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(54) **Compound for forming organic film, and organic light emitting device and flat panel display device including the same**

Verbindung zum Bilden einer organischen Schicht und organische lichtemittierende Vorrichtung und Flachbildschirmvorrichtung, die diese beinhaltet

Composé pour la formation d'un film organique, dispositif électroluminescent organique et dispositif à écran plan l'incluant

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(56) References cited:
EP-A1- 1 661 888
EP-A1- 1 862 524
WO-A-03/008515
JP-A- 11 035 532
JP-A- 2004 087 395
JP-A- 2007 126 439
US-A1- 2005 221 124
US-A1- 2007 231 503

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to compounds for forming organic films, to organic light emitting devices including the organic films, and to flat panel display devices including the organic light emitting devices.

2. Description of the Related Art

[0002] Organic light emitting diodes are self light emitting devices which have wide viewing angles, excellent contrast, and quick response times. As such, organic light emitting diodes are receiving a lot of attention. Moreover, organic light emitting diodes have excellent driving voltage characteristics and response speeds, and can emit light of many colors.

[0003] A conventional organic light emitting diode has an anode/emissive layer/cathode structure. The organic light emitting diode may further include at least one of a hole injection layer, a hole transport layer, and an electron injection layer between the anode and the emissive layer, or between the emissive layer and the cathode, to form an anode/hole transport layer/emissive layer/cathode structure, or an anode/hole transport layer/emissive layer/cathode structure.

[0004] As materials for forming the hole transport layer, polyphenyl compounds or anthracene derivatives have been used. However, organic light emitting devices including hole injection layers and/or hole transport layers formed of these conventional materials do not have satisfactory life spans, efficiency, and power consumption. US2005221124 discloses fluorene-based compounds for use in organic electroluminescenct devices. JP2004-087395 discloses the use of electric charge transfer polyethers in organic electroluminescenct devices. US2007231503 and EP1862524 disclose organic light emitting devices that include an organic layer that comprises a compound having a carbazole group. EP1661888 discloses a phenylcarbazole-based compound and organic electroluminescent device employing the same. JP2007126439 discloses a carbazole-containing amine compound. JPH1135532 discloses an arylene or heterocycle-based compound useful for durable light emission devices.

SUMMARY OF THE INVENTION

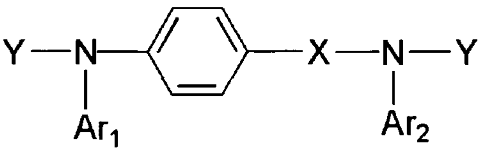
[0005] In one embodiment of the present invention, a compound for forming an organic film has high electrical stability, good charge transporting characteristics, and a high glass transition temperature, thereby preventing crystallization. The compound is suitable for use in phosphorescent and fluorescent organic light emitting devices for emitting light of all colors including red, green, blue, and white.

[0006] According to another embodiment of the present invention, an organic light emitting device includes the organic film, has high efficiency, low voltage, and high brightness.

[0007] In yet another embodiment of the present invention, a flat-panel display device includes the organic light-emitting device.

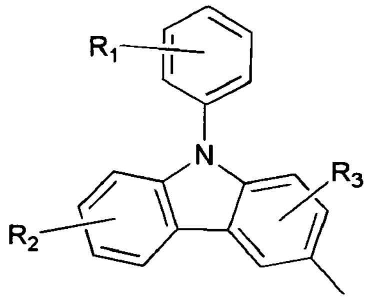
[0008] According to the present invention, a compound is represented by Formula 1 below.

Formula 1

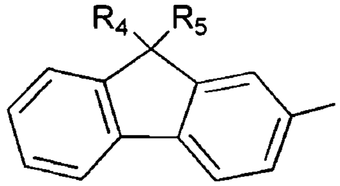


[0009] In Formula 1, X is selected from substituted and unsubstituted groups as defined in claim 1. Each of Ar_1 and Ar_2 is independently selected from substituted and unsubstituted groups as defined in claim 1. Y is selected from substituents represented by Formulae 2 and 3 below.

Formula 2



Formula 3



[0010] In Formulae 2 and 3, each of R_1, R_2, R_3, R_4 and R_5 is independently selected from hydrogen, substituted or unsubstituted C_1-C_{10} alkyl groups, substituted or unsubstituted C_{6-} C_{20} aryl groups, substituted or unsubstituted C_1-C_{10} alkoxy groups, fluorine, cyano groups, and amine groups. In some embodiments, adjacent R groups among R_1, R_2, R_3, R_4 and R_5 may bond with one another to form a saturated or unsaturated carbon ring.

[0011] According to another embodiment of the present invention, an organic light-emitting device includes a first electrode, a second electrode, and an organic film between the first and second electrodes, the organic film including the compound of Formula 1.

[0012] In one embodiment, the organic film may be a hole injection layer, a hole transport layer, or an emissive layer.

[0013] The organic light emitting device including the organic film including the compound of Formula 1 may have a low driving voltage, high brightness, high efficiency, high current density and the like.

[0014] According to another embodiment of the present invention, a flat-panel display device includes the organic light emitting device, and the first electrode of the organic light emitting device is electrically connected to a source electrode or a drain electrode of a thin film transistor.

[0015] According to a first aspect of the invention, there is provided a compound as set out in claim 1. Preferred features of this aspect are set out in claims 2 to 7.

[0016] According to a second aspect of the invention, there is provided an organic light emitting device as set out in claim 8. Preferred features of this aspect are set out in claims 9 to 14.

[0017] According to a third aspect of the invention, there is provided a flat panel display device as set out in claim 15.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The above and other features and advantages of the present invention will become more apparent by reference to the following detailed description when considered in conjunction with the attached drawings in which:

FIG. 1 is a diagram of a structure of an organic light emitting device according to an embodiment of the present invention;

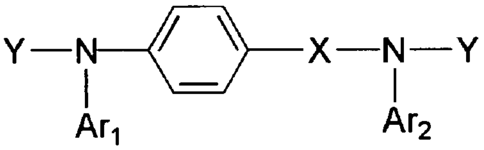
FIG. 2 is a graph comparing the life span of the organic light emitting device prepared according to Example 1 to the life span of the organic light emitting device prepared according to Comparative Example 1; and

FIG. 3 is a graph comparing the brightness characteristics with respect to driving voltage of the organic light emitting devices prepared according to Examples 6 through 9 to the brightness characteristics with respect to driving voltage of the organic light emitting device prepared according to Comparative Example 2.

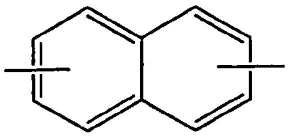
DETAILED DESCRIPTION OF THE INVENTION

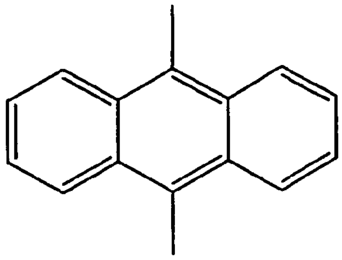
[0019] According to the present invention, a compound is represented by Formula 1 below.

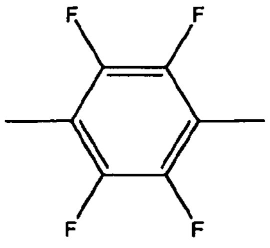
Formula 1

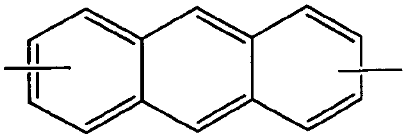


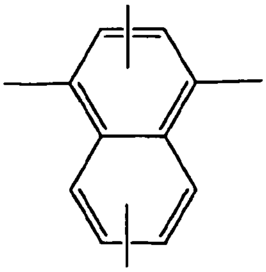
In Formula 1, X is selected from substituted and unsubstituted structures represented by:

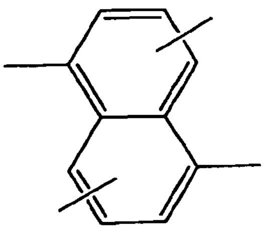


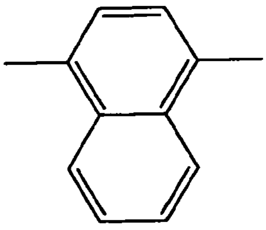


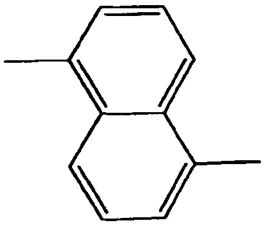






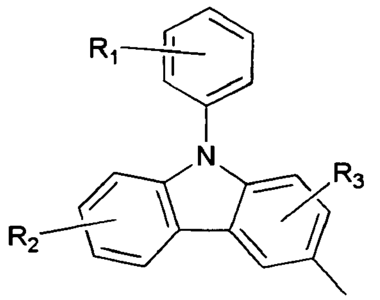




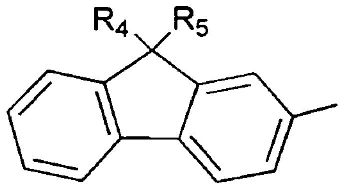


, and substituted and unsubstituted C_4-C_{20} condensed polycyclic groups. Y is selected from substituents represented by the below structures.

Formula 2



Formula 3



[0020] In Formula 2 and 3, each of R_1, R_2, R_3, R_4 and R_5 is independently selected from hydrogen, substituted and unsubstituted C_1-C_{10} alkyl groups, substituted and unsubstituted C_1-C_{10} alkoxy groups, substituted and unsubstituted C_6-C_{20} aryl groups, fluorine, cyano groups, and amine groups, or at least two adjacent R groups among R_1, R_2, R_3, R_4 and R_5 may bond with one another to form a saturated or unsaturated carbon ring.

[0021] When any one of R_1, R_2, R_3, R_4, R_5, Ar_1, Ar_2, X, and Y is an aryl group or a condensed polycyclic group with

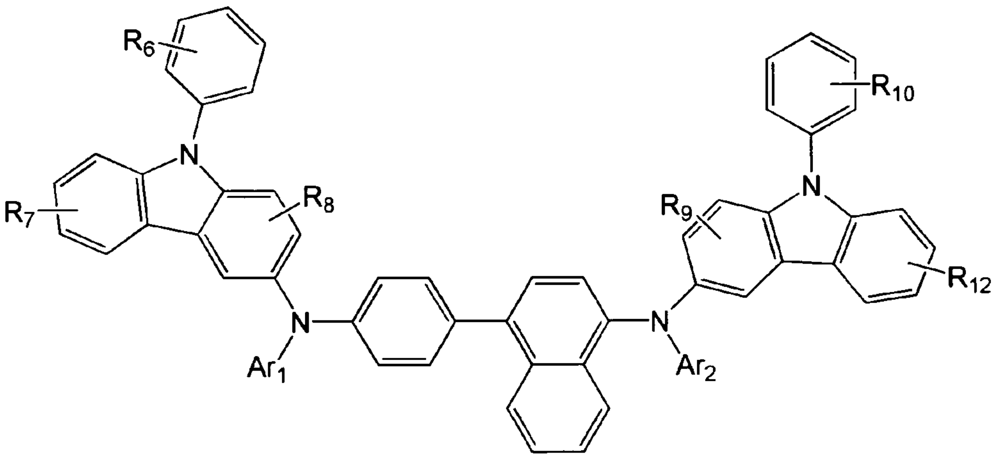
21 or more carbon atoms, the molecular weight of the compound may be too large for easy deposition.

[0022] According to some embodiments of the present invention, the compound of Formula 1 may have a hole injection, hole transport, and/or emission function. In particular, if Y is a phenylcarbazole structure, the compound of Formula 1 will include at least two rigid phenylcarbazole structures, thereby increasing the glass transition temperature (Tg) or melting point. Moreover, if Y is a fluorene compound, and in particular, if a naphthalene group or an anthracene group is introduced, the glass transition temperature (Tg) or melting point increases, which is desirable.

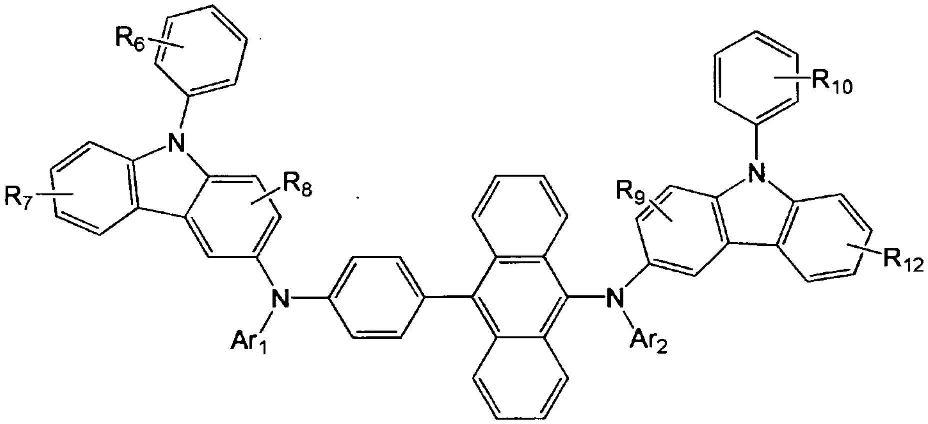
[0023] According to embodiments of the present invention, the glass transition temperature (Tg) or melting point of the compound of Formula 1 is high. As a result, during field-emission, heat resistance is increased against Joule's heat produced inside the organic layers, between organic layers or between an organic layer and a metal electrode, and resistance is increased against a high temperature environment. Such organic light emitting devices manufactured using the compounds of Formula 1 are highly durable under both storing and operating conditions.

[0024] In one embodiment, the compound of Formula 1 may be a phenylcarbazole compound represented by Formula 4 or Formula 5 below.

Formula 4



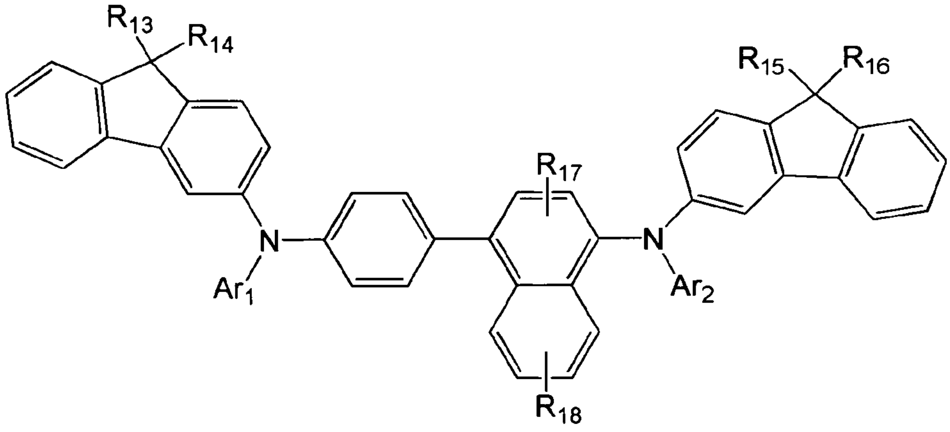
Formula 5



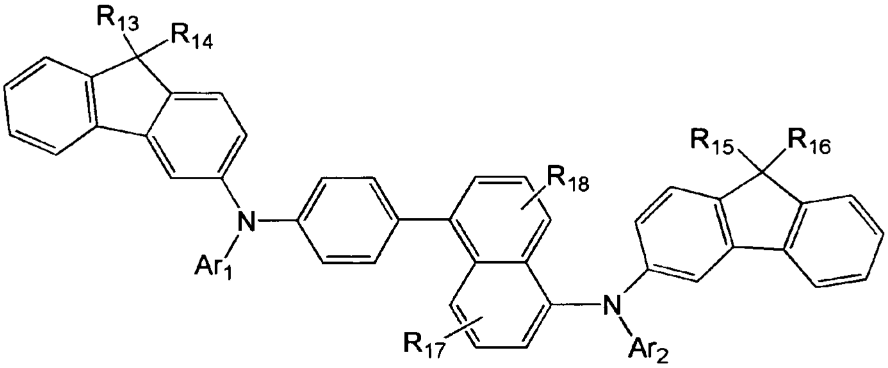
In Formulae 4 and 5, each of R_6, R_7, R_8, R_9, R_{10}, R_{11} and R_{12} is independently selected from hydrogen, substituted and unsubstituted C_1-C_{10} alkyl groups, substituted and unsubstituted C_1-C_{10} alkoxy groups, fluorine, cyano groups, and amine groups. In some embodiments, adjacent R groups among R_6, R_7, R_8, R_9, R_{10}, R_{11} and R_{12} may bond with one another to form a saturated or unsaturated carbon ring. Each of Ar_1 and Ar_2 is as defined for Formula 1.

