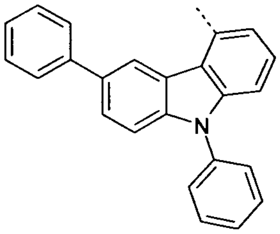
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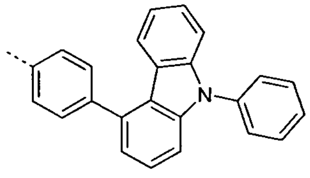	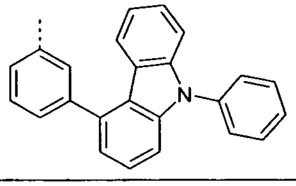	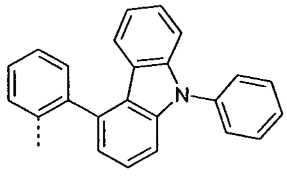
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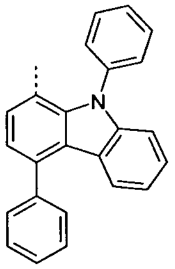	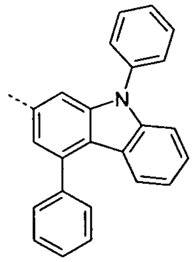	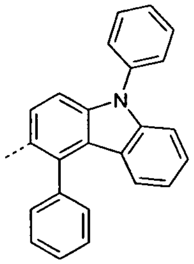
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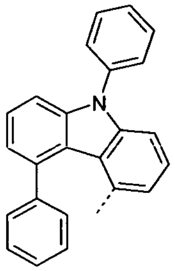	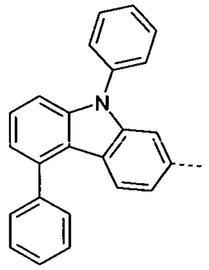	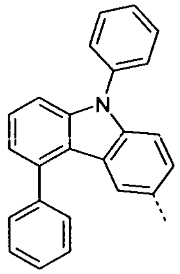
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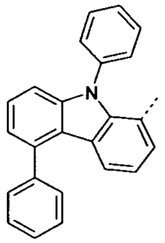	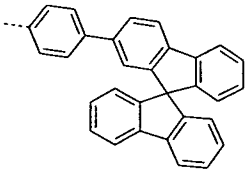	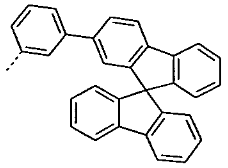
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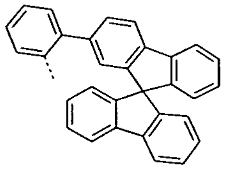	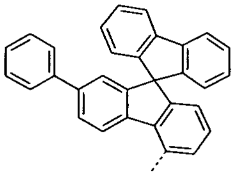	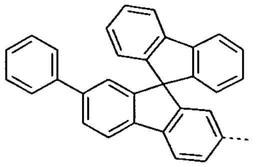
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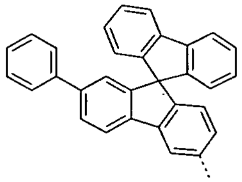	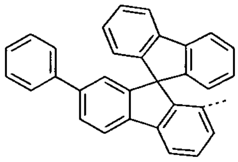	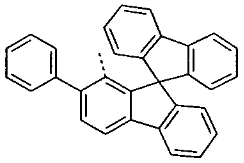
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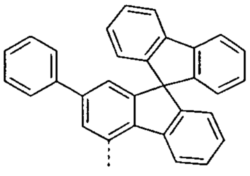	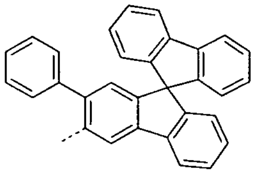	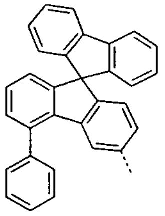
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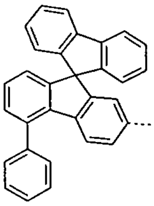	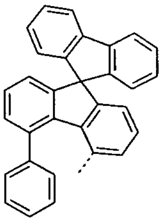	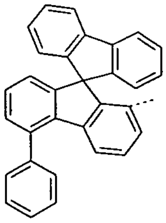
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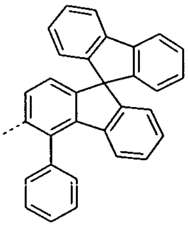	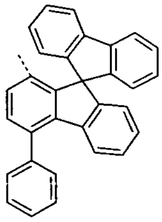	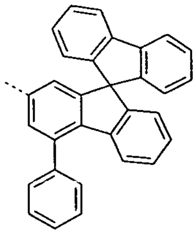
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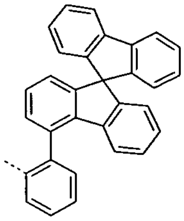	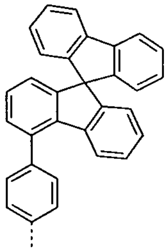	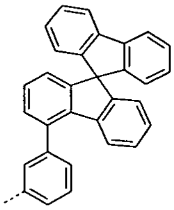
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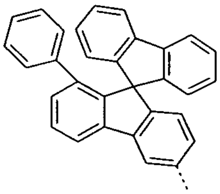	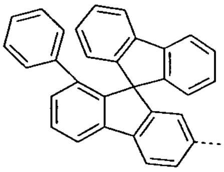	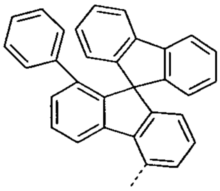
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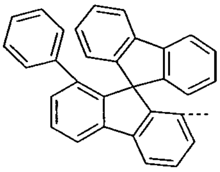	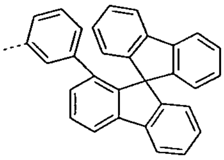	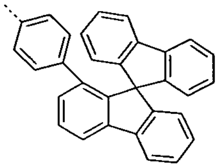
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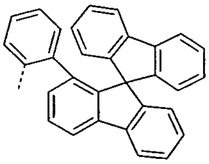
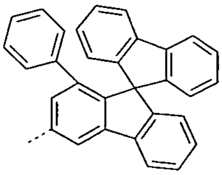
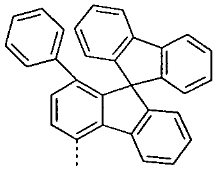
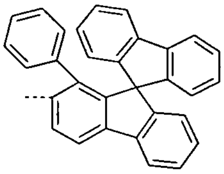
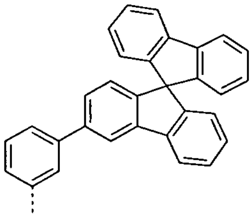
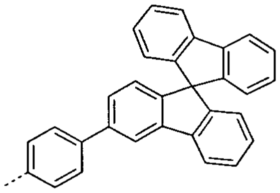
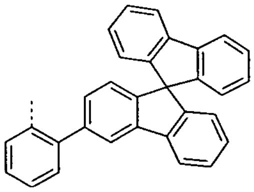
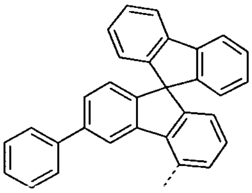
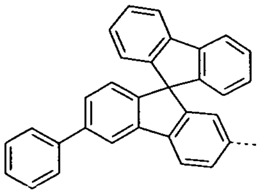
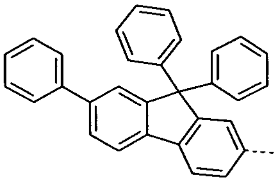
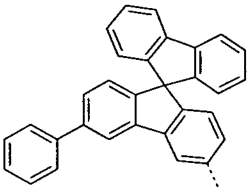
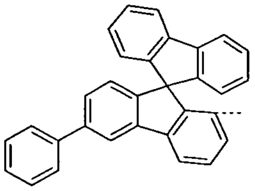
		
Ar2-289	Ar2-290	Ar2-291

		
Ar2-292	Ar2-293	Ar2-294
		
Ar2-295	Ar2-296	Ar2-297
		
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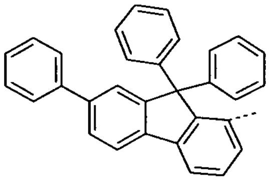	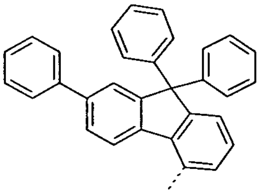	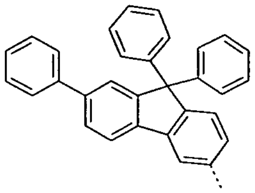
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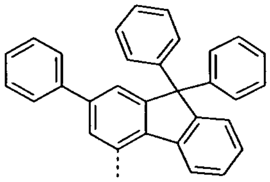	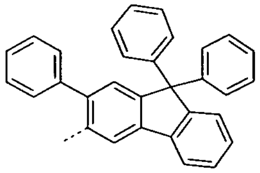	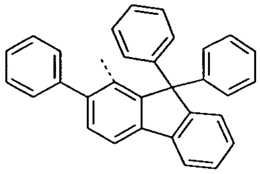
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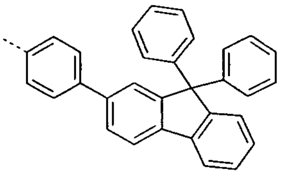	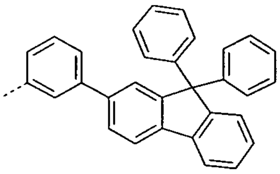	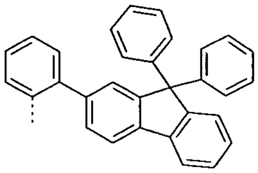
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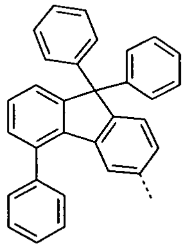	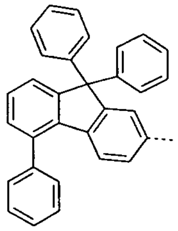	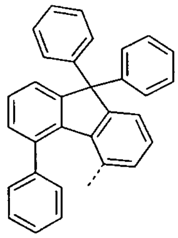
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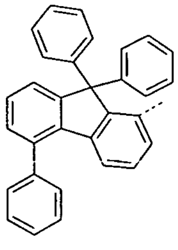	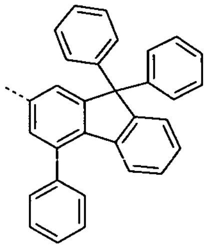	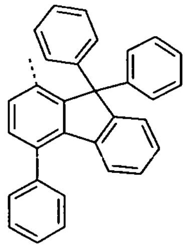
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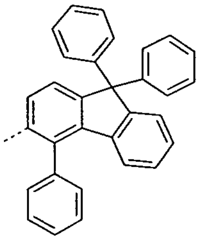	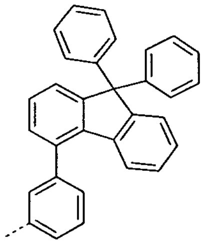	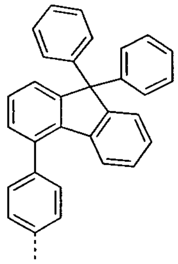
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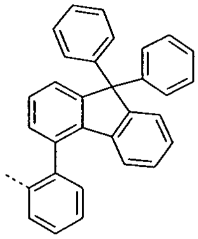	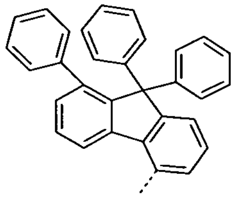	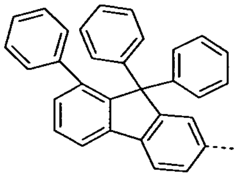
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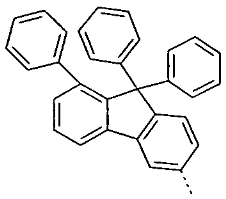	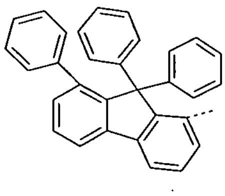	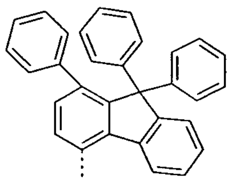
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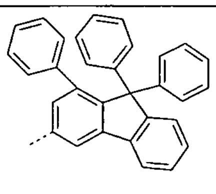	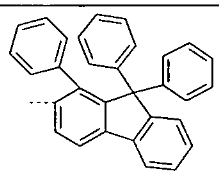	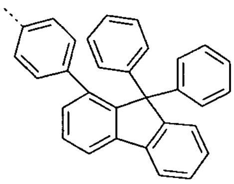
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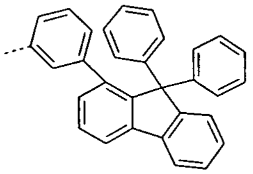	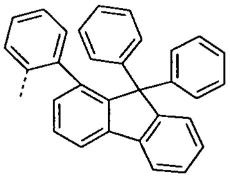	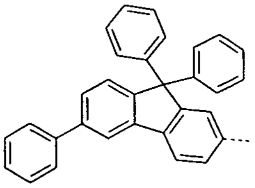
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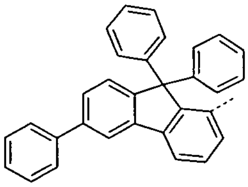	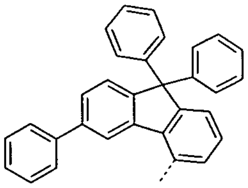	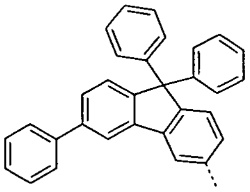
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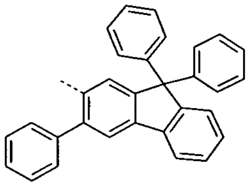	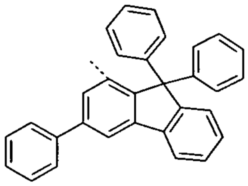	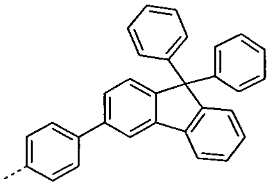
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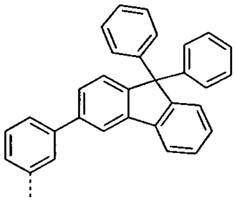	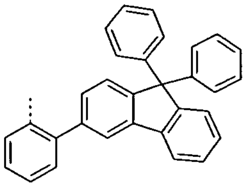	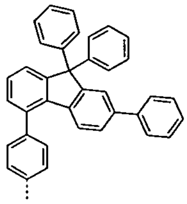
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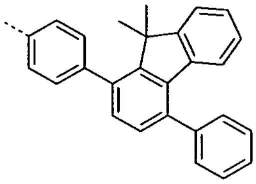	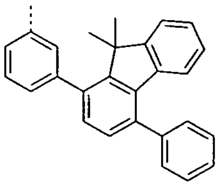	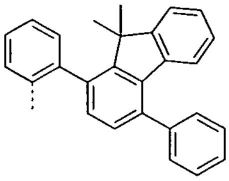
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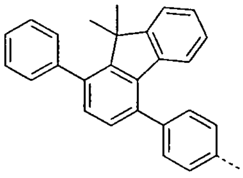	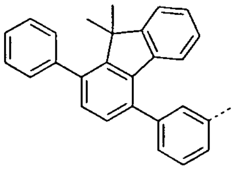	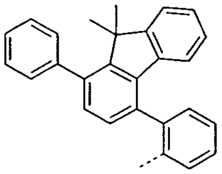
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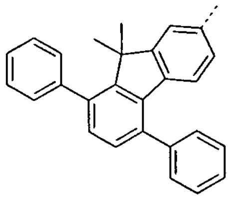	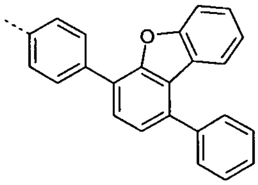	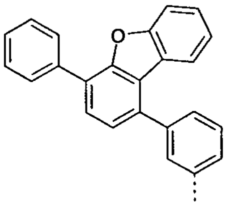
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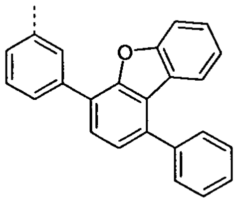	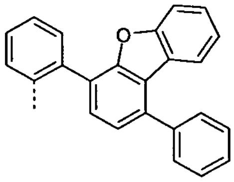	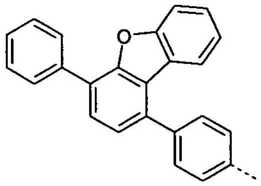
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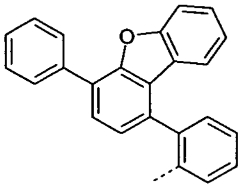	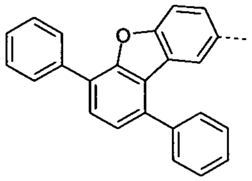	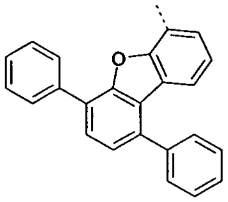
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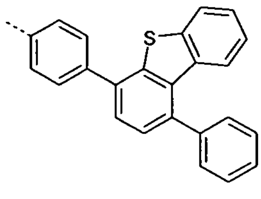	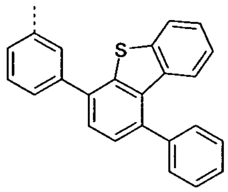	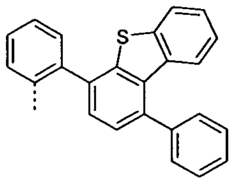
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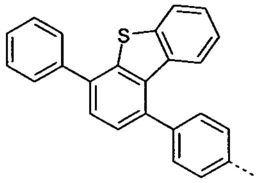	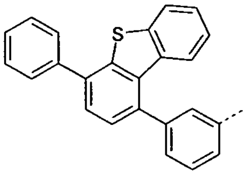	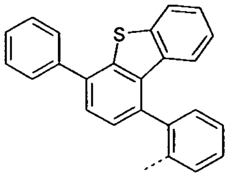
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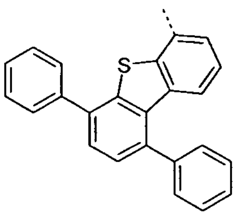	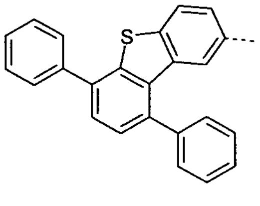	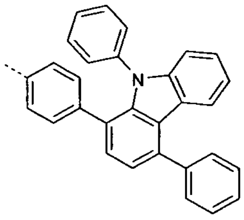
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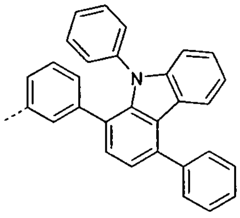	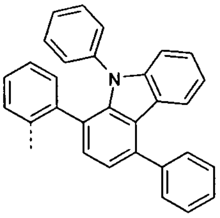	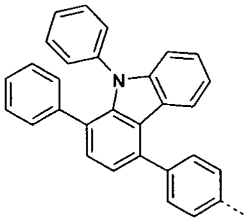
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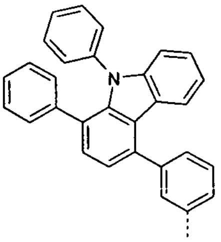	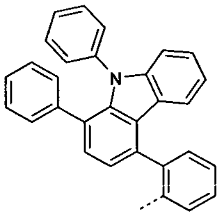	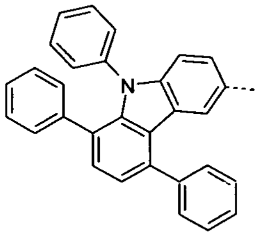
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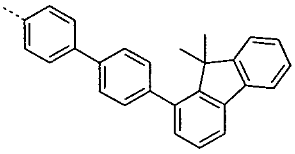	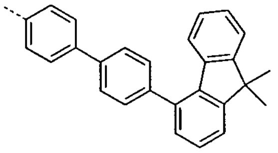	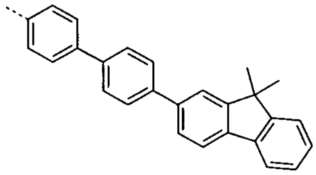
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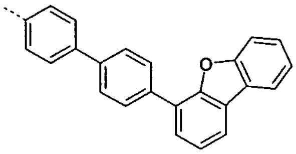	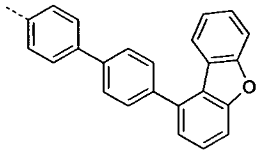	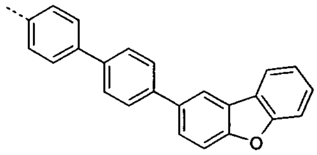
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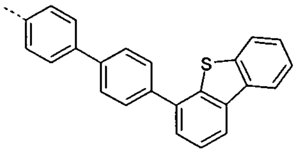	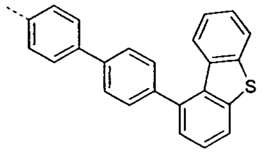	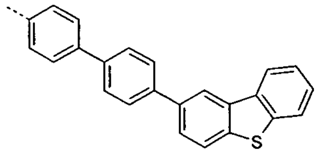
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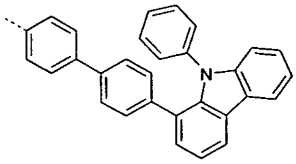	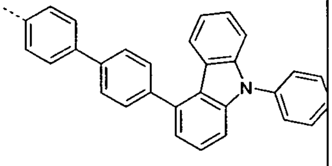	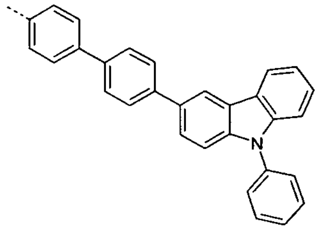
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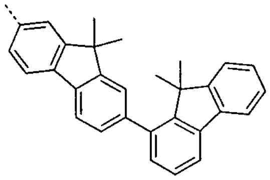	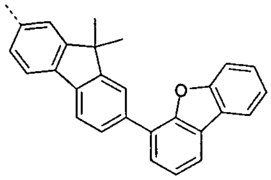	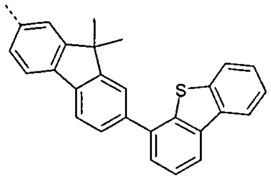
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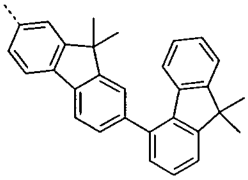	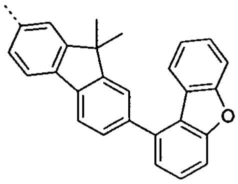	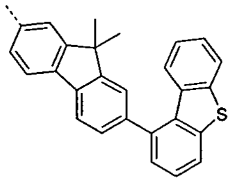
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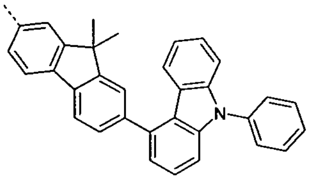	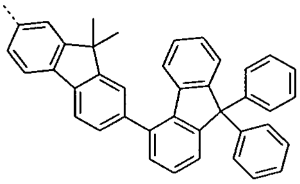	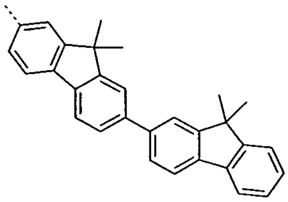
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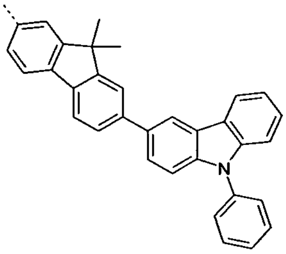	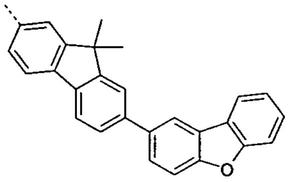	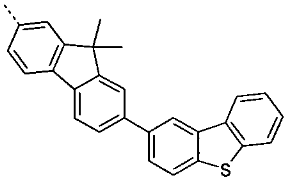
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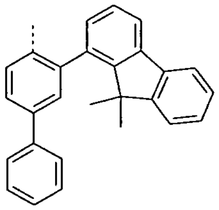	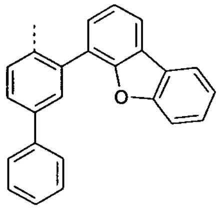	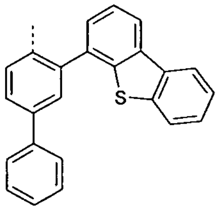
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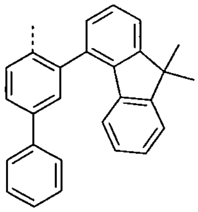	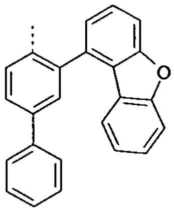	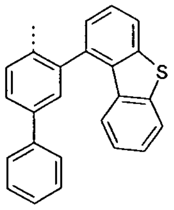
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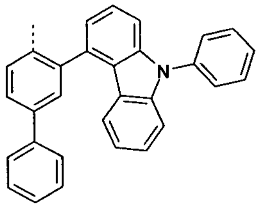
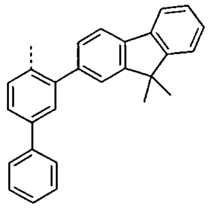
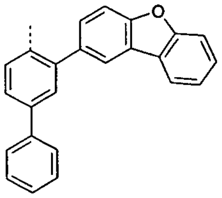
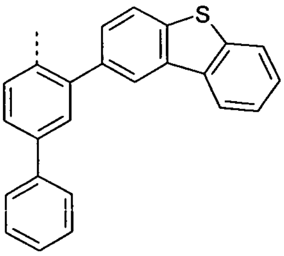
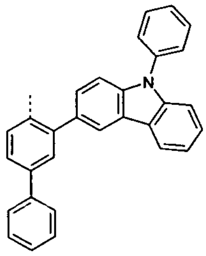
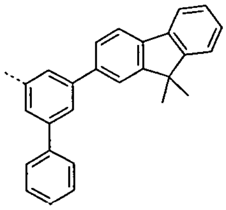
		
Ar2-400	Ar2-401	Ar2-402
		
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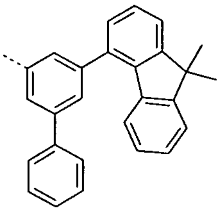	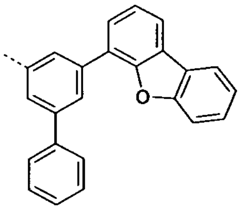	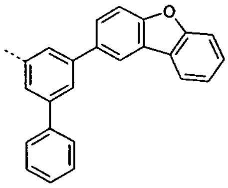
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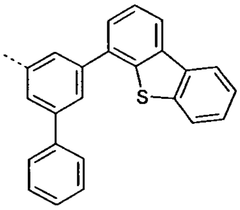	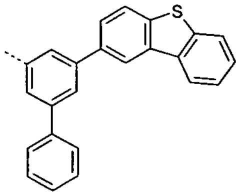	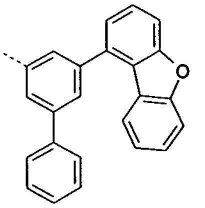
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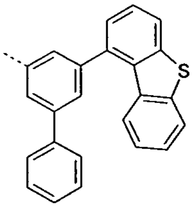	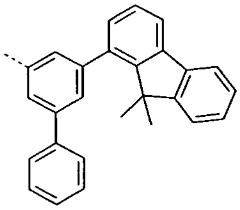	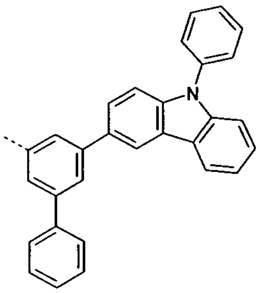
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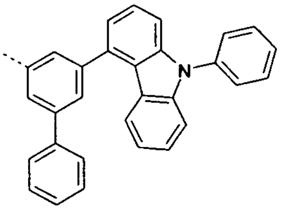	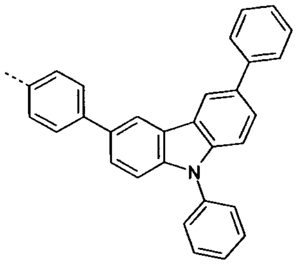	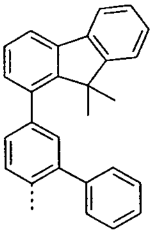
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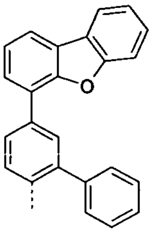	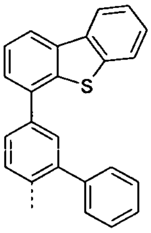	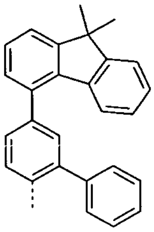
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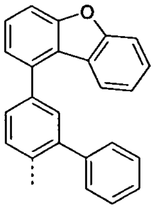	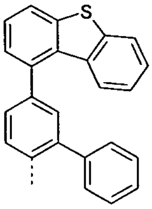	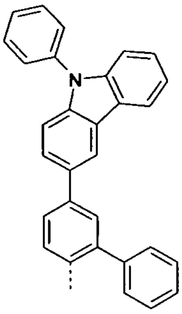
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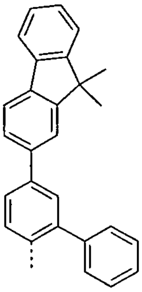	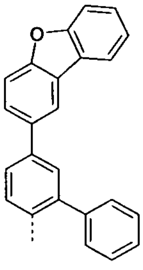	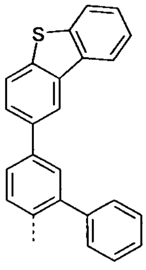
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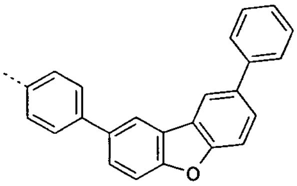	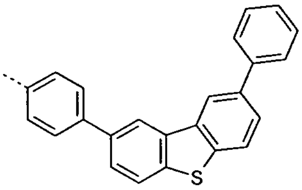	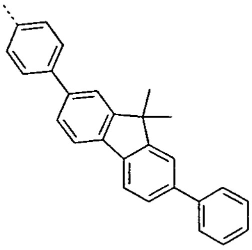
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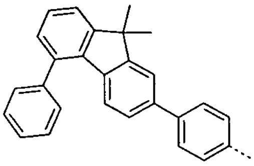	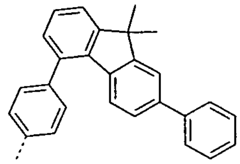	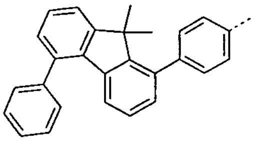
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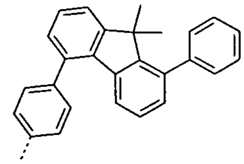	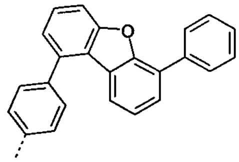	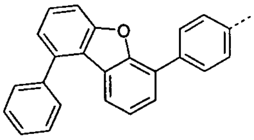
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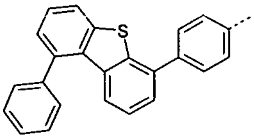	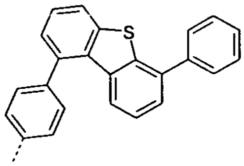	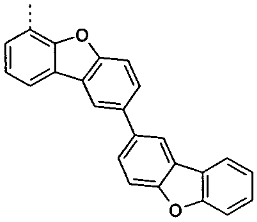
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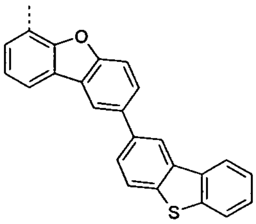	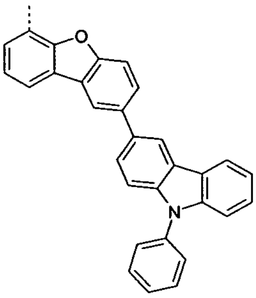	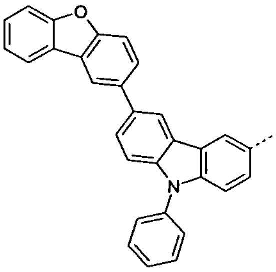
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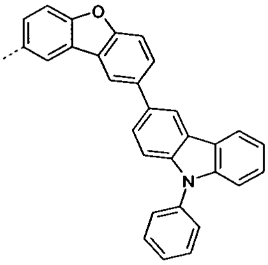
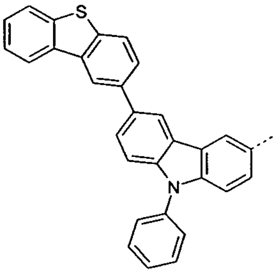
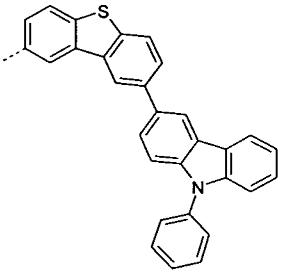
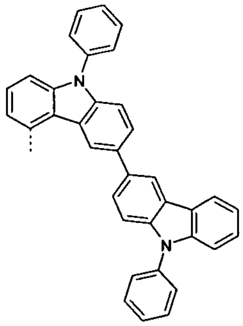
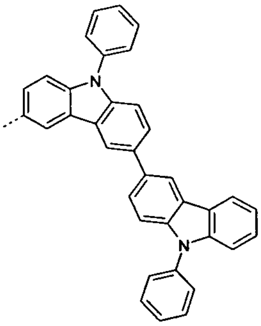
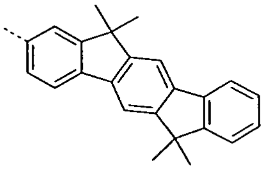
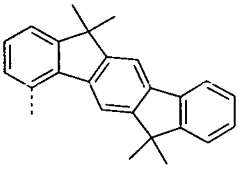
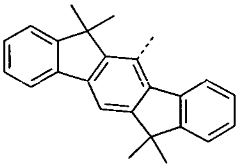
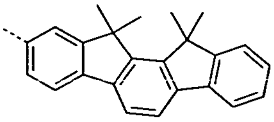
		
Ar2-443	Ar2-444	Ar2-445

		
Ar2-446	Ar2-447	Ar2-448
		
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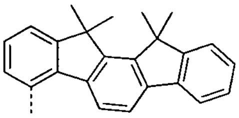
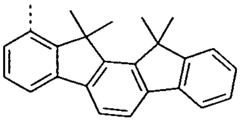
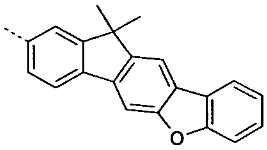
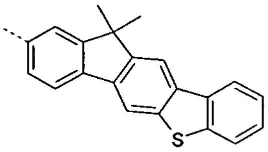
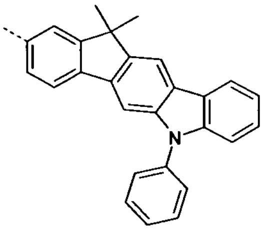
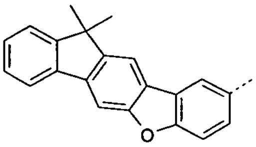
		
Ar2-452	Ar2-453	Ar2-454
		
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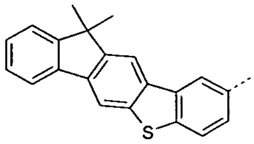
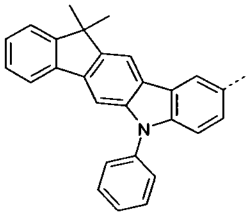
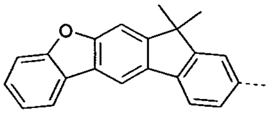
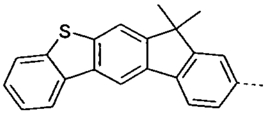
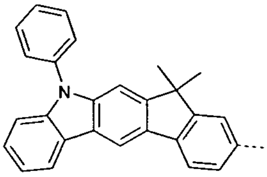
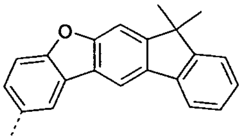
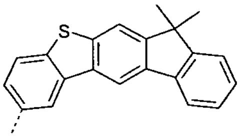
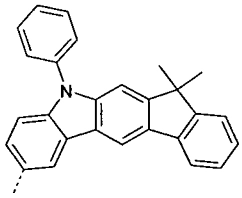
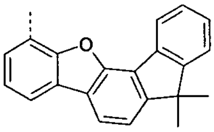
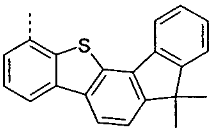
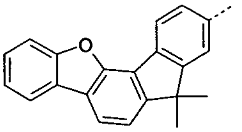
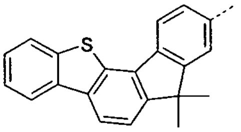
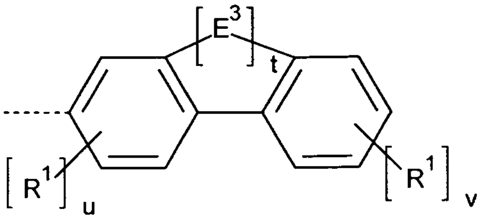
		
Ar2-458	Ar2-459	Ar2-460
		
Ar2-461	Ar2-462	Ar2-463

		
Ar2-464	Ar2-465	Ar2-466
		
Ar2-467	Ar2-468	Ar2-469

where the dashed bonds in Ar2-13 to Ar2-469 indicate the bonds to the nitrogen atom.