[0025] In some embodiments, the compound of Formula 1 may be a fluorene compound represented by one of Formulae 6 to 8 below.

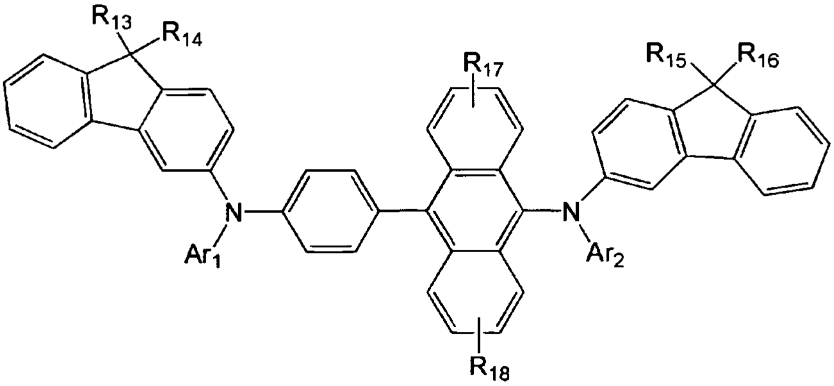
Formula 6



Formula 7



Formula 8



In Formula 6 through 8, each of R_{13}, R_{14}, R_{15}, R_{16}, R_{17} and R_{18} is independently selected from hydrogen, substituted and unsubstituted C_1-C_{10} alkyl groups, substituted and unsubstituted C_1-C_{10} alkoxy groups, fluorine, cyano groups, and amine groups. In some embodiments, adjacent R groups among R_{13}, R_{14}, R_{15}, R_{16}, R_{17} and R_{18} may bond with one another to form a saturated or unsaturated carbon ring. Each of Ar_1 and Ar_2 is as defined for Formula 1.

[0026] In the invention each of Ar_1 and Ar_2 is independently selected from substituted and unsubstituted phenyl groups, naphthyl groups, biphenyl groups and anthracenyl groups.

[0027] For each of Ar_1 and Ar_2 an aromatic ring is substituted with one to three substituents selected from C_1-C_4 alkyl groups, C_1-C_5 alkoxy groups, cyano group, amine groups, phenoxy groups, phenyl groups, and halogen atoms.

[0028] Nonlimiting examples of suitable unsubstituted alkyl groups for use in the Formulae according to embodiments of the present invention include methyl groups, ethyl groups, propyl groups, isobutyl groups, sec-butyl groups, pentyl groups, iso-amyl groups, and hexyl groups. In some embodiments, at least one hydrogen of the alkyl group may be substituted with a substituent selected from halogen atoms, hydroxyl groups, nitro groups, cyano groups, amino groups, amidino groups, hydrazine groups, hydrazone groups, carboxylic acid groups and salts thereof, sulfonic acid groups and salts thereof, phosphoric acid groups and salts thereof, C_1-C_{10} alkyl groups, C_1-C_{10} alkenyl groups, C_1-C_{10} alkynyl groups, C_6-C_{10} aryl groups, C_7-C_{10} arylalkyl groups, C_4-C_{10} heteroaryl groups, and C_5-C_{10} heteroarylalkyl groups.

[0029] Nonlimiting examples of suitable unsubstituted alkoxy groups for use in the Formulae according to embodiments of the present invention include methoxy groups, ethoxy groups, cyclohexyloxy groups, and isopropyloxy groups. In some embodiments, at least one hydrogen atom of the alkoxy group may be substituted with the same substituent groups as previously described with respect to the alkyl groups.

[0030] The unsubstituted aryl group, either by itself or in combination, refers to an aromatic carbon ring including at least one ring, wherein the rings may be attached in a pendant configuration, or may be fused. At least one hydrogen atom of the aryl group may be substituted with the same substituent groups as previously described with respect to the alkyl groups.

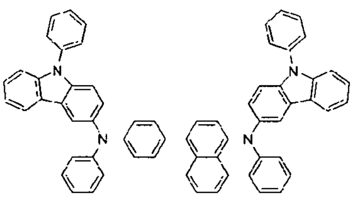
[0031] In some embodiments, at least one hydrogen atom of the phenyloxy group may be substituted with the same substituent groups as previously described with respect to the alkyl groups.

[0032] The unsubstituted heteroaryl group refers to a monovalent monocyclic or bicyclic aromatic organic compound with from 4 to 30 ring atoms including 1, 2, or 3 heteroatoms selected from N, O, P, and S, and wherein the remaining ring atoms are C.

[0033] In some embodiments, at least one hydrogen atom of the heteroaryl group may be substituted with the same substituent groups as previously described with respect to the alkyl groups.

[0034] Nonlimiting examples of suitable heteroaryl groups include pyrazolyl groups, imidazolyl groups, oxazolyl groups, thiazolyl groups, triazolyl groups, tetrazolyl groups, oxadiazolyl groups, pyridinyl groups, pyridazinyl groups, pyrimidinyl groups, triazinyl groups, carbazolyl groups, and indolyl groups.

[0035] Nonlimiting examples of suitable compounds satisfying Formula 1 included Compounds 1 to 54 and 105 to 242 below (Compounds 55 to 104 are not according to the invention, but useful for understanding the same).



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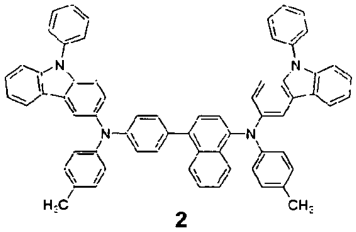

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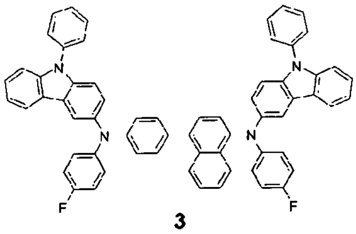

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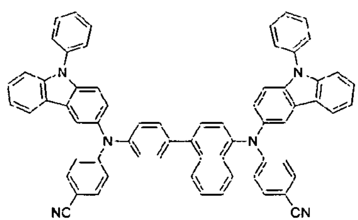

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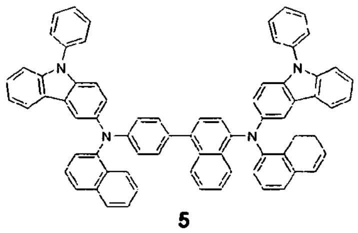

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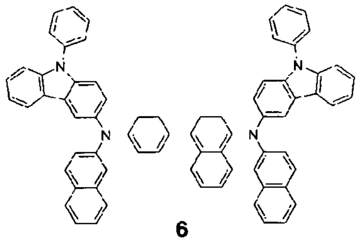

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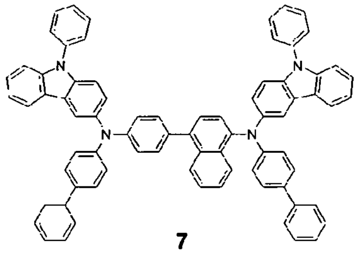

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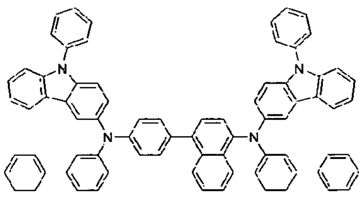

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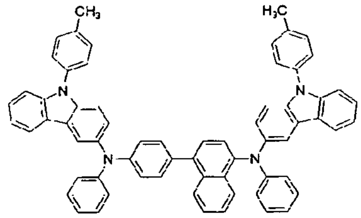

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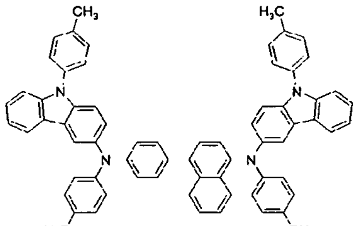

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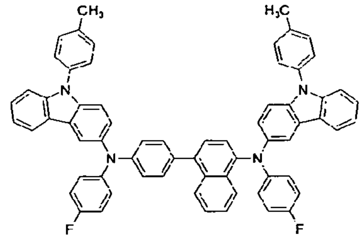

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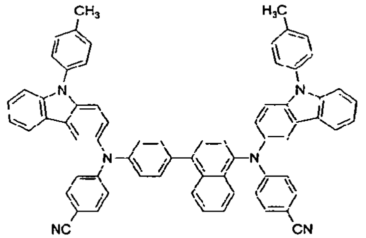

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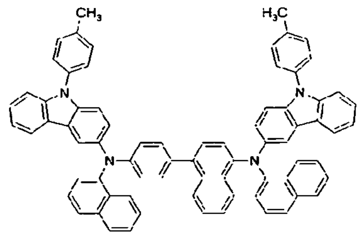

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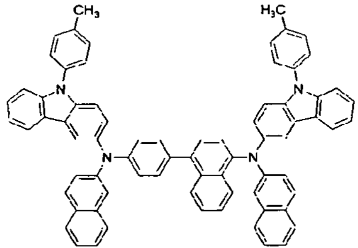

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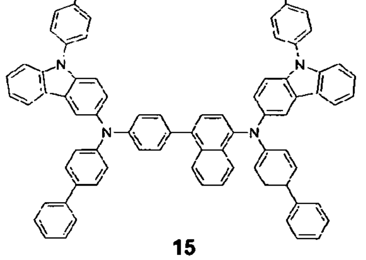

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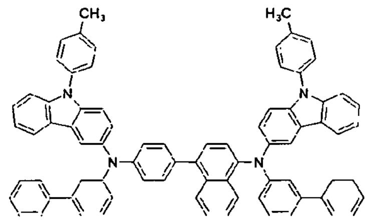

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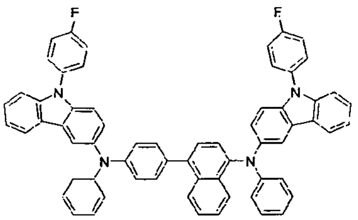

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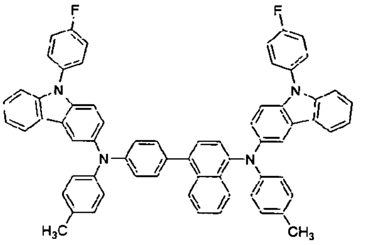

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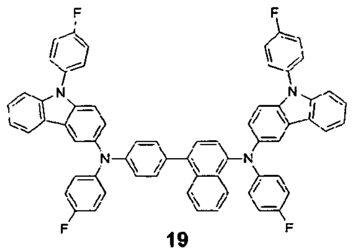

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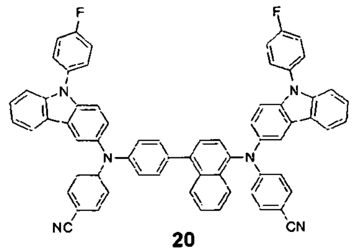

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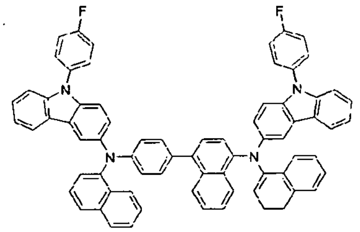

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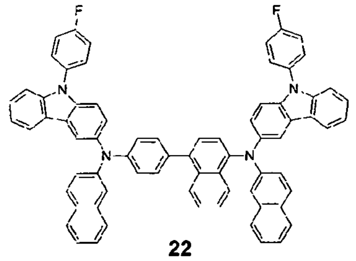

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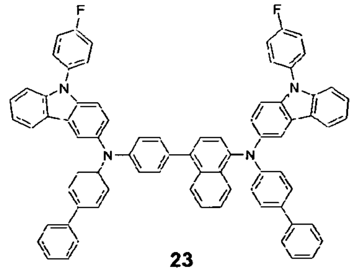

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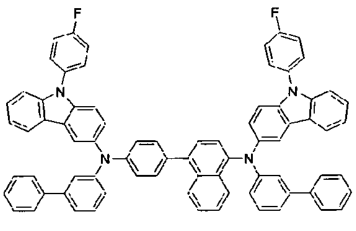

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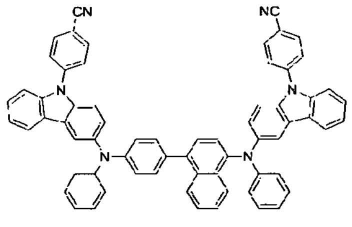

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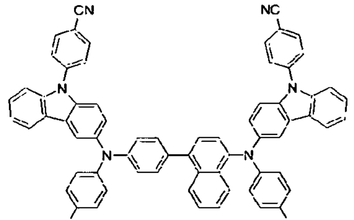

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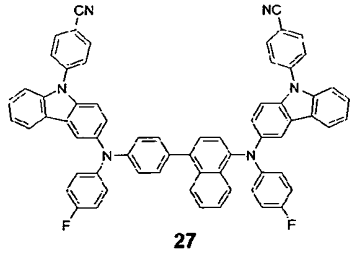

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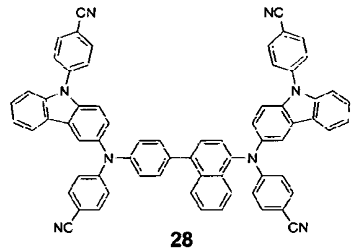

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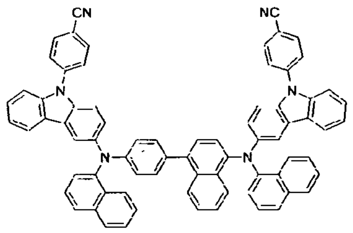

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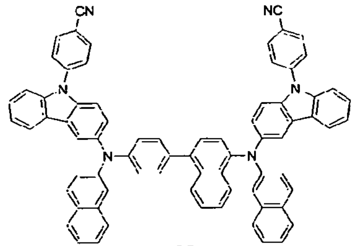

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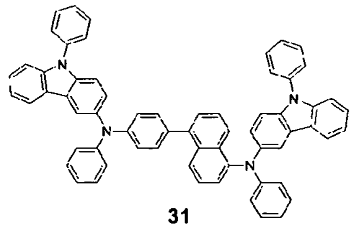

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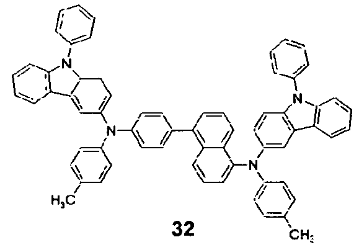

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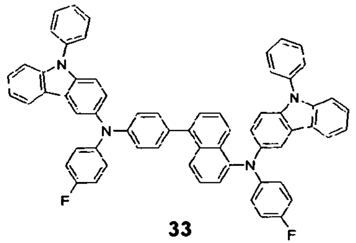

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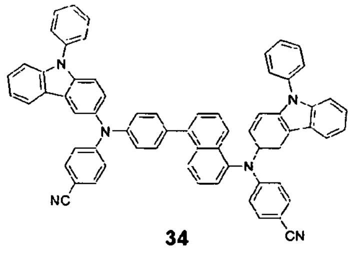

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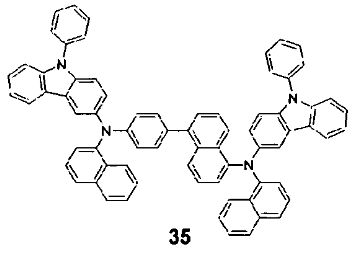

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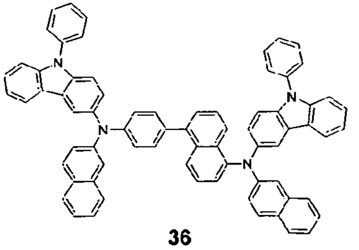

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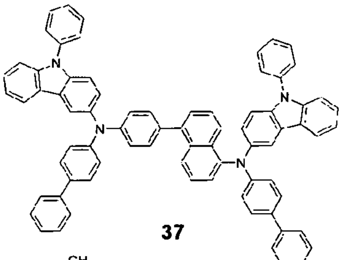

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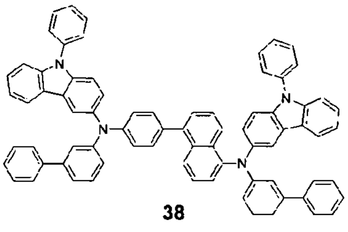

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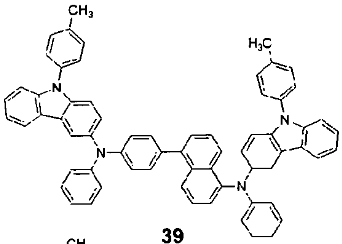

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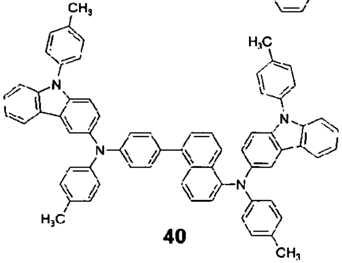