Among the groups Ar2-13 to Ar2-469, following groups are preferred: Ar2-13 to Ar2-27, Ar2-100 to Ar2-103, Ar2-105, Ar2-106, Ar2-118, Ar2-131 to Ar2-133, Ar2-136, Ar2-138, Ar2-142 to Ar2-144, Ar2-148, Ar2-152 to Ar2-154, Ar2-159, Ar2-162 to Ar2-164, Ar2-170 to Ar2-174, Ar2-178, Ar2-182 to Ar2-185, Ar2-192 to Ar2-194, Ar2-199, Ar2-207 to Ar2-214, Ar2-219, Ar2-243 to Ar2-245, Ar2-251, Ar2-261, Ar2-266, Ar2-267, Ar2-274, Ar2-298, Ar2-302, Ar2-311, Ar2-317 to Ar2-319, Ar2-383 to Ar2-385, Ar2-391 to Ar2-410, Ar2-414, Ar2-419 to Ar2-421 and Ar2-424 to Ar2-427.

In accordance with a preferred embodiment of the invention, the group Ar^1 is selected from the groups of formula (Ar1-2),



formula (Ar1-2)

where R^1 has the same meaning as above and where

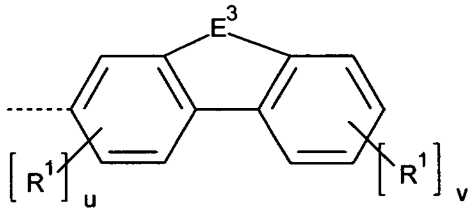
E^3 is a divalent bridge selected from $B(R^0)$, $C(R^0)_2$, $Si(R^0)_2$, C=O, $C=NR^0$, $C=C(R^0)_2$, O, S, S=O, SO_2, $N(R^0)$, $P(R^0)$ and $P(=O)R^0$, where R^0 has the same meaning as above; and

t is 0 or 1; where t is 0 means that the divalent bridge E is absent;

u is 0, 1, 2, 3 or 4; where $u + t \leq 4$

v is 0, 1, 2, 3, 4 or 5; where $v + t \leq 5$.

It is furthermore preferred that the index t is equal to 1 and that the group Ar^1 is selected from the groups of formula (Ar1-2a):



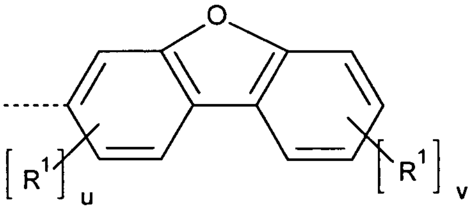
formula (Ar1-2a)

where the symbols E^3 and R^1 have the same meaning as above, and where:

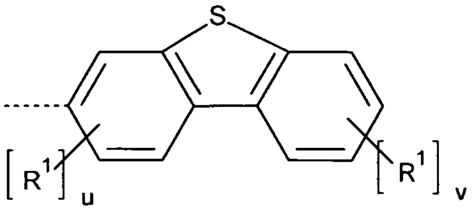
u is 0, 1 or 3;

v is 0, 1, 2, 3 or 4.

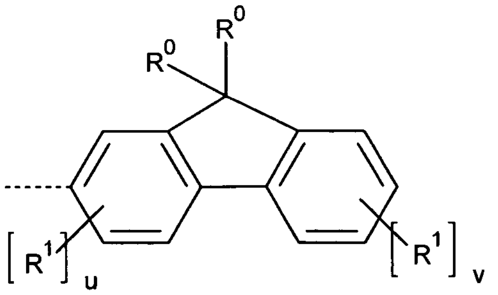
It is particularly preferred that the group Ar^1 is selected from the groups of formula (Ar1-3) to (Ar1-6):



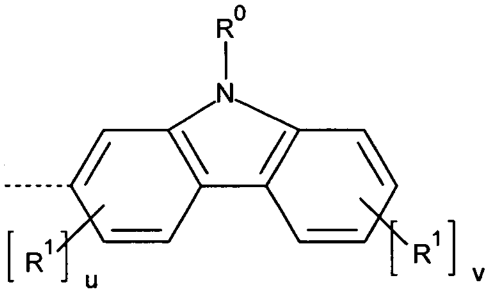
formula (Ar1-3)



formula (Ar1-4)



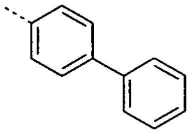
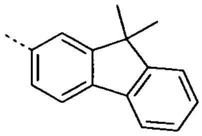
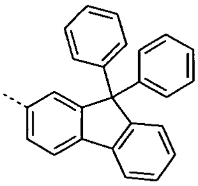
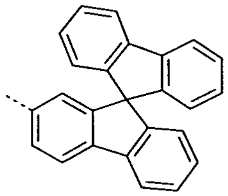
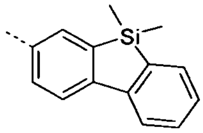
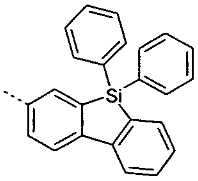
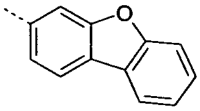
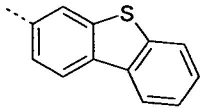
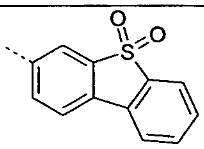
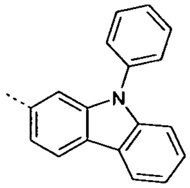
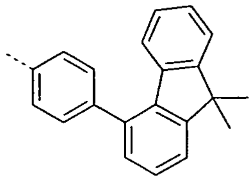
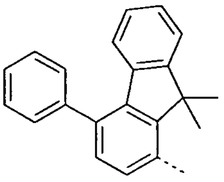
formula (Ar1-5)

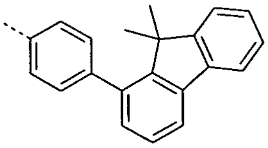
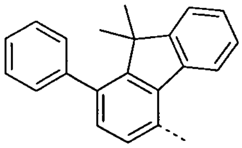
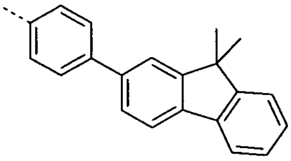
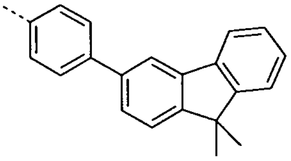
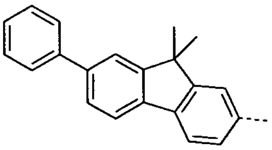
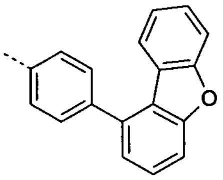
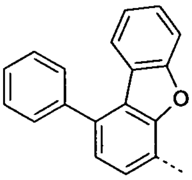
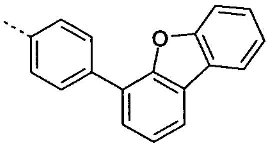
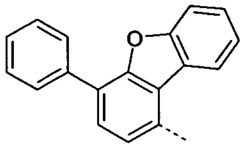
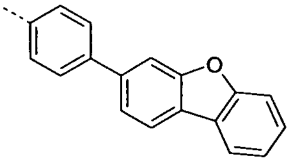
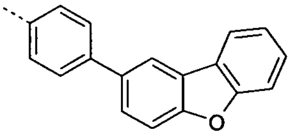
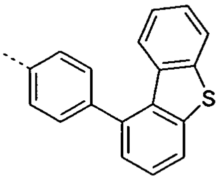
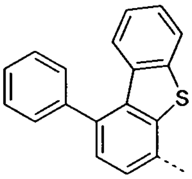
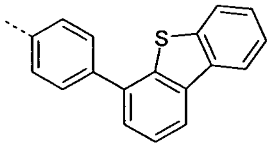
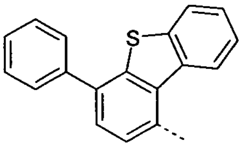
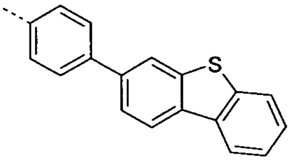
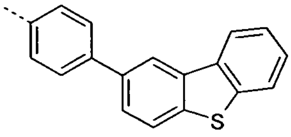
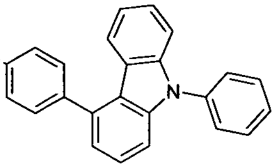
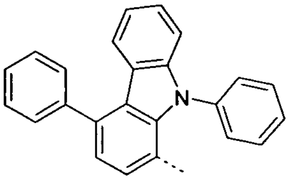
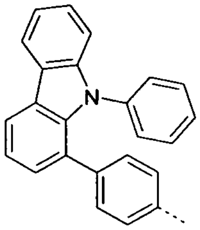
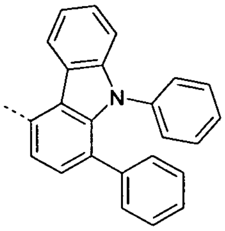


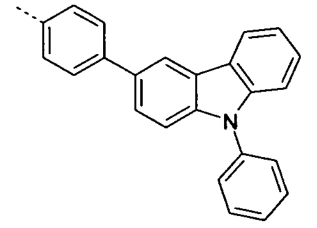
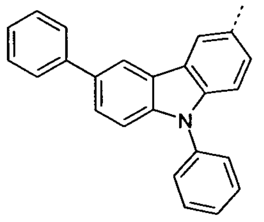
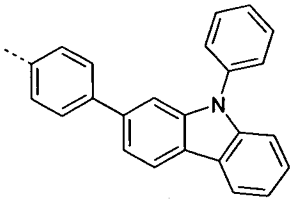
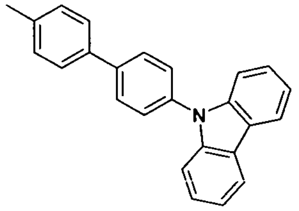
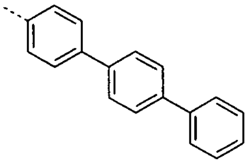
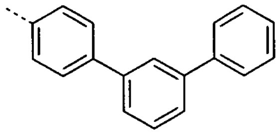
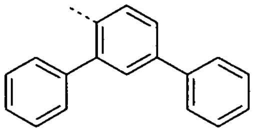
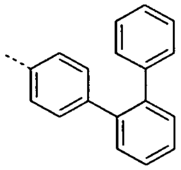
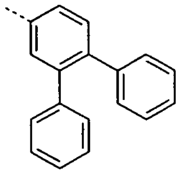
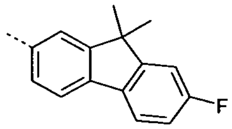
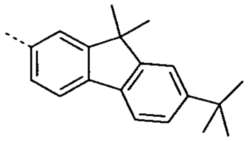
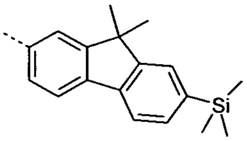
formula (Ar1-6)

where the symbols R^0 and R^1 and indices u and v have the same meaning as above.

Example of suitable groups Ar^1 are the groups Ar1-7 to Ar1-51 are depicted below:

		
Ar1-7	Ar1-8	Ar1-9
		
Ar1-10	Ar1-11	Ar1-12
		
Ar1-13	Ar1-14	Ar1-15
		
Ar1-16	Ar1-17	Ar1-18

		
Ar1-19	Ar1-20	Ar1-21
		
Ar1-22	Ar1-23	Ar1-24
		
Ar1-25	Ar1-26	Ar1-27
		
Ar1-28	Ar1-29	Ar1-30
		
Ar1-31	Ar1-32	Ar1-33
		
Ar1-34	Ar1-35	Ar1-36
		
Ar1-37	Ar1-38	Ar1-39

		
Ar1-40	Ar1-41	Ar1-42
		
Ar1-43	Ar1-44	Ar1-45
		
Ar1-46	Ar1-47	Ar1-48
		
Ar1-49	Ar1-50	Ar1-51

Among the groups of formulae Ar1-7 to Ar1-51, the groups Ar1-7, Ar1-8, Ar1-9, Ar1-13, Ar1-14 and Ar1-16 are preferred.

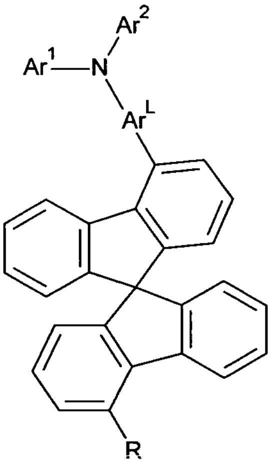
In accordance with a preferred embodiment, the groups E^1, E^2 and/or E^3 are, identically or differently, selected from $C(R^0)_2$, O, S or $N(R^0)$.

Preferably, R^0 is selected on each occurrence, identically or differently, from the group consisting of H, D, F, CN, $Si(R^2)_3$, a straight-chain alkyl having 1 to 10 C atoms or a branched or cyclic alkyl group having 3 to 10 C atoms, each of which may be substituted by one or more radicals R^2, where in each case one or more H atoms may be replaced by F, or an aryl or heteroaryl group having 5 to 40 aromatic ring atoms, which may in each case be substituted by one or more radicals R^2, where two adjacent substituents R^0, may form a mono- or polycyclic, aliphatic ring system or aromatic ring system, which may be substituted by one or more radicals R^2.

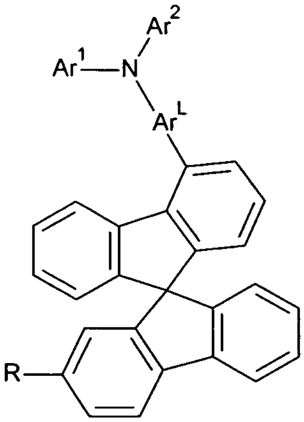
It is furthermore preferred that the groups R and R^1 are selected, identically or differently on each occurrence, from the group consisting of H, D, F, CN, a straight-chain alkyl or alkoxy group having 1 to 10 C atoms or a branched or cyclic alkyl or alkoxy group having 3 to 10 C atoms, each of which may be substituted by one or more radicals R^2, where one or more non-adjacent CH_2 groups may be replaced by O and where one or more H atoms may be replaced by F, an aromatic or heteroaromatic ring system having 5 to 24 aromatic ring atoms, which may in each case be substituted by one or more radicals R^2.

It is furthermore preferred that R^2 is selected, identically or differently on each occurrence, from the group consisting of H, D, F, CN, a straight-chain alkyl or alkoxy group having 1 to 10 C atoms or a branched or cyclic alkyl or alkoxy group having 3 to 10 C atoms, each of which may be substituted by one or more radicals R^3, where one or more non-adjacent CH_2 groups may be replaced by O and where one or more H atoms may be replaced by F, an aromatic or heteroaromatic ring system having 5 to 24 aromatic ring atoms, which may in each case be substituted by one or more radicals R^3.

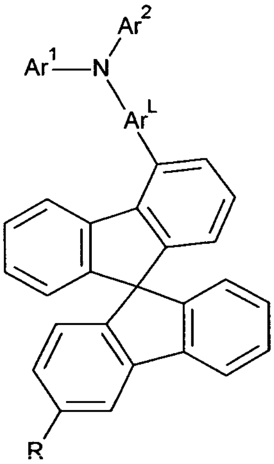
In accordance with a preferred embodiment of the invention, the compounds of formula (1) are selected from the compounds of the following formulae (1-1) to (1-30),



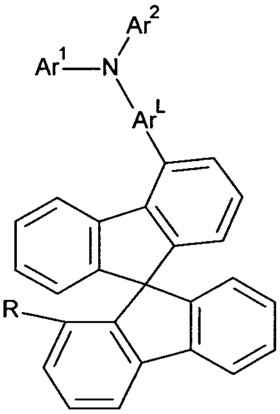
formula (1-1)



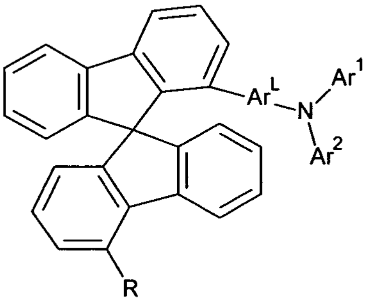
formula (1-2)



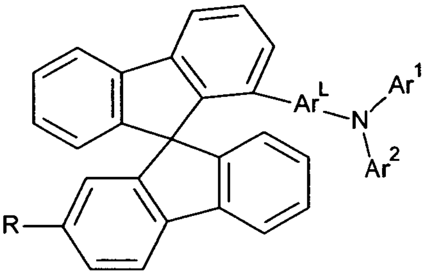
formula (1-3)



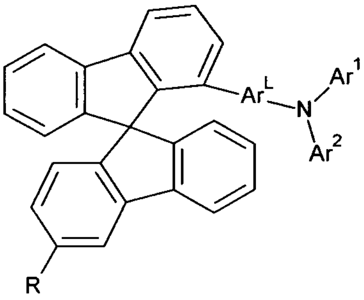
formula (1-4)



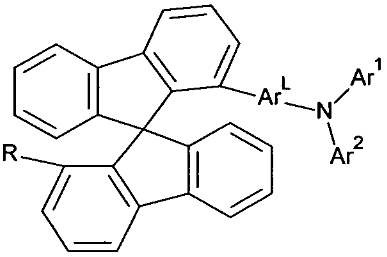
formula (1-5)



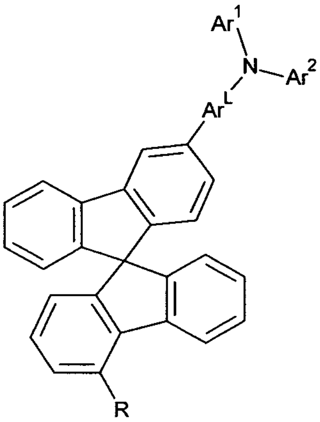
formula (1-6)



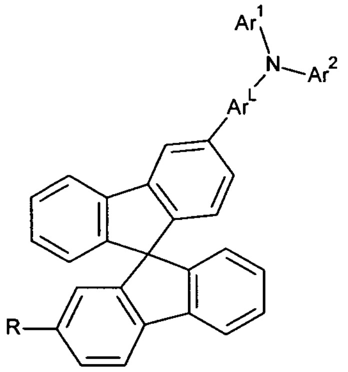
formula (1-7)



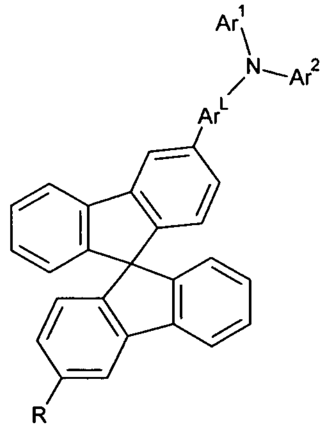
formula (1-8)



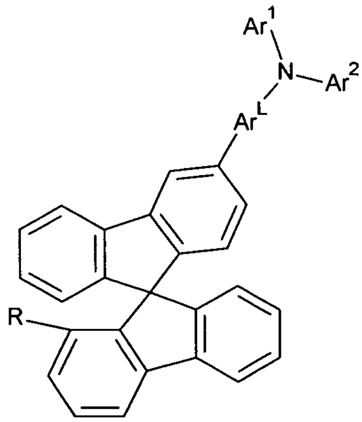
formula (1-9)



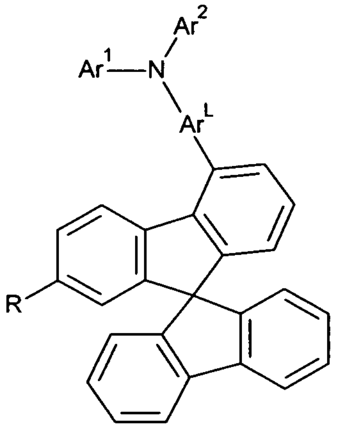
formula (1-10)



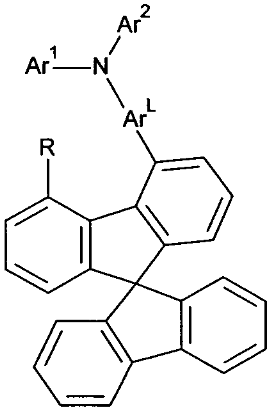
formula (1-11)



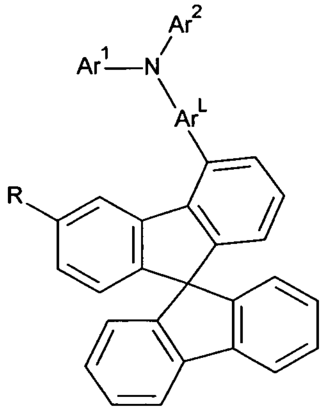
formula (1-12)



formula (1-13)



formula (1-14)



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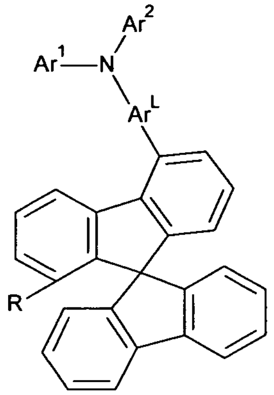
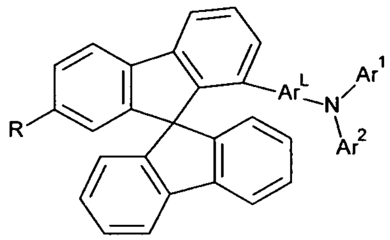
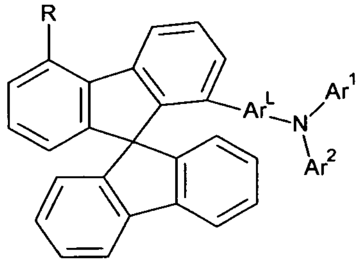


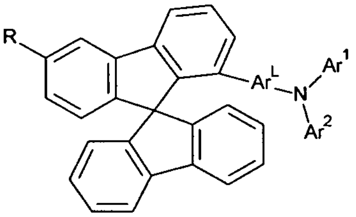
formula (1-16)



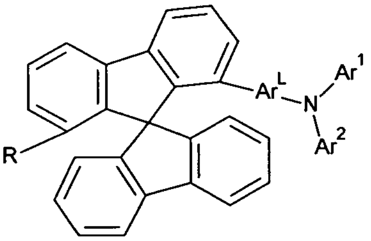
formula (1-17)



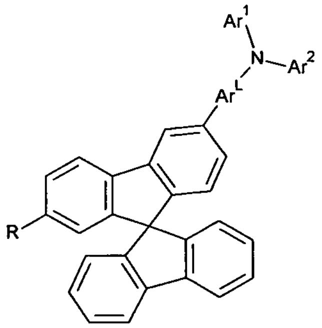
formula (1-18)



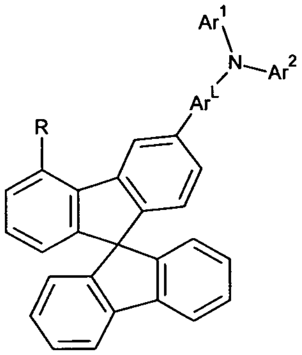
formula (1-19)



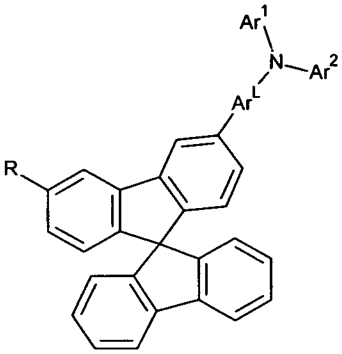
formula (1-20)



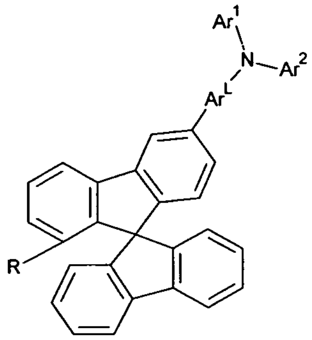
formula (1-21)



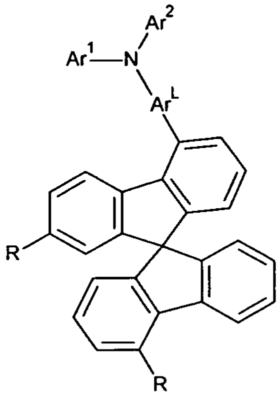
formula (1-22)



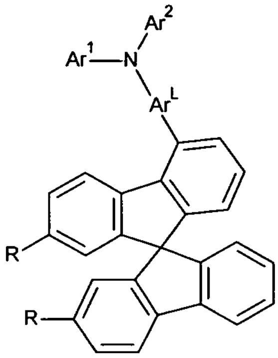
formula (1-23)



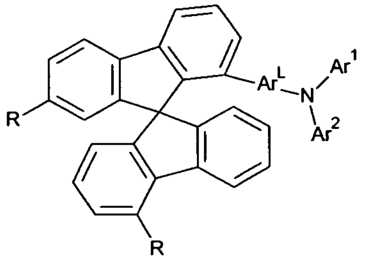
formula (1-24)



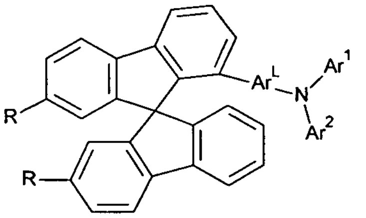
formula (1-25)



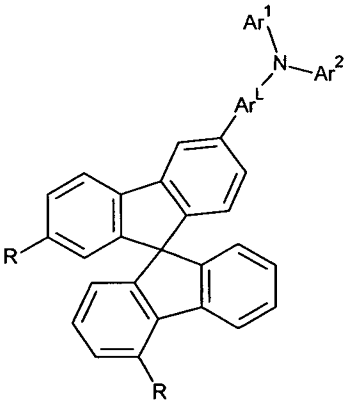
formula (1-26)



formula (1-27)



formula (1-28)



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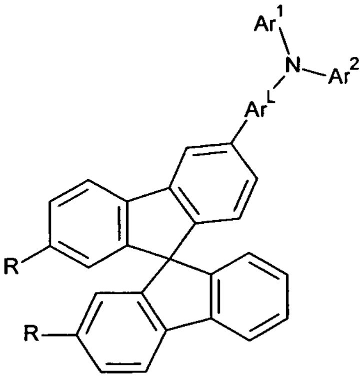
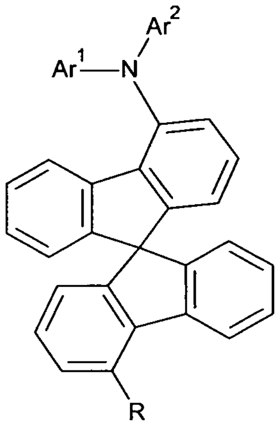


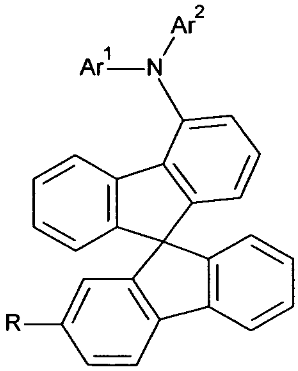
formula (1-30)

where the symbols and indices used have the meaning as given above.

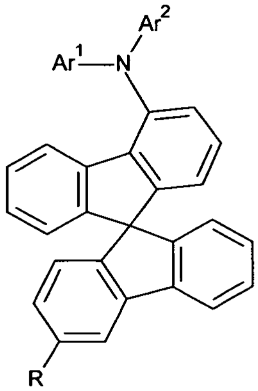
In accordance with a further preferred embodiment of the invention, the compounds of formula (1) are selected from the compounds of the following formulae (1-31) to (1-60),



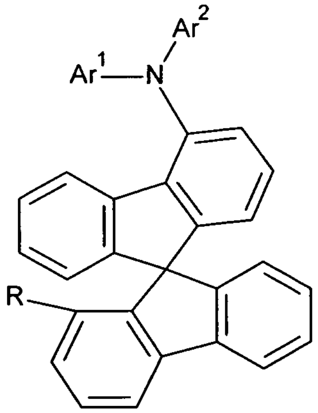
formula (1-31)



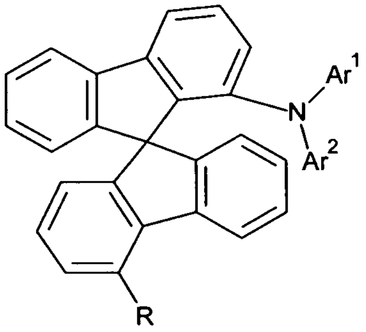
formula (1-32)



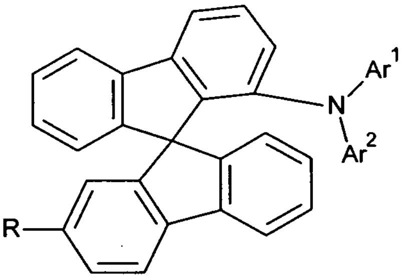
formula (1-33)



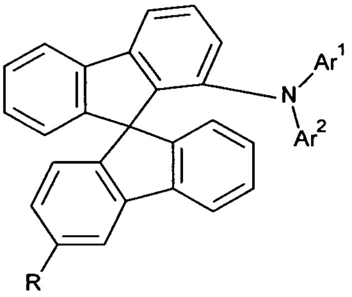
formula (1-34)



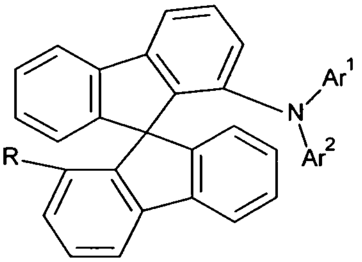
formula (1-35)



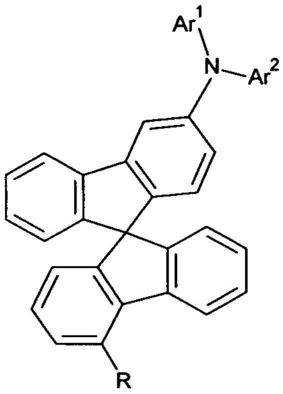
formula (1-36)



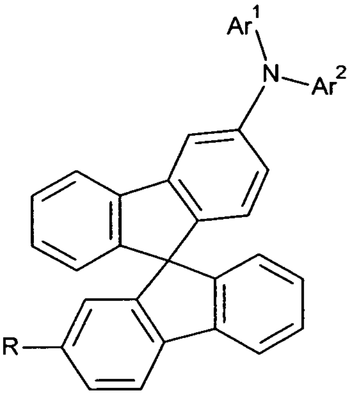
formula (1-37)



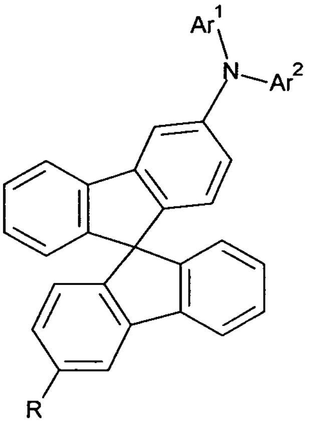
formula (1-38)



formula (1-39)



formula (1-40)



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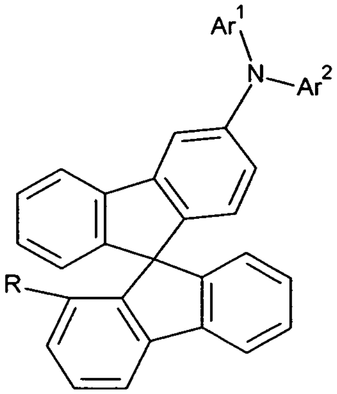

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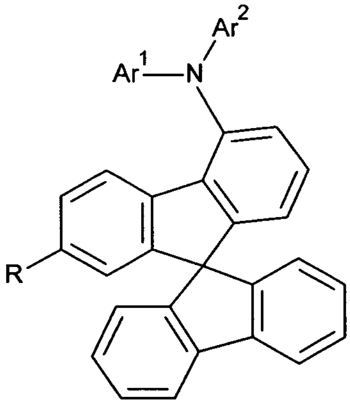

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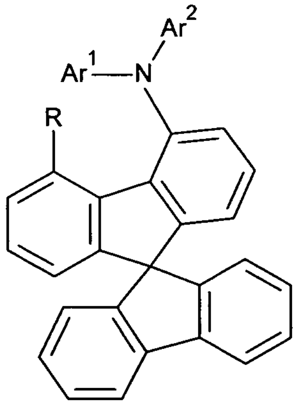

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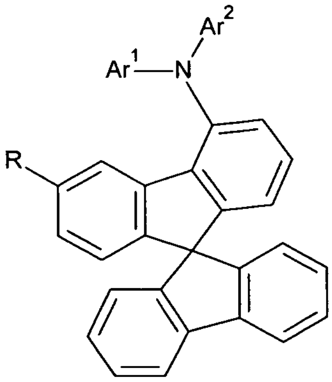

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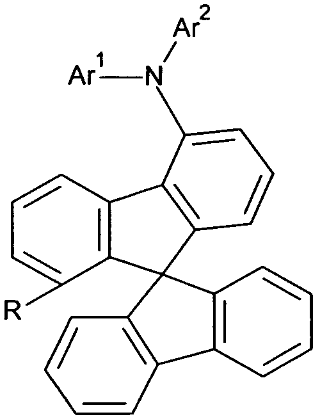

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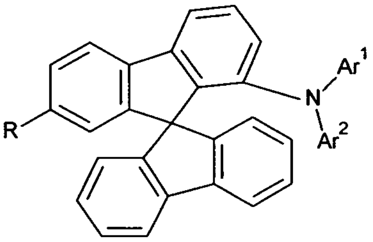

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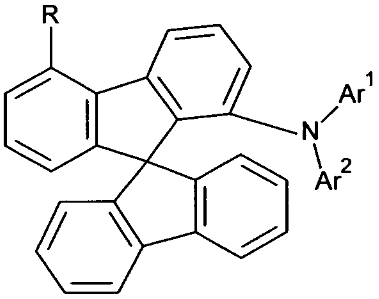
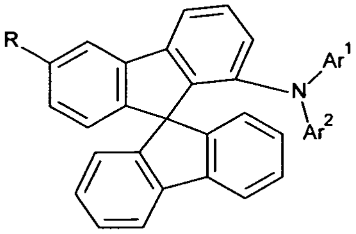
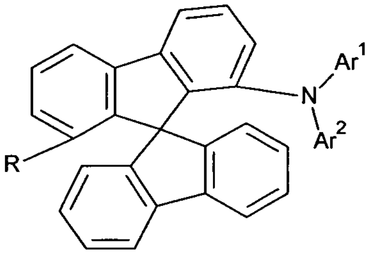


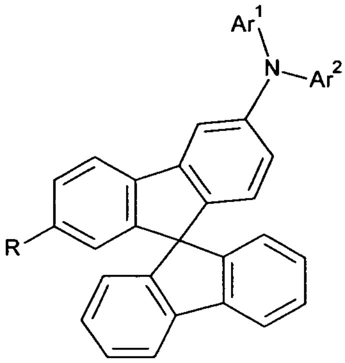
formula (1-48)



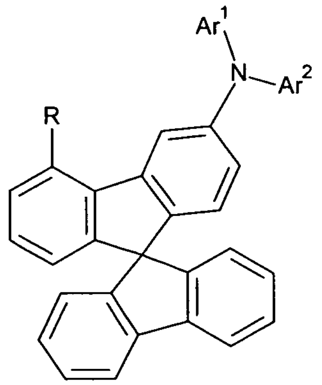
formula (1-49)



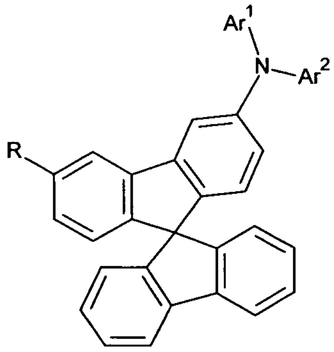
formula (1-50)



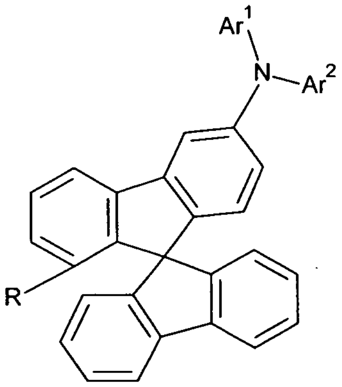
formula (1-51)



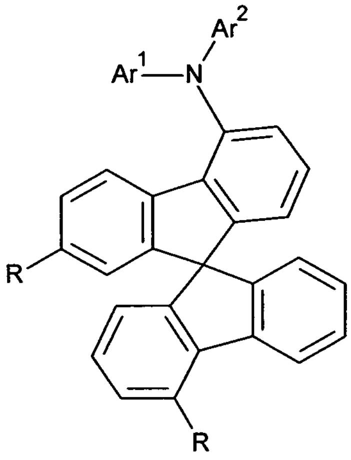
formula (1-52)



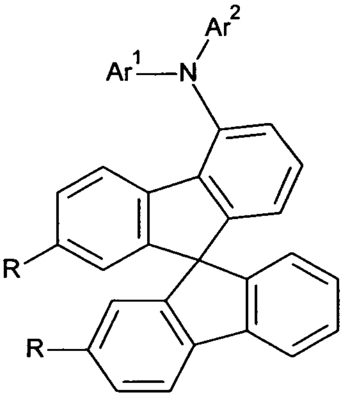
formula (1-53)



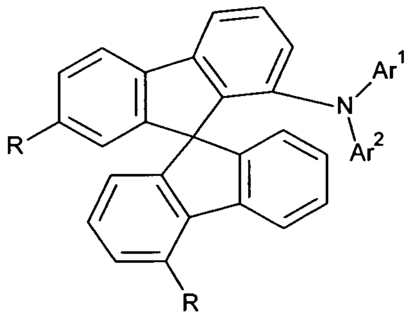
formula (1-54)



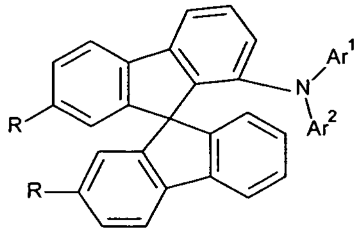
formula (1-55)



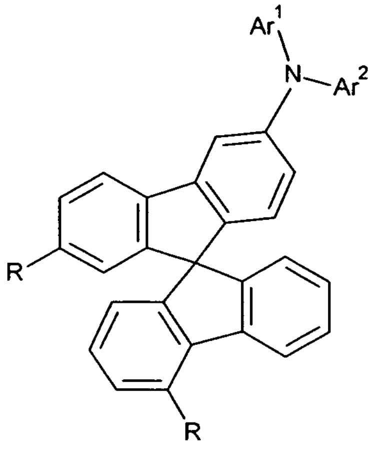
formula (1-56)



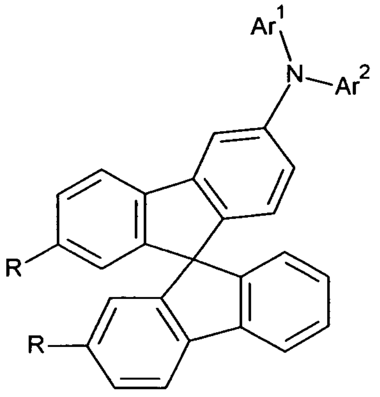
formula (1-57)



formula (1-58)



formula (1-59)

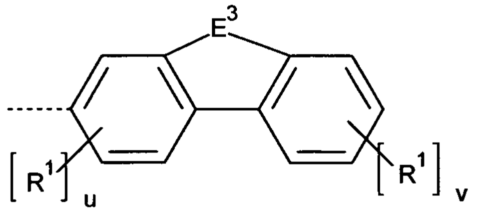


formula (1-60)

Among formulae (1-1) to (1-60), formulae (1-1) to (1-12) and (1-31) to (1-42) are preferred. Formulae (1-1) to (1-4) und (1-31) to (1-34) are particularly preferred. Very particularly preferred formulae are formulae (1-1), (1-2), (1-31) and (1-32).

Particular preference is given to compounds of the formulae (1) and (1-1) to (1-60), in which the preferred embodiments mentioned above occur simultaneously. Particular preference is therefore given to compounds of formula (1) for which:

Ar^1 is selected from the groups of formula (Ar1-2a),



formula (Ar1-2a)

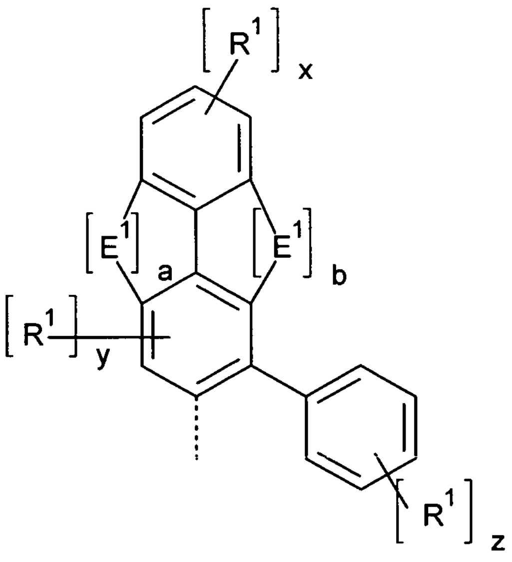
where the symbols E^3 and R^1 have the same meaning as above, and where:

u is 0, 1 or 3;

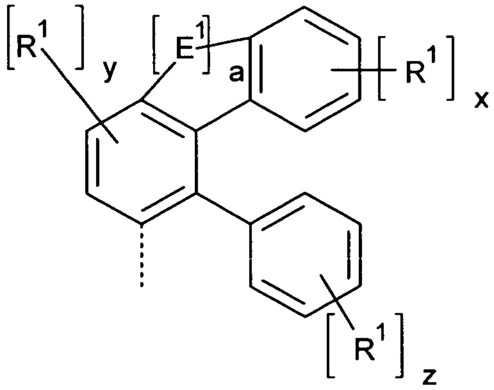
v is 0, 1, 2, 3 or 4.

E^3 is $C(R^0)_2$, O S or $N(R^0)$;

Ar^2 is selected from the groups of formula (Ar2-6a) or (Ar2-7a),



formula (Ar2-7a)



formula (Ar2-8a)

where

a, b are 0 or 1, where $a + b \leq 1$;

x, z are identically or differently, 0, 1, 2, 3, 4 or 5; with $a + b + x \leq 5$ in formula (Ar2-7a) and $a + x \leq 5$ in formula (Ar2-8a);

y is 0, 1, 2 or 3, with $y + a + b \leq 3$ in formula (Ar2-7a) and $a + x \leq 3$ in formula (Ar2-8a);

E^1 is $C(R^0)_2$, O S or $N(R^0)$;

Ar^L is a benzene group, which may be substituted at each free position by a group R^1;

R^0 is selected on each occurrence, identically or differently, from the group consisting of H, D, F, CN, $Si(R^2)_3$, a straight-chain alkyl having 1 to 10 C atoms or a branched or cyclic alkyl group having 3 to 10 C atoms, each of which may be substituted by one or more radicals R^2, where in each case one or more H atoms may be replaced by F, or an aryl or heteroaryl group having 5 to 40 aromatic ring atoms, which may in each case be substituted by one or more radicals R^2, where two adjacent substituents R^0, may form a mono- or polycyclic, aliphatic ring system or aromatic ring system, which may be substituted by one or more radicals R^2.

R and R^1 are selected, identically or differently on each occurrence, from the group consisting of H, D, F, CN, a straight-chain alkyl or alkoxy group having 1 to 10 C atoms or a branched or cyclic alkyl or alkoxy group having 3 to 10 C atoms, each of which may be substituted by one or more radicals R^2, where one or more non-adjacent CH_2 groups may be replaced by O and where one or more H atoms may be replaced by F, an aromatic or heteroaromatic ring system having 5 to 24 aromatic ring atoms, which may in each case be substituted by one or more radicals R^2.

R^2 is selected, identically or differently on each occurrence, from the group consisting of H, D, F, CN, a straight-chain alkyl or alkoxy group having 1 to 10 C atoms or a branched or cyclic alkyl or alkoxy group having 3 to 10 C atoms, each of which may be substituted by one or more radicals R^3, where one or more non-adjacent CH_2 groups may be replaced by O and where one or more H atoms may be replaced by F, an aromatic or heteroaromatic ring system having 5 to 24 aromatic ring atoms, which may in each case be substituted by one or more radicals R^3.

R^3 is selected on each occurrence, identically or differently, from the group consisting of H, D, F, Cl, Br, I, CN, a straight-chain alkyl, alkoxy or thioalkyl group having 1 to 20 C atoms or a branched or cyclic alkyl, alkoxy or thioalkyl group having 3 to 20 C atoms, where in each case one or more non-adjacent CH_2 groups may be replaced by SO, SO_2, O, S and where one or more H atoms may be replaced by D, F, Cl, Br or I, an aromatic or heteroaromatic ring system having 5 to 24 C atoms;

Ar^3 is an aryl having 6 to 18 C atoms or an heteroaryl having 5 to 18 aromatic ring atoms, which may in each case also be substituted by one or more radicals R^3;

i is 0 or 1; and

m, n are equal to 0.

For compounds which are processed by vacuum evaporation, the alkyl groups preferably have not more than four C atoms, particularly preferably not more than 1 C atom. For compounds which are processed from solution, suitable compounds are also those which are substituted by linear, branched or cyclic alkyl groups having up to 10 C atoms or which are substituted by oligoarylene groups, for example ortho-, meta-, para- or branched terphenyl or quaterphenyl groups.

Examples of preferred structures for compounds according to formula (1) are compounds of formula (1-1) or (1-31), where:

R is H

Ar^L in formulae (1-1) is a phenyl group of formula (Ar^L-1), (Ar^L-2) or (Ar^L-3); and

Ar^1 and Ar^2 are combined as listed in the tables below;

Ar^1	**Ar^2**
Ar1-8	Ar2-13
Ar1-8	Ar2-14
Ar1-8	Ar2-15
Ar1-8	Ar2-16

Ar^1	**Ar^2**
Ar1-14	Ar2-13
Ar1-14	Ar2-14
Ar1-14	Ar2-15
Ar1-14	Ar2-16

Ar1-8	Ar2-17
Ar1-8	Ar2-18
Ar1-8	Ar2-19
Ar1-8	Ar2-20
Ar1-8	Ar2-21
Ar1-8	Ar2-22
Ar1-8	Ar2-23
Ar1-8	Ar2-24
Ar1-8	Ar2-25
Ar1-8	Ar2-26
Ar1-8	Ar2-27
Ar1-8	Ar2-100
Ar1-8	Ar2-101
Ar1-8	Ar2-102
Ar1-8	Ar2-103
Ar1-8	Ar2-105
Ar1-8	Ar2-106
Ar1-8	Ar2-118
Ar1-8	Ar2-131
Ar1-8	Ar2-132
Ar1-8	Ar2-133
Ar1-8	Ar2-136
Ar1-8	Ar2-138
Ar1-8	Ar2-142
Ar1-8	Ar2-143
Ar1-8	Ar2-144
Ar1-8	Ar2-148
Ar1-8	Ar2-152
Ar1-8	Ar2-153
Ar1-8	Ar2-154

Ar1-14	Ar2-17
Ar1-14	Ar2-18
Ar1-14	Ar2-19
Ar1-14	Ar2-20
Ar1-14	Ar2-21
Ar1-14	Ar2-22
Ar1-14	Ar2-23
Ar1-14	Ar2-24
Ar1-14	Ar2-25
Ar1-14	Ar2-26
Ar1-14	Ar2-27
Ar1-14	Ar2-100
Ar1-14	Ar2-101
Ar1-14	Ar2-102
Ar1-14	Ar2-103
Ar1-14	Ar2-105
Ar1-14	Ar2-106
Ar1-14	Ar2-118
Ar1-14	Ar2-131
Ar1-14	Ar2-132
Ar1-14	Ar2-133
Ar1-14	Ar2-136
Ar1-14	Ar2-138
Ar1-14	Ar2-142
Ar1-14	Ar2-143
Ar1-14	Ar2-144
Ar1-14	Ar2-148
Ar1-14	Ar2-152
Ar1-14	Ar2-153
Ar1-14	Ar2-154

Ar1-8	Ar2-159
Ar1-8	Ar2-162
Ar1-8	Ar2-163
Ar1-8	Ar2-164
Ar1-8	Ar2-170
Ar1-8	Ar2-171
Ar1-8	Ar2-172
Ar1-8	Ar2-173
Ar1-8	Ar2-174
Ar1-8	Ar2-178
Ar1-8	Ar2-182
Ar1-8	Ar2-183
Ar1-8	Ar2-184
Ar1-8	Ar2-185
Ar1-8	Ar2-192
Ar1-8	Ar2-193
Ar1-8	Ar2-194
Ar1-8	Ar2-199
Ar1-8	Ar2-207
Ar1-8	Ar2-208
Ar1-8	Ar2-209
Ar1-8	Ar2-210
Ar1-8	Ar2-211
Ar1-8	Ar2-212
Ar1-8	Ar2-213
Ar1-8	Ar2-214
Ar1-8	Ar2-219
Ar1-8	Ar2-243
Ar1-8	Ar2-244
Ar1-8	Ar2-245

Ar1-14	Ar2-159
Ar1-14	Ar2-162
Ar1-14	Ar2-163
Ar1-14	Ar2-164
Ar1-14	Ar2-170
Ar1-14	Ar2-171
Ar1-14	Ar2-172
Ar1-14	Ar2-173
Ar1-14	Ar2-174
Ar1-14	Ar2-178
Ar1-14	Ar2-182
Ar1-14	Ar2-183
Ar1-14	Ar2-184
Ar1-14	Ar2-185
Ar1-14	Ar2-192
Ar1-14	Ar2-193
Ar1-14	Ar2-194
Ar1-14	Ar2-199
Ar1-14	Ar2-207
Ar1-14	Ar2-208
Ar1-14	Ar2-209
Ar1-14	Ar2-210
Ar1-14	Ar2-211
Ar1-14	Ar2-212
Ar1-14	Ar2-213
Ar1-14	Ar2-214
Ar1-14	Ar2-219
Ar1-14	Ar2-243
Ar1-14	Ar2-244
Ar1-14	Ar2-245

Ar1-8	Ar2-251
Ar1-8	Ar2-261
Ar1-8	Ar2-266
Ar1-8	Ar2-267
Ar1-8	Ar2-274
Ar1-8	Ar2-298
Ar1-8	Ar2-302
Ar1-8	Ar2-311
Ar1-8	Ar2-317
Ar1-8	Ar2-318
Ar1-8	Ar2-319
Ar1-8	Ar2-382
Ar1-8	Ar2-383
Ar1-8	Ar2-384
Ar1-8	Ar2-385
Ar1-8	Ar2-391
Ar1-8	Ar2-392
Ar1-8	Ar2-393
Ar1-8	Ar2-394
Ar1-8	Ar2-395
Ar1-8	Ar2-396
Ar1-8	Ar2-397
Ar1-8	Ar2-398
Ar1-8	Ar2-399
Ar1-8	Ar2-400
Ar1-8	Ar2-401
Ar1-8	Ar2-402
Ar1-8	Ar2-403
Ar1-8	Ar2-404
Ar1-8	Ar2-405

Ar1-14	Ar2-251
Ar1-14	Ar2-261
Ar1-14	Ar2-266
Ar1-14	Ar2-267
Ar1-14	Ar2-274
Ar1-14	Ar2-298
Ar1-14	Ar2-302
Ar1-14	Ar2-311
Ar1-14	Ar2-317
Ar1-14	Ar2-318
Ar1-14	Ar2-319
Ar1-14	Ar2-382
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Ar1-14	Ar2-385
Ar1-14	Ar2-391
Ar1-14	Ar2-392
Ar1-14	Ar2-393
Ar1-14	Ar2-394
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Ar1-14	Ar2-400
Ar1-14	Ar2-401
Ar1-14	Ar2-402
Ar1-14	Ar2-403
Ar1-14	Ar2-404
Ar1-14	Ar2-405

Ar1-8	Ar2-406
Ar1-8	Ar2-407
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Ar1-8	Ar2-409
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Ar1-13	Ar2-24
Ar1-13	Ar2-25
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Ar1-14	Ar2-425
Ar1-14	Ar2-426
Ar1-14	Ar2-427
Ar1-16	Ar2-13
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Ar1-16	Ar2-24
Ar1-16	Ar2-25
Ar1-16	Ar2-26
Ar1-16	Ar2-27
Ar1-16	Ar2-100
Ar1-16	Ar2-101

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Ar1-13	Ar2-148
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Ar1-13	Ar2-219
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Ar1-16	Ar2-194
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Ar1-16	Ar2-243
Ar1-16	Ar2-244
Ar1-16	Ar2-245
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Ar1-7	Ar2-26
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Ar1-7	Ar2-106
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Ar1-7	Ar2-133
Ar1-7	Ar2-136
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Ar1-7	Ar2-142
Ar1-7	Ar2-143
Ar1-7	Ar2-144

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Ar1-9	Ar2-420
Ar1-9	Ar2-421
Ar1-9	Ar2-424
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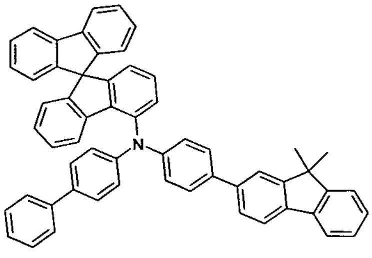
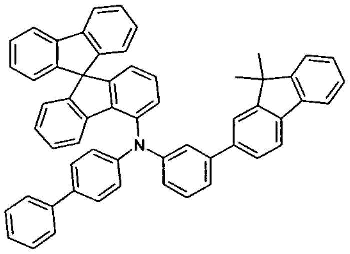
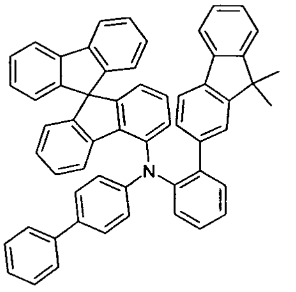
Ar1-9	Ar2-427