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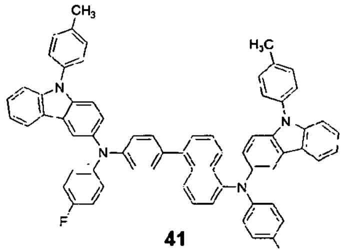

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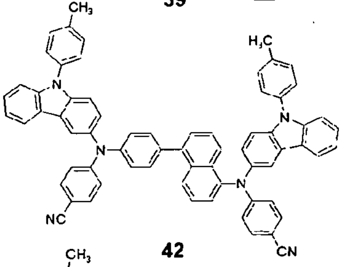

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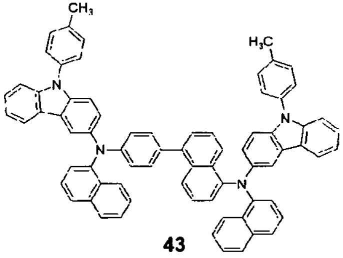

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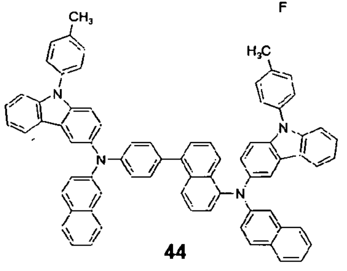

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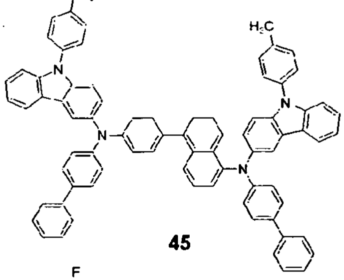

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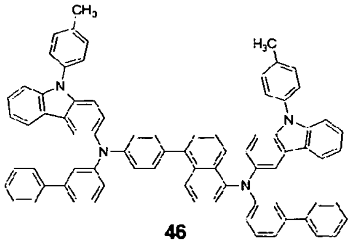

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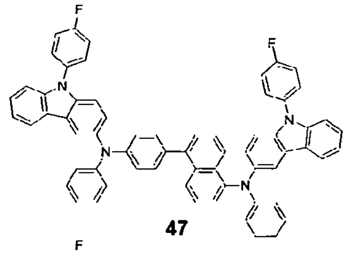

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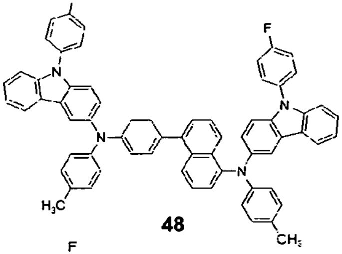

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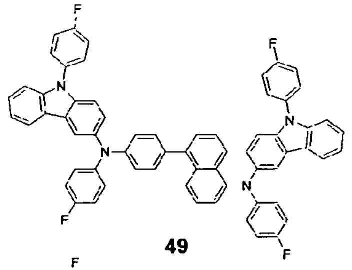

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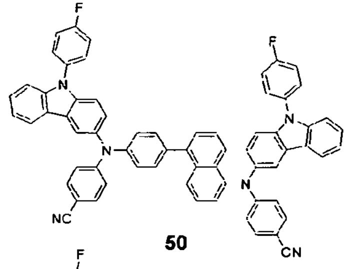

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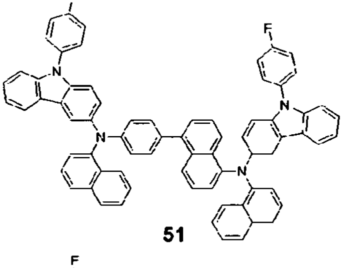

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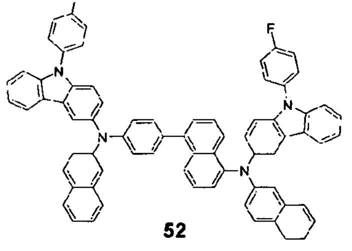

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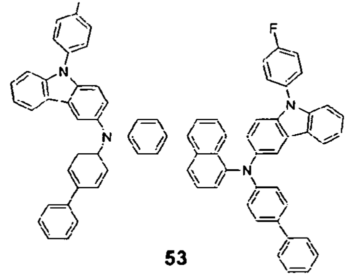

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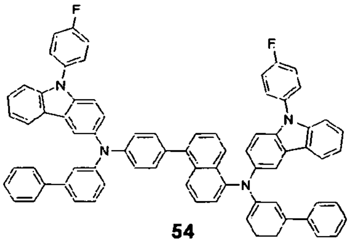

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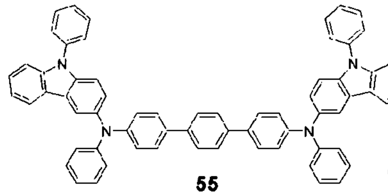

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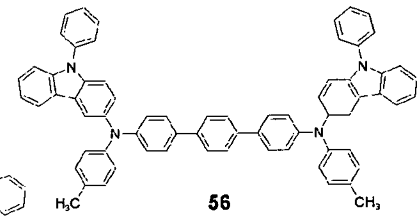

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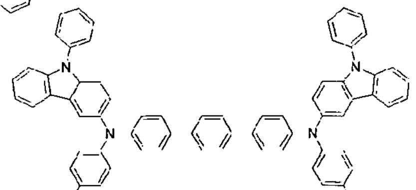

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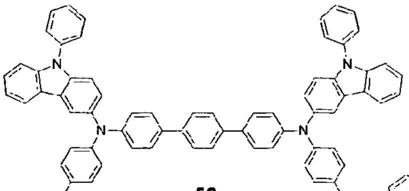

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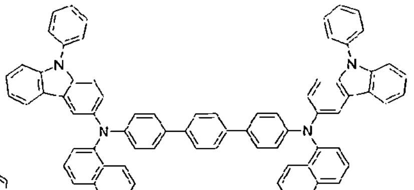

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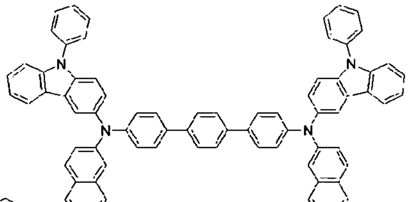

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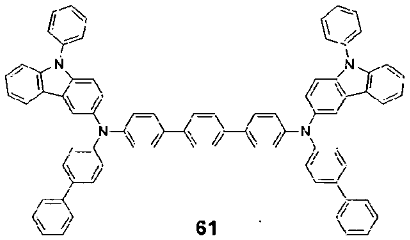

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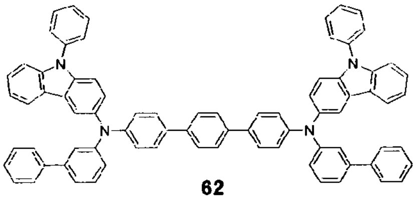

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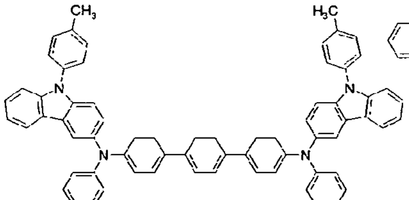

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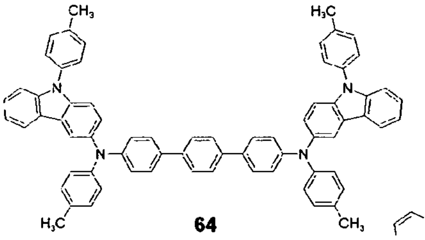

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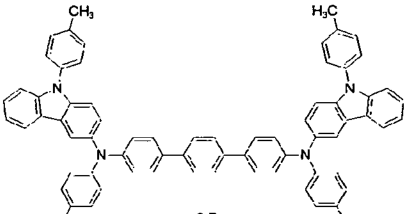

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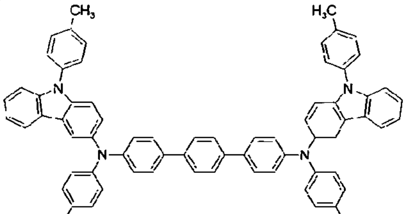

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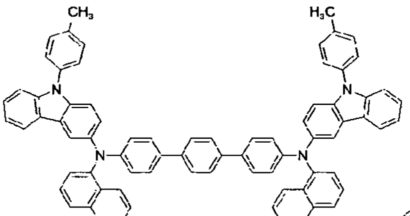

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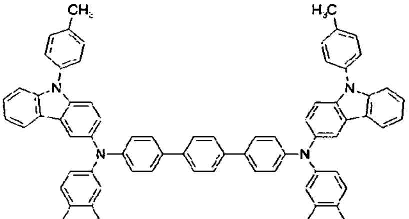

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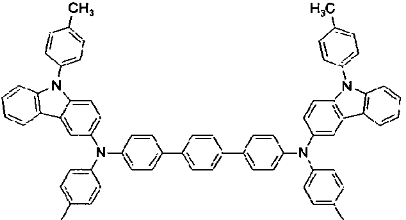

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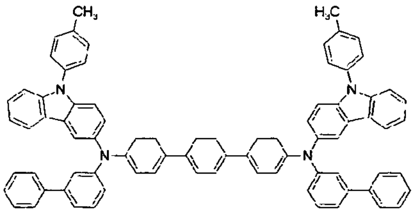

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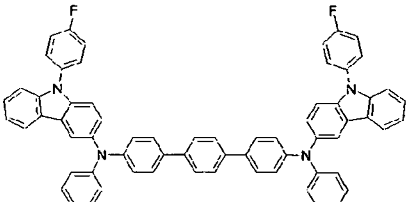

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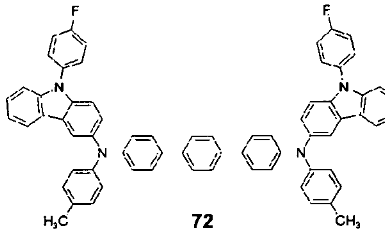

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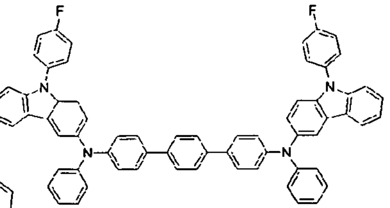

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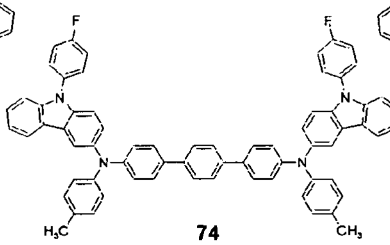

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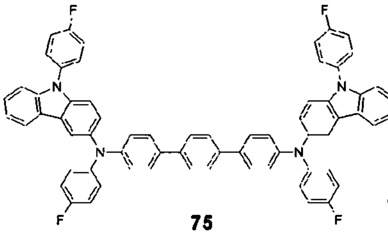

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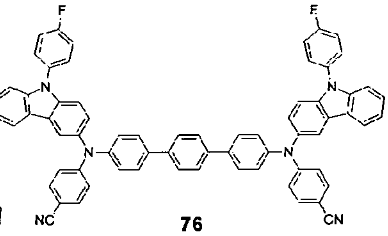

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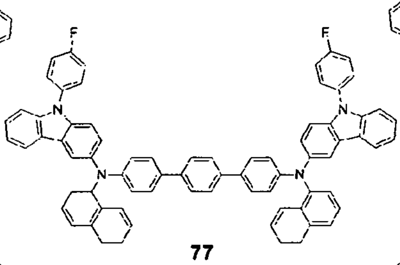

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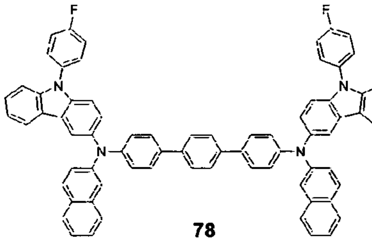

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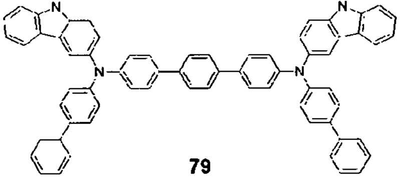

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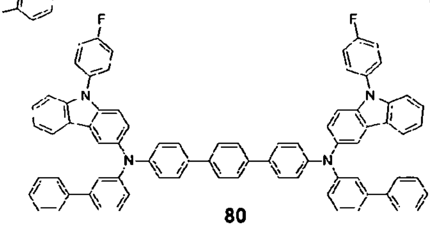

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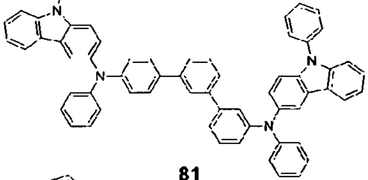

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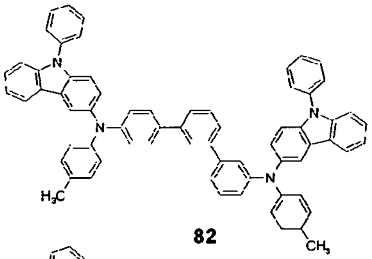

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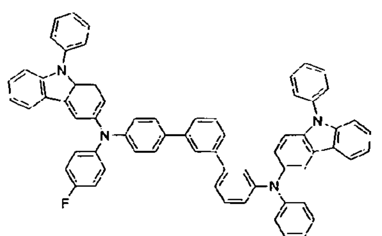

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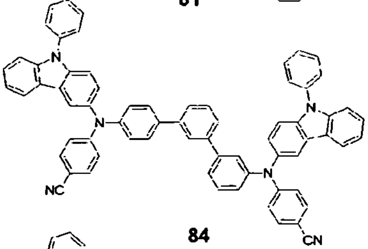

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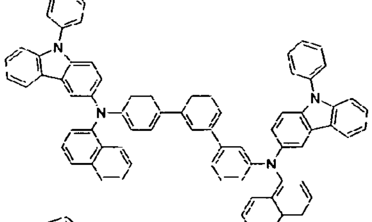

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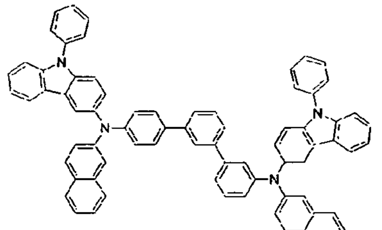

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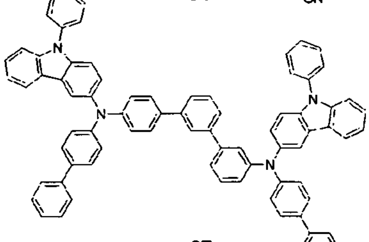

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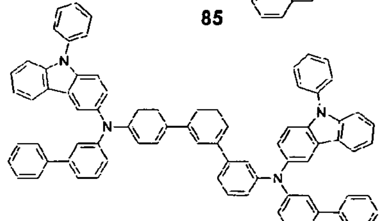

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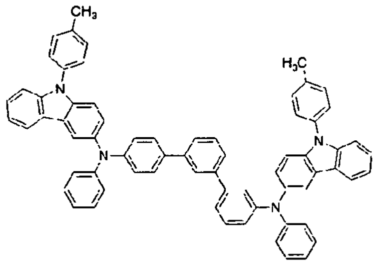

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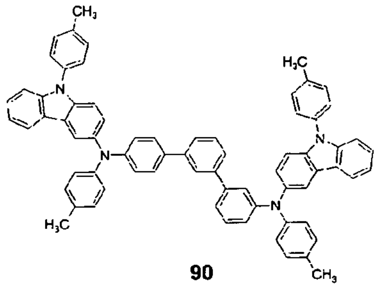

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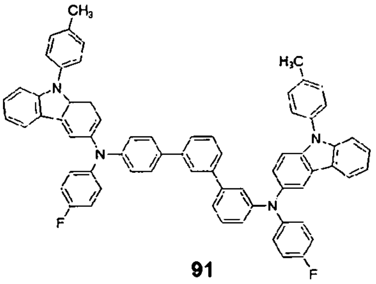

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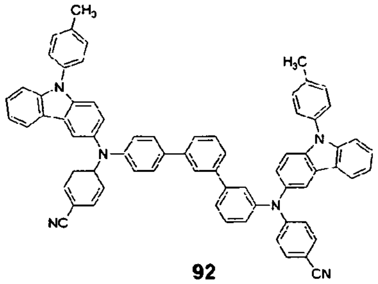

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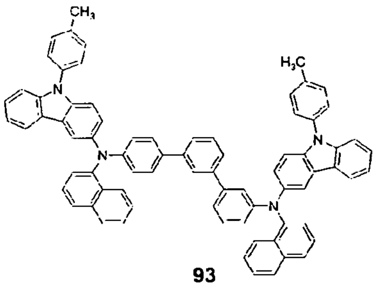

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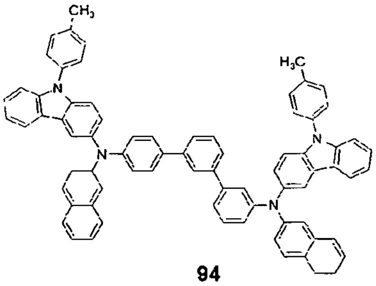

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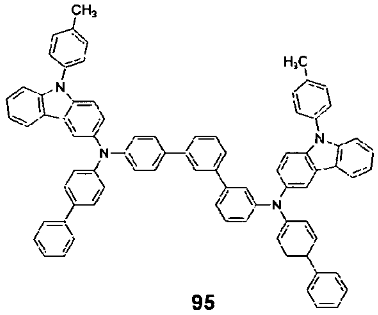

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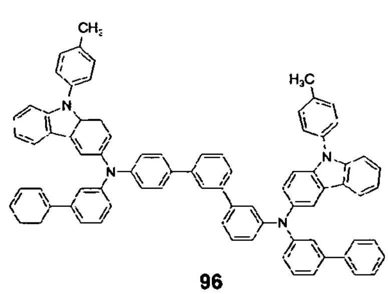

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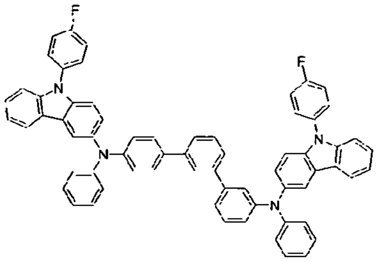

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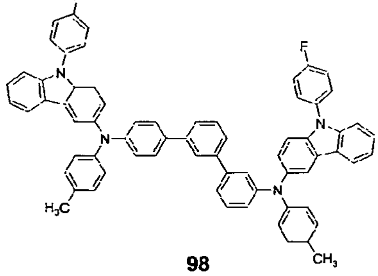

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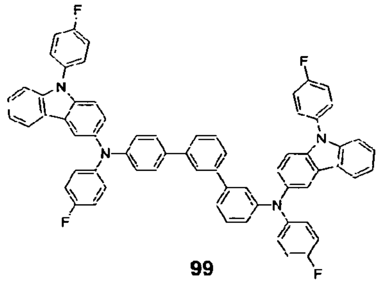

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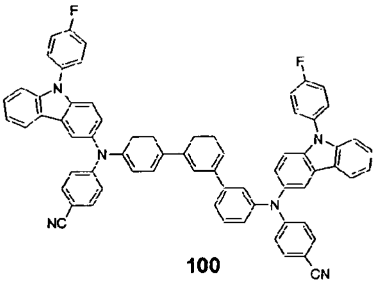

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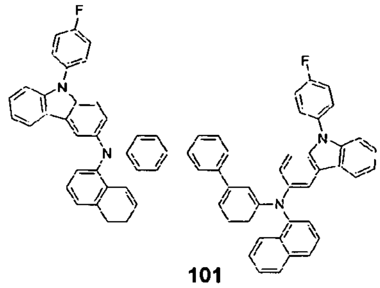

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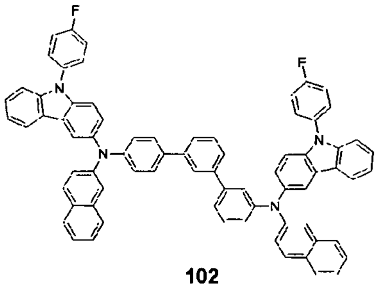

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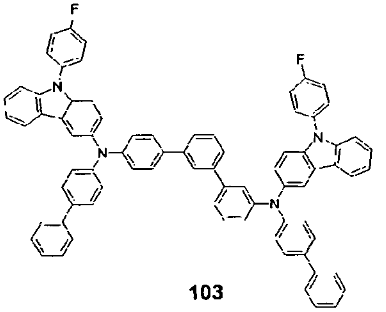

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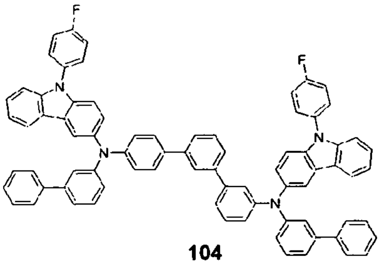

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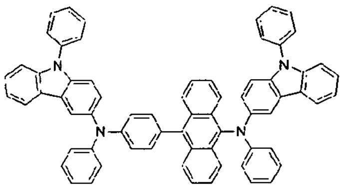

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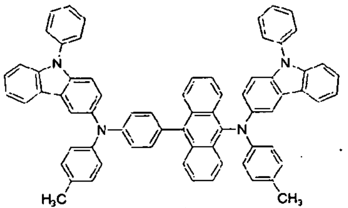

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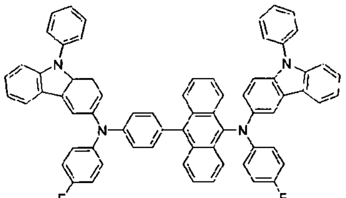

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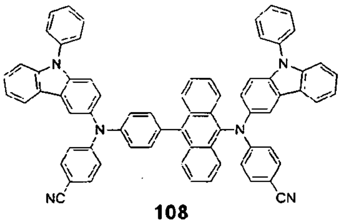

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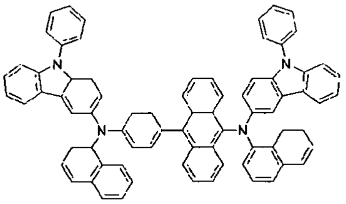

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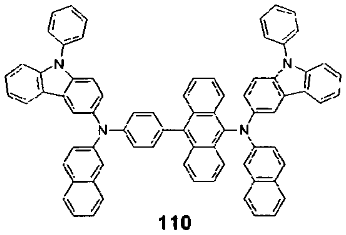

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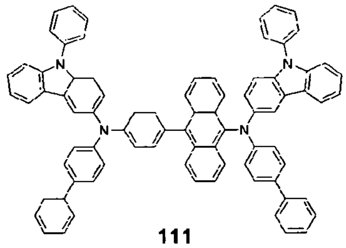

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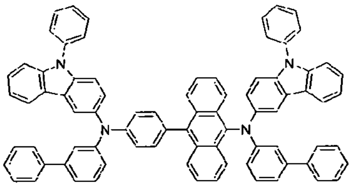

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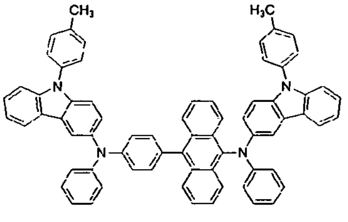

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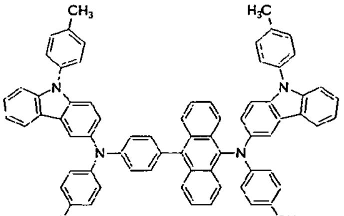

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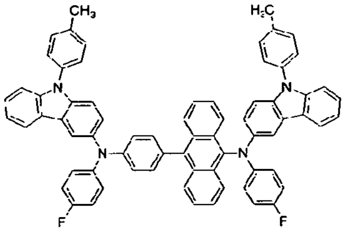

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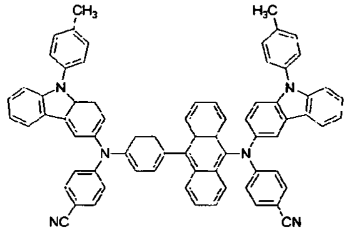

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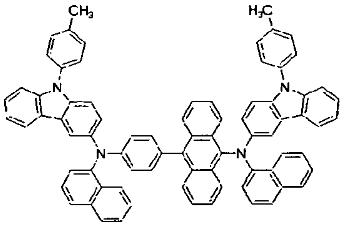

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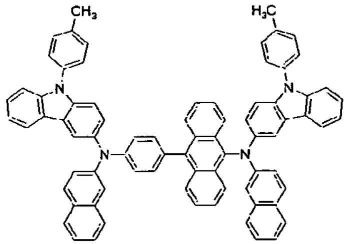

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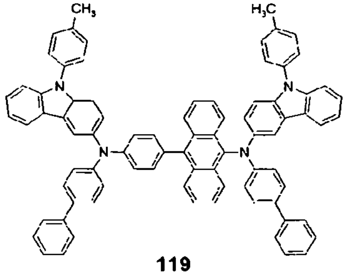

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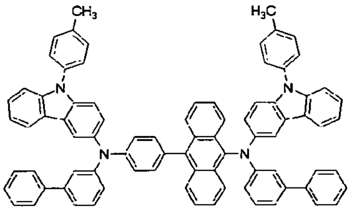

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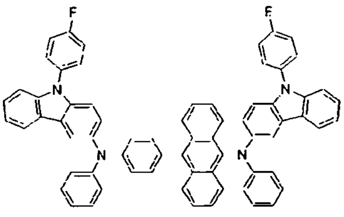

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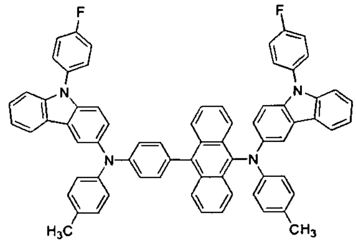

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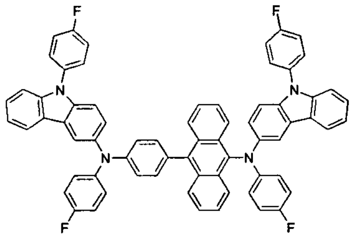

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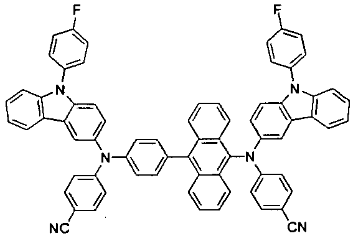

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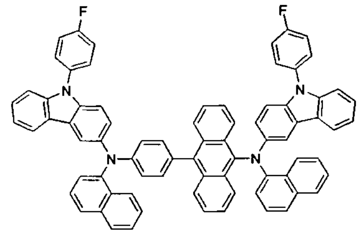

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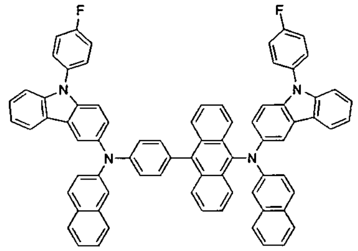

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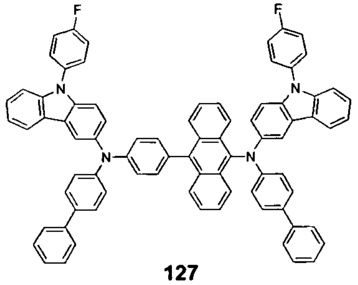

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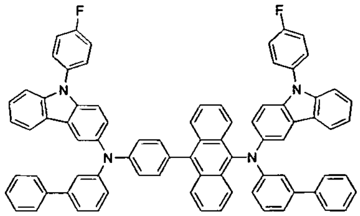

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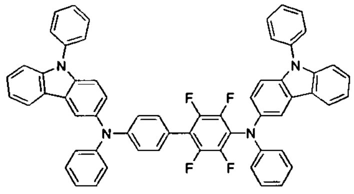

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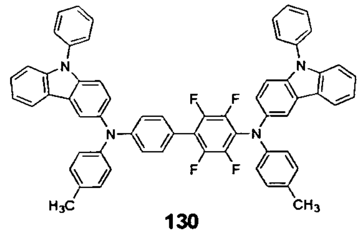

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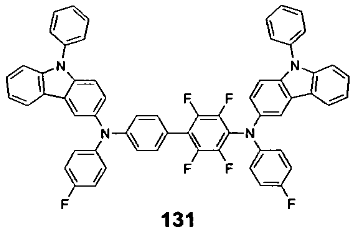

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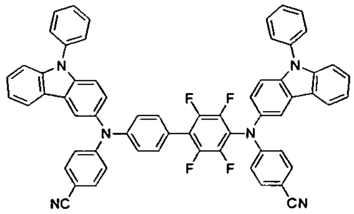

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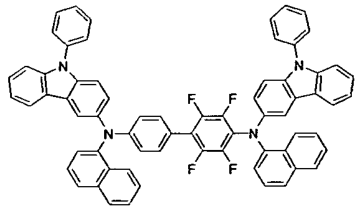

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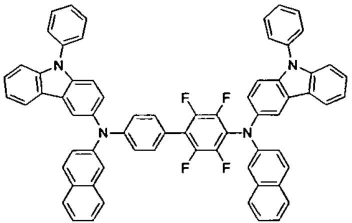

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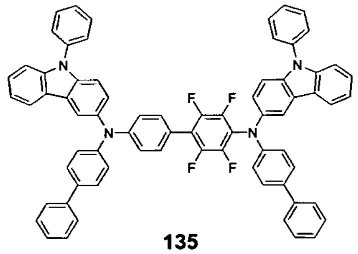

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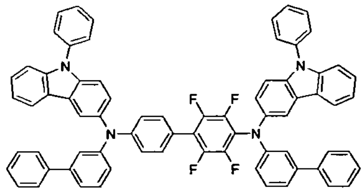

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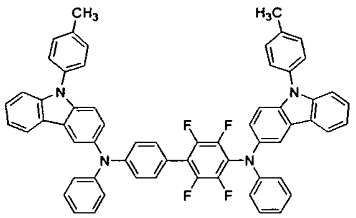

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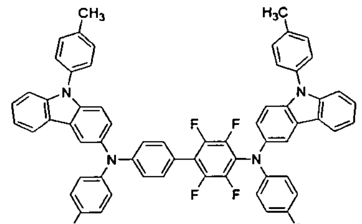

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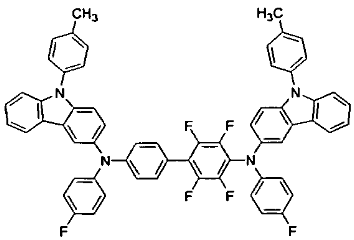

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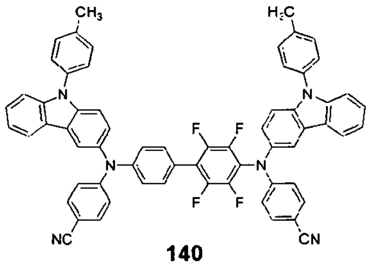

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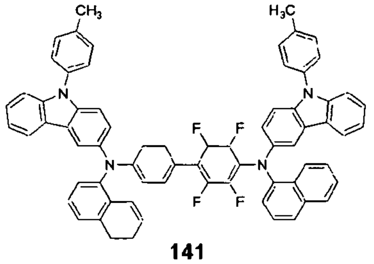

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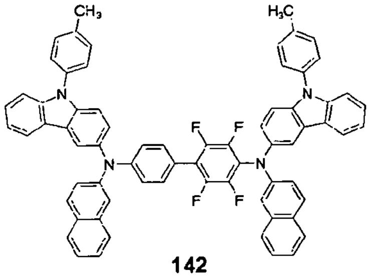

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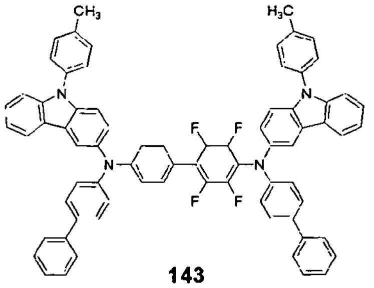

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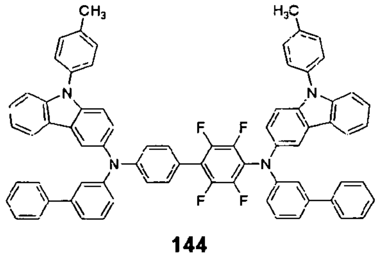

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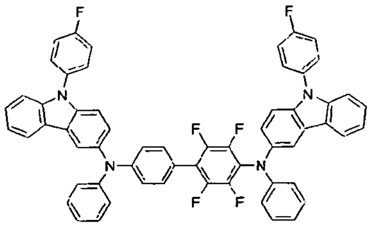

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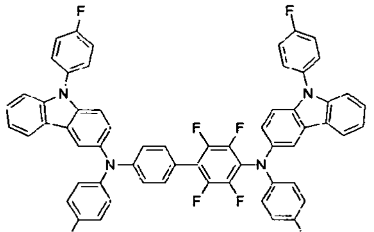