Other examples of suitable compounds according to the invention are the compounds shown in the following table: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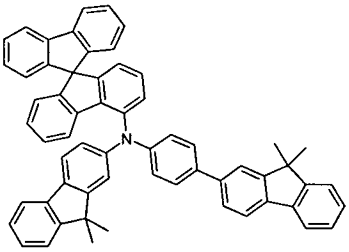	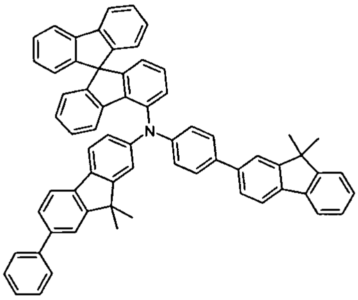	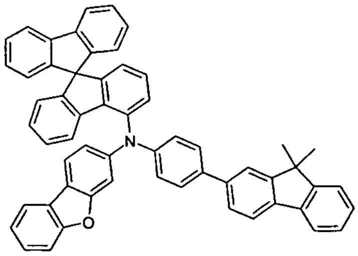
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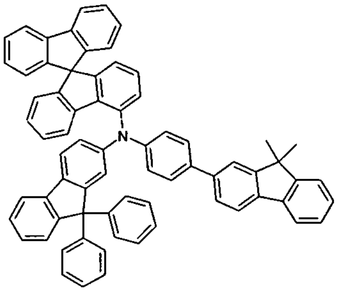	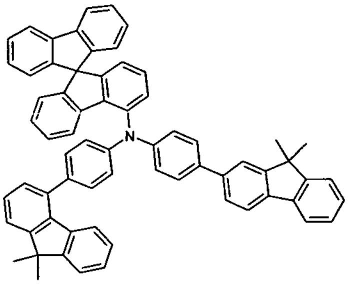	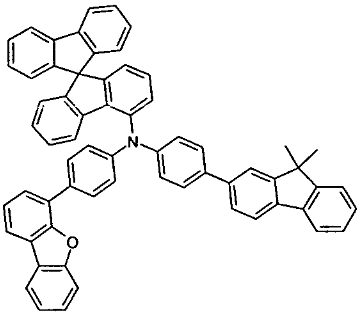
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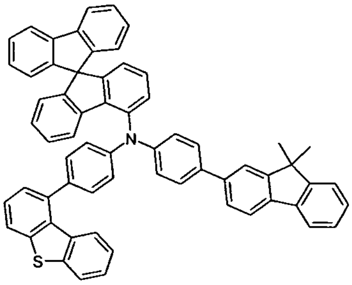	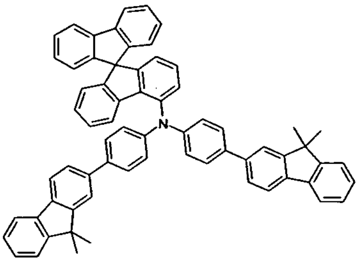	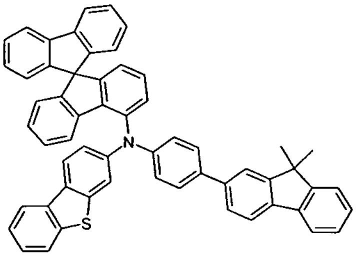
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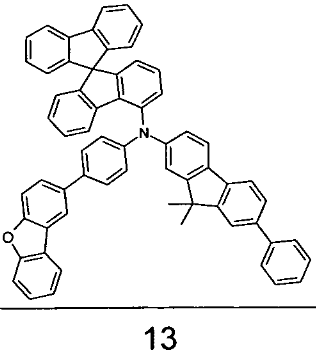	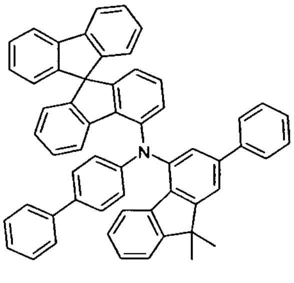	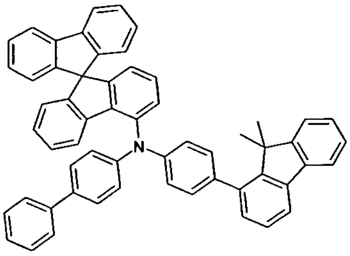
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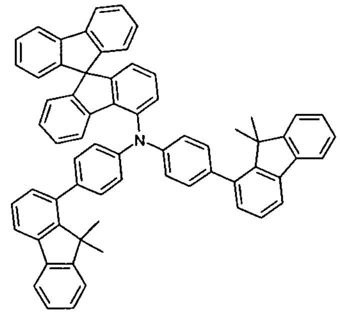	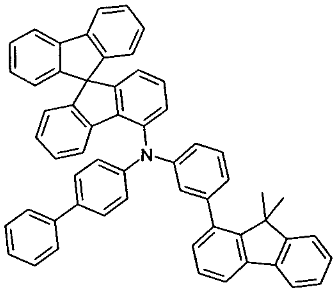	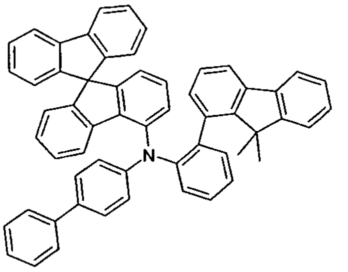
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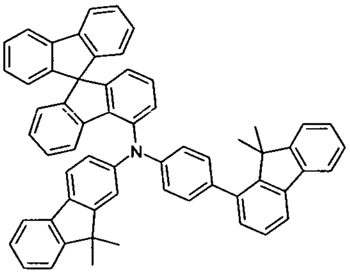	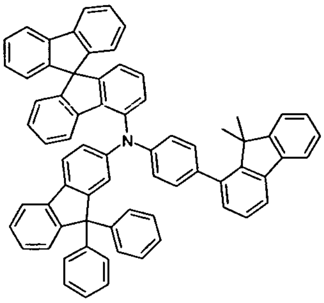	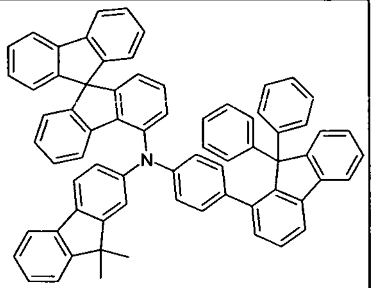
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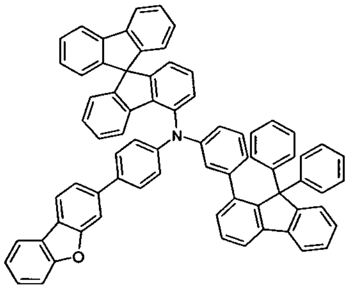	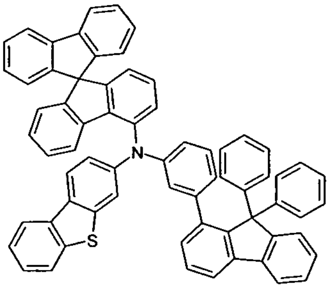	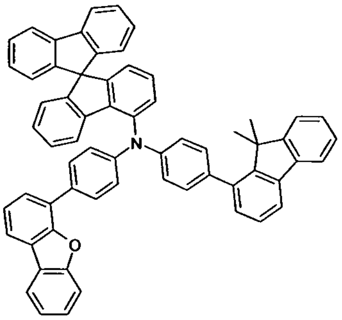
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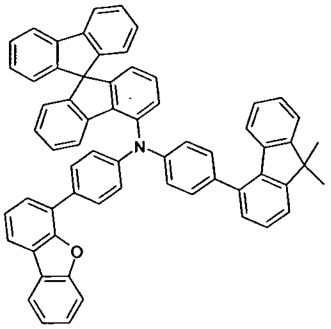	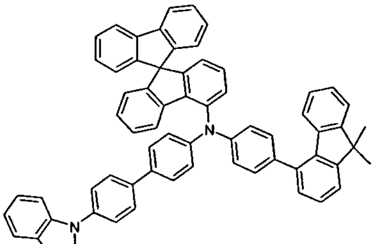	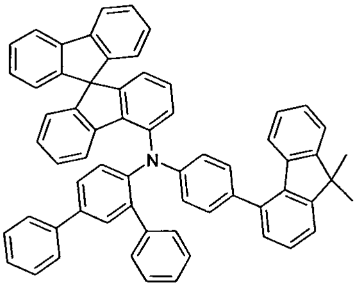
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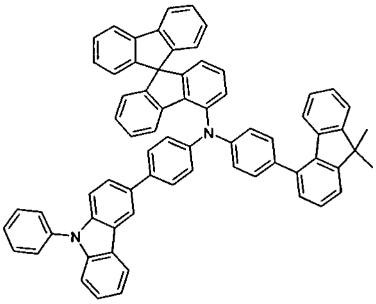	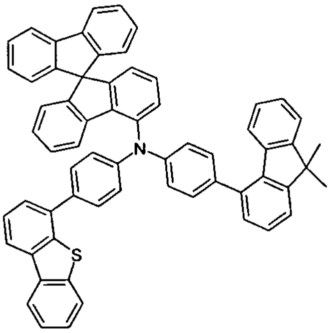	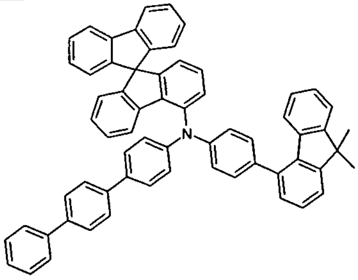
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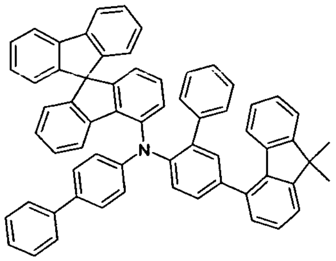	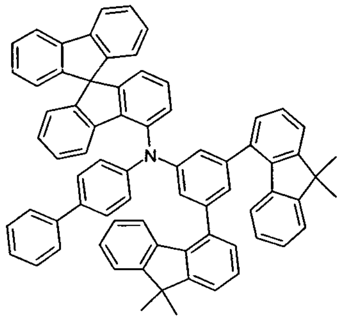	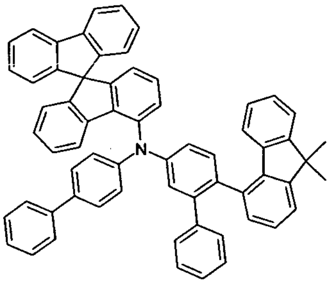
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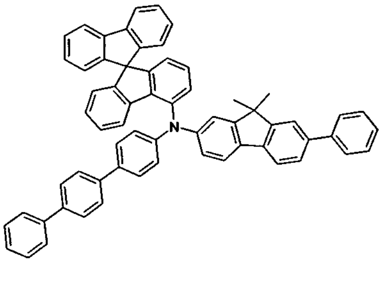	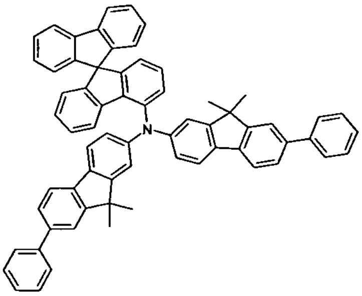	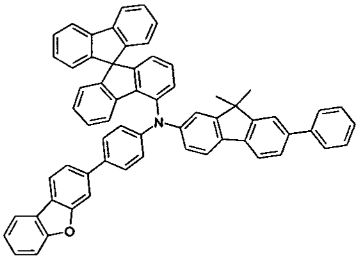
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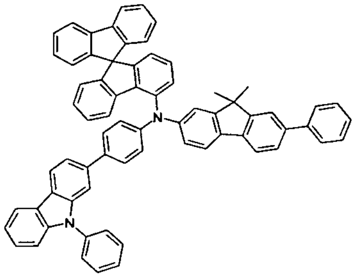	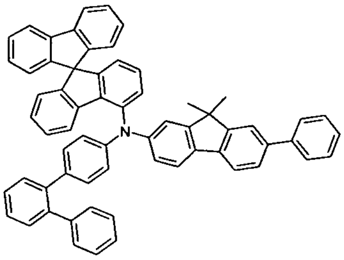	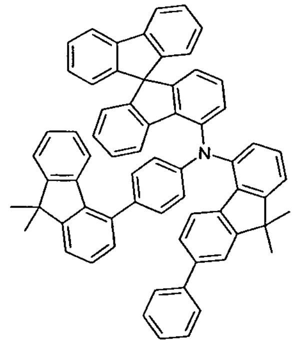
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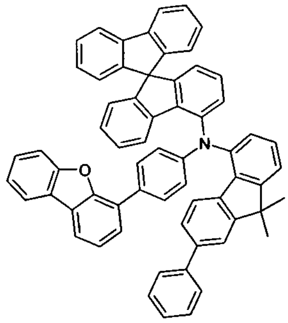	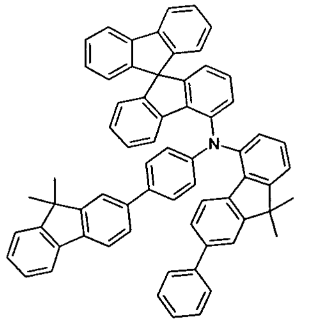	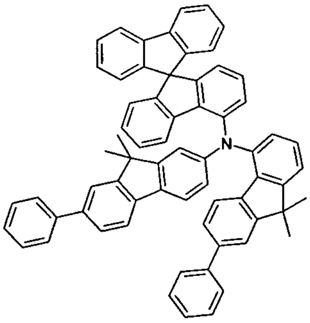
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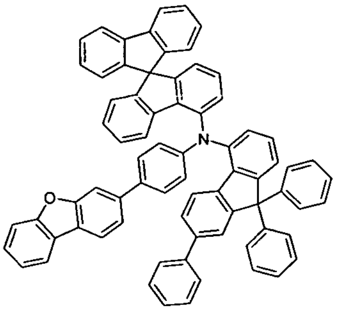	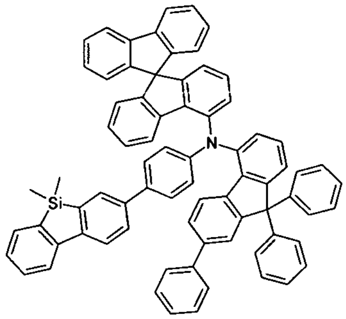	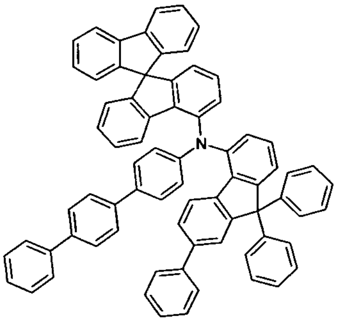
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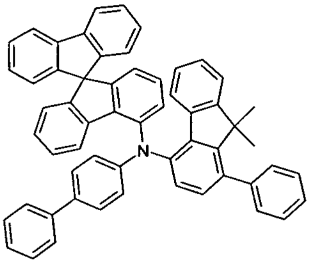	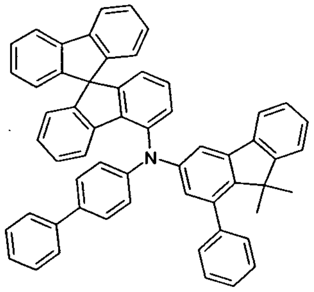	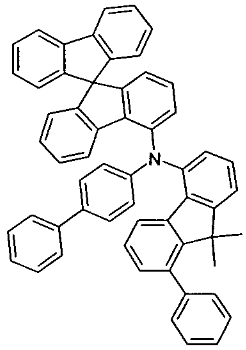
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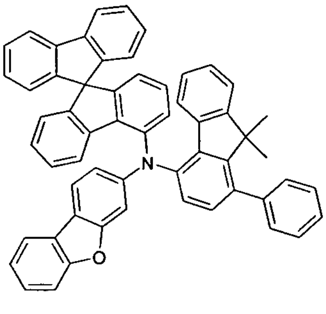	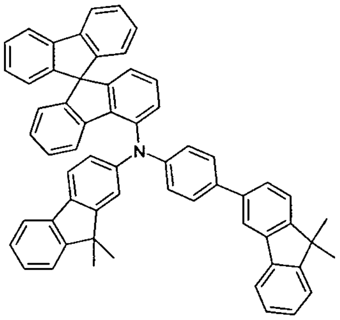	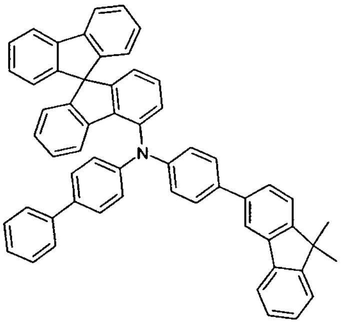
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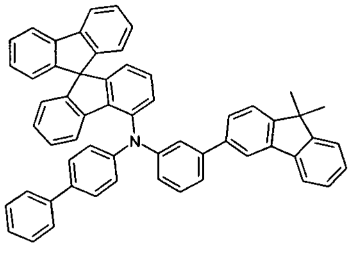	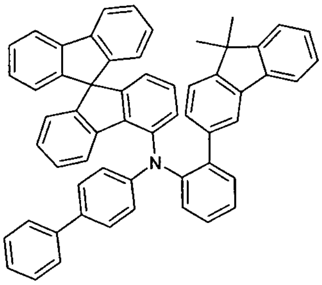	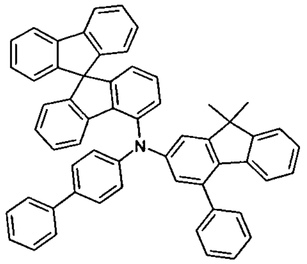
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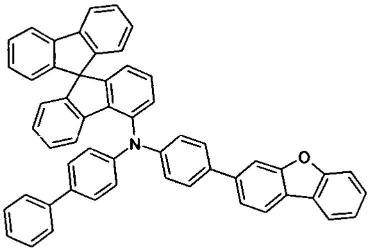	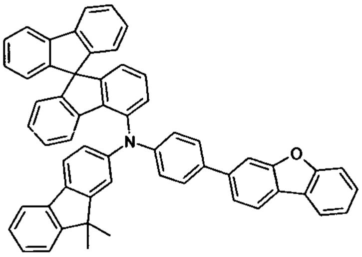	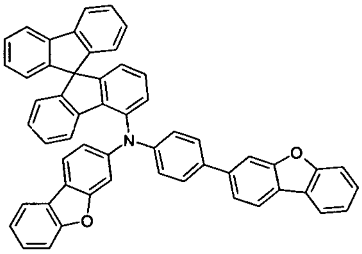
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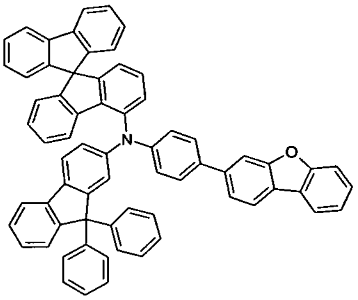	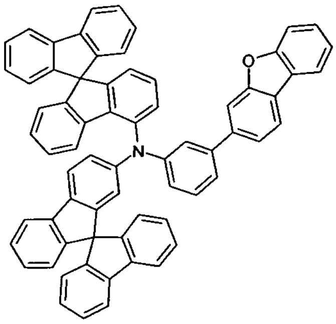	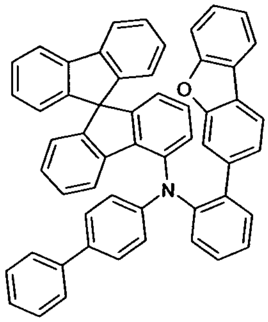
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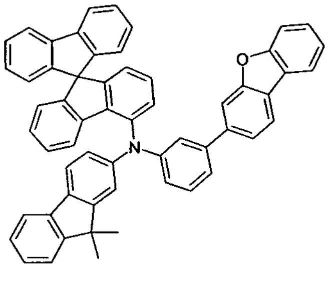	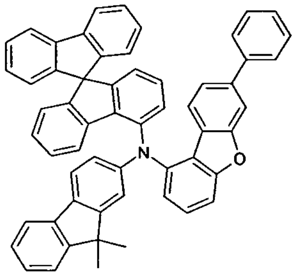	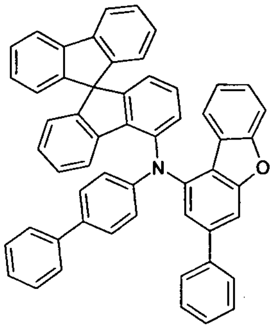
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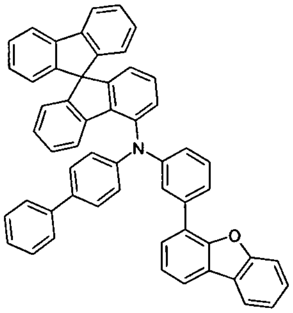	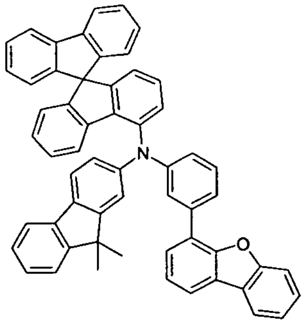	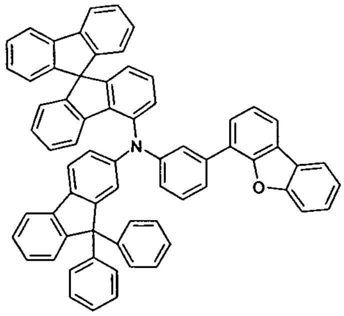
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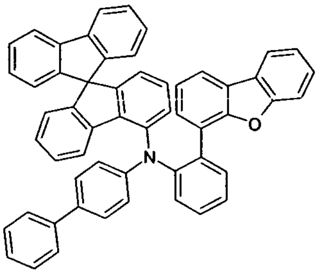	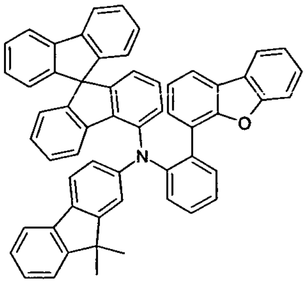	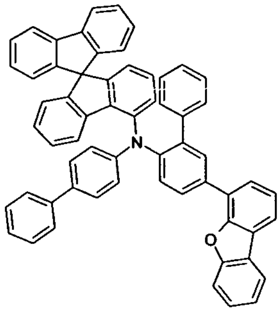
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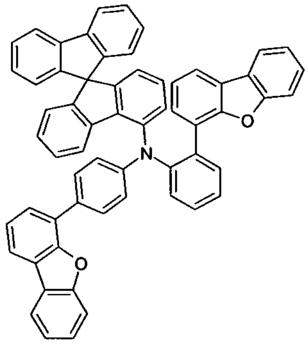	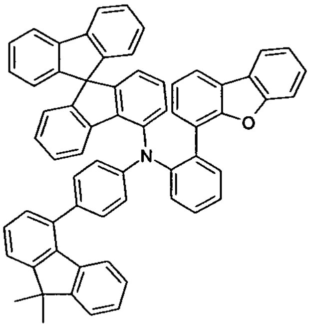	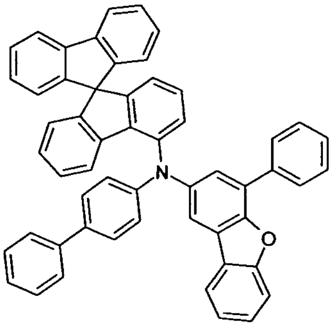
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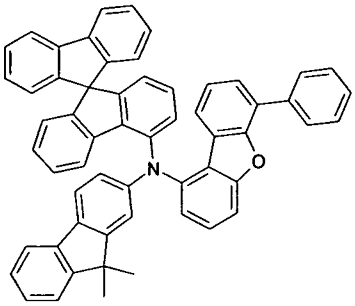	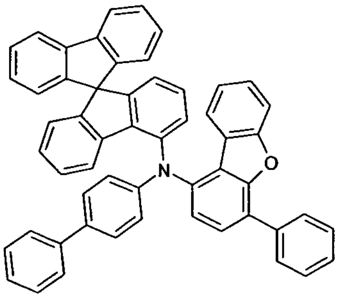	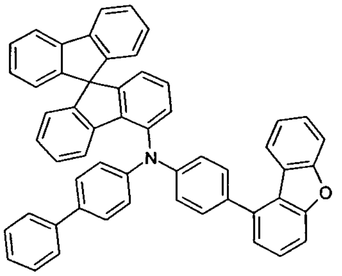
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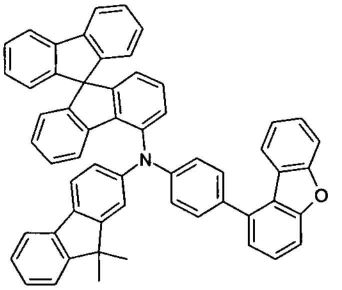	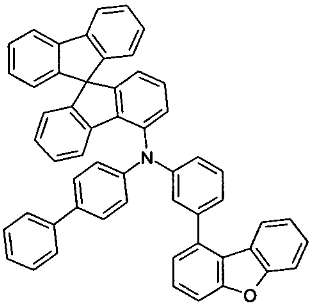	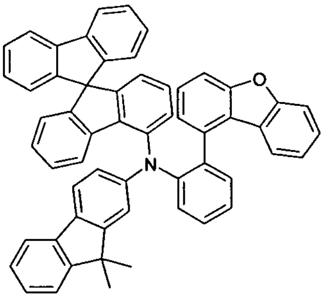
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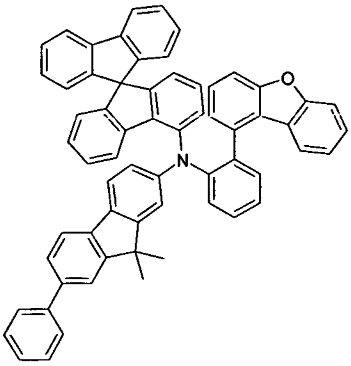	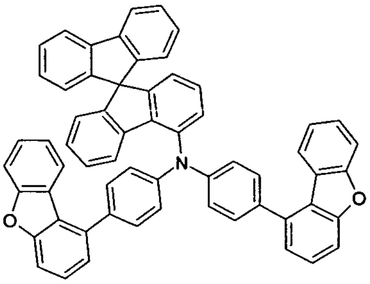	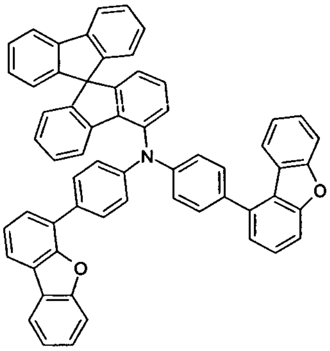
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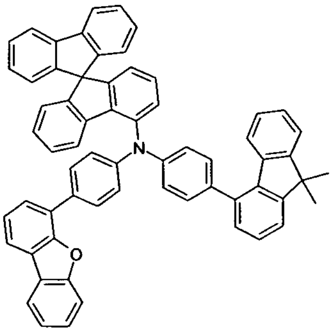	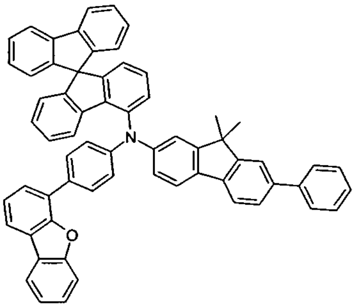	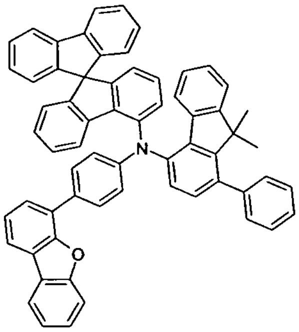
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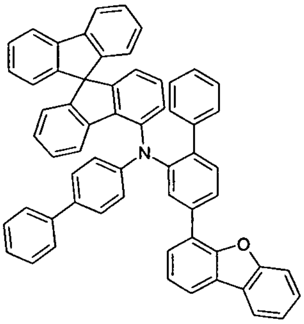	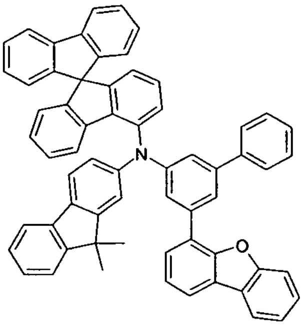	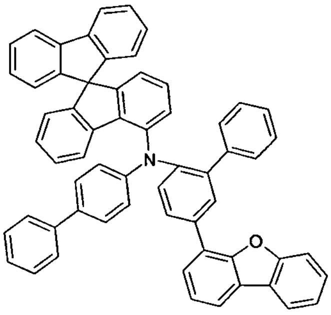
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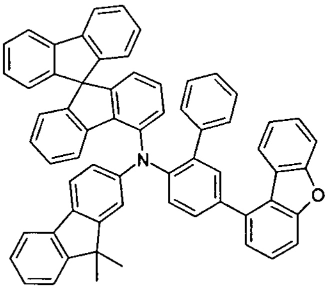	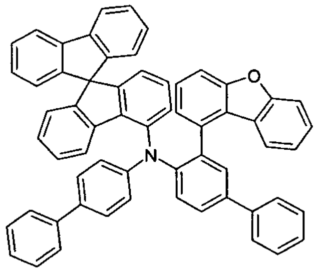	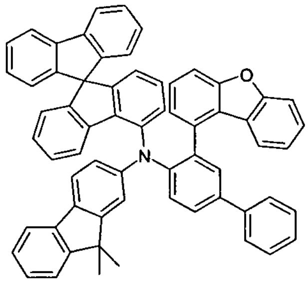
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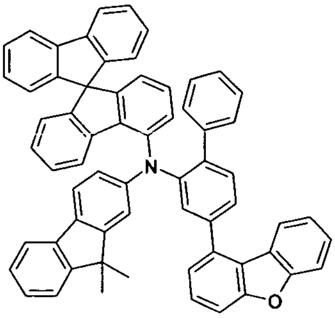	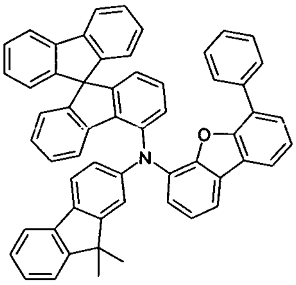	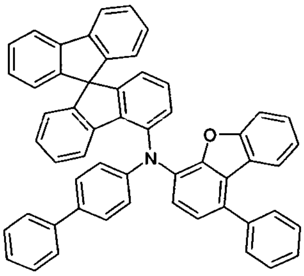
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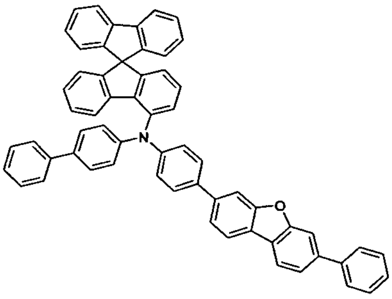	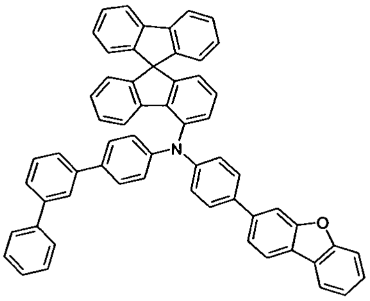	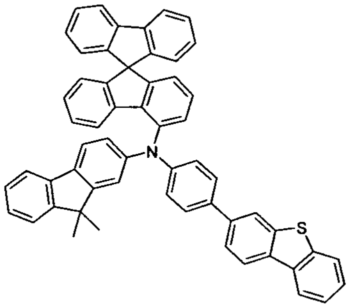
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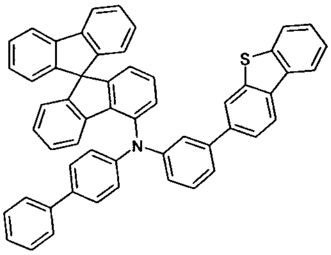	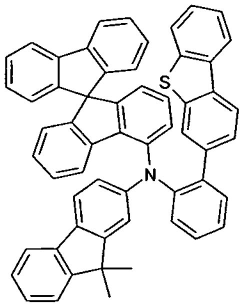	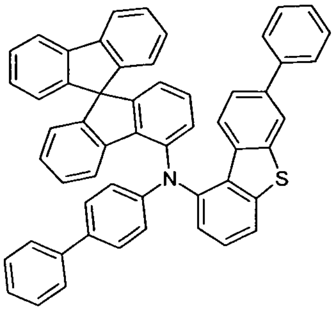
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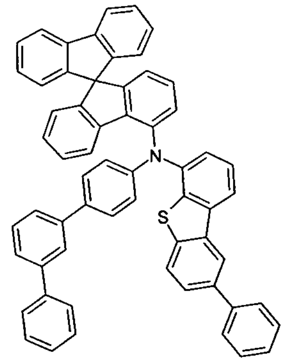	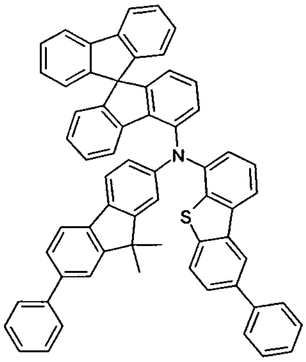	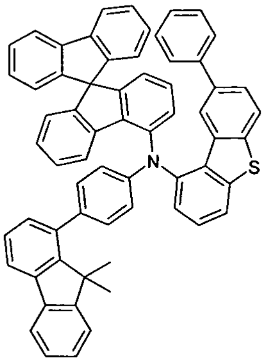