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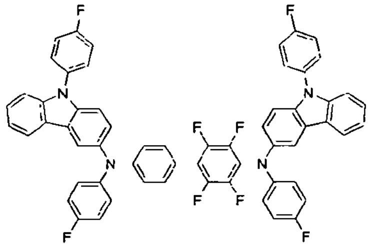

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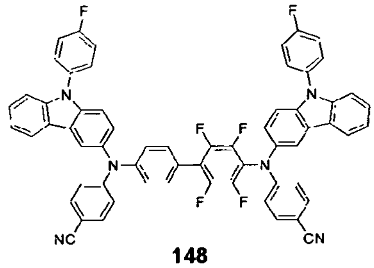

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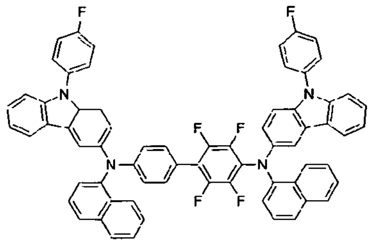

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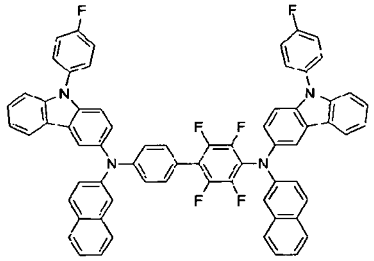

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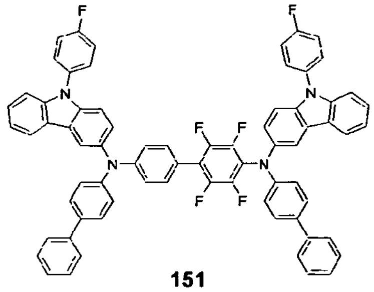

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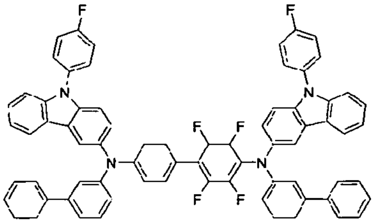

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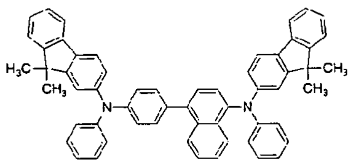

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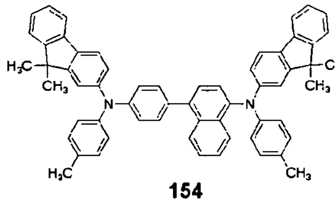

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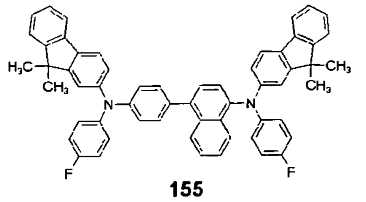

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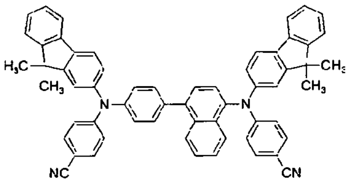

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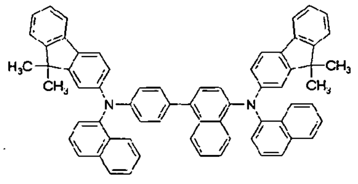

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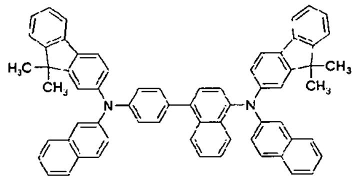

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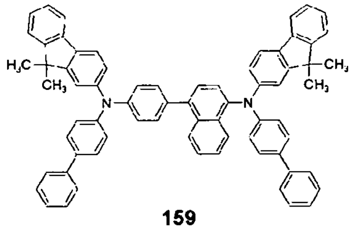

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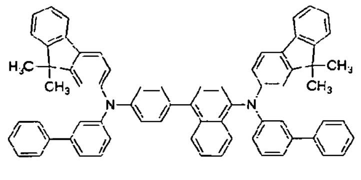

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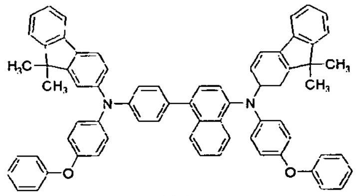

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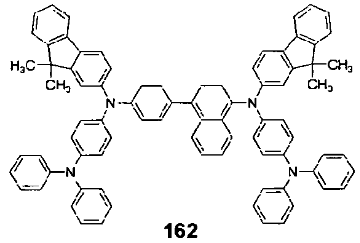

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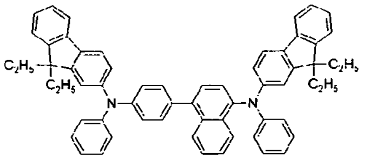

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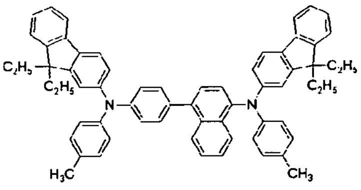

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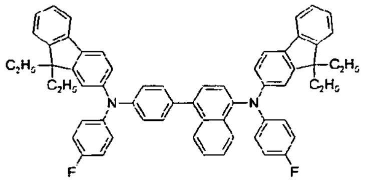

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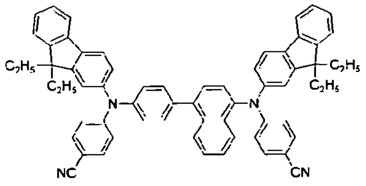

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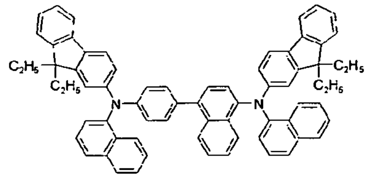

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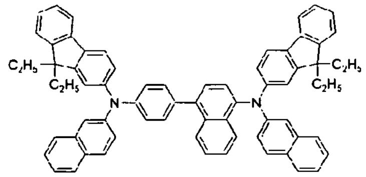

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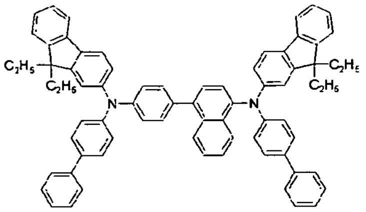

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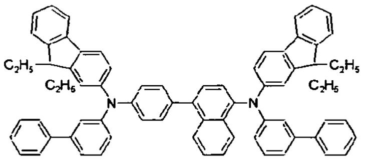

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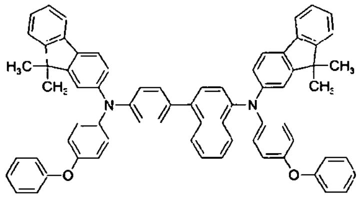

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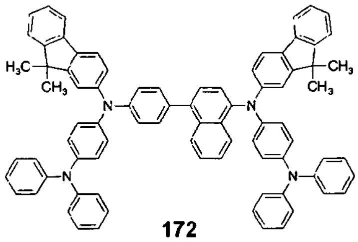

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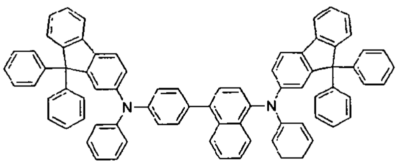

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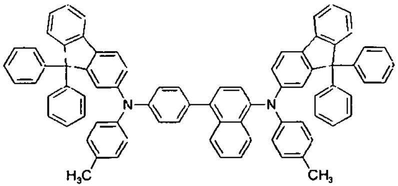

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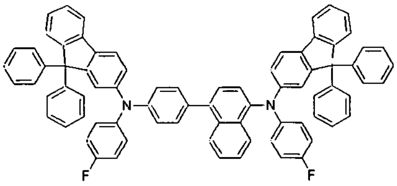

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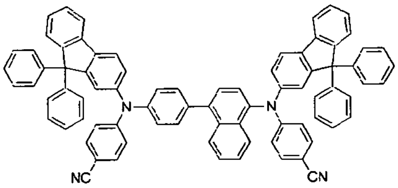

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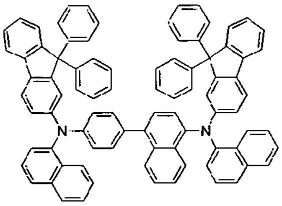

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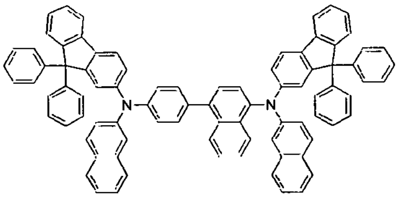

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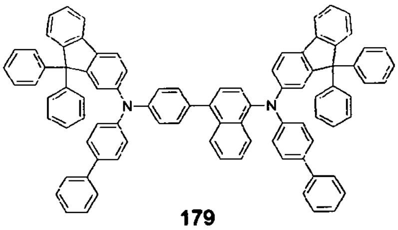

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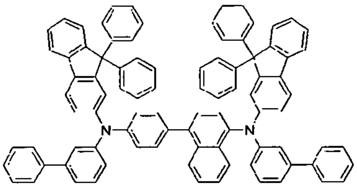

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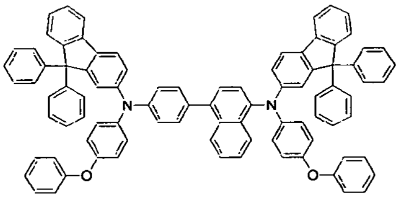

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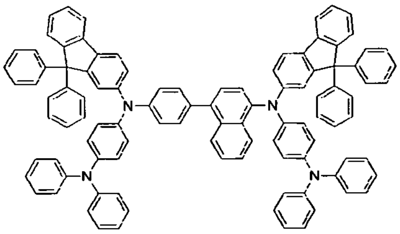

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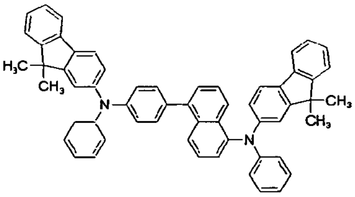

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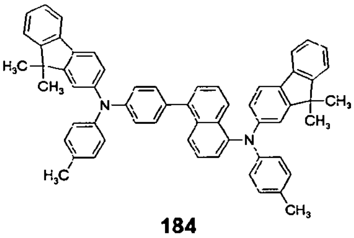

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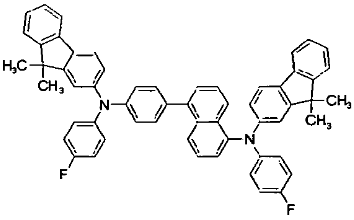

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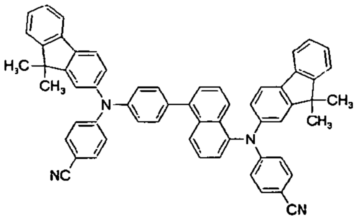

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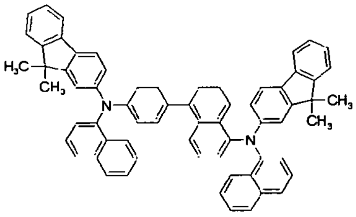

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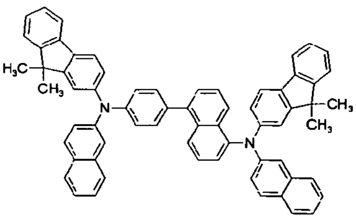

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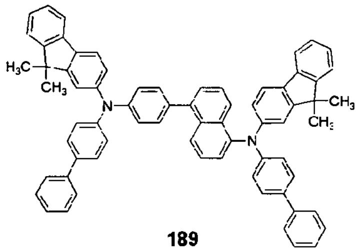

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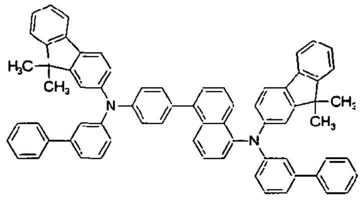

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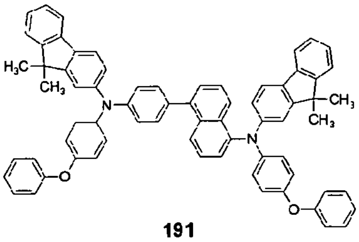

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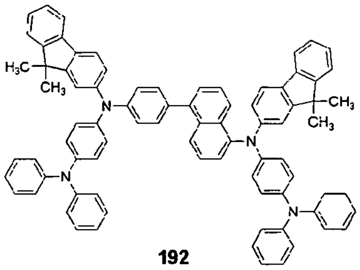

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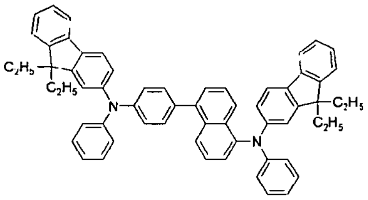

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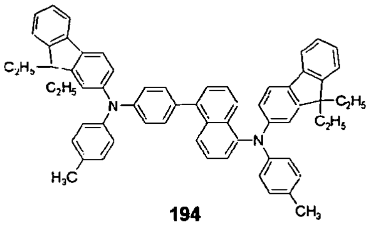

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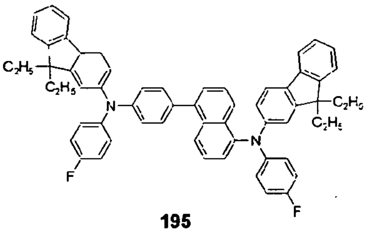

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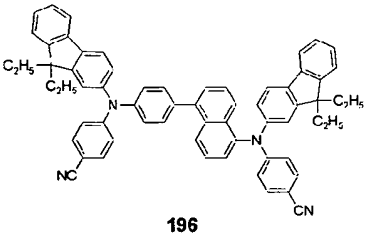

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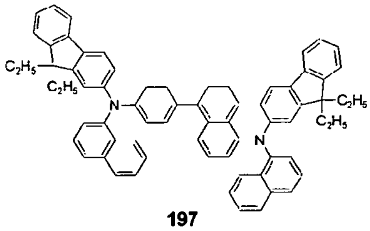

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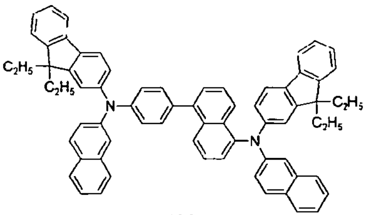

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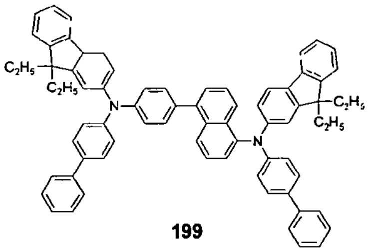

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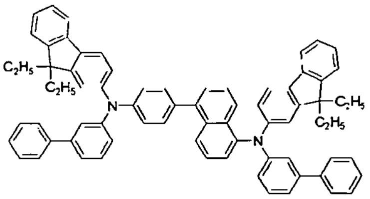

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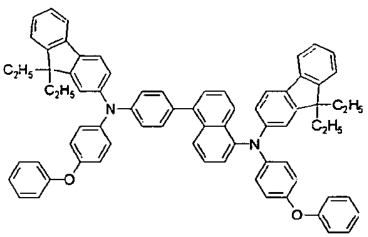

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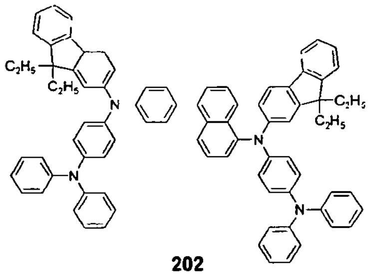

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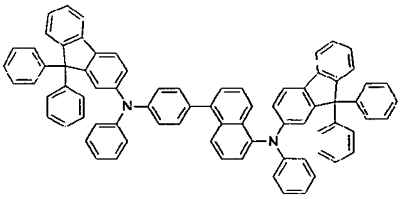

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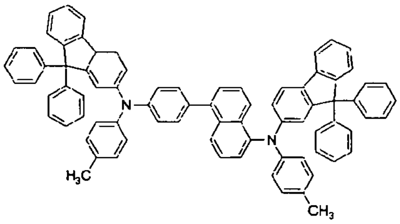

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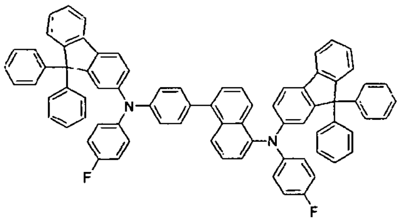

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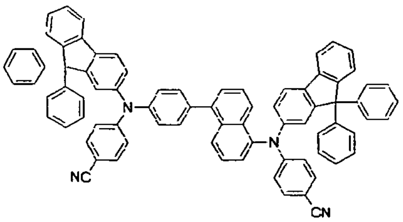