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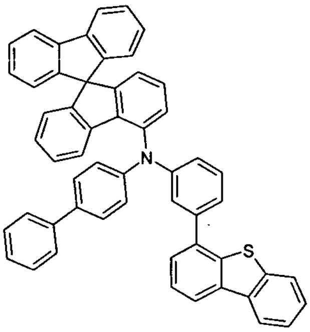	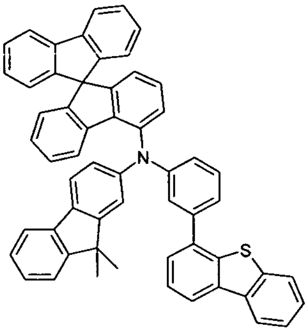	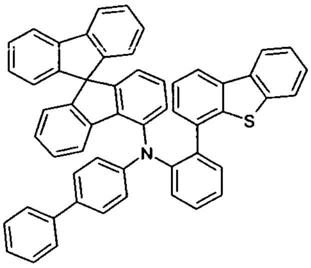
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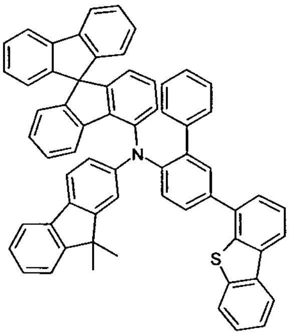	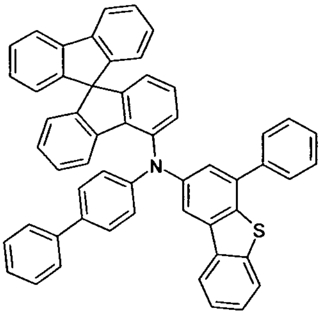	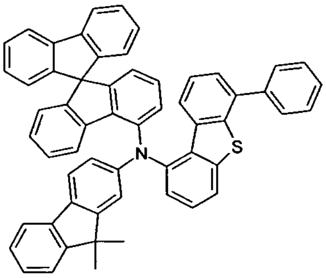
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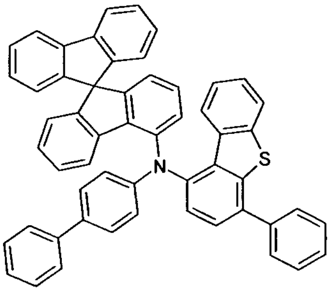	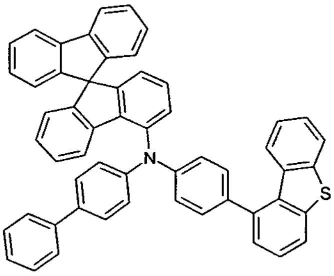	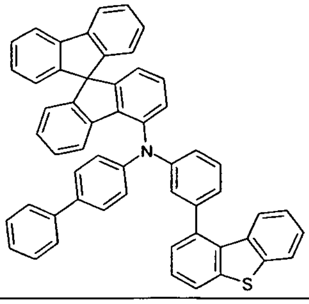
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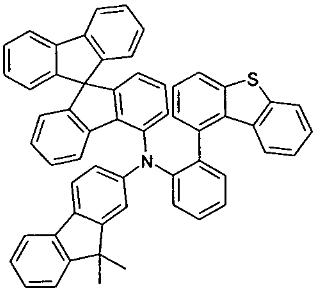	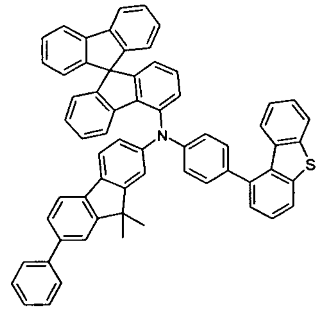	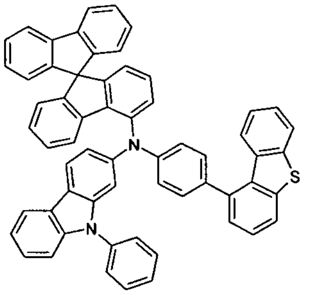
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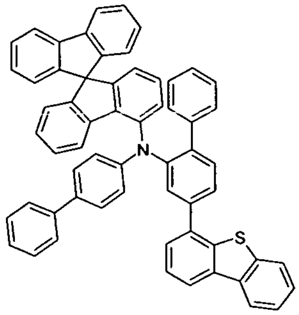	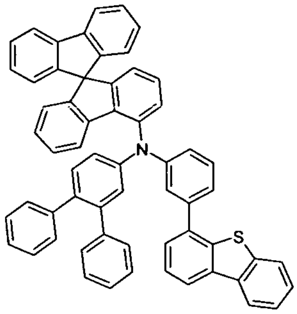	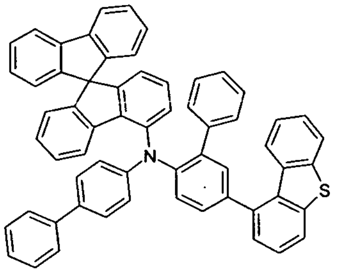
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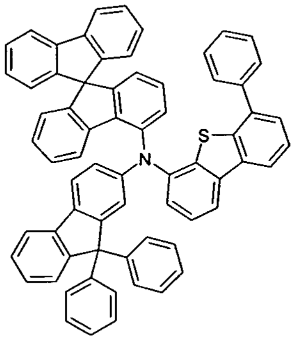	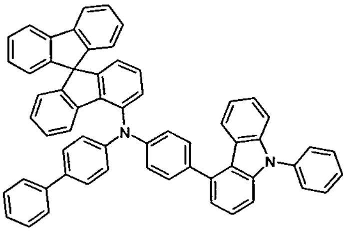	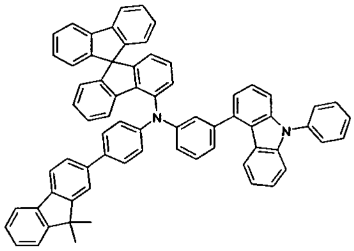
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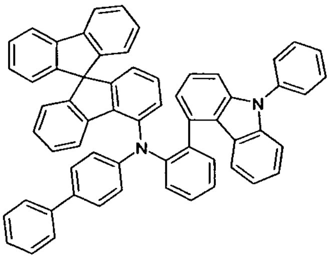	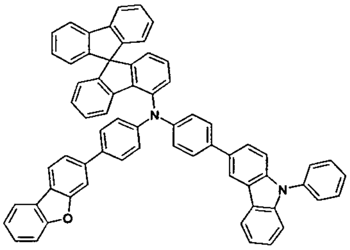	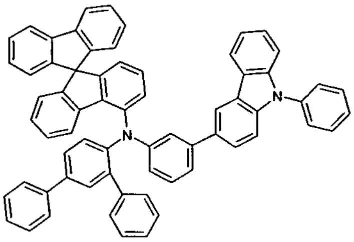
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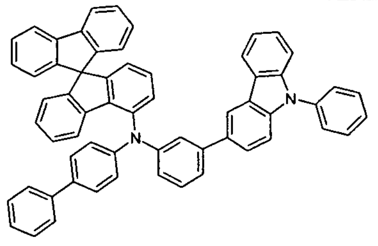	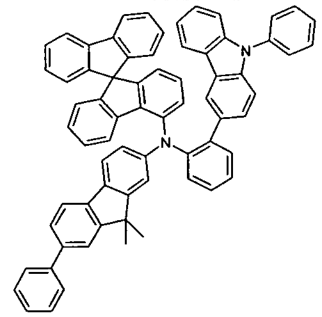	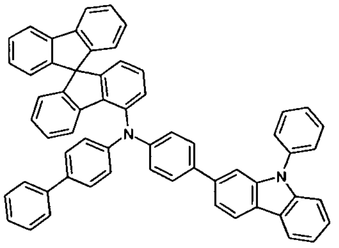
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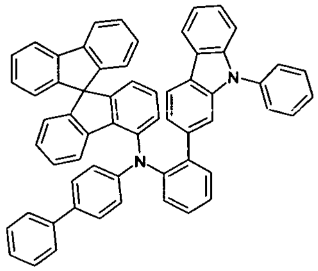	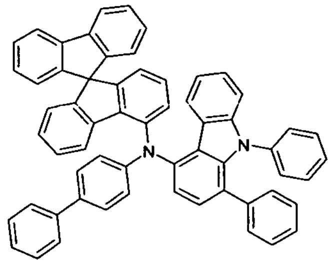	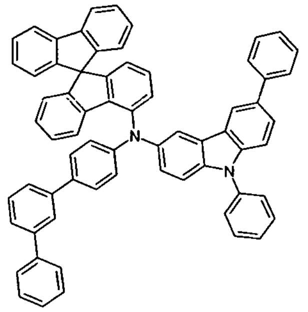
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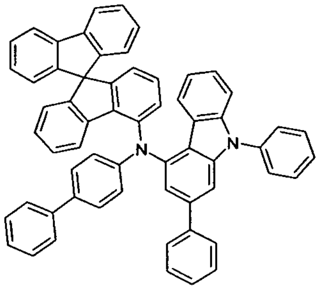	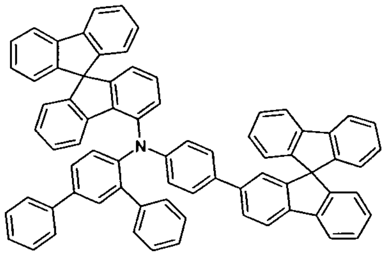	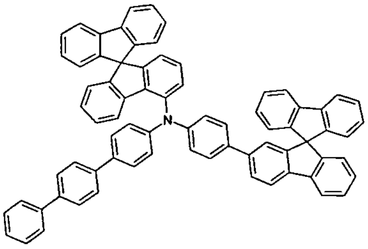
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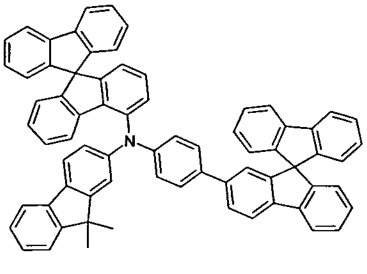	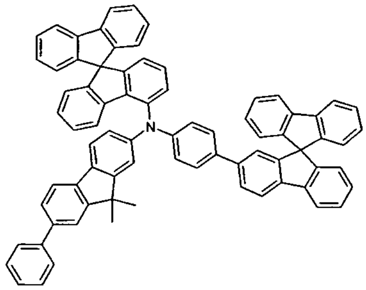	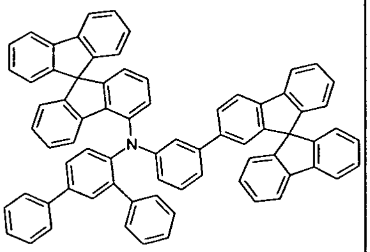
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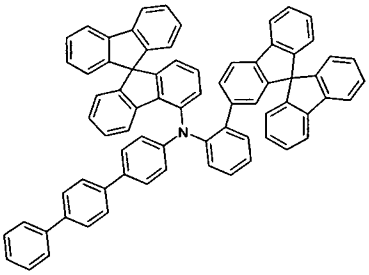	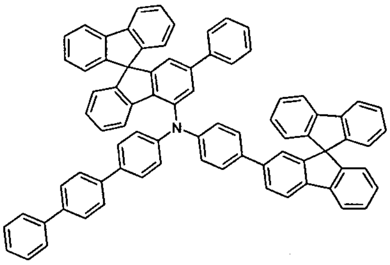	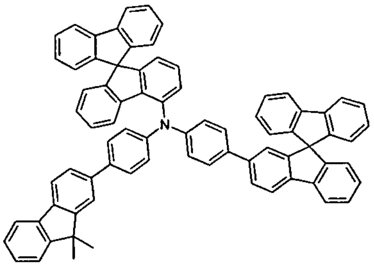
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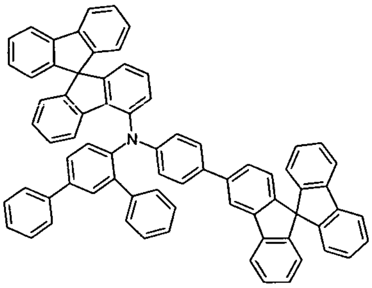	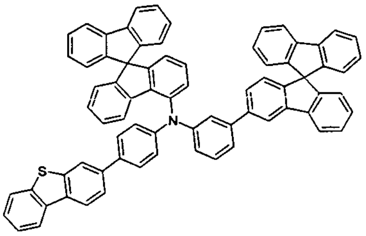	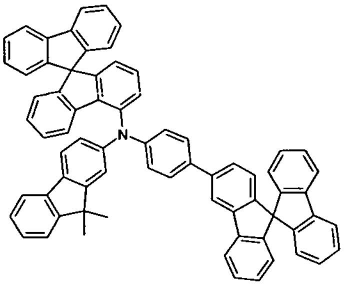
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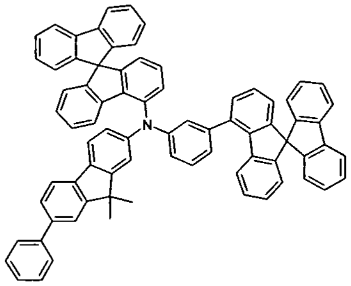	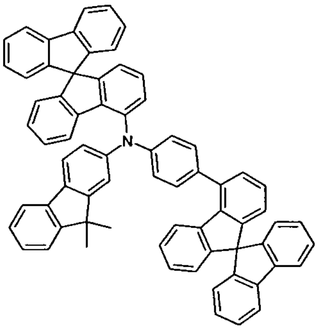	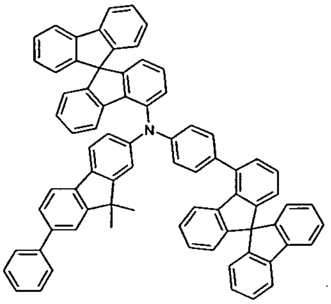
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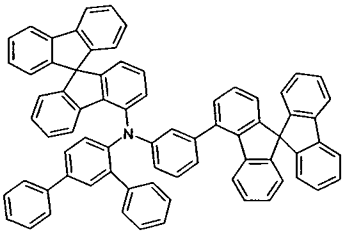	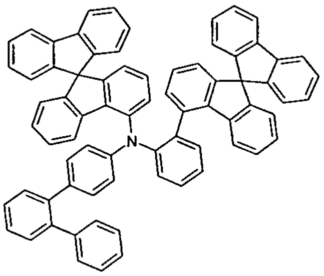	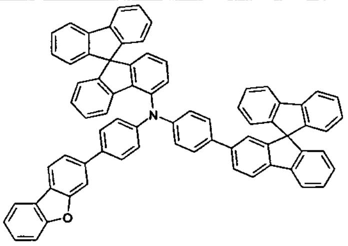
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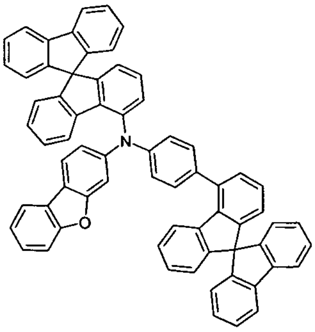	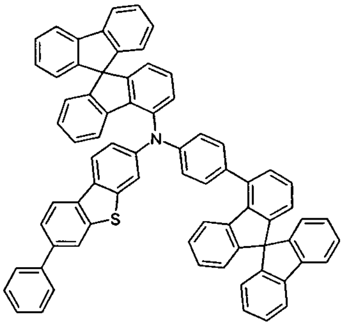	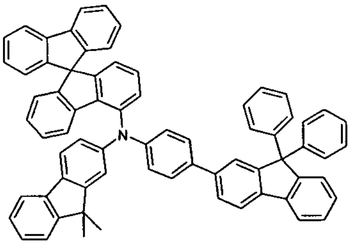
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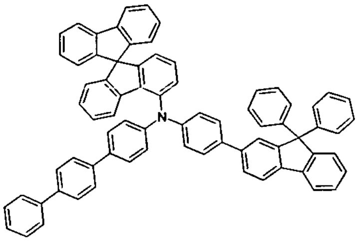	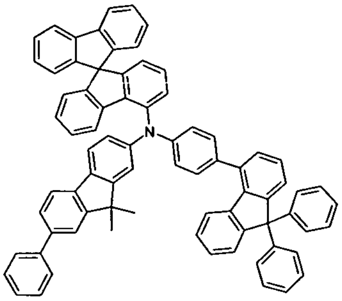	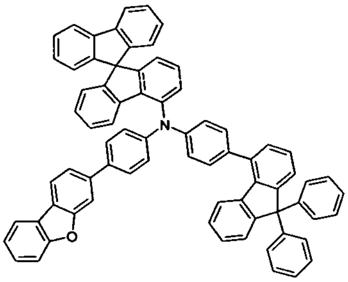
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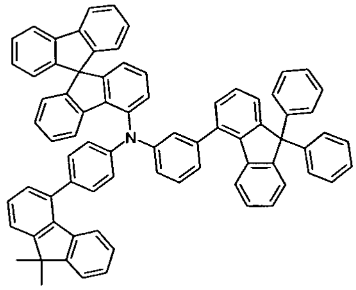	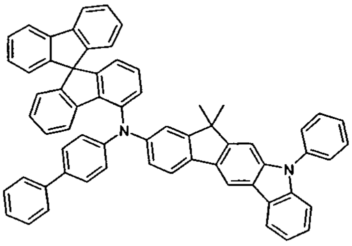	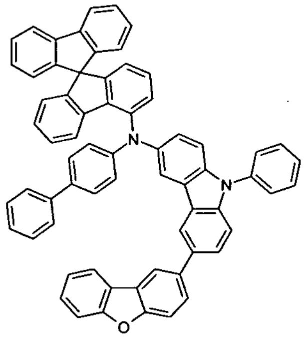
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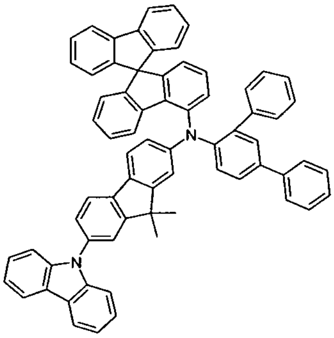	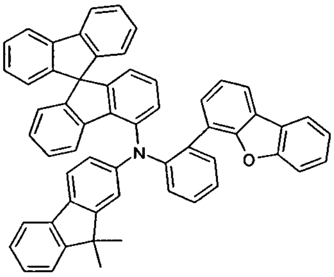	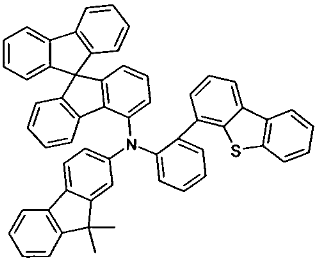
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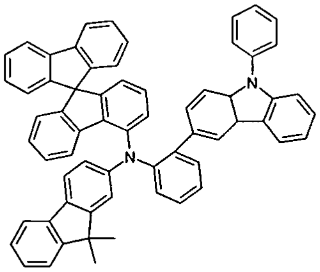	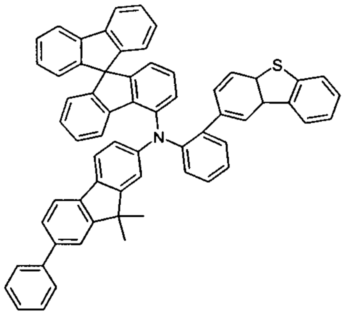	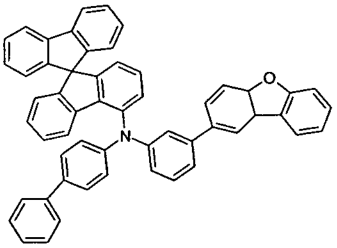
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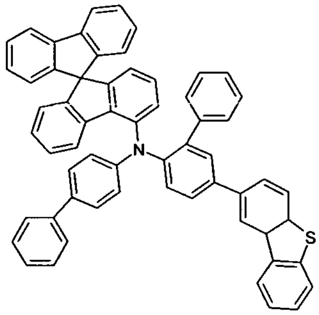	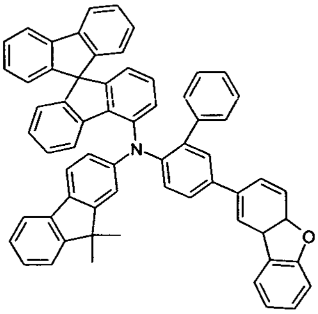	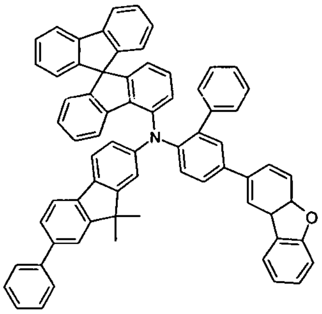
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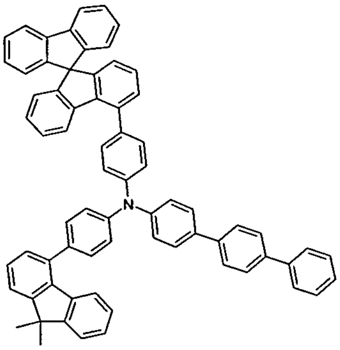	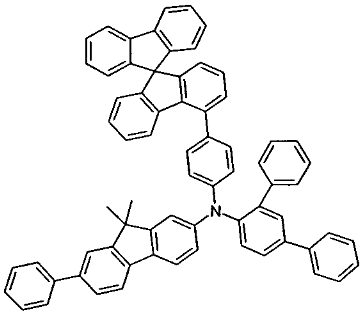	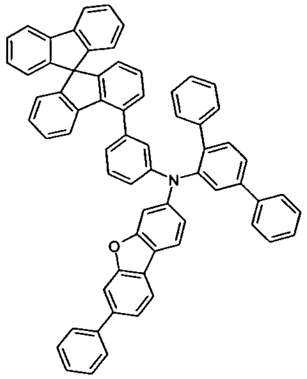
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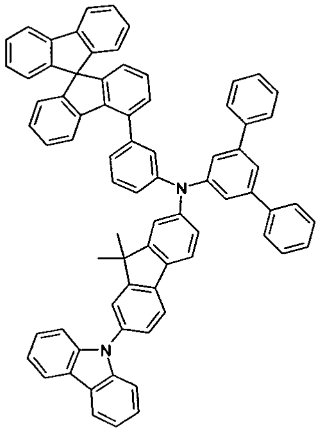	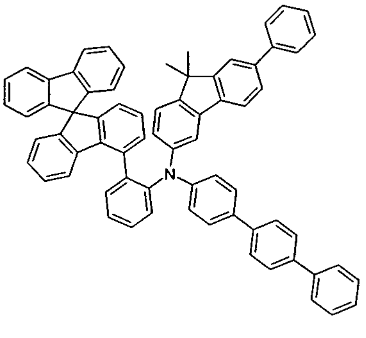	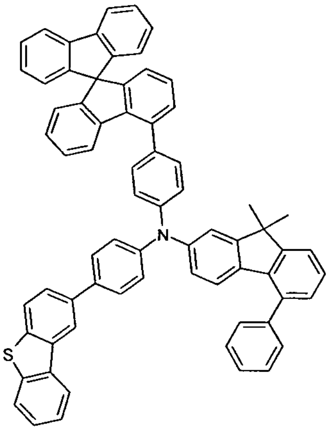
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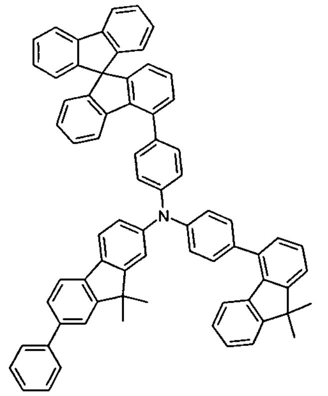	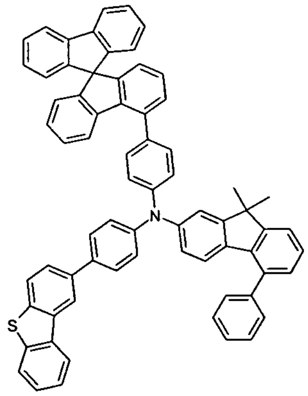	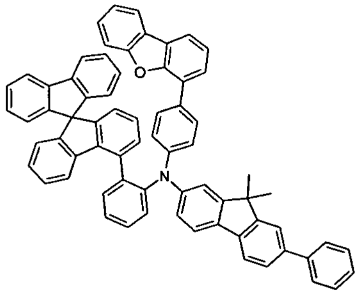
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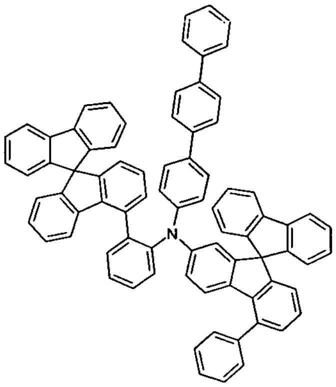	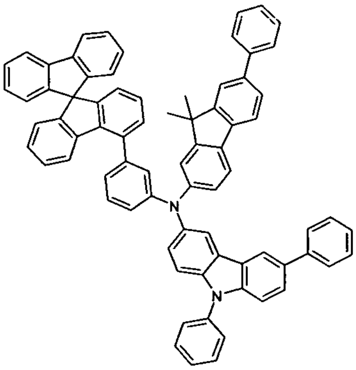	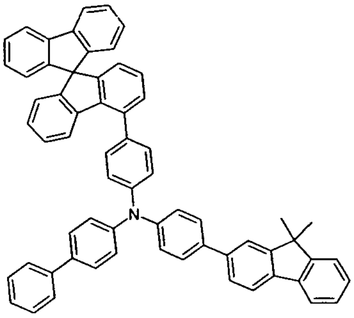
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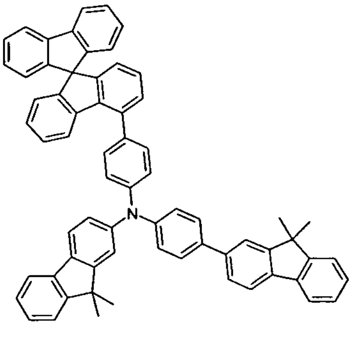	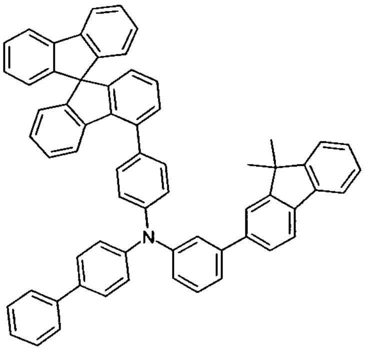	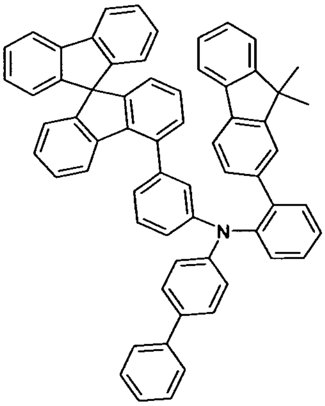
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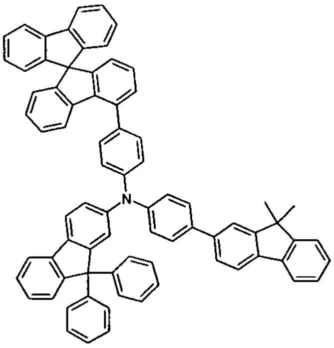	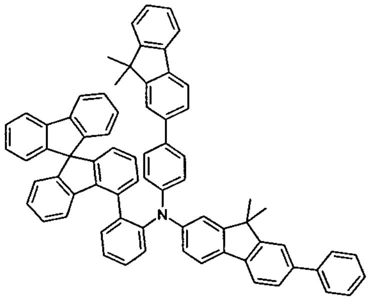	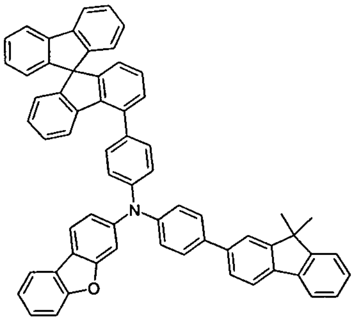
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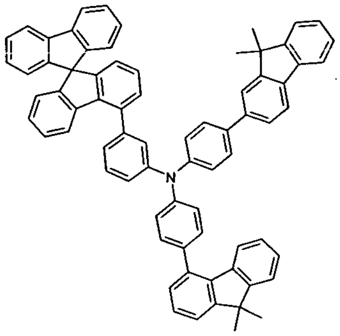	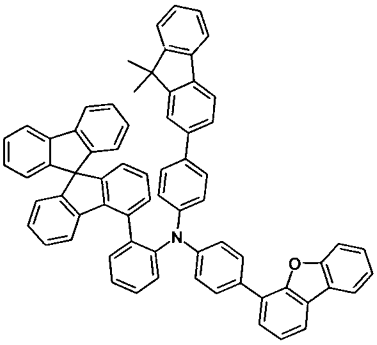	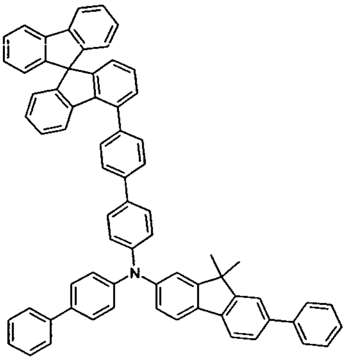
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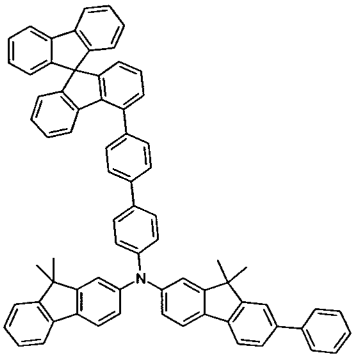	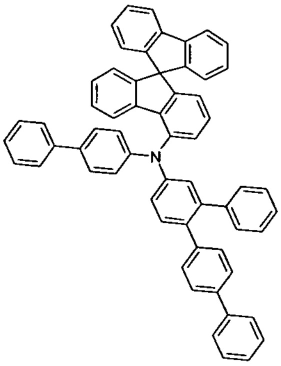	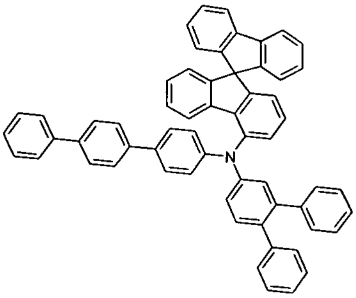
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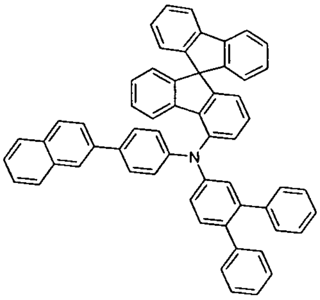	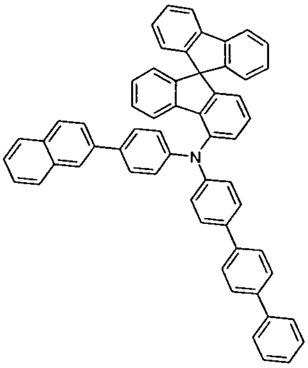	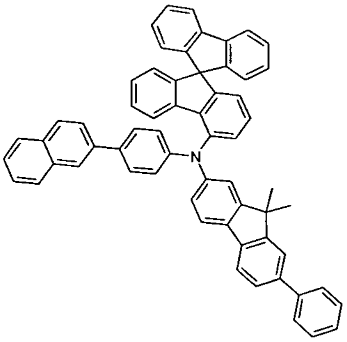
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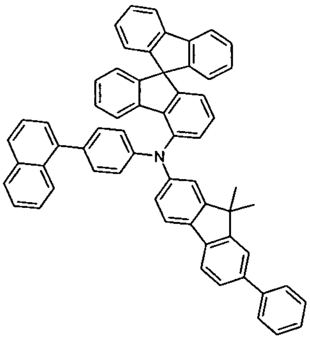	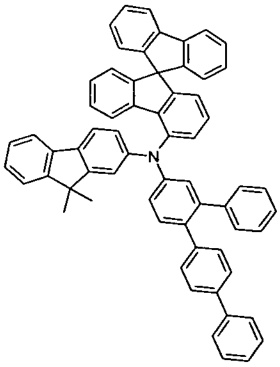	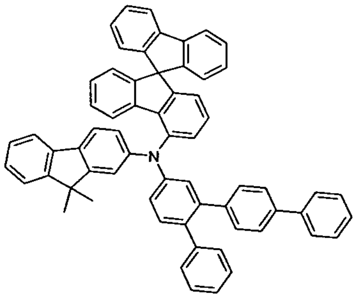
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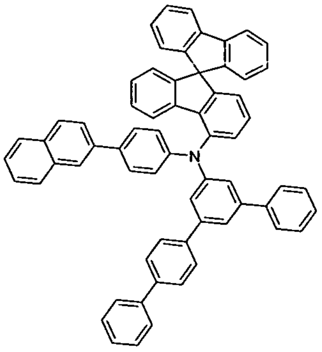	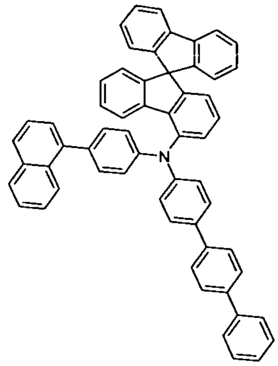	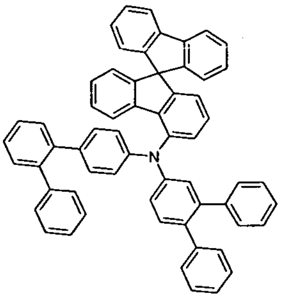
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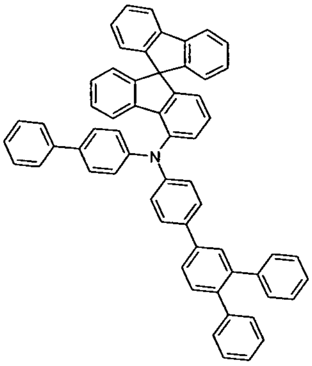
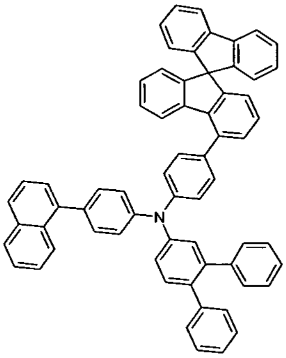
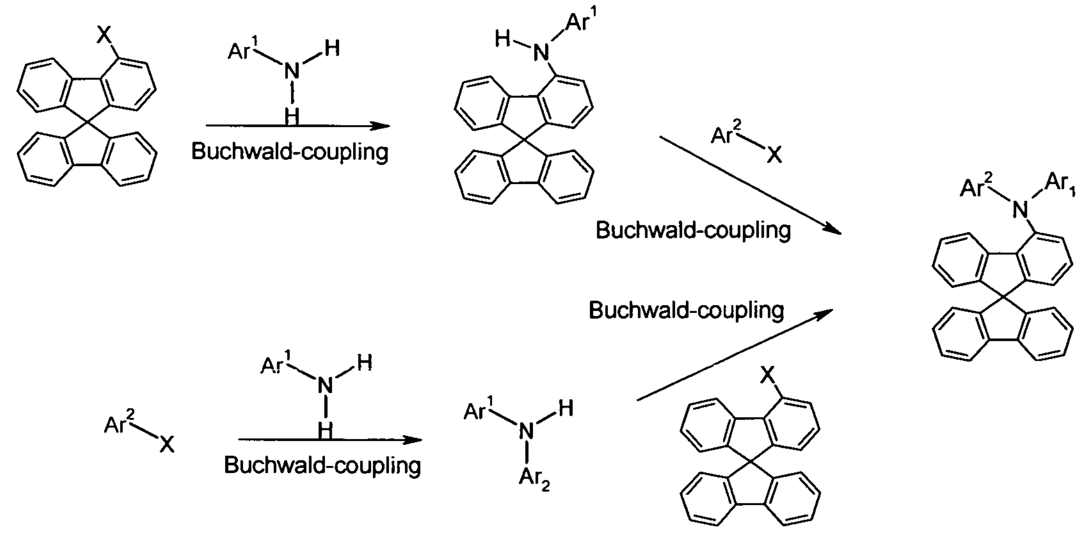
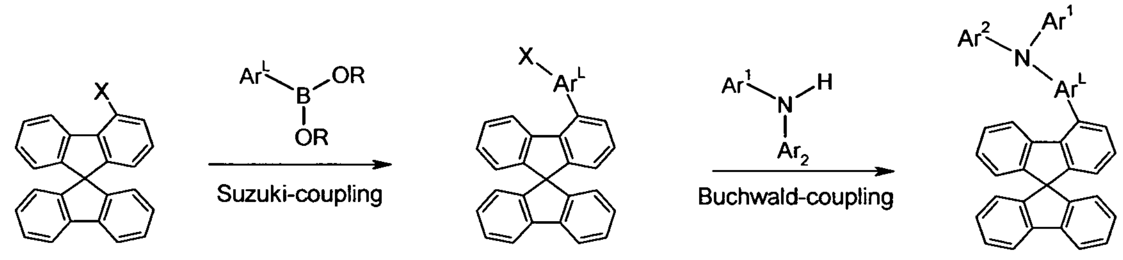
		