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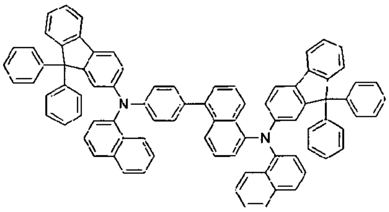

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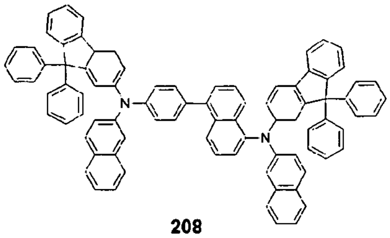

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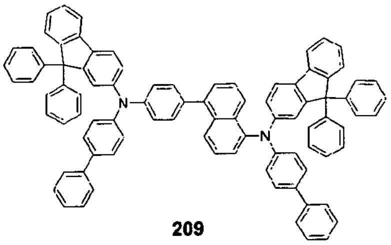

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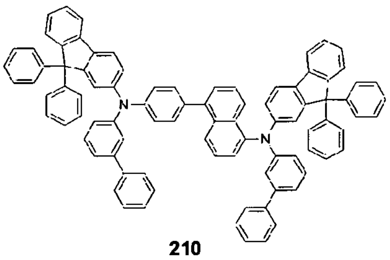

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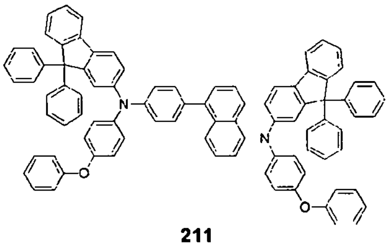

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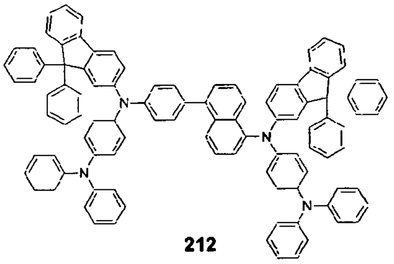

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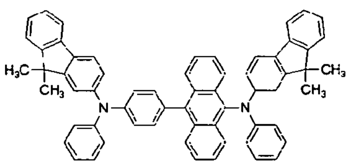

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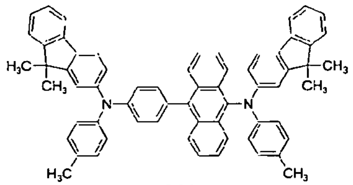

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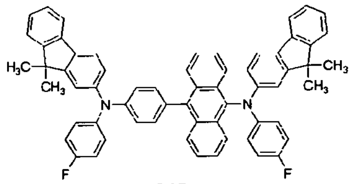

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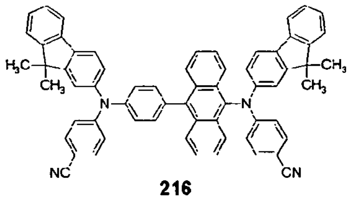

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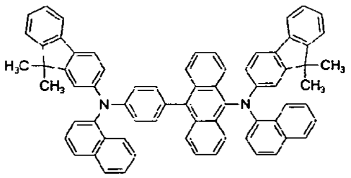

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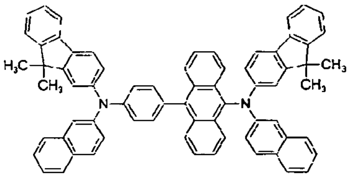

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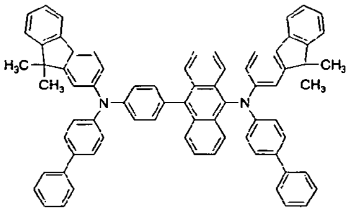

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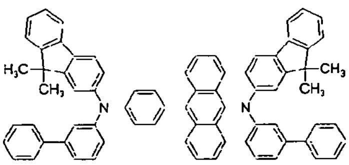

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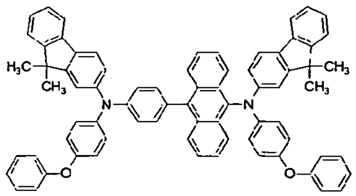

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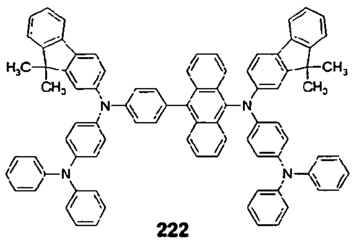

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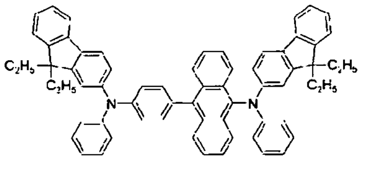

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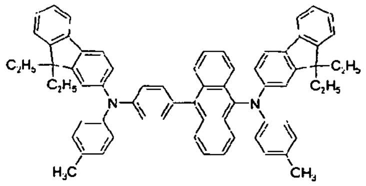

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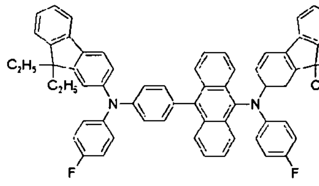

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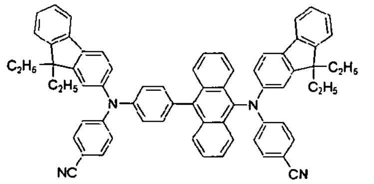

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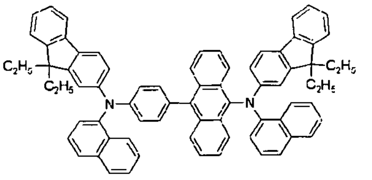

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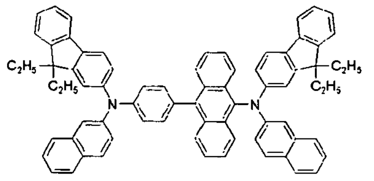

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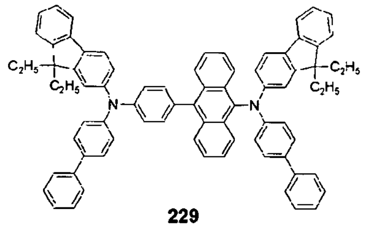

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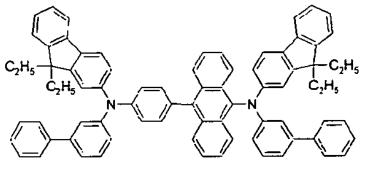

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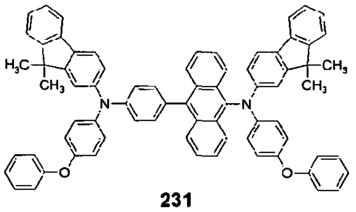

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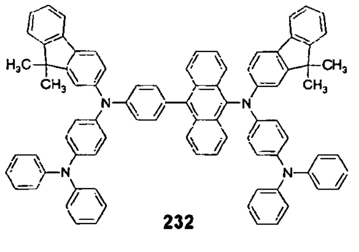

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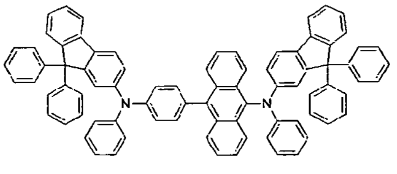

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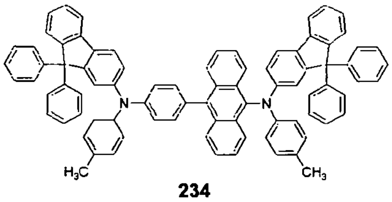

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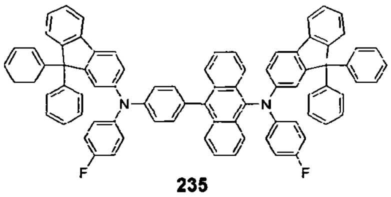

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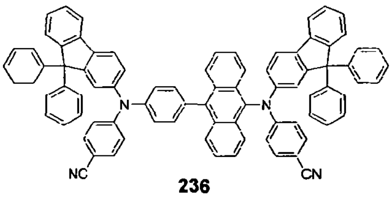

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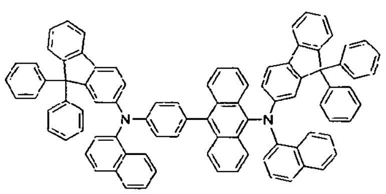

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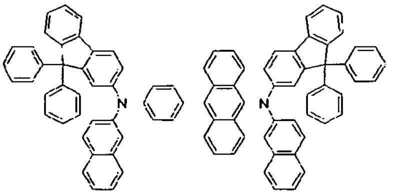

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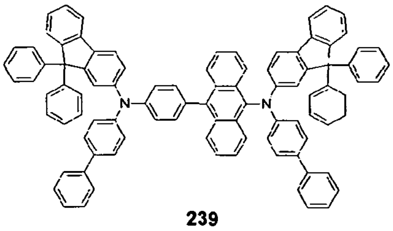

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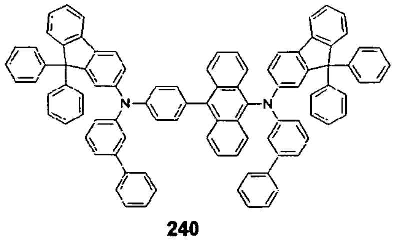

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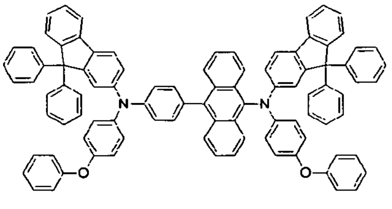

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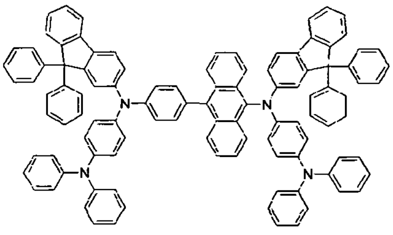

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[0036] In some embodiments, for example, the compound satisfying Formula 1 is selected from Compounds 1, 2, 3, 32,105,153,157,159,173,184 and 213 above.

[0037] According to another embodiment of the present invention, an organic light-emitting device includes a first electrode, a second electrode, and an organic film between the first electrode and the second electrode. The organic film includes a compound represented by Formula 1 and may be a hole injection layer or a hole transport layer. The organic film may also be a single film having both a hole injection function and a hole transport function. Alternatively, the organic film may be an emissive layer. The compound represented by Formula 1 may be used as a host material for phosphorescent or fluorescent blue, green, or red color materials.

[0038] In one embodiment, the organic film may be a hole injection layer or a hole transport layer.

[0039] The first electrode may be an anode, and the second electrode may be a cathode. Alternatively, the first electrode may be a cathode, and the second electrode may be an anode.

[0040] The organic light emitting device may further include, whenever necessary or desired, at least one additional layer selected from hole injection layers, hole transport layers, electron blocking layers, emissive layers, hole blocking layers, electron transport layers, and electron injection layers. In addition, the organic light emitting device may include a double-layered organic layer including two of the above organic layers, whenever necessary or desired.

[0041] For example, an organic light emitting device according to embodiments of the present invention may have a first electrode/hole injection layer/emissive layer/second electrode structure, a first electrode/hole injection layer/hole transport layer/emissive layer/electron transport layer/second electrode structure, or a first electrode/hole injection layer/hole transport layer/emissive layer/electron transport layer/electron injection layer/second electrode structure. Alternatively, the organic light emitting device may have a first electrode/single organic film with both hole injection and hole transport functions/emissive layer/electron transport layer/second electrode structure, or a first electrode/single organic film with both hole injection and hole transport functions/emissive layer/electron transport layer/electron injection layer/second electrode structure.

[0042] The organic light emitting devices according to embodiments of the present invention may be used in various applications such as top emission type organic light emitting devices and bottom emission type organic light emitting devices.

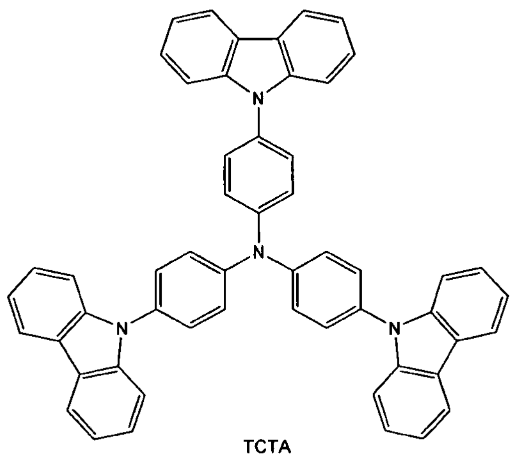
[0043] A method of preparing an organic light emitting device according to an embodiment of the present invention will now be described with reference to the organic light emitting device illustrated in FIG. 1. As shown in FIG. 1, an organic light emitting device according to one embodiment of the present invention includes a substrate, a first electrode (e.g., an anode), a hole injection layer, a hole transport layer, an emissive layer, an electron transport layer, and a second electrode (e.g., a cathode).

[0044] The first electrode is formed by applying a first electrode forming material having a high work function on a substrate by deposition or sputtering. The first electrode may either be an anode or a cathode. The substrate may be any conventional substrate used in organic light emitting devices. For example, the substrate may be a glass substrate or a transparent plastic substrate, both of which have excellent mechanical strength, thermal stability, transparency, surface planarity, convenience in handling, and water resistance. The first electrode forming material may include a material selected from indium tin oxide (ITO), indium zinc oxide (IZO), tin oxide (SnO_2), zinc oxide (ZnO), Al, Ag, Mg, and combinations thereof. The first electrode forming material has excellent conductivity and may be used to form a transparent or reflective electrode.

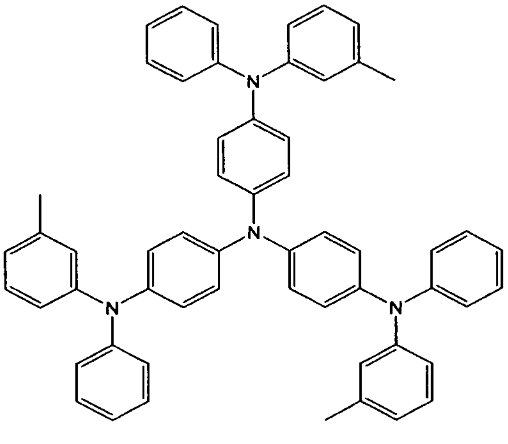
[0045] The hole injection layer (HIL) may be formed on the first electrode using a variety of methods such as vacuum deposition, spin coating, casting, and Langmuir-Blodget (LB) deposition. When forming the HIL using vacuum deposition, the deposition conditions may differ depending on the compound used as the material for the HIL and the desired structure and thermal properties of the HIL. However, in some embodiments, the deposition conditions may include a deposition temperature ranging from about 100 to about 500°C, a vacuum pressure ranging from about 10^{-8} to about 10^{-3} torr, a deposition rate ranging from about 0.01 to about 100 Å/sec, and a film thickness ranging from about 10 Å to about 5 μm.

[0046] When forming the HIL by spin coating, the coating conditions may differ depending on the compound used as the material for the HIL and the desired structure and thermal properties of the HIL. However, in some embodiments, the spin coating conditions may include a coating speed ranging from about 2000 to about 5000 rpm, and a heat-treatment temperature for removing a solvent after coating ranging from about 80 to about 200°C.

[0047] The HIL material may be the compound represented by Formula 1, as described above. Alternatively, any known HIL material may be used. For example, a phthalocyanine compound (such as copper phthalocyanine) may be used. Additionally, TCTA (shown below), m-MTDATA (shown below) and m-MTDAPB, which are starburst-type amine derivatives can be used. Soluble conductive polymers, such as Pani/DBSA (polyaniline/dodecylbenzenesulfonic acid), PEDOT/PSS (poly(3,4-ethylenedioxythiophene)/poly(4-styrenesulfonate), Pani/CSA (polyaniline /camphor sulfonic acid), and PANI/PSS (polyaniline)/poly (4-styrene-sulfonate) may also be used.



TCTA

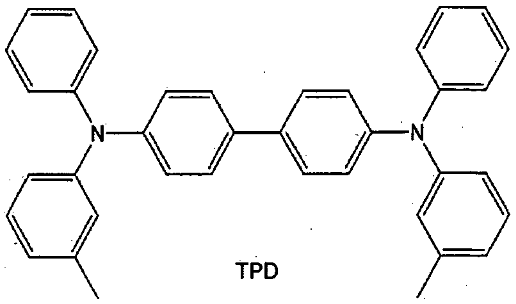


m-MTDATA

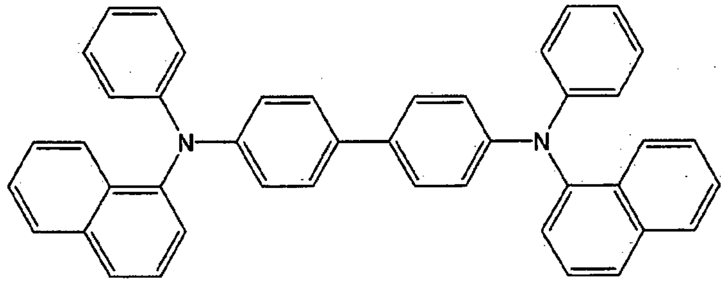
[0048] The thickness of the HIL may range from about 100 to about 10000 Å. For example, in one embodiment, the thickness may range from about 100 to about 1000Å. If the thickness of the HIL is less than about 100 Å, the hole injection properties may deteriorate, and if the thickness of the HIL is greater than about 10000 Å, the driving voltage may increase.

[0049] The hole transport layer (HTL) may be formed on the HIL by a variety of methods, such as vacuum deposition, spin coating, casting, and LB deposition. When the HTL is formed using vacuum deposition or spin coating, the deposition or coating conditions may differ depending on the compounds used, but may generally include the deposition and coating conditions described above with respect to the HIL.

[0050] The HTL material may be a compound represented by Formula 1 described above. Alternatively, any known HTL material may be used, for example, carbazole derivatives (such as N-phenylcarbazole and polyvinylcarbazole) and conventional amine derivatives having condensed aromatic condensed rings (such as 4,4'-bis[N-(1-naphthyl)-N-phenylamino]biphenyl (NPB), N,N'-bis(3-methylphenyl)- N,N'-diphenyl-[1,1-biphenyl]-4,4'-diamine (TPD)(shown below), and N,N'-di(naphthalene-1-yl)-N,N'-diphenyl benzidine (α-NPD) (shown below)).



TPD



α -NPD

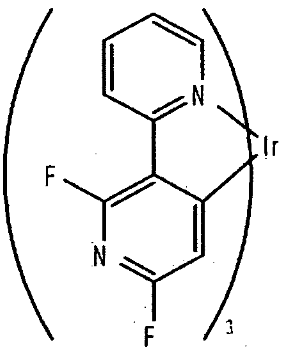
[0051] The thickness of the HTL may range from about 50 to about 1000 Å. For example, in one embodiment, the thickness ranges from about 100 to about 600Å. If the thickness of the HTL is less than about 50 Å, the hole transporting properties may deteriorate, and if the thickness of the HTL is greater than about 1000 Å, the driving voltage may increase.

[0052] The emissive layer (EML) may be formed on the HTL by a variety of methods, such as vacuum deposition, spin coating, casting, and LB deposition. When the EML is formed by vacuum deposition or spin coating, the deposition or coating conditions may differ depending on the compounds used, but may generally include the deposition and coating conditions described above with respect to the HIL.

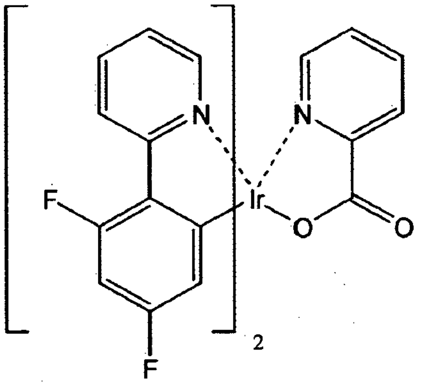
[0053] The EML may include a compound represented by Formula 1 described above. In particular, the compound represented by Formula 1 may be used as a host. The EML may be formed using a variety of known light emitting materials, and may be formed using known hosts and dopants. The dopant may be any known dopant and may be either a phosphorescent dopant or a fluorescent dopant.

[0054] Nonlimiting examples of suitable hosts include Alq_3, CPB (4,4'-N,N'-dicarbazole-biphenyl), PVK (poly(n-vinylcarbazole)), DSA (distyrylarylene), or IDE215 (from Idemitsu Co.).

[0055] Nonlimiting examples of suitable phosphorescent dopants include IDE102, IDE105 and IDE118 (available from Idemitsu Co.). Nonlimiting examples of suitable fluorescent dopants include $Ir(ppy)_3$ (ppy is an abbreviation of phenylpyridine)(green), 4,6-$F2(ppy)_2Irpic$, TEB002 (from Cobion Co.), PtOEP (platinum(II) octaethylporphyrin), compounds represented by Formula 3 below, Firpric (shown below), and RD61 (which is a red fluorescent dopant from UDC Co.).



...Formula 3



...Firpic

[0056] The content of the dopant may range from about 0.1 to about 20 parts by weight based on 100 parts by weight of the EML forming material (i.e., the total weight of the host and the dopant is 100 parts by weight). In one embodiment, for example, the dopant is present in an amount ranging from about 0.5 to about 12 parts by weight based on 100 parts by weight of the EML forming material. If the dopant is present in an amount less than about 0.1 parts by weight based on the total weight of the host and the dopant, the effect of adding the dopant is minute. If the dopant is present in an amount greater than about 20 parts by weight based on the total weight of the host and the dopant, concentration extinction (e.g. concentration quenching) of both the phosphorescent and the fluorescent components may occur.

[0057] The thickness of the EML may range from about 100 to about 1000 Å. In one embodiment, for example, the thickness ranges from about 200 to about 600 Å. If the thickness of the EML is less than about 100 Å, the light emitting properties may deteriorate, and if the thickness of the EML is greater than about 1000 Å, the driving voltage may increase.

[0058] When the EML includes a phosphorescent dopant, a hole blocking layer (HBL) may be formed on the EML to prevent triplet excitons or holes from diffusing to the electron transport layer (not shown in FIG. 1). The HBL material is not particularly limited, and may be selected from any known HBL materials. Nonlimiting examples of suitable HBL materials include oxadiazole derivatives, triazole derivatives, phenathroline derivatives, Balq and BCP.

[0059] The thickness of the HBL may range from about 50 to about 1000Å. In one embodiment, for example, the thickness may range from about 100 to about 300Å. If the thickness of the HBL is less than about 50Å, the hole-blocking properties may deteriorate, and if the thickness of the HBL is greater than about 1000Å, the driving voltage may increase.

[0060] The electron transport layer (ETL) may be formed on the HBL or on the EML by a variety of methods, such as vacuum deposition, spin coating, and casting. When the ETL is formed by vacuum deposition or spin coating, the deposition or coating conditions may differ depending on the compounds used, but may generally include the deposition and coating conditions described above with respect to the HIL.

[0061] The ETL material is not particularly limited, and may be selected from any known ETL forming materials. Nonlimiting examples of suitable ETL materials include quinoline derivatives, and in particular, tris(8-quinolinolate)aluminum (Alq_3) and TAZ.

[0062] The thickness of the ETL may range from about 100 to about 1000 Å. In one embodiment, for example, the thickness ranges from about 100 to about 500 Å. If the thickness of the ETL is less than about 100 Å, the electron transporting properties may deteriorate, and if the thickness of the EML is greater than about 1000 Å, the driving voltage may increase.

[0063] In addition, an electron injection layer (EIL) may be deposited on the ETL. The EIL facilitates the injection of electrons from the cathode. The EIL may be formed of any known EIL material, nonlimiting examples of which include LiF, NaCl, CsF, Li_2O, and BaO. The deposition or coating conditions may differ depending on the compounds used, but may generally include the deposition and coating conditions described above with respect to the HIL.

[0064] The thickness of the EIL may range from about 1 to about 100 Å. In one embodiment, for example, the thickness may range from about 5 to about 90 Å. If the thickness of the EIL is less than about 1Å, the electron injecting properties may deteriorate, and if the thickness of the EIL is greater than about 100 Å, the driving voltage may increase.

[0065] Finally, the second electrode may be formed on the EIL by any suitable method, such as vacuum deposition or sputtering. The second electrode may be a cathode or an anode. The material for forming the second electrode may be a metal, an alloy, or an electrically conductive compound with a low work function. Nonlimiting examples of such materials include Li, Mg, Al, Al-Li, Ca, Mg-In, and Mg-Ag. In addition, a transparent cathode, such as ITO or IZO may be used in order to obtain a top emission device.

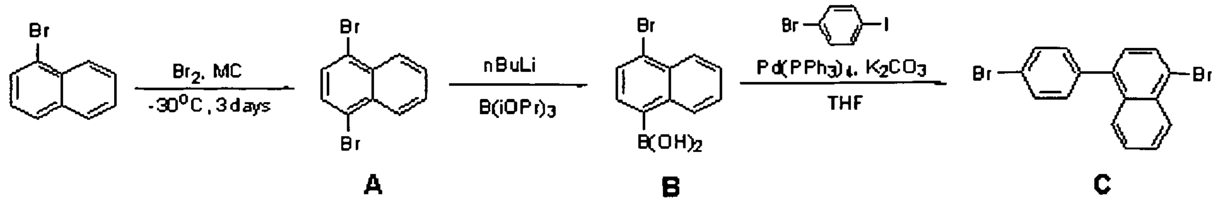
[0066] The organic light emitting device according to embodiments of the present invention may be used in many applications, including flat panel display devices such as passive matrix organic light emitting display devices and active matrix organic light emitting display devices. In particular, when the organic light emitting device is included in an active matrix organic light emitting display device, the first electrode on the substrate is a pixel electrode and is electrically connected to a source electrode or a drain electrode of a thin film transistor. Moreover, the organic light-emitting device may also be included in a flat panel display device having a double-sided screen.

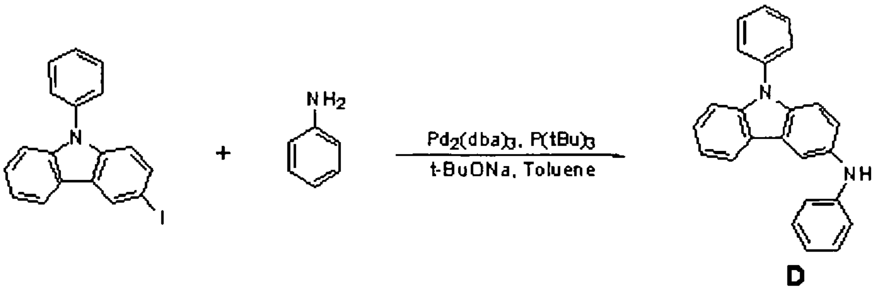
[0067] The following Examples and Synthesis Examples describe compounds 1, 2, 3, 32, 105, 153, 173, 184, and 242 and the synthesis thereof. However, the Examples and Synthesis Examples are presented for illustrative purposes only and do not limit the scope of the present invention.

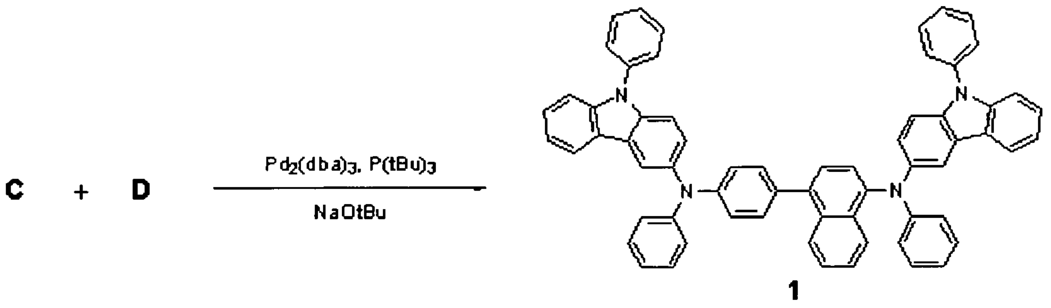
Synthesis Example 1: Preparation of Compound 1

[0068] Compound 1 was synthesized by the reaction pathway represented by Reaction Scheme 1 below.

Reaction Scheme 1







Synthesis of Intermediate A

[0069] 20.7 g (100 mmol) of 1-bromonaphthalene was dissolved in 300 ml dichloromethane, and was maintained at a temperature of -30°C. A solution of 2.56 g (50 mmol) of bromine dissolved in 30 ml of dichloromethane was adjusted to a temperature of -30°C and then slowly added to the 1-bromonaphthalene solution. The resulting product was blocked from light, and incubated in a freezer at -30 °C for 48 hours. After the reaction was complete, 10% sodium thiosulfate solution was added to the solution, and an organic layer was collected from the solution. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was recrystallized with diethyl ether and normal hexane to obtain 24.3 g of Intermediate A, a white solid (yield: 85%). The structure of the product was confirmed by ^{1}H and ^{13}C NMR. (^{1}H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.26-8.24 (m, 2H), 7.66-7.63 (m, 4H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 132.9, 130.0, 128.2, 127.8, 122.6).

Synthesis of Intermediate B

[0070] 14.3 g (50 mmol) of Intermediate A was dissolved in 150 ml diethyl ether, and held at -78 °C while adding 20 ml (2.5M in hexane) of normal butyl lithium. The temperature was slowly raised to room temperature after 30 minutes. After 30 minutes, a solution of 23 ml of triisopropylborate (100 mmol) dissolved in 50 ml of diethyl ether was maintained at -78°C and slowly added to the Intermediate A solution. The mixture was stirred for 5 hours at room temperature, water was added thereto, and the mixture was washed with 200 ml of diethyl ether 3 times. The washed diethyl ether layer was dried with $MgSO_4$, and dried under reduced pressure to obtain a product, which was recrystallized with normal hexane to obtain 9.6 g of Intermediate B, a white solid (yield 77%). The structure of the product was confirmed by ^{1}H and ^{13}C NMR. (^{1}H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.05 (d, 1H), 7.85 (d, 1H), 7.73 (m, 4H), 7.35 (s, 2H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 141.4, 131.0, 130.8, 130.4, 130.1, 127.0, 126.2, 102.2,101.0).

Synthesis of Intermediate C

[0071] 7.53 g (30 mmol) of Intermediate B, 17 g (60 mmol) of 4-bromoiodobenzene, 1.7 g (1.5 mmol) of $Pd(PPh_3)_4$ and 20 g of K_2CO_3 were dissolved in 100 ml of a THF/H_2O (2:1) mixed solution, and then stirred for 5 hours at 80 °C. The reaction solution was extracted 3 times with 600 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was recrystallized with dichloromethane and normal hexane to obtain 7.38 g of Intermediate C (yield: 68%). The structure of the product was confirmed by ^{1}H NMR. (^{1}H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.32 (d, 1H), 7.83-7.80 (m, 2H), 7.63-7.59 (m, 3H), 7.51-7.46 (m, 1H), 7.32 (d, 2H), 7.22 (d, 1H)).

Synthesis of Intermediate D

[0072] 36.9 g (100 mmol) of 3-iodo-9-phenylcarbazole, 13.7mL(150mmol) of aniline, 14 g (150mmol) of t-BuONa, 1.83g(2mmol) of $Pd_2(dba)_3$, 400mg(2 mmol) of $P(t\text{-}Bu)_3$ were dissolved in 250 ml of toluene, and then stirred for 3 hours at 90°C. After the reaction was complete, the product was cooled to room temperature, and then extracted 3 times with deionized water and 200 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 3.07g of Intermediate D (yield 92%). The structure of the product was confirmed by ^{1}H and ^{13}C NMR. (^{1}H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.03-7.99 (m, 1H), 7.67 (d, 1H), 7.49 (d, 5H), 7.43 (d, 1H), 7.36-7.32 (m, 3H), 7.20-7.16 (m, 2H), 7.02 (dd, 2H), 6.96 (dd, 1H), 6.75-6.71(m, 1H), 5.68(NH); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 144.7, 139.9, 137.4, 135.7, 129.8, 129.4, 128.1, 127.4, 127.1, 126.3, 119.1, 119.0, 118.7, 118.5, 116.8, 113.1, 111.2, 109.4, 102.5).

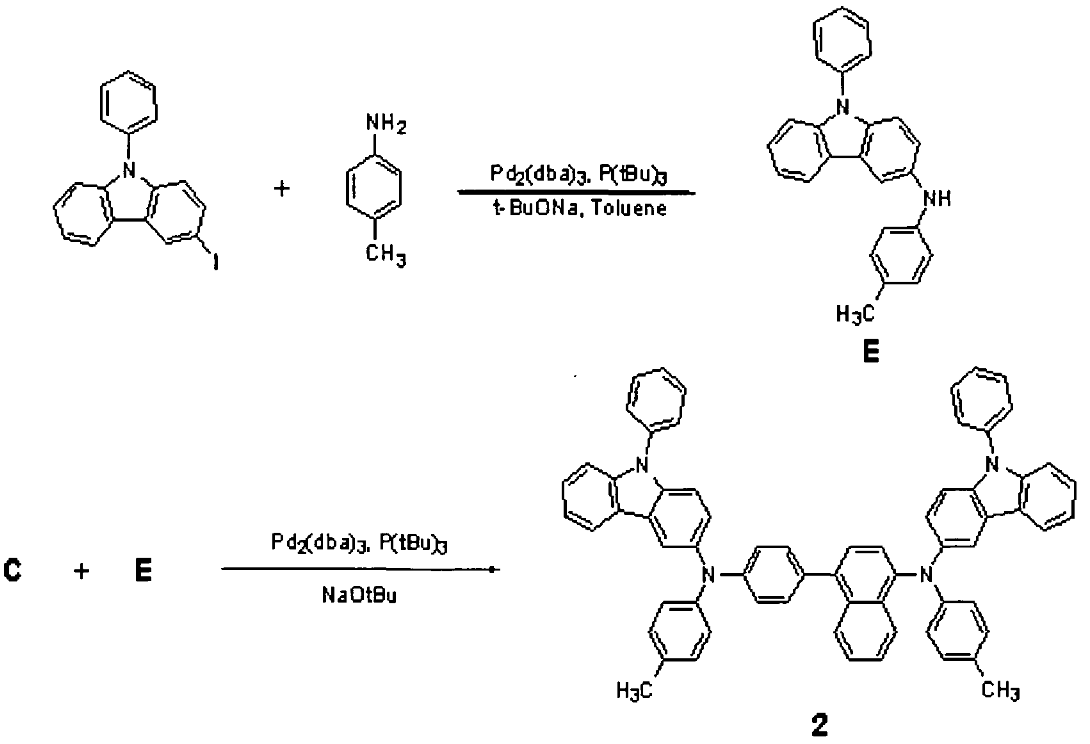
Synthesis of Compound 1

[0073] 3.62g(10mmol) of Intermediate C, 7.36g(22mmol) of Intermediate D, 2.9g(30mmol) of t-BuONa, 366mg(0.4mmol) of $Pd_2(dba)_3$, and 80mg(0.4mmol) of $P(t\text{-}Bu)_3$ were dissolved in 60ml of toluene, and stirred for 3 hours at 90°C. After the reaction was complete, the product was cooled to room temperature, and then extracted 3 times with deionized water and 50 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 7.13g of Compound 1 (yield 82%). The structure of the product was confirmed by ^{1}H and ^{13}C NMR. (^{1}H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.21 (d, 2H), 7.93 (d, 2H), 7.65-7.28 (m, 32H), 6.64-6.59 (m, 2H), 6.43-6.40 (m, 2H), 5.70-5.64 (m, 4H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 153.3, 151.4, 150.6, 148.3, 146.1, 142.5, 137.9, 137.7, 136.4, 134.8, 133.9, 131.6, 131.4, 129.8, 129.4, 129.2, 128.1, 127.4, 127.1, 126.3, 126.1, 125.9, 124.1, 123.6, 123.4, 122.9, 122.3, 121.3, 120.4, 118.1, 117.3, 117.2, 117.0, 116.7, 116.4, 116.2, 114.4, 111.7, 111.5, 108.4).

Synthesis Example 2: Preparation of Compound 2

[0074] Compound 2 was synthesized by the reaction pathway represented by Reaction Scheme 2 below.

Reaction Scheme 2



Synthesis of Intermediate E

[0075] 36.9g (100mmol) of 3-iodo-9-phenylcarbazole, 16g (150mmol) of toluidine, 14g (150mmol) of t-BuONa, 1.83g (2mmol) of $Pd_2(dba)_3$, and 400mg (2 mmol) of $P(t\text{-}Bu)_3$ were dissolved in 250 ml of toluene, and stirred for 3 hours at 90°C. After the reaction was complete, the product was cooled to room temperature, and then extracted 3 times with deionized water and 200 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 33.5 g of Intermediate E (yield: 96%). The structure of the product was confirmed by ^1H and ^{13}C NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.02-7.99 (m, 1H), 7.66 (s, 1H), 7.49 (d, 4H), 7.43 (d, 1H), 7.36-7.31 (m, 4H), 7.01 (d, 2H), 6.96 (dd, 1H), 6.87 (d, 2H), 5.68 (NH), 2.25 (s, 3H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 140.2, 139.9, 137.4, 135.7, 129.8, 129.7, 128.1, 127.4, 127.1, 126.3, 119.1, 118.7, 118.5, 113.1, 111.2, 109.4, 102.5,20.4).

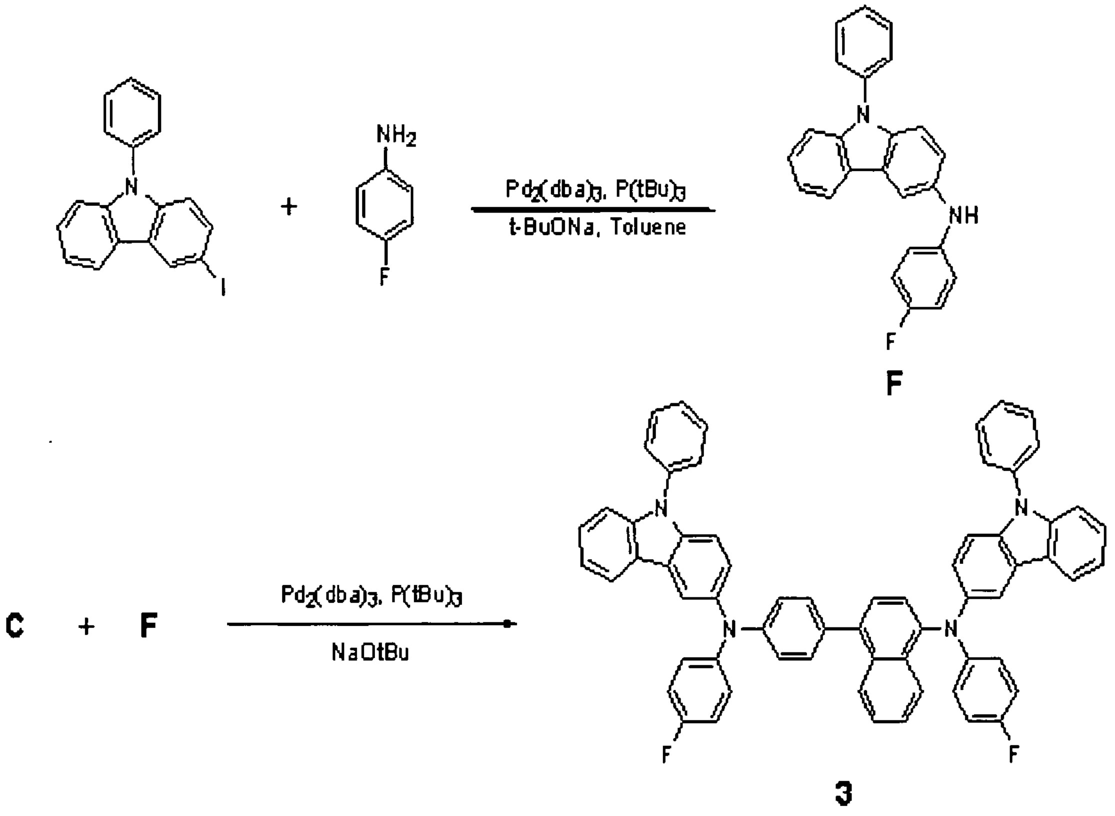
Synthesis of Compound 2

[0076] 3.62g (10mmol) of Intermediate C, 7.7g (22mmol) of Intermediate E, 2.9g (30mmol) of t-BuONa, 366mg (0.4 mmol) of $Pd_2(dba)_3$, and 80mg (0.4 mmol) of $P(t\text{-}Bu)_3$ were dissolved in 60 ml of toluene, and stirred for 3 hours at 90°C. After the reaction was complete, the product was cooled to room temperature, and then extracted 3 times with deionized water and 50 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 7.62g of Compound 2 (yield: 85%). The structure of the product was confirmed by ^1H and ^{13}C NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.21 (d, 1H), 7.93 (d, 2H), 7.63-7.31 (m, 29H), 7.05 (dd, 4H), 6.42 (d, 2H), 6.25 (t, 4H), 2.27 (s, 6H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 153.3, 151.4, 151.3, 147.8, 146.1, 142.5, 137.9, 137.7, 136.4, 134.8, 134.6, 133.9, 132.7, 131.4, 129.8, 129.2, 128.1, 127.4, 127.1, 126.3, 126.1, 125.9, 124.1, 123.6. 122.3, 121.2, 121.0, 120.4, 118.1, 117.3, 117.0, 116.7, 116.4, 116.2, 111.7, 114.4, 111.7, 111.5, 108.4, 20.4).

Synthesis Example 3: Preparation of Compound 3

[0077] Compound 3 was synthesized by the reaction pathway represented by Reaction Scheme 3 below.

Reaction Scheme 3



Synthesis of Intermediate F

[0078] 18.45g (50mmol) of 3-iodo-9-phenylcarbazole, 8g (75mmol) of toluidine, 7g (75mmol) of t-BuONa, 920mg (1mmol) of $Pd_2(dba)_3$, and 200mg (1mmol) of $P(t\text{-}Bu)_3$ were dissolved in 150 ml of toluene, and stirred for 3 hours at 90°C. After the reaction was complete, the product was cooled to room temperature, and then extracted 3 times with deionized water and 100 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 16.39g of Intermediate F (yield 93%). The structure of the product was confirmed by ^1H and ^{13}C NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.03-8.01 (m, 1H), 7.96-7.92 (m, 2H), 7.67 (d, 1H), 7.49 (d, 4H), 7.43 (d, 1H), 7.37-7.32 (m, 4H), 7.23-7.18 (m, 2H), 6.95 (dd, 1H), 5.68 (s, 1H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 161.0, 154.5, 140.8, 139.9, 13 7.4, 13 5.7, 129.8, 127.4, 127.1, 126.5, 119.1, 118.7, 118.5, 116.5, 115.8, 113.1, 111.7, 111.5, 111.2, 109.4, 102.5).

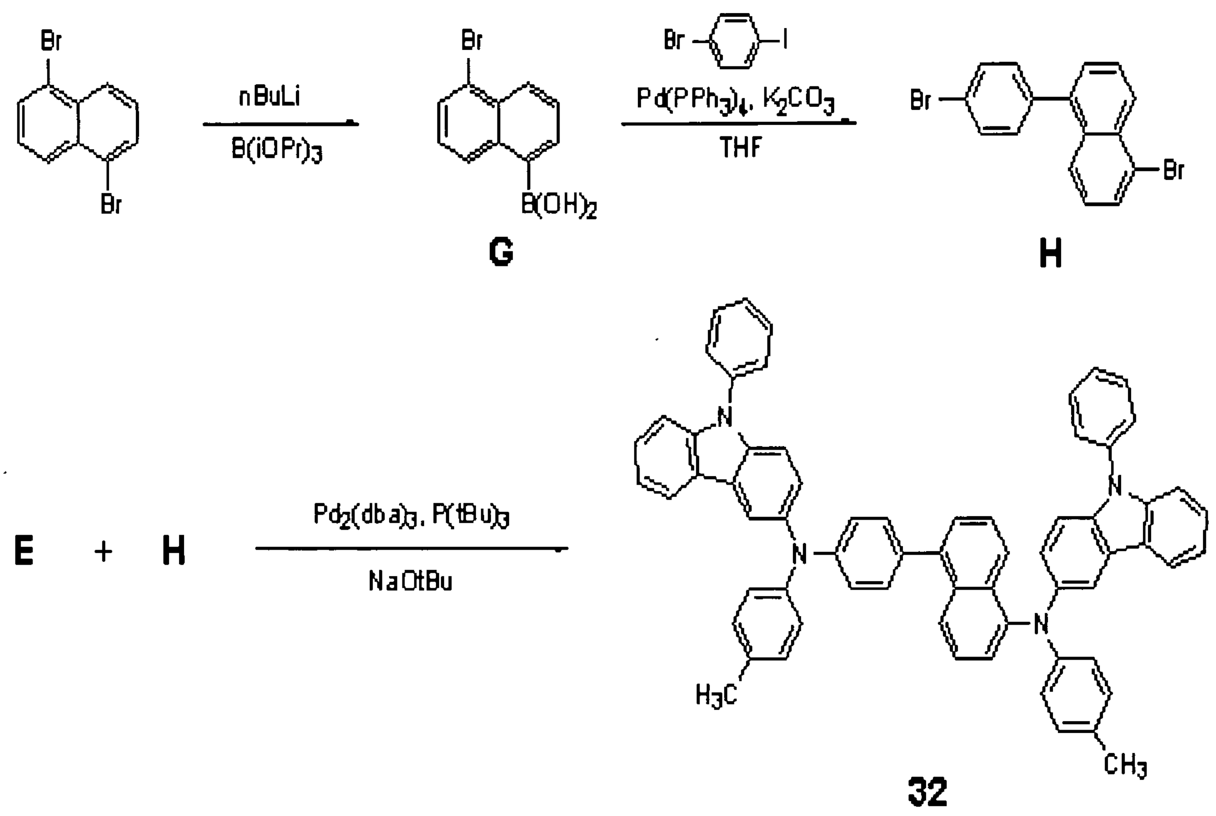
Synthesis of Compound 3

[0079] 3.62g (10mmol) of Intermediate C, 7.75g (22mmol) of Intermediate F, 2.9g (30mmol) of t-BuONa, 366mg (0.4 mmol) of $Pd_2(dba)_3$, and 80mg (0.4 mmol) of $P(t\text{-}Bu)_3$ were dissolved in 60 ml of toluene and stirred for 3 hours at 90°C. After the reaction was complete, the product was cooled to room temperature, and then extracted 3 times with deionized water and 50 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 7.96g of Compound 3 (yield: 88%). The structure of the product was confirmed by ^1H and ^{13}C NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.21 (d, 1H), 7.93 (d, 2H), 7.65-7.31 (m, 29H), 7.11-7.05 (m, 4H), 6.79-6.73 (m, 4H), 6.44-6.40 (m, 2H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 162.0, 155.5, 152.3, 150.4, 149.3, 149.2, 145.1, 144.2, 144.1, 141.5, 137.9, 137.7, 136.4, 134.8, 133.9, 131.4, 129.8, 129.2, 128.1, 127.4, 127.1, 126.3, 126.1, 126.0, 125.9, 125.8, 125.6, 124.1, 123.6, 122.3, 121.3, 120.4, 118.1, 118.0, 117.3, 117.2, 117.0, 116.7, 116.4, 116.2, 115.5, 114.4, 111.7, 111.5, 108.4).

Synthesis Example 4: Preparation of Compound 32

[0080] Compound 32 was synthesized by the reaction pathway represented by Reaction Scheme 4 below.

Reaction Scheme 4



Synthesis of Intermediate G

[0081] 14.3 g (50 mmol) of 1,5-dibromonaphthalene was dissolved in 150 ml of diethyl ether, and held at -78°C while adding normal butyl lithium (20 ml, 2.5 M in hexane). The temperature was raised slowly to room temperature after 30 minutes. After another 30 minutes, a solution of 23 ml (100 mmol) triisopropyl borate dissolved in 50 ml of diethyl ether was maintained at -78°C, and the solution of 1,5-dibromonaphthalene was slowly added thereto. The mixture was stirred for 5 hours at room temperature, and water was added thereto. The mixture was washed three times with diethyl ether (200 ml). The washed diethyl ether layer was dried with $MgSO_4$, and was dried under reduced pressure to obtain a product, which was recrystallized with normal hexane to obtain 9.15 g (yield: 88%) of white solid Intermediate G (yield: 88%). The structure of the product was confirmed by ^1H and ^{13}C NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.06-8.01 (m, 2H), 7.85 (dd, 1H), 7.65 (dd, 1H), 7.52-7.48 (t, 1H), 7.35 (s, 1H), 7.20 (t, 1H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 141.4, 138.6, 138.1, 137.7, 137.2, 130.8, 130.6, 130.4, 129.8, 129.7, 126.2, 101.0).

Synthesis of Intermediate H

[0082] 7.53 g (30mmol) of Intermediate G, 17 g (60mmol) of 4-bromoiodobenzene, 1.7g (1.5mmol) of $Pd(PPh_3)_4$ and 20 g(150mmol) of K_2CO_3 were dissolved in 100 ml of a THF/H_2O (2:1) mixed solution, and stirred for 5 hours at 80°C. The reactant solution was extracted three times with 600 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was recrystallized with dichloromethane and normal hexane to obtain 7.06 of Intermediate H (yield: 65%). The structure of the product was confirmed by ^