199	200	

The compounds according to the invention can be prepared by synthetic steps known to the person skilled in the art, such as, for example, bromination, borylation, Ullmann arylation, Hartwig-Buchwald coupling, Suzuki-coupling as depicted in Scheme 1 or Schema 2 below.

Scheme 1:



Schema 2



X is a halogen or another leaving group
Ar^1, Ar^2 are aromatic or heteroaromatic ring systems

The present invention therefore furthermore relates to a process for the preparation of a compound of the formula (1), characterised in that the diarylamino group is introduced by a C-N coupling reaction between a 1- or 3- or 4-halogenated spirobifluorene and a diarylamine.

The compounds according to the invention described above, in particular compounds which are substituted by reactive leaving groups, such as chlorine, bromine, iodine, tosylate, triflate, boronic acid or boronic acid ester, can be used as monomers for the preparation of corresponding oligomers, dendrimers or polymers. The oligomerisation or polymerisation here is preferably carried out via the halogen functionality or the boronic acid functionality.

The invention therefore furthermore relates to oligomers, polymers or dendrimers comprising one or more compounds of the formula (1), where the bond(s) to the polymer, oligomer or dendrimer may be localised at any desired positions in formula (1) substituted by R. Depending on the linking of the compound of the formula (1), the compound is part of a side chain of the oligomer or polymer or part of the main chain. An oligomer in the sense of this invention is taken to mean a compound which is built up from at least three monomer units. A polymer in the sense of the invention is taken to mean a compound which is built up from at least ten monomer units. The polymers, oligomers or dendrimers according to the invention may be conjugated, partially conjugated or non-conjugated. The oligomers or polymers according to the invention may be linear, branched or dendritic. In the structures linked in a linear manner, the units of the formula (1) may be linked directly to one another or linked to one another via a divalent group, for example via a substituted or unsubstituted alkylene group, via a heteroatom or via a divalent aromatic or heteroaromatic group. In branched and dendritic structures, three or more units of the formula (1) may, for example, be linked via a trivalent or polyvalent group, for example via a trivalent or polyvalent aromatic or heteroaromatic group, to give a branched or dendritic oligomer or polymer. The same preferences as described above for compounds of the formula (1) apply to the recurring units of the formula (1) in oligomers, dendrimers and polymers.

For the preparation of the oligomers or polymers, the monomers according to the invention are homopolymerised or copolymerised with further monomers. Suitable and preferred comonomers are selected from fluorenes (for example in accordance with EP 842208 or WO 00/22026), spirobifluorenes (for example in accordance with EP 707020, EP 894107 or WO 06/061181), para-phenylenes (for example in accordance with WO 92/18552), carbazoles (for example in accordance with WO 04/070772 or WO 04/113468), thiophenes (for example in accordance with EP 1028136), dihydrophenanthrenes (for example in accordance with WO 05/014689 or WO 07/006383), cis- and trans-indenofluorenes (for example in accordance with WO 04/041901 or WO 04/113412), ketones (for example in accordance with WO 05/040302), phenanthrenes (for example in accordance with WO 05/104264 or WO 07/017066) or also a plurality of these units. The polymers, oligomers and dendrimers usually also contain further units, for example emitting (fluorescent or phosphorescent) units, such as, for example, vinyltriarylamines (for example in accordance with WO 07/068325) or phosphorescent metal complexes (for example in accordance with WO 06/003000), and/or charge-transport units, in particular those based on triarylamines.

The polymers and oligomers according to the invention are generally prepared by polymerisation of one or more types of monomer, at least one monomer of which results in recurring units of the formula (1) in the polymer. Suitable polymerisation reactions are known to the person skilled in the art and are described in the literature. Particularly suitable and preferred polymerisation reactions which result in C-C or C-N links are the following:

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

The way in which the polymerisation can be carried out by these methods and the way in which the polymers can then be separated off from the reaction medium and purified is known to the person skilled in the art and is described in detail in the literature, for example in WO 2003/048225, WO 2004/037887 and WO 2004/037887.

The present invention thus also relates to a process for the preparation of the polymers, oligomers and dendrimers according to the invention, which is characterised in that they are prepared by SUZUKI polymerisation, YAMAMOTO polymerisation, STILLE polymerisation or HARTWIG-BUCHWALD polymerisation. The dendrimers according to the invention can be prepared by processes known to the person skilled in the art or analogously thereto. Suitable processes are described in the literature, such as, for example, in Frechet, Jean M. J.; Hawker, Craig J., "Hyperbranched polyphenylene and hyperbranched polyesters: new soluble, three-dimensional, reactive polymers", Reactive & Functional Polymers (1995), 26(1-3), 127-36; Janssen, H. M.; Meijer, E. W., "The synthesis and characterization of dendritic molecules", Materials Science and Technology (1999), 20 (Synthesis of Polymers), 403-458; Tomalia, Donald A., "Dendrimer molecules", Scientific American (1995), 272(5), 62-6; WO 02/067343 A1 and WO 2005/026144 A1.

The compounds according to the invention are suitable for use in an electronic device. An electronic device here is taken to mean a device which comprises at least one layer which comprises at least one organic compound. However, the component here may also comprise inorganic materials or also layers built up entirely from inorganic materials.

The present invention therefore furthermore relates to the use of the compounds according to the invention in an electronic device, in particular in an organic electroluminescent device.

The present invention still furthermore relates to an electronic device comprising at least one compound according to the invention. The preferences stated above likewise apply to the electronic devices.

The electronic device is preferably selected from the group consisting of organic electroluminescent devices (organic light-emitting diodes, OLEDs), organic integrated circuits (O-ICs), organic field-effect transistors (O-FETs), organic thin-film transistors (O-TFTs), organic light-emitting transistors (O-LETs), organic solar cells (O-SCs), organic dye-sensitised solar cells (ODSSCs), organic optical detectors, organic photoreceptors, organic field-quench devices (O-FQDs), light-emitting electrochemical cells (LECs), organic laser diodes (O-lasers) and organic plasmon emitting devices (D. M. Koller *et al.*, *Nature Photonics* **2008**, 1-4), but preferably organic electroluminescent devices (OLEDs), particularly preferably phosphorescent OLEDs.

The organic electroluminescent devices and the light-emitting electrochemical cells can be employed for various applications, for example for monochromatic or polychromatic displays, for lighting applications or for medical and/or cosmetic applications, for example in phototherapy.

The organic electroluminescent device comprises a cathode, an anode and at least one emitting layer. Apart from these layers, it may also comprise further layers, for example in each case one or more hole-injection layers, hole-transport layers, hole-blocking layers, electron-transport layers, electron-injection layers, exciton-blocking layers, electron-blocking layers and/or charge-generation layers. Interlayers, which have, for example, an exciton-blocking function, may likewise be introduced between two emitting layers. However, it should be pointed out that each of these layers does not necessarily have to be present.

The organic electroluminescent device here may comprise one emitting layer or a plurality of emitting layers. If a plurality of emission layers is present, these preferably have in total a plurality of emission maxima between 380 nm and 750 nm, resulting overall in white emission, i.e. various emitting compounds which are able to fluoresce or phosphoresce are used in the emitting layers. Particular preference is given to systems having three emitting layers, where the three layers exhibit blue, green and orange or red emission (for the basic structure see, for example, WO 2005/011013). It is possible here for all emitting layers to be fluorescent or for all emitting layers to be phosphorescent or for one or more emitting layers to be fluorescent and one or more other layers to be phosphorescent.

The compound according to the invention in accordance with the embodiments indicated above can be employed here in different layers, depending on the precise structure. Preference is given to an organic electroluminescent device comprising a compound of the formula (1) or the preferred embodiments as hole-transport material in a hole-transport or hole-injection or exciton-blocking layer or as matrix material for fluorescent or phosphorescent emitters, in particular for phosphorescent emitters. The preferred embodiments indicated above also apply to the use of the materials in organic electronic devices.

In a preferred embodiment of the invention, the compound of the formula (1) or the preferred embodiments is employed as hole-transport or hole-injection material in a hole-transport or hole-injection layer. The emitting layer here can be fluorescent or phosphorescent. A hole-injection layer in the sense of the present invention is a layer which is directly adjacent to the anode. A hole-transport layer in the sense of the present invention is a layer which is located between a hole-injection layer and an emitting layer.

In still a further preferred embodiment of the invention, the compound of the formula (1) or the preferred embodiments is employed in an exciton-blocking layer. An exciton-blocking layer is taken to mean a layer which is directly adjacent to an emitting layer on the anode side.

The compound of the formula (1) or the preferred embodiments is particularly preferably employed in a hole-transport or exciton-blocking layer.

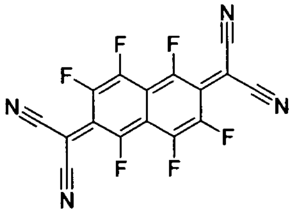
If the compound of the formula (1) is employed as a hole-transport material in a hole-tranport layer, a hole-injection layer or an exciton-blocking layer, then the compound of formula (1) can be used in such a layer as a single material, i.e. in a proportion of 100%, or the compound of formula (1) can be used in combination with one or more further compounds in such a layer. According to a preferred embodiment, the organic layer comprising the compound of formula (1) additionally comprises one or more p-dopants. Preferred p-dopant for the present invention are organic compounds that can accept electrons (electron acceptors) and can oxidize one or more of the other compounds present in the mixture.

Particularly preferred embodiments of p-dopants are described in WO 2011/073149, EP 1968131, EP 2276085, EP 2213662, EP 1722602, EP 2045848, DE 102007031220, US 8044390, US 8057712, WO 2009/003455, WO 2010/094378, WO 2011/120709, US 2010/0096600, WO 2012/095143 and DE 102012209523.

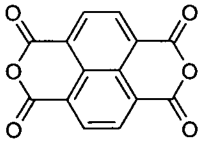
Particularly preferred as p-dopants are quinodimethane compounds, azaindenofluorendione, azaphenalene, azatriphenylene, I_2, metal halides, preferably transition metal halides, metal oxides, preferably metal oxides containing at least one transition metal or a metal of the 3rd main group and transition metal complexes, preferably complexes of Cu, Co, Ni , Pd and Pt with ligands containing at least one oxygen atom as binding site. Also preferred are transition metal oxides as dopants, preferably oxides of rhenium, molybdenum and tungsten, particularly preferably Re_2O_7, MoO_3, WO_3 and ReO_3.

The p-dopants are preferably distributed substantially uniformly in the p-doped layers. This can be achieved for example by co-evaporation of the p-dopant and of the hole-transport material matrix.

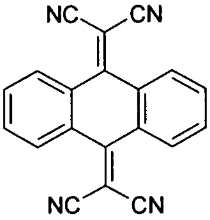
Particularly preferred p-dopants are selected from the compounds (D-1) to (D-13):



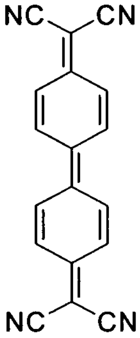
(D-1)



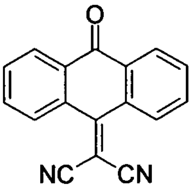
(D-2)



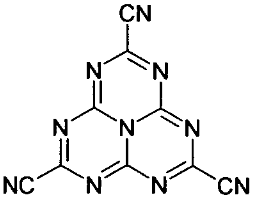
(D-3)



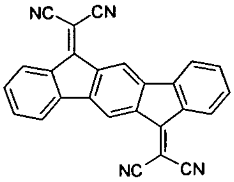
(D-4)



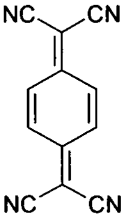
(D-5)



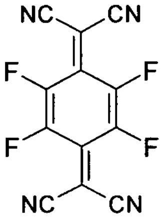
(D-6)



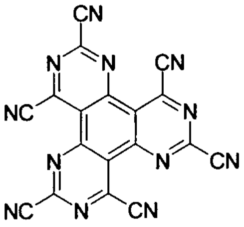
(D-7)



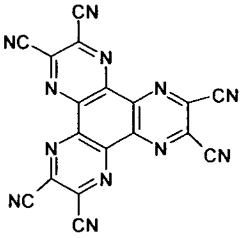
(D-8)



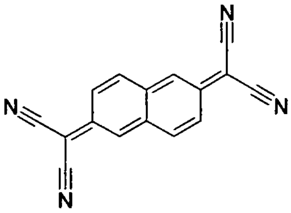
(D-9)



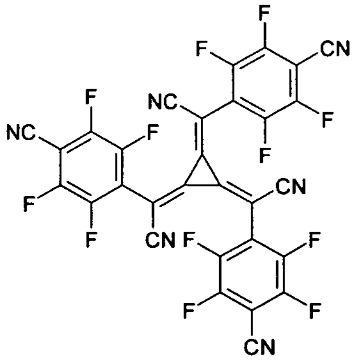
(D-10)



(D-11)



(D-12)



(D-13)

In an embodiment of the invention, the compound of the formula (1) or the preferred embodiments is used in a hole-transport or -injection layer in combination with a layer which comprises a hexaazatriphenylene derivative, in particular hexacyanohexaazatriphenylene (for example in accordance with EP 1175470). Thus, for example, preference is given to a combination which looks as follows: anode – hexaazatriphenylene derivative – hole-transport layer, where the hole-transport layer comprises one or more compounds of the formula (1) or the preferred embodiments. It is likewise possible in this structure to use a plurality of successive hole-transport layers, where at least one hole-transport layer comprises at least one compound of the formula (1) or the preferred embodiments. A further preferred combination looks as follows: anode – hole-transport layer – hexaazatriphenylene derivative – hole-transport layer, where at least one of the two hole-transport layers comprises one or more compounds of the formula (1) or the preferred embodiments. It is likewise possible in this structure to use a plurality of successive hole-transport layers instead of one hole-transport layer, where at least one hole-transport layer comprises at least one compound of the formula (1) or the preferred embodiments.

In a further preferred embodiment of the invention, the compound of the formula (1) or the preferred embodiments is employed as matrix material for a fluorescent or phosphorescent compound, in particular for a phosphorescent compound, in an emitting layer. The organic electroluminescent device here may comprise one emitting layer or a plurality of emitting layers, where at least one emitting layer comprises at least one compound according to the invention as matrix material.

If the compound of the formula (1) or the preferred embodiments is employed as matrix material for an emitting compound in an emitting layer, it is preferably employed in combination with one or more phosphorescent materials (triplet emitters). Phosphorescence in the sense of this invention is taken to mean the luminescence from an excited state having a spin multiplicity > 1, in particular from an excited triplet state. For the purposes of this application, all luminescent complexes containing transition metals or lanthanoids, in particular all luminescent iridium, platinum and copper complexes, are to be regarded as phosphorescent compounds.

The mixture comprising the matrix material, which comprises the compound of the formula (1) or the preferred embodiments, and the emitting compound comprises between 99.9 and 1% by weight, preferably between 99 and 10% by weight, particularly preferably between 97 and 60% by weight, in particular between 95 and 80% by weight, of the matrix material, based on the entire mixture comprising emitter and matrix material. Correspondingly, the mixture comprises between 0.1 and 99% by weight, preferably between 1 and 90% by weight, particularly preferably between 3 and 40% by weight, in particular between 5 and 20% by weight, of the emitter, based on the entire mixture comprising emitter and matrix material. The limits indicated above apply, in particular, if the layer is applied from solution. If the layer is applied by vacuum evaporation, the same numerical values apply, with the percentage in this case being indicated in % by vol. in each case.

A particularly preferred embodiment of the present invention is the use of the compound of the formula (1) or the preferred embodiments as matrix material for a phosphorescent emitter in combination with a further matrix material. Particularly suitable matrix materials which can be employed in combination with the compounds of the formula (1) or the preferred embodiments are aromatic ketones, aromatic phosphine oxides or aromatic sulfoxides or sulfones, for example in accordance with WO 2004/013080, WO 2004/093207, WO 2006/005627 or WO 2010/006680, triarylamines, carbazole derivatives, for example CBP (N,N-biscarbazolylbiphenyl), m-CBP or the carbazole derivatives disclosed in WO 2005/039246, US 2005/0069729, JP 2004/288381, EP 1205527 or WO 2008/086851, indolocarbazole derivatives, for example in accordance with WO 2007/063754 or WO 2008/056746, indenocarbazole derivatives, for example in accordance with WO 2010/136109 or WO 2011/000455, azacarbazole derivatives, for example in accordance with EP 1617710, EP 1617711, EP 1731584, JP 2005/347160, bipolar matrix materials, for example in accordance with WO 2007/137725, silanes, for example in accordance with WO 2005/111172, azaboroles or boronic esters, for example in accordance with WO 2006/117052, triazine derivatives, for example in accordance with WO 2010/015306, WO 2007/063754 or WO 08/056746, zinc complexes, for example in accordance with EP 652273 or WO 2009/062578, fluorene derivatives, for example in accordance with WO 2009/124627, diazasilole or tetraazasilole derivatives, for example in accordance with WO 2010/054729, diazaphosphole derivatives, for example in accordance with WO 2010/054730, or bridged carbazole derivatives, for example in accordance with US 2009/0136779, WO 2010/050778, WO 2011/042107 or WO 2011/088877. It is furthermore possible to use an electronically neutral co-host which has neither hole-transporting nor electron-transporting properties, as described, for example, in WO 2010/108579.

It is likewise possible to use two or more phosphorescent emitters in the mixture. In this case, the emitter which emits at shorter wavelength acts as co-host in the mixture.

Suitable phosphorescent compounds (= triplet emitters) are, in particular, compounds which emit light, preferably in the visible region, on suitable excitation and in addition contain at least one atom having an atomic number greater than 20, preferably greater than 38 and less than 84, particularly preferably greater than 56 and less than 80, in particular a metal having this atomic number. The phosphorescent emitters used are preferably compounds which contain copper, molybdenum, tungsten, rhenium, ruthenium, osmium, rhodium, iridium, palladium, platinum, silver, gold or europium, in particular compounds which contain iridium, platinum or copper.

Examples of the emitters described above are revealed by the applications WO 2000/70655, WO 2001/41512, WO 2002/02714, WO 2002/15645, EP 1191613, EP 1191612, EP 1191614, WO 2005/033244, WO 2005/019373, US 2005/0258742, WO 2009/146770, WO 2010/015307, WO 2010/031485, WO 2010/054731, WO 2010/054728, WO 2010/086089, WO 2010/099852, WO 2010/102709, WO 2011/157339 or WO 2012/007086. In general, all phosphorescent complexes as used in accordance with the prior art for phosphorescent OLEDs and as are known to the person skilled in the art in the area of organic electroluminescence are suitable, and the person skilled in the art will be able to use further phosphorescent complexes without inventive step.

In a further embodiment of the invention, the organic electroluminescent device according to the invention does not comprise a separate hole-injection layer and/or hole-transport layer and/or hole-blocking layer and/or electron-transport layer, i.e. the emitting layer is directly adjacent to the hole-injection layer or the anode, and/or the emitting layer is directly adjacent to the electron-transport layer or the electron-injection layer or the cathode, as described, for example, in WO 2005/053051. It is furthermore possible to use a metal complex which is identical or similar to the metal complex in the emitting layer as hole-transport or hole-injection material directly adjacent to the emitting layer, as described, for example, in WO 2009/030981.

It is furthermore possible to use the compound of the formula (1) or the preferred embodiments both in a hole-transport layer or exciton-blocking layer and as matrix in an emitting layer.

In the further layers of the organic electroluminescent device according to the invention, it is possible to use all materials as usually employed in accordance with the prior art. The person skilled in the art will therefore be able, without inventive step, to employ all materials known for organic electroluminescent devices in combination with the compounds of the formula (1) according to the invention or the preferred embodiments.

Preference is furthermore given to an organic electroluminescent device, characterised in that one or more layers are applied by means of a sublimation process, in which the materials are vapour-deposited in vacuum sublimation units at an initial pressure of usually less than 10^{-5} mbar, preferably less than 10^{-6} mbar. However, it is also possible for the initial pressure to be even lower, for example less than 10^{-7} mbar.

Preference is likewise given to an organic electroluminescent device, characterised in that one or more layers are applied by means of the OVPD (organic vapour phase deposition) process or with the aid of carrier-gas sublimation, in which the materials are applied at a pressure between 10^{-5} mbar and 1 bar. A special case of this process is the OVJP (organic vapour jet printing) process, in which the materials are applied directly through a nozzle and thus structured (for example M. S. Arnold *et al.*, *Appl. Phys. Lett.* **2008**, *92*, 053301).

Preference is furthermore given to an organic electroluminescent device, characterised in that one or more layers are produced from solution, such as, for example, by spin coating, or by means of any desired printing process, such as, for example, LITI (light induced thermal imaging, thermal transfer printing), ink-jet printing, screen printing, flexographic printing, offset printing or nozzle printing. Soluble compounds, which are obtained, for example, by suitable substitution, are necessary for this purpose. These processes are also particularly suitable for the compounds according to the invention, since these generally have very good solubility in organic solvents.

Also possible are hybrid processes, in which, for example, one or more layers are applied from solution and one or more further layers are applied by vapour deposition. Thus, for example, the emitting layer can be applied from solution and the electron-transport layer by vapour deposition.

These processes are generally known to the person skilled in the art and can be applied by him without inventive step to organic electroluminescent devices comprising the compounds according to the invention.

The processing of the compounds according to the invention from the liquid phase, for example by spin coating or by printing processes, requires formulations of the compounds according to the invention. These formulations can be, for example, solutions, dispersions or mini-emulsions. It may be preferred to use mixtures of two or more solvents for this purpose. Suitable and preferred solvents are, for example, toluene, anisole, o-, m- or p-xylene, methyl benzoate, dimethylanisole, mesitylene, tetralin, veratrol, THF, methyl-THF, THP, chlorobenzene, dioxane or mixtures of these solvents.

The present invention therefore furthermore relates to a formulation, in particular a solution, dispersion or mini-emulsion, comprising at least one compound of the formula (1) or the preferred embodiments indicated above and at least one solvent, in particular an organic solvent. The way in which solutions of this type can be prepared is known to the person skilled in the art and is described, for example, in WO 2002/072714, WO 2003/019694 and the literature cited therein.

The present invention furthermore relates to mixtures comprising at least one compound of the formula (1) or the preferred embodiments indicated above and at least one further compound. The further compound can be, for example, a fluorescent or phosphorescent dopant if the compound according to the invention is used as matrix material. The mixture may then also additionally comprise a further material as additional matrix material.

The invention is explained in greater detail by the following examples, without wishing to restrict it thereby. On the basis of the descriptions, the person skilled in the art will be able to carry out the invention throughout the range disclosed and prepare further compounds according to the invention without inventive step and use them in electronic devices or use the process according to the invention.

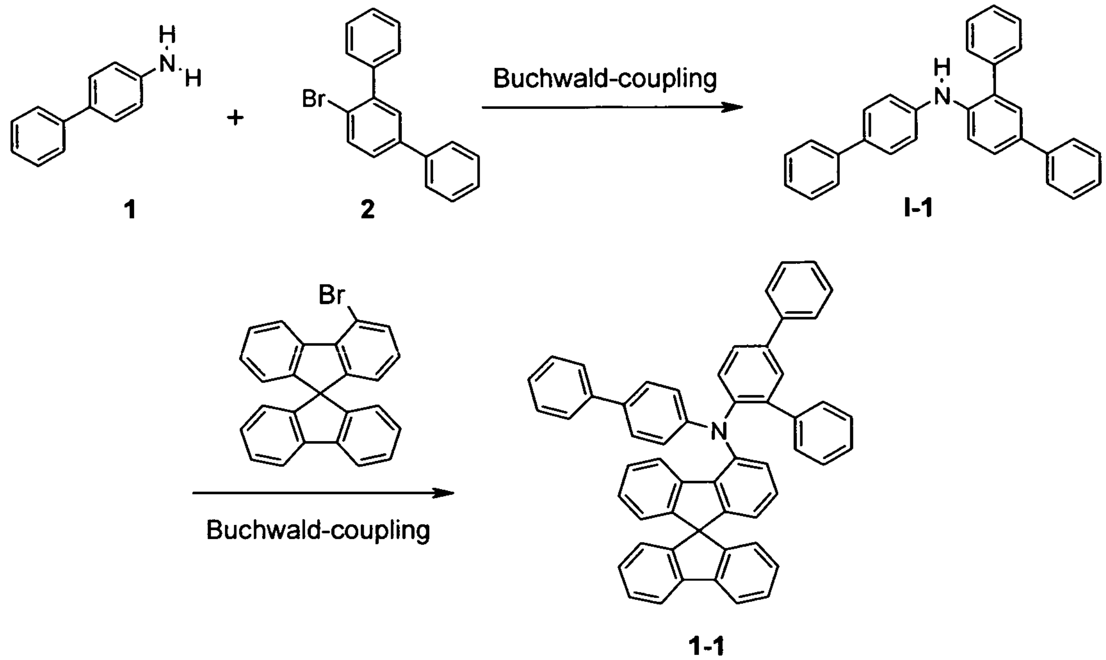
Examples:

A) Synthesis examples

The following syntheses are carried out under a protective-gas atmosphere, unless indicated otherwise. The starting materials can be purchased from ALDRICH or ABCR. The numbers in square brackets in the case of the starting materials known from the literature are the corresponding CAS numbers.

Example 1

Synthesis of biphenyl-4-yl-([1,1';3',1"]terphenyl-4'-yl-9,9'-spirobifluoren-4-yl)amine (1-1) and derivatives (1-2) to (1-25)



1-1

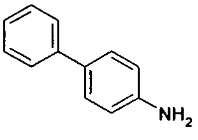
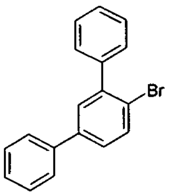
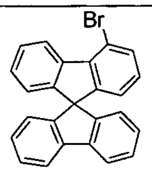
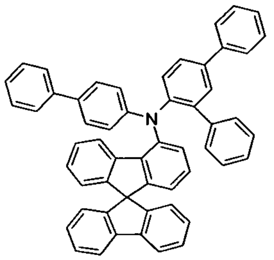
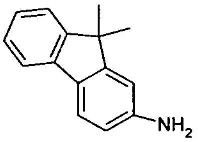
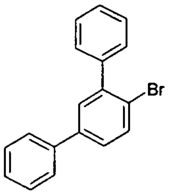
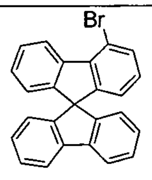
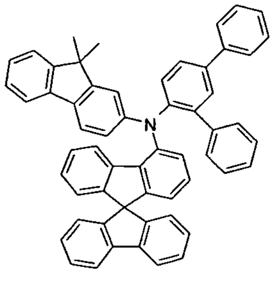
a) Synthesis of intermediate biphenyl-4-yl-[1,1';3',1"]terphenyl-4'-yl-amine (I-1)

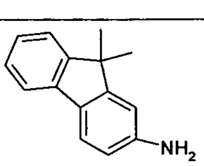
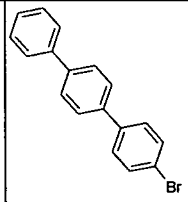
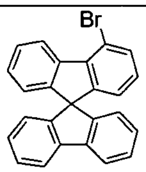
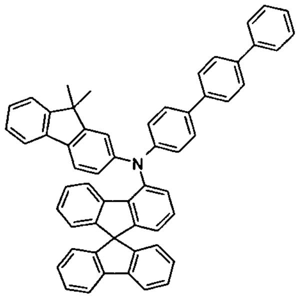
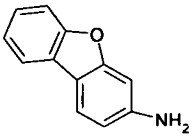
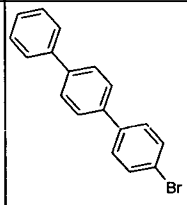
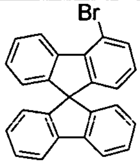
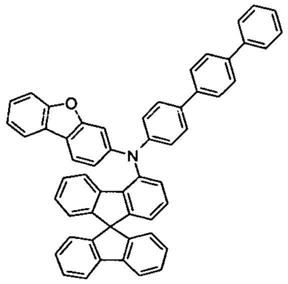
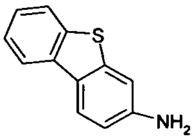
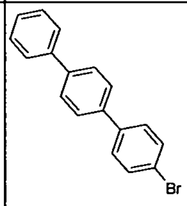
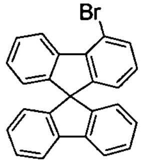
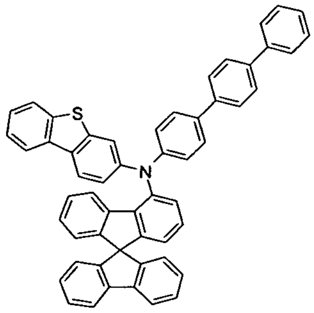
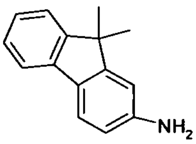
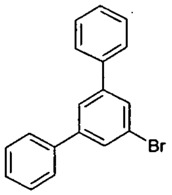
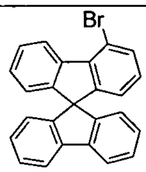
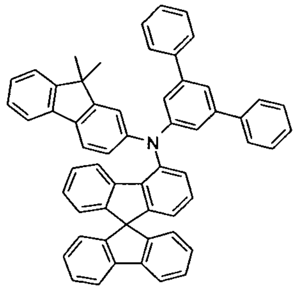
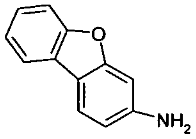
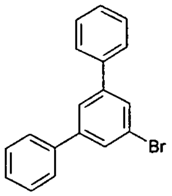
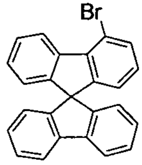
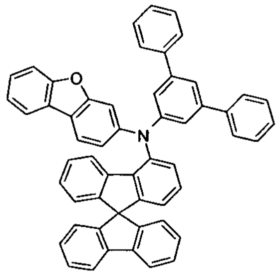
1,1'-Bis(diphenylphosphino)ferrocene (0.9 g, 1.67 mmol), palladium acetate (360 mg, 1.67 mmol) and sodium tert-butoxide (10.1 g, 105 mmol) are added to a solution of biphenyl-4-ylamine (13.7 g, 80.8 mmol) and 4'-Bromo-[1,1';3',1"]terphenyl (25 g, 80.8 mmol) in degassed toluene (400 ml), and the mixture is heated under reflux for 20 h. The reaction mixture is cooled to room temperature, diluted with toluene and filtered through Celite. The filtrate is diluted with water, re-extracted with toluene, and the combined organic phases are dried and evaporated *in vacuo*. The residue is filtered through silica gel (heptane/dichloromethane) and crystallised from isopropanol. Biphenyl-4-yl-[1,1';3',1"]terphenyl-4'-yl-amine is obtained in the form of a pale-yellow solid (27 g, 85% of theory).

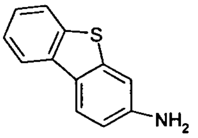
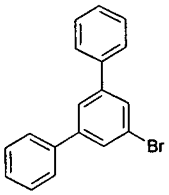
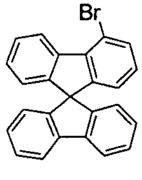
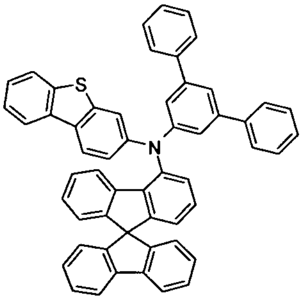
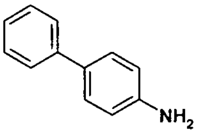
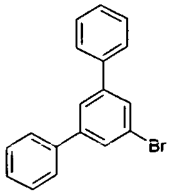
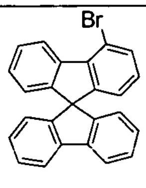
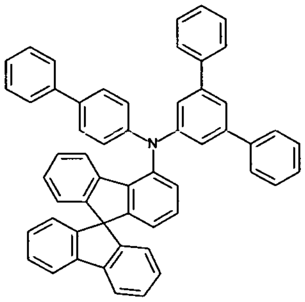
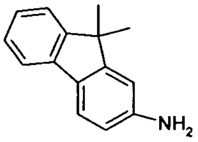
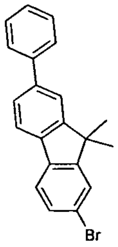
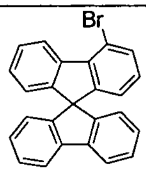
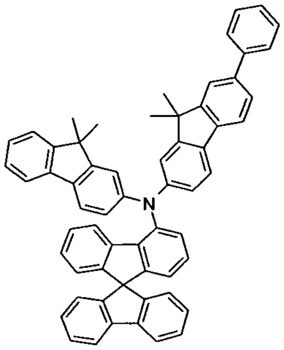
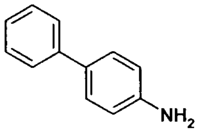
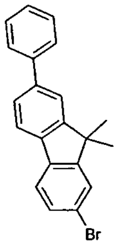
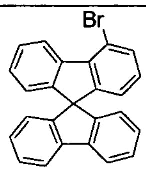
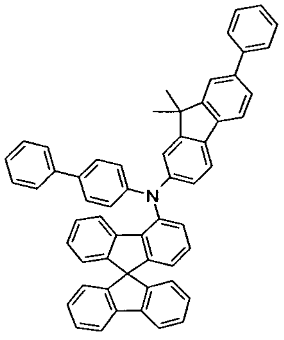
b) Synthesis of biphenyl-4-yl-([1,1';3',1"]terphenyl-4'-yl-9,9'-spirobifluoren-4-yl)amine (1-1)

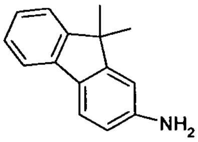
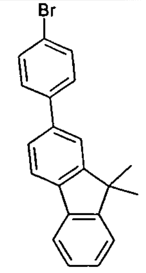
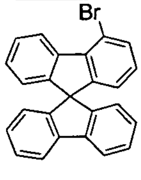
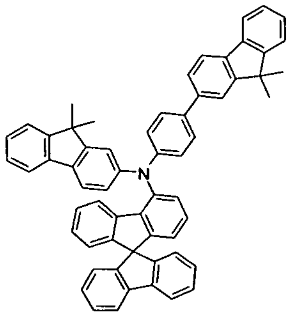
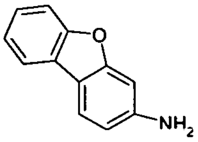
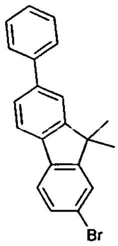
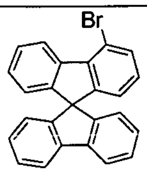
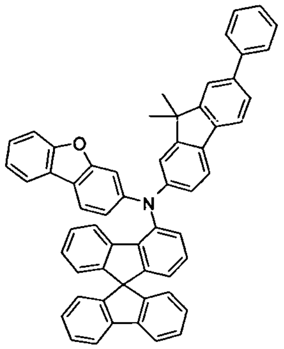
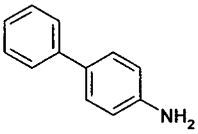
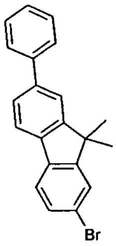
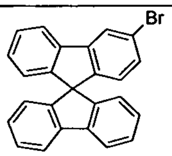
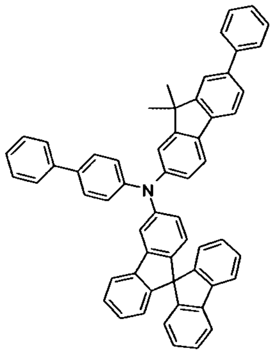
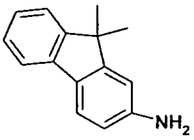
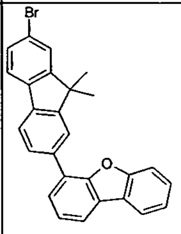
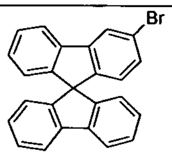
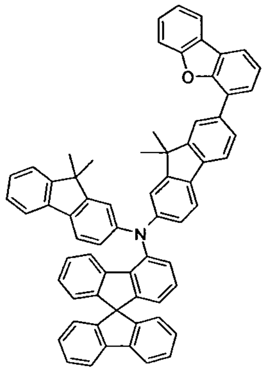
Tri-tert-butylphosphine (2.5 ml of a 1.0 M solution in toluene, 2.5 mmol), palladium acetate (284 mg, 1.26 mmol) and sodium tert-butoxide (9.12g, 95 mmol) are added to a solution of biphenyl-4-yl-[1,1';3',1"]terphenyl-4'-yl-amine (25.2 g, 63 mmol) and 4-bromo-9,9'-spirobifluorene (25 g, 63 mmol) in degassed toluene (500 ml), and the mixture is heated under reflux for 3 h. The reaction mixture is cooled to room temperature, diluted with toluene and filtered through Celite. The filtrate is evaporated in vacuo, and the residue is crystallised from toluene/heptane. The crude product is extracted in a Soxhlet extractor (toluene) and purified by recrystallization in heptane/toluene (23 g, 51% of theory). After sublimation in vacuo, the product is isolated in the form of an off-white solid.

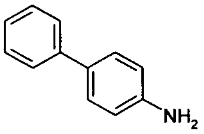
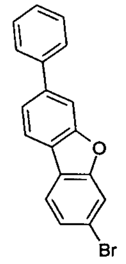
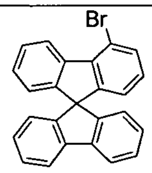
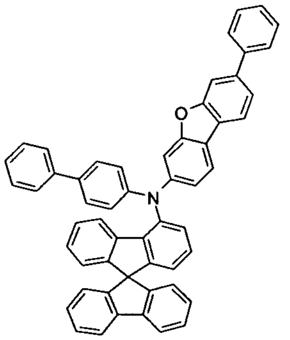
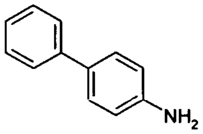
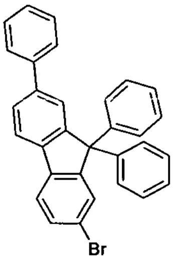
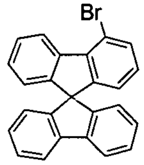
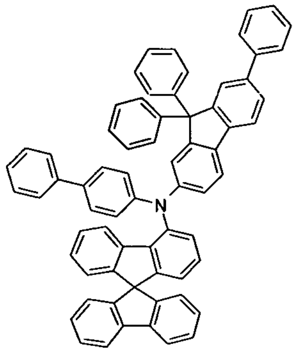
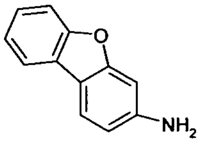
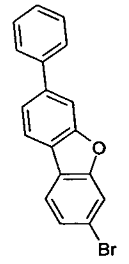
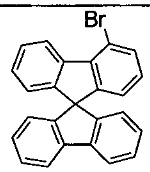
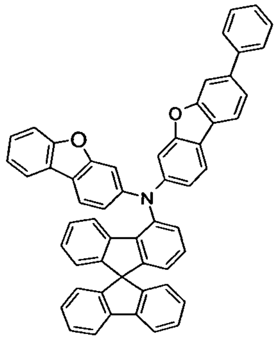
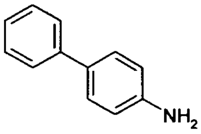
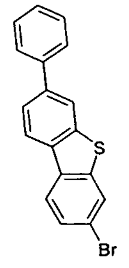
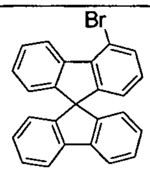
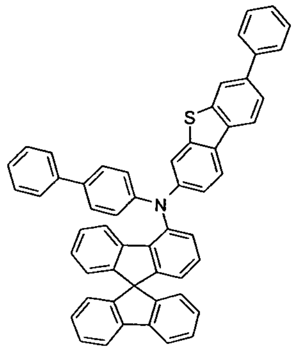
The following compounds are obtained analogously:

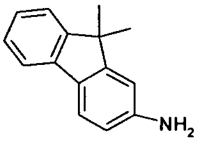
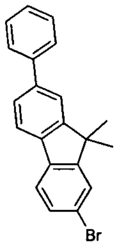
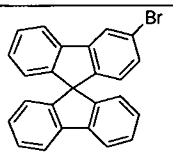
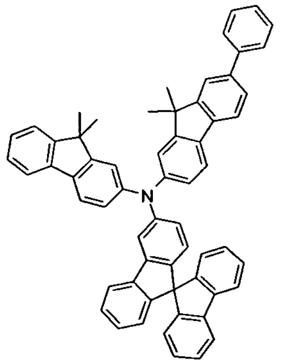
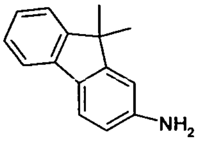
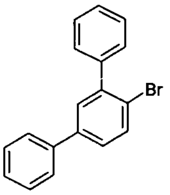
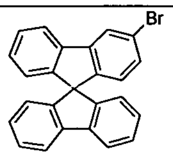
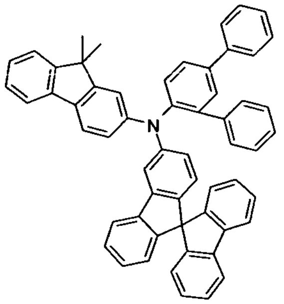
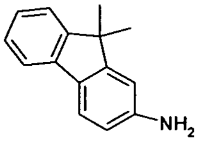
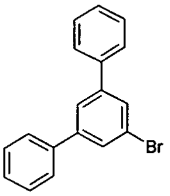
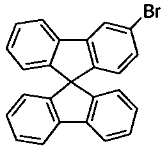
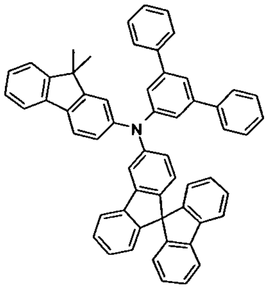
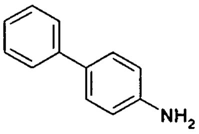
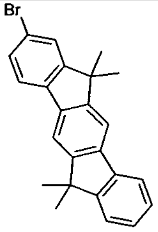
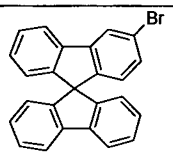
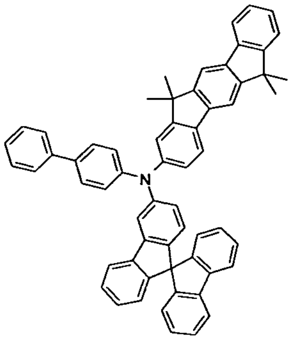
Ex.	Arylamine	Aryl-bromide 1	Aryl-bromide 2	Product	Yield
1-1	 [92-67-1]	 [60631-86-3]	 [1161009-88-6]		43%
1-2	 [108714-73-4]	 [60631-86-3]	 [1161009-88-6]		38%

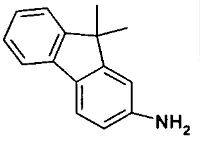
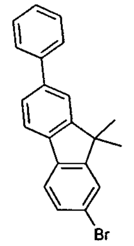
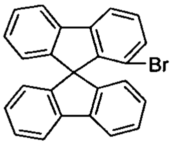
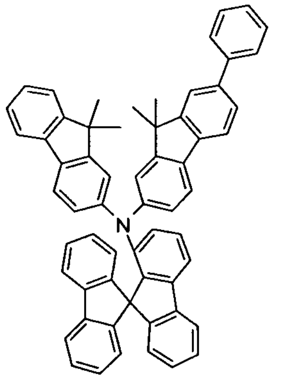
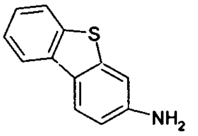
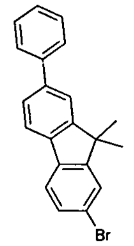
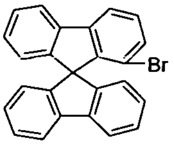
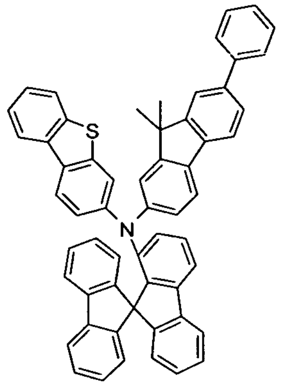
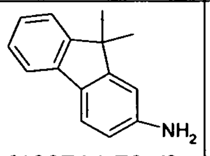
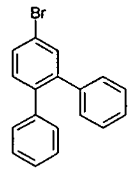
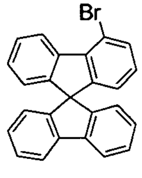
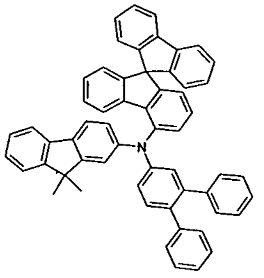
1-3	 [108714-73-4]	 [1762-84-1]	 [1161009-88-6]		63%
1-4	 [4106-66-5]	 [1762-84-1]	 [1161009-88-6]		48%
1-5	 [25288-76-0]	 [1762-84-1]	 [1161009-88-6]		52%
1-6	 [108714-73-4]	 [103068-20-8]	 [1161009-88-6]		39%
1-7	 [4106-66-5]	 [103068-20-8]	 [1161009-88-6]		45%

1-8	 [25288-76-0]	 [103068-20-8]	 [1161009-88-6]		51%
1-9	 [92-67-1]	 [103068-20-8]	 [1161009-88-6]		60%
1-10	 [108714-73-4]	 [1047992-04-0]	 [1161009-88-6]		45%
1-11	 [92-67-1]	 [1047992-04-0]	 [1161009-88-6]		45%

1-12	 [108714-73-4]	 [574750-94-0]	 [1161009-88-6]		51%
1-13	 [4106-66-5]	 [1047992-04-0]	 [1161009-88-6]		52%
1-14	 [92-67-1]	 [1047992-04-0]	 [1361227-58-8]		55%
1-15	 [108714-73-4]	 [1186644-60-9]	 [1361227-58-8]		29%

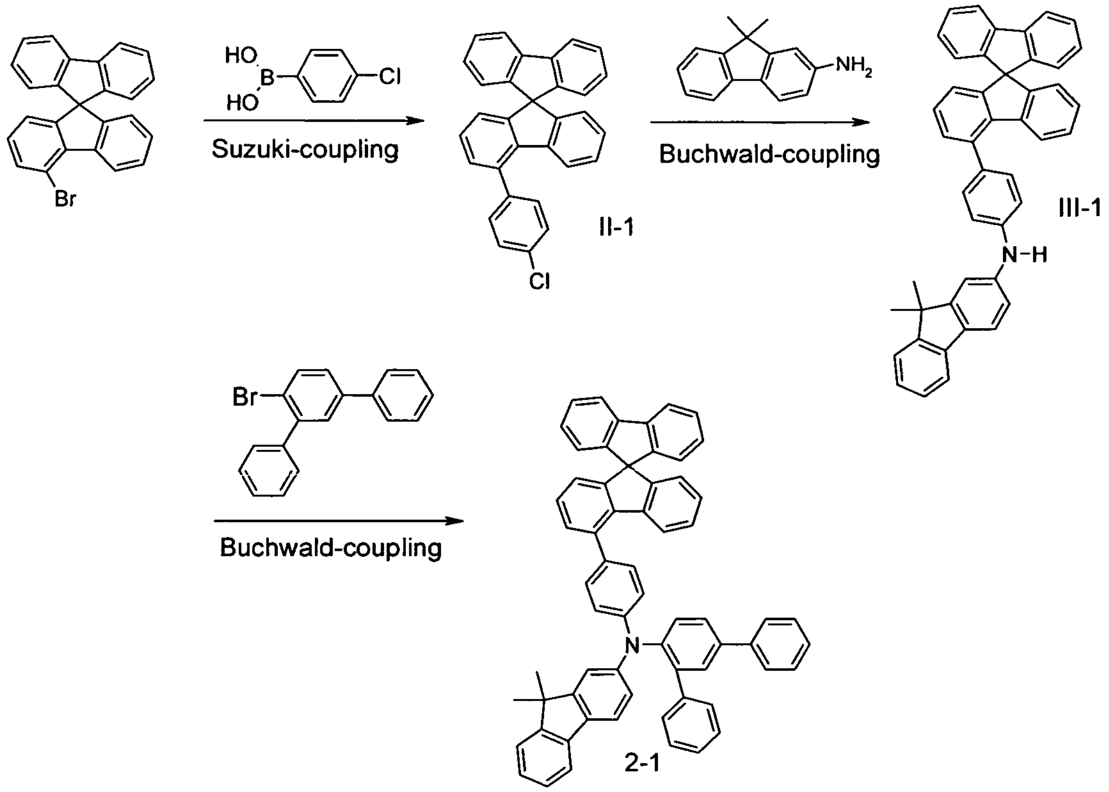
1-16	 [92-67-1]		 [1161009-88-6]		34%
1-17	 [92-67-1]	 [1021857-42-0]	 [1161009-88-6]		48%
1-18	 [4106-66-5		 [1161009-88-6]		26%
1-19	 [92-67-1]		 [1161009-88-6]		33%

1-20	 [108714-73-4]	 [1047992-04-0]	 [1361227-58-8]		35%
1-21	 [108714-73-4]	 [60631-86-3]	 [1361227-58-8]		42%
1-22	 [108714-73-4]	 [103068-20-8]	 [1361227-58-8]		47%
1-23	 [92-67-1]	 [1205547-68-7]	 [1361227-58-8]		39%

1-24	 [108714-73-4]	 [1047992-04-0]	 [1450933-18-2]		27%
1-25	 [25288-76-0]	 [1047992-04-0]	 [1450933-18-2]		30%
1-26	 [108714-73-4]	 [24253-40-5]	 [1161009-88-6]		36%

Example 2

Synthesis of (9,9-dimethyl-9H-fluoren-2-yl)- [1,1';3',1'']terphenyl-4'-yl- [4-(9,9'-spiro-bifluoren-4-yl)-phenyl]-amine (2-1) and the derivatives (2-2) to (2-4)

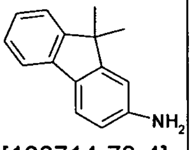
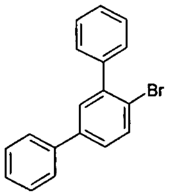
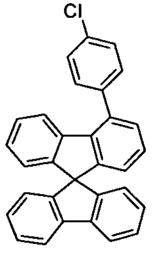
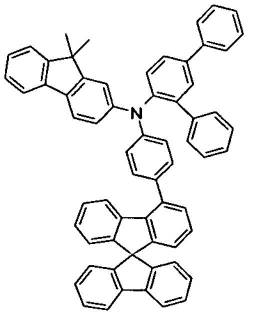
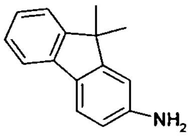
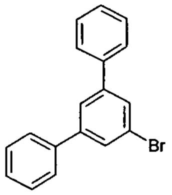
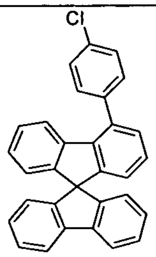
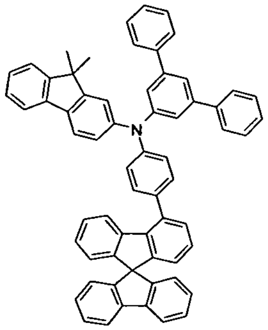
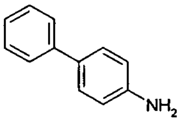
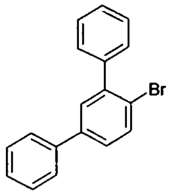
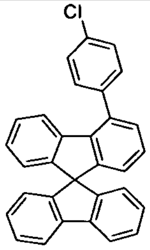
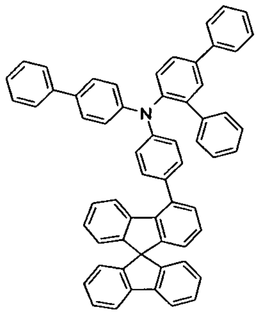
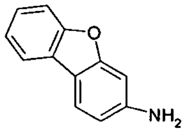
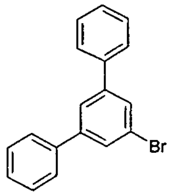
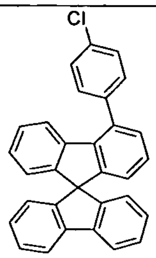
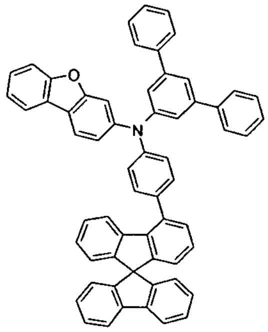


a) Synthesis of 4-chloro-4-[(9,9'-spiro-bifluoren)]. Intermediate II-1

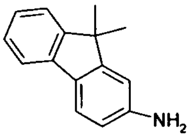
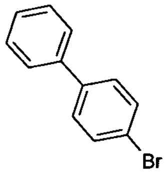
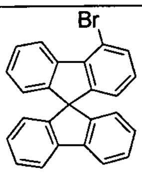
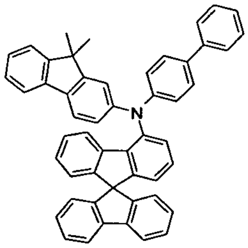
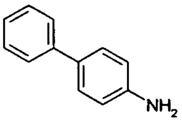
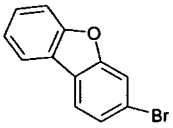
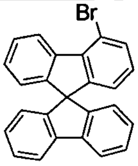
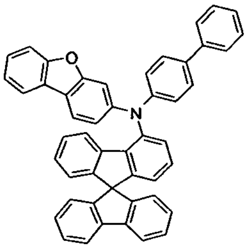
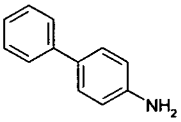
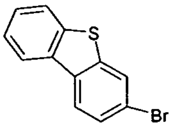
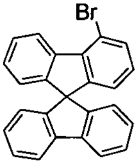
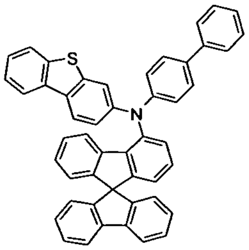
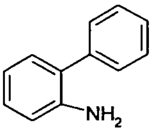
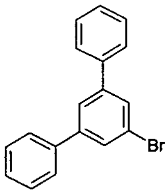
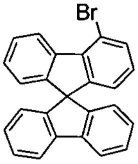
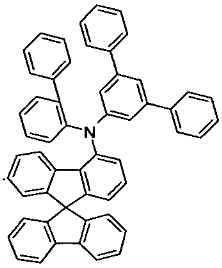
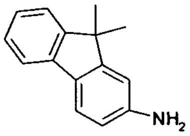
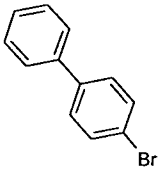
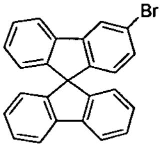
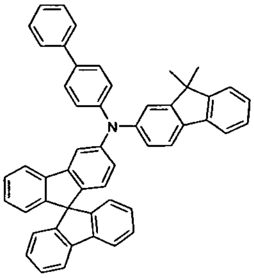
49 g (320 mmol) of 4-chloro-phenylboronic acid, 120 g (304 mmol) of 4-bromo-spirobifluorene, 3.51 g (3.04 mmol) of $Pd(PPh_3)_4$, 122 g (1 mol) of potasium carbonate are dissolved in 700 mL of toluene. The reaction mixture is refluxed and stirred under an argon atmosphere for 12 hours and after cooling to room temperature, the mixture is filtered through Celite. The filtrate is evaporated in vacuo, and the residue is crystallised from heptane. The product is isolated in the form of a white solid (110 g, 85% of theory).

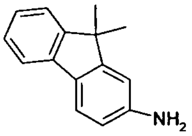
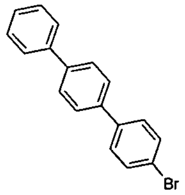
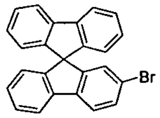
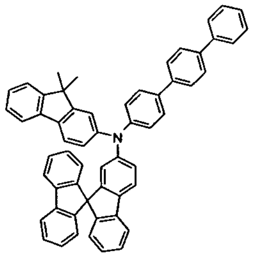
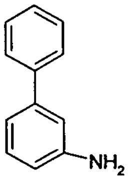
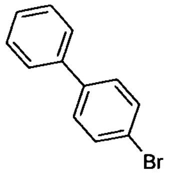
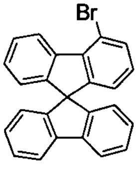
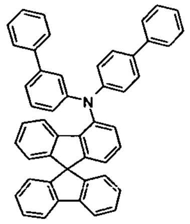
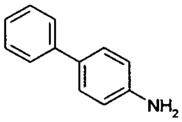
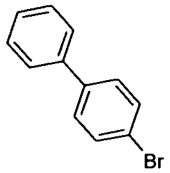
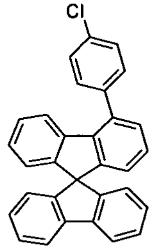
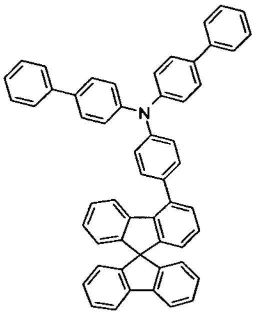
b) (9,9-dimethyl-9H-fluoren-2-yl)- [1,1';3',1'']terphenyl-4'-yl- [4-(9,9'-spiro-bifluoren-4-yl)-phenyl]-amine (2-1)

The synthesis of intermediates III and compounds 2-1 to 2-4 are carried out analogously as described for the synthesis of intermediate I-1 and compound 1-1.

Ex.	Arylamine	Aryl-bromide 1	Aryl-bromide 2	Product	Yield
2-1	 [108714-73-4]	 [60631-86-3]	 [1421789-08-3]		35%
2-2	 [108714-73-4]	 [103068-20-8]			20%
2-3	 [92-67-1]	 [60631-86-3]			28%
2-4	 [4106-66-5	 [103068-20-8]			40%

Comparative examples ST1 to ST8 are obtained analogously:

Ex.	**Arylamine**	**Aryl-bromide 1**	**Aryl-bromide 2**	**Product**
ST-1				
ST-2				
ST-3				
ST-4				
ST-5				

ST-6				
ST-7				
ST-8				

B) Devices examples

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).

The data for various OLEDs are presented in Examples below (see Tables 1 to 2). The substrates used are glass plates coated with structured ITO (indium tin oxide) in a thickness of 50nm. The OLEDs basically have the following layer structure: substrate / hole-injection layer (HIL) / hole-transport layer (HTL) / electron-blocking layer (EBL) / emission layer (EML) / electron-transport layer (ETL) / electron-injection layer (EIL) and finally a cathode. The cathode is formed by an aluminium layer with a thickness of

100nm. The precise structure of the OLEDs is shown in table 1. The materials required for the production of the OLEDs are shown in table 3.

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 H1:SEB (5%) here means that material H1 is present in the layer in a proportion by volume of 95% and SEB is present in the layer in a proportion of 5%. Analogously, other layers may also consist of a mixture of two or more materials.

The OLEDs are characterised by standard methods. For this purpose, the electroluminescence spectra and the external quantum efficiency (EQE, given in percent) as a function of the luminous density, calculated from current/voltage/luminous density characteristic lines (IUL characteristic lines) assuming Lambert emission characteristics and the lifetime are determined. The expression EQE @ 10mA/cm^2 denotes the external quantum efficiency at an operating current density of 10mA/cm^2. LT80 @ 60mA/cm^2 is the lifetime until the OLED has dropped from its initial luminance of i.e. 5000cd/m^2 to 80% of the initial intensity, i.e. to 4000cd/m^2 without using any acceleration factor. The data for the various OLEDs containing inventive and comparative materials are summarised in table 2.

Use of compounds according to the invention as hole-transport materials in fluorescent OLEDs

In particular, compounds according to the invention are suitable as HIL, HTL, EBL or matrix material in the EML in OLEDs. They are suitable as a single layer, but also as mixed component as HIL, HTL, EBL or within the EML. Compared with components from prior art (V1 to V9), the samples comprising the compounds according to the invention exhibit higher efficiencies and/or improved lifetimes both in singlet blue and also in triplet green.

Table 1: Structure of the OLEDs

Ex.	*HIL*	*HTL*	*EBL*	*EML*	*ETL*	*EIL*
	Thickness / nm	Thickness / nm	Thickness / nm	Thickness / nm	Thickness / nm	Thickness / nm
V1	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTMV1 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
V2	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTMV2 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
V3	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTMV3 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
V4	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTMV4 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
V5	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTMV5 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
V6	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTMV6 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
V7	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTMV7 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
V8	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTMV8 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
V9	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTMV9 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E1	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM1 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E2	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM2 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E3	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM3 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E4	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM4 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E5	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM5 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E6	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM6 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E7	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM7 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E8	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM8 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E9	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM9 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E10	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM10 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm

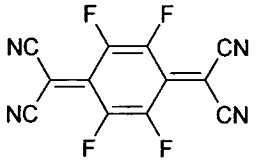
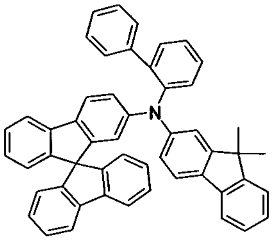
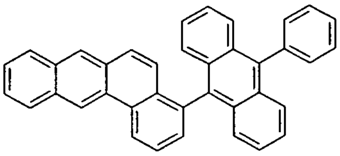
E11	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM11 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E12	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM12 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E13	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM13 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E14	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM14 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E15	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM15 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E16	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM16 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E17	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM17 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E18	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM18 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E19	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM19 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E20	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM20 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E21	HIM: F4TCNQ(5%) 20 nm	HIM 180 nm	HTM21 10 nm	H1:SEB(5%) 20 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm

Table 2: Data for the OLEDs

Ex.	U @ 10mA/cm^2	EQE @ 10mA/cm^2	LT80 @ 60mA/cm^2
	[V]	%	[h]
HTMV1	3.8	7.6	210
HTMV2	3.7	7.9	120
HTMV3	3.7	7.5	90
HTMV4	4.2	9.3	170
HTMV5	4.0	9.0	110
HTMV6	3.7	6.9	240
HTMV7	4.1	8.5	55
HTMV8	4.1	9.3	250
HTMV9	3.9	7.6	215
HTM1	3.9	7.5	220
HTM2	3.8	7.7	125
HTM3	3.8	7.4	90
HTM4	3.7	7.9	155
HTM5	3.6	7.5	150
HTM6	3.6	7.2	115

HTM7	3.8	8.0	300
HTM8	3.7	7.8	135
HTM9	3.9	7.4	165
HTM10	3.9	8.0	180
HTM11	3.9	8.4	185
HTM12	4.2	8.1	285
HTM13	4.0	8.6	195
HTM14	4.1	8.4	160
HTM15	4.0	8.6	85
HTM16	3.9	8.7	120
HTM17	4.0	8.4	125
HTM18	4.0	9.1	115
HTM19	4.0	9.0	265
HTM20	4.0	8.9	275
HTM21	4.1	8.7	285

Table 3 – Structures of the materials used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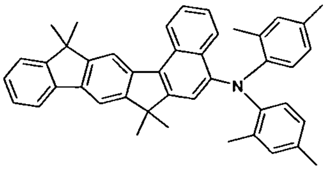
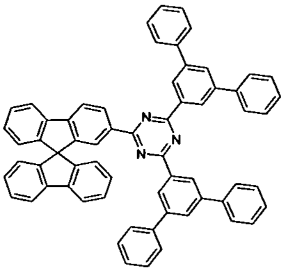
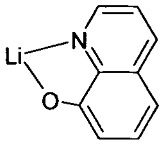
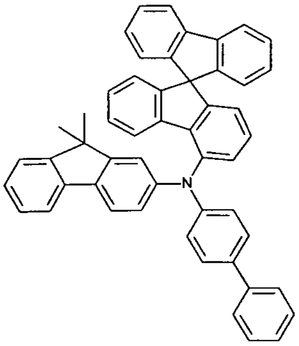
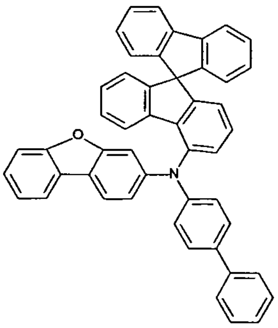
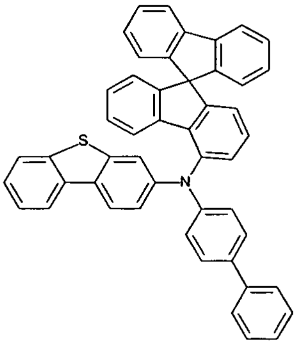
		
SEB	ETM	LiQ
		
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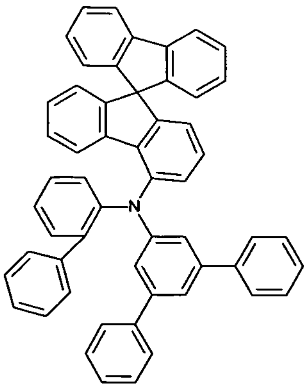	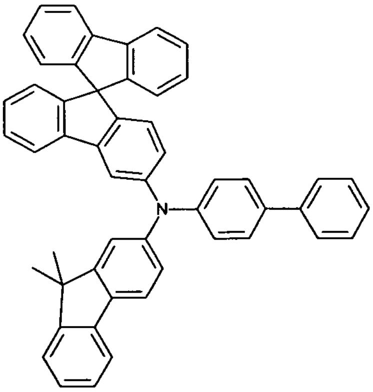	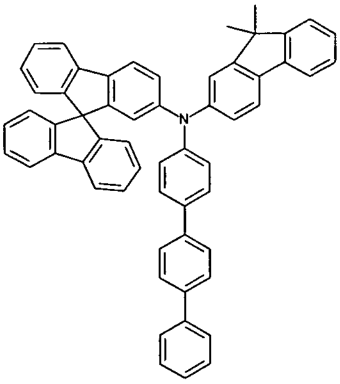
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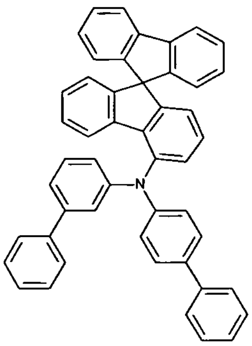	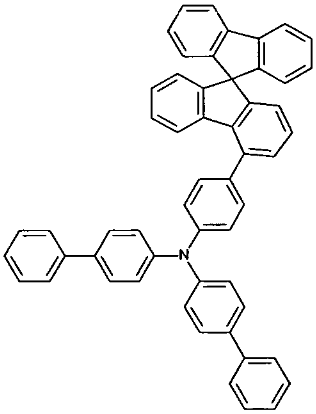	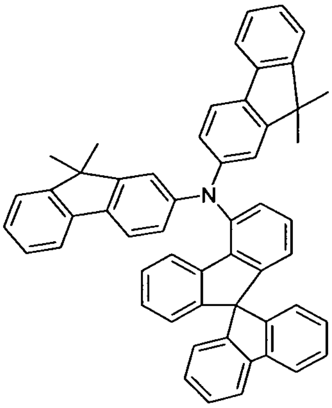
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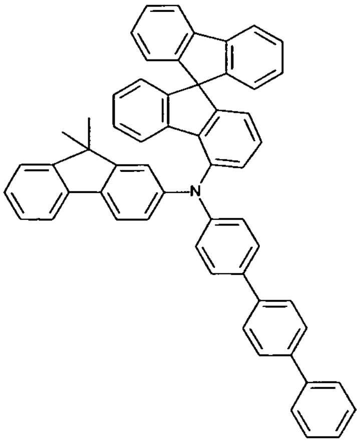	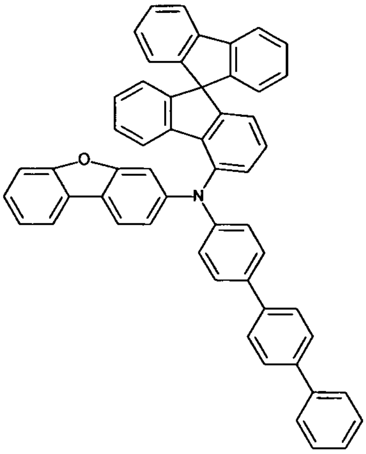	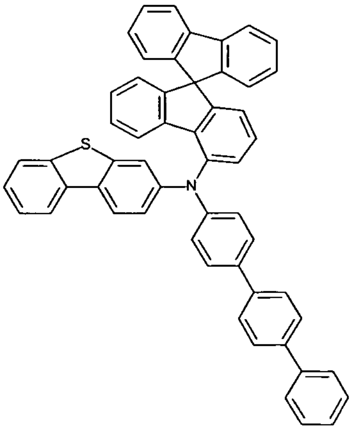
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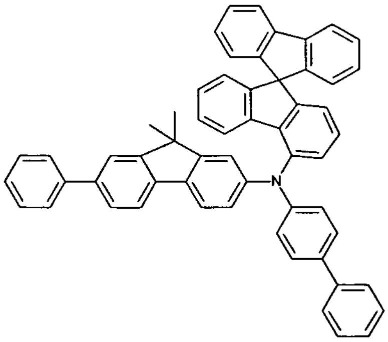	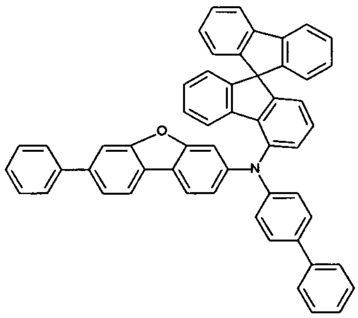	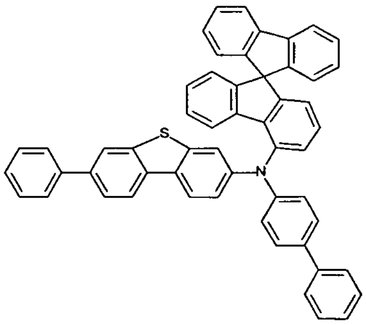
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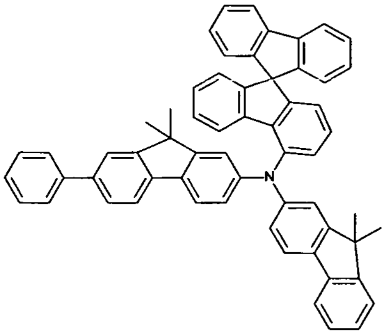	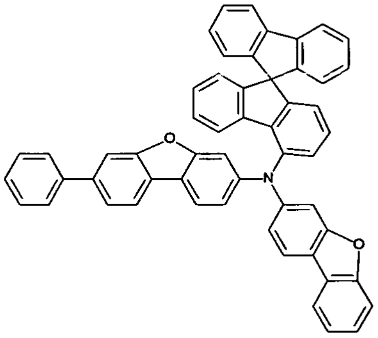	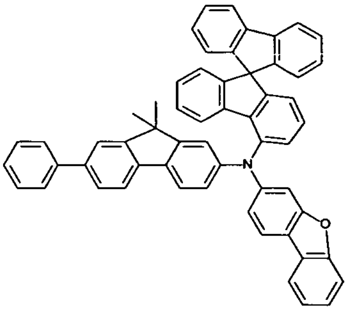
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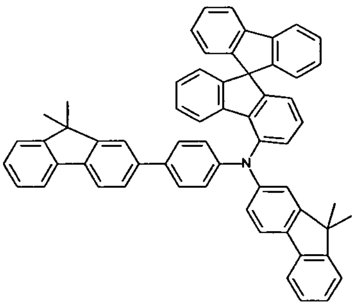	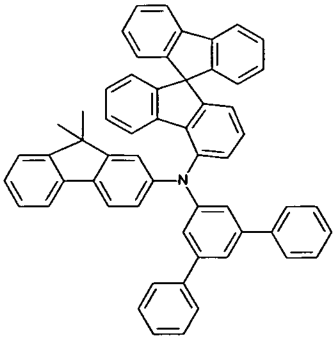	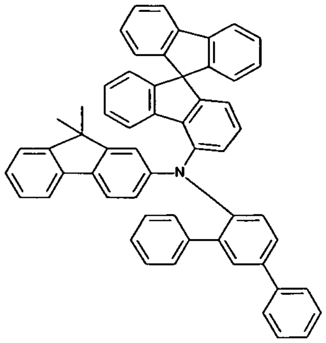
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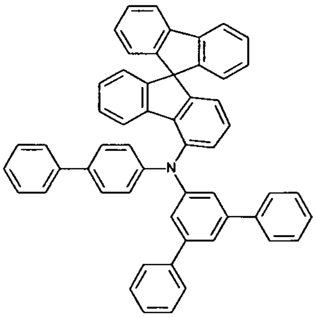	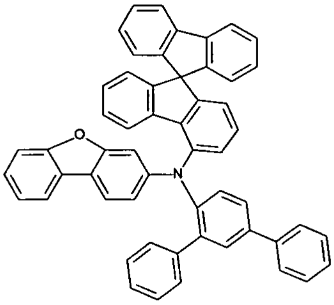	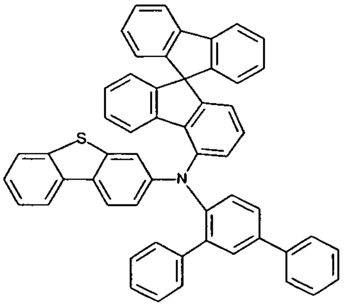
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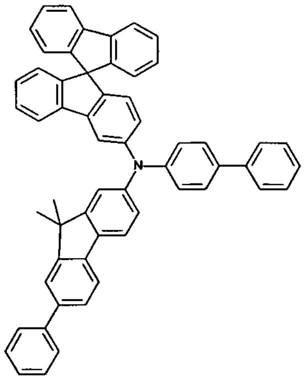
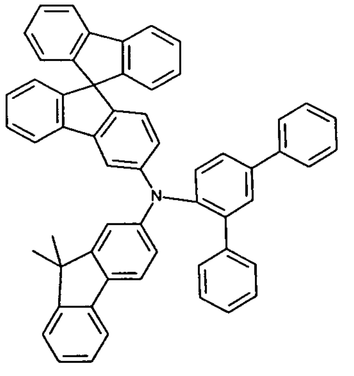
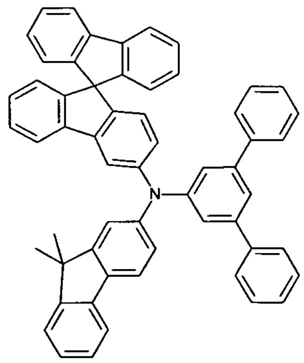
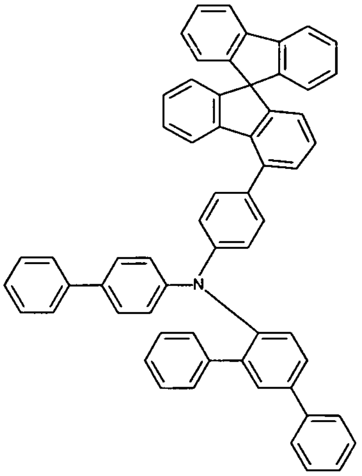
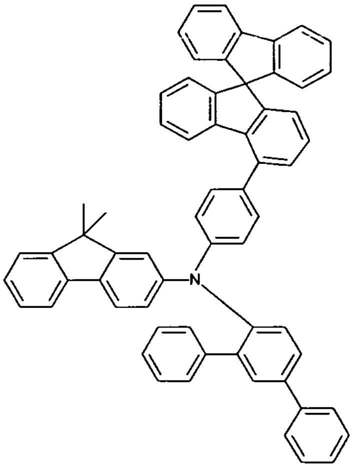
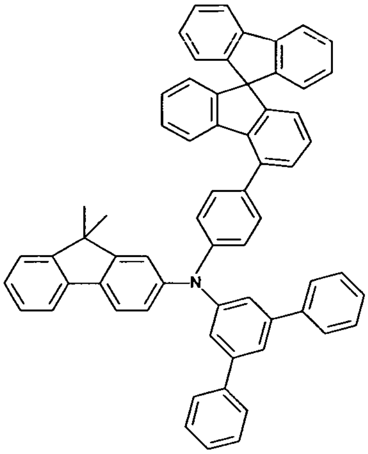
		
HTM16	HTM17	HTM18
		
HTM19	HTM20	HTM21

Examples

OLED devices with the structures shown in table 1 are produced. Table 2 shows the performance data of the examples described. The device is a fluorescent blue device with comparison of HTMV1 and HTM1 as material in the electron blocking layer (EBL). It can be shown, that the lifetime of device E1 is better than the comparative example V1. Material HTM4 shows lower voltage and higher efficiency in device (E4) than comparative example V1. Materials HTM10 and HTM11 show at least higher efficiencies in devices (E10, E11) than comparative example V1. Material HTM12 shows better efficiency and better lifetime in device (E12) than comparative example V1.

Compared to reference material HTMV2 the inventive materials HTM2, HTM8 and HTM9 show better lifetime (V2 vs. E2, E8, E9). Material HTM15 shows better efficiency than reference material HTMV2 (E15 vs. V2). Material HTM5 has lower voltage and better efficiency than HTMV2 (E5 vs. V2). Material HTM14 have better efficiency and better lifetime in device (E14) than reference device V2.

Compared to reference Material HTMV3 and reference device V3 the inventive material HTM3 has higher lifetime in device E3, material HTM15 shows much higher efficiency in device 15 and material HTM6 has lower voltage and higher lifetime in device E6. Material HTM11 shows better lifetime compared to reference material HTMV4 (E11 vs. V4). Compared to reference material HTMV6 the inventive material HTM1 has better efficiency (E1 vs. E6).

Compared to reference material HTMV5 the device (E16) with material HTM16 has lower voltage and better lifetime than reference (V5). Material HTM17 shows better lifetime than reference (V5 vs. E17). Material HTM18 shows better efficiency and lifetime compared to reference device (E18 vs. V5).

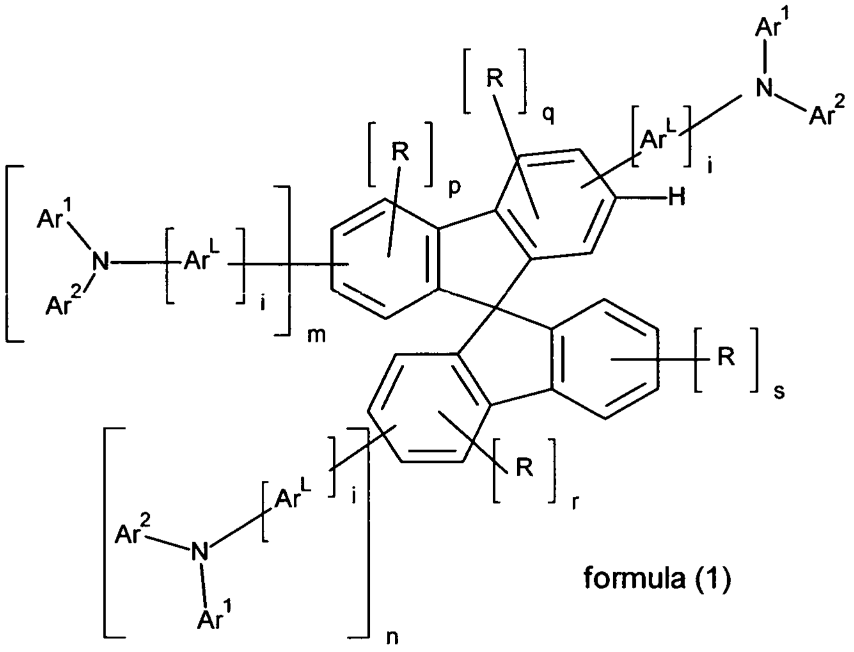
Compared to reference material HTMV7 the inventive material HTM13 shows lower voltage, better efficiency and better lifetime (V7 vs. E13).

Compared to reference material HTMV8 the inventive materials HTM19, HTM20 and HTM21 have similar or better voltage and better lifetimes (V8 vs. E19, E20 and E21).

Compared to reference material HTMV9 the material HTM7 shows better voltage, better efficiency and better lifetime.

Patent Claims

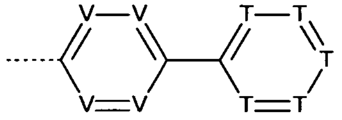
1. Compound of the formula (1),



formula (1)

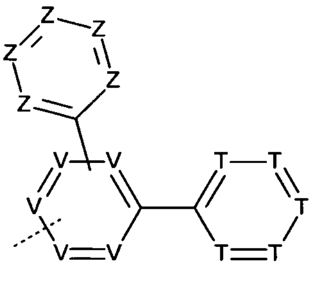
where the following applies to the symbols and indices used:

Ar^1 is a group of formula (Ar1-1),

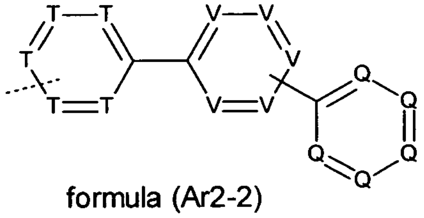


formula (Ar1-1)

Ar^2 is a group of formula (Ar2-1) or (Ar2-2),



formula (Ar2-1)



formula (Ar2-2)

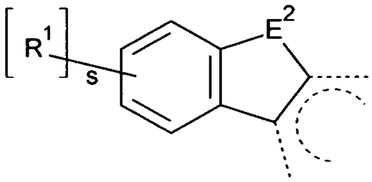
V, Z, T, Q are on each occurrence, identically or differently, N or CR^1, with the proviso that there is a maximum of three N atoms per 6-membered rings;

or V is C and is linked to one adjacent group Z, which is also C, via a bridge E^1;

or V is C and is linked to one adjacent group T, which is also C, via a bridge E^1;

or V is C and is linked to one adjacent group Q, which is also C, via a bridge E^1;

or two adjacent groups V (V-V or V=V), two adjacent groups T (T-T or T=T), two adjacent groups Z (Z-Z or Z=Z) and/or two adjacent groups Q (Q-Q or Q=Q) stand for a group of the formula (E-1),



formula (E-1)

in which the dashed lines indicate respectively the linking to the rest of the 6-membered ring comprising the groups V, the rest of the 6-membered ring comprising the groups T, the rest of the 6-membered ring comprising the groups Z or the rest of the 6-membered ring comprising the groups Q;

E^1, E^2 are identically or differently on each occurrence, a divalent bridge selected from $B(R^0)$, $C(R^0)_2$, $Si(R^0)_2$, C=O, $C=NR^0$, $C=C(R^0)_2$, O, S, S=O, SO_2, $N(R^0)$, $P(R^0)$ and $P(=O)R^0$;

Ar^L is an aromatic or heteroaromatic ring system having 5 to 40 aromatic ring atoms, which may in each case be substituted by one or more radicals R^1;

R, R^0, R^1 are selected on each occurrence, identically or differently, from the group consisting of H, D, F, Cl, Br, I, CHO, CN, $C(=O)Ar^3$, $P(=O)(Ar^3)_2$, $S(=O)Ar^3$, $S(=O)_2Ar^3$, NO_2, $Si(R^2)_3$, $B(OR^2)_2$, OSO_2R^2, straight-chain alkyl, alkoxy or thioalkyl groups having 1 to 40 C atoms or branched or cyclic alkyl, alkoxy or thioalkyl groups having 3 to 40 C atoms, each of which may be substituted by one or more radicals R^2, where in each case one or more non-adjacent CH_2 groups may be replaced by $R^2C=CR^2$, C≡C, $Si(R^2)_2$, $Ge(R^2)_2$, $Sn(R^2)_2$, C=O, C=S, C=Se, $P(=O)(R^2)$, SO, SO_2, O, S or $CONR^2$ and where one or more H atoms may be replaced by D, F, Cl, Br, I, CN or NO_2, aromatic or heteroaromatic ring systems having 5 to 60 aromatic ring atoms, which may in each case be substituted by one or more radicals R^2, and aryloxy groups having 5 to 40 aromatic ring atoms, which may be substituted by one or more radicals R^2, where two adjacent substituents R, two adjacent substituents R^0 and/or two adjacent substituents R^1, may form a mono- or polycyclic, aliphatic ring system or aromatic ring system, which may be substituted by one or more radicals R^2;

R^2 is selected on each occurrence, identically or differently, from the group consisting of H, D, F, Cl, Br, I, CHO, CN, $C(=O)Ar^3$, $P(=O)(Ar^3)_2$, $S(=O)Ar^3$, $S(=O)_2Ar^3$, NO_2, $Si(R^3)_3$, $B(OR^3)_2$, OSO_2R^3, straight-chain alkyl, alkoxy or thioalkyl groups having 1 to 40 C atoms or branched or cyclic alkyl, alkoxy or thioalkyl groups having 3 to 40 C atoms, each of which may be substituted by one or more radicals R^3, where in each case one or more non-adjacent CH_2 groups may be replaced by $R^3C=CR^3$, C≡C, $Si(R^3)_2$, $Ge(R^3)_2$, $Sn(R^3)_2$, C=O, C=S, C=Se, $P(=O)(R^3)$, SO, SO_2, O, S or $CONR^3$ and where one or more H atoms may be replaced by D, F, Cl, Br, I, CN or NO_2, aromatic or heteroaromatic ring systems having 5 to 60 aromatic ring atoms, which may in each case be substituted by one or more radicals R^3, and aryloxy group having 5 to 60 aromatic ring atoms, which may be substituted by one or more radicals R^3, where two adjacent substituents R^2 may form a mono- or polycyclic, aliphatic ring system or aromatic ring system, which may be substituted by one or more radicals R^3;

R^3 is selected on each occurrence, identically or differently, from the group consisting of H, D, F, Cl, Br, I, CN, straight-chain alkyl, alkoxy or thioalkyl groups having 1 to 20 C atoms or branched or cyclic alkyl, alkoxy or thioalkyl groups having 3 to 20 C atoms, where in each case one or more non-adjacent CH_2 groups may be replaced by SO, SO_2, O, S and where one or more H atoms may be replaced by D, F, Cl, Br or I, and aromatic or heteroaromatic ring system having 5 to 24 C atoms;

Ar^3 is an aromatic or heteroaromatic ring system having 5 to 24 aromatic ring atoms, which may in each case also be substituted by one or more radicals R^3;

i is on each occurrence, identically or differently, 0 or 1;

m, n are, identically or differently, 0 or 1;

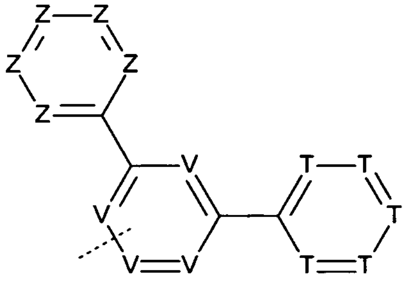
s, p, r are, identically or differently, 0, 1, 2, 3 or 4; where $r + n \leq 4$ and $p + m \leq 4$;

q is 0, 1 or 2.

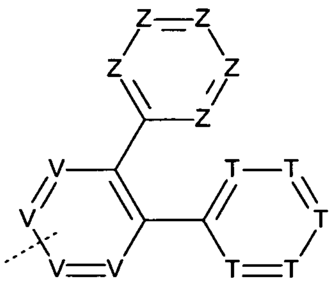
2. Compound according to claim 1, characterised in that m + n = 0.

3. Compound according to claim 1 or 2, characterised in that the index i is 0.

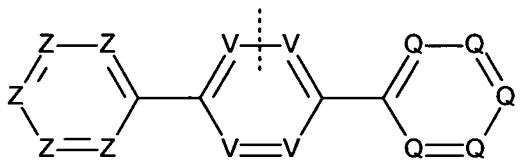
4. Compound according to one or more of the preceding claims, characterised in that Ar^2 is selected from the groups of formulae (Ar2-3) to (Ar2-6),



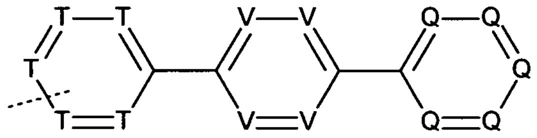
formula (Ar2-3)



formula (Ar2-4)



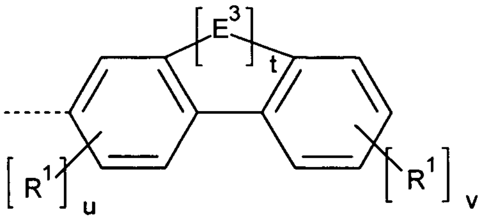
formula (Ar2-5)



formula (Ar2-6)

where the symbols Z, V, T and Q have the same meaning as defined in claim 1.

5. Compound according to one or more of the preceding claims, characterised in that the group Ar^1 is selected from the groups of formula (Ar1-2),



formula (Ar1-2)

where R^1 has the same meaning as in claim 1 and where

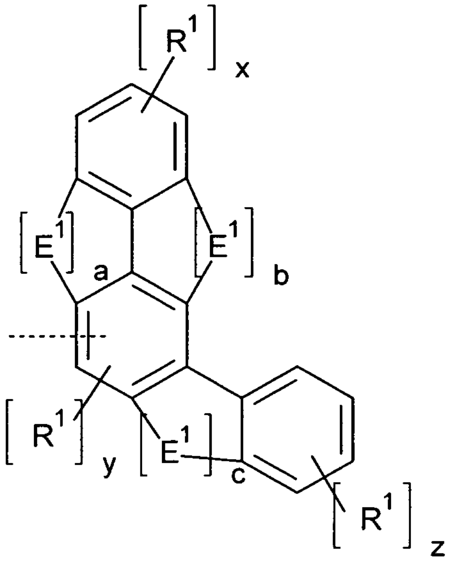
E^3 is a divalent bridge selected from $B(R^0)$, $C(R^0)_2$, $Si(R^0)_2$, C=O, C=NR^0, C=C$(R^0)_2$, O, S, S=O, SO_2, $N(R^0)$, $P(R^0)$ and P(=O)R^0, where R0 has the same meaning as in claim 1;

t is 0 or 1; where t is 0 means that the divalent bridge E^3 is absent;

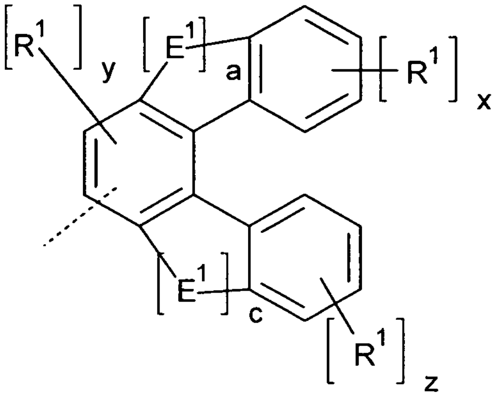
u is 0, 1, 2, 3 or 4; where $u + t \leq 4$

v is 0, 1, 2, 3, 4 or 5; where $v + t \leq 5$.

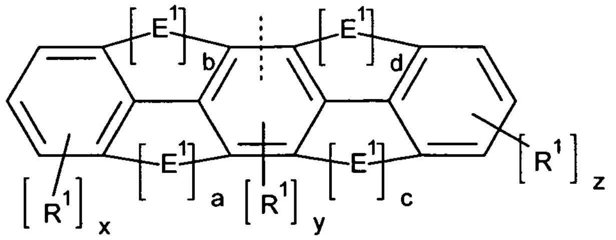
6. Compound according to one or more of the preceding claims, characterised in that the group Ar^2 is selected from the groups of the following formulae (Ar2-7) to (Ar2-10),



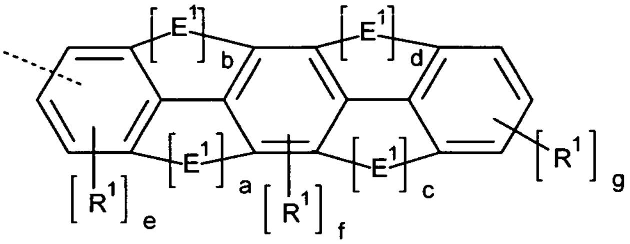
formula (Ar2-7)



formula (Ar2-8)



formula (Ar2-9)



formula (Ar2-10)

where the symbols E^1, R^1 have the same meaning as in claim 1, and where

a, b, c, d are, identically or differently, 0 or 1;

x, z, g are identically or differently, 0, 1, 2, 3, 4 or 5; where $a + b + x \leq 5$ and $z + c \leq 5$ in formulae (Ar2-7), $a + x \leq 5$ and $z + c \leq 5$ in formula (Ar2-8), $a + b + x \leq 5$ and $z + c + d \leq 5$ in formula (Ar2-9) and $g + c + d \leq 5$ in formula (Ar2-10);

y is 0, 1, 2 or 3; where $y + a + b + c \leq 3$ in formulae (Ar2-7), $y + a + c \leq 3$ in formula (Ar2-8) and $y + a + b + c + d \leq 3$ in formula (Ar2-9);

e, f are identically or differently, 0, 1, 2, 3 or 4; where $e + a + b \leq 4$ and $f + a + b + c + d \leq 4$.

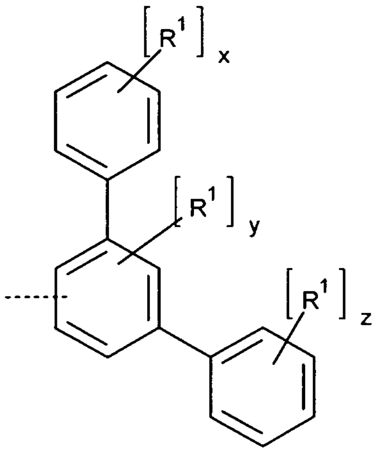
7. Compound according to claim 6, characterized in that $a + b \leq 1$ and $c + d \leq 1$.

8. Compound according to claim 6 or 7, characterized in that $c = d = 0$.

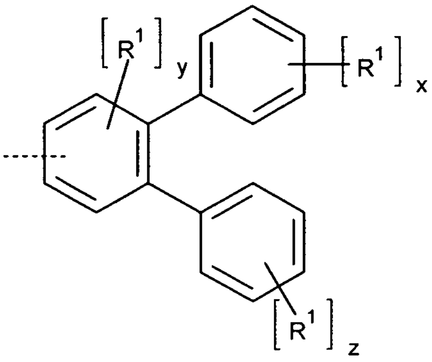
9. Compound according to one or more of the preceding claims, characterised in that E^1, E^2 and/or E^3 are, identically or differently, selected from $C(R^0)_2$, O, S and $N(R^0)$.

10. Compound according to one or more of the preceding claims, characterized in that R^0 is selected on each occurrence, identically or differently, from the group consisting of H, D, F, CN, $Si(R^2)_3$, straight-chain alkyl groups having 1 to 10 C atoms or branched or cyclic alkyl groups having 3 to 10 C atoms, each of which may be substituted by one or more radicals R^2, where in each case one or more H atoms may be replaced by F, and aryl or heteroaryl groups having 5 to 40 aromatic ring atoms, which may in each case be substituted by one or more radicals R^2, where two adjacent substituents R^0 may form a mono- or polycyclic, aliphatic ring system or aromatic ring system, which may be substituted by one or more radicals R^2.

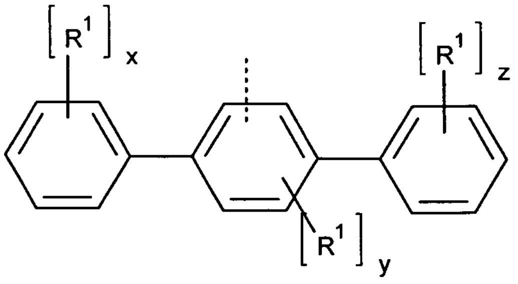
11. Compound according to one or more of the preceding claims, characterised in that the group Ar^2 is selected from the group of formulae (Ar2-7-1) to (Ar2-10-1),



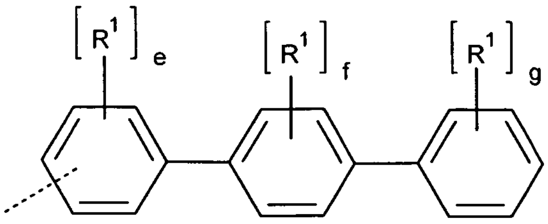
formula (Ar2-7-1)



formula (Ar2-8-1)



formula (Ar2-9-1)



formula (Ar2-10-1)

where the symbol R^1 has the same meaning as in claim 1, and

x, z, g are 0, 1, 2, 3, 4 or 5;
y is 0, 1, 2 or 3; and
e, f are 0, 1, 2, 3 or 4.

12. Compound according to one or more of the preceding claims, characterised in that Ar^L is selected from aromatic or heteroaromatic ring systems having 5 to 14 aromatic ring atoms, which may in each case also be substituted by one or more radicals R^2.

13. Compound according to one or more of the preceding claims, characterised in that R, R^1 are selected, identically or differently on each occurrence, from the group consisting of H, D, F, CN, straight-chain alkyl or alkoxy groups having 1 to 10 C atoms or branched or cyclic alkyl or alkoxy groups having 3 to 10 C atoms, each of which may be substituted by one or more radicals R^2, where one or more non-adjacent CH_2 groups may be replaced by O and where one or more H atoms may be replaced by F, and aromatic or heteroaromatic ring systems having 5 to 24 aromatic ring atoms, which may in each case be substituted by one or more radicals R^2.

14. Process for the preparation of a compound according to one or more of the preceding claims, characterised in that a diarylamino group is intro-

duced by a C-N coupling reaction between a 1- or 3- or 4-halogenated spirobifluorene and a diarylamine or triarylamine.

15. Formulation comprising at least one compound according to one or more of the claims 1 to 13 and at least one solvent.

16. Use of a compound according to one or more of claims 1 to 13 in an electronic device, in particular in an organic electroluminescent device.

17. Electronic device comprising at least one compound according to one or more of claims 1 to 13, preferably selected from the group consisting of organic electroluminescent devices, organic integrated circuits, organic field-effect transistors, organic thin-film transistors, organic light-emitting transistors, organic solar cells, dye-sensitised organic solar cells, organic optical detectors, organic photoreceptors, organic field-quench devices, light-emitting electrochemical cells, organic laser diodes and organic plasmon emitting devices.

18. Electronic device according to claim 17, which is an organic electroluminescent device, characterised in that the compound according to one or more of claims 1 to 13 is employed as hole-transport material in a hole-transport or hole-injection or exciton-blocking or electron-blocking layer or as matrix material for fluorescent or phosphorescent emitters.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/002010

A. CLASSIFICATION OF SUBJECT MATTER
INV. C07D333/76 C07C211/54 C07D407/12 C07D307/91 C09K11/06
H01L51/50 C07C211/61
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C07D C07C C09K H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	WO 2016/078747 A1 (MERCK PATENT GMBH [DE]) 26 May 2016 (2016-05-26) page 104, compound 9r -----	1
X,P	EP 2 978 040 A1 (SAMSUNG DISPLAY CO LTD [KR]) 27 January 2016 (2016-01-27) page 36, compound 40 -----	1
X	WO 2015/022051 A1 (MERCK PATENT GMBH [DE]) 19 February 2015 (2015-02-19) page 95, compound 1.3 -----	1-18
X	WO 2015/014434 A1 (MERCK PATENT GMBH [DE]) 5 February 2015 (2015-02-05) page 48, compound 38 ----- -/--	1-18

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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Date of the actual completion of the international search 10 January 2017	Date of mailing of the international search report 19/01/2017
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Bérillon, Laurent

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International application No
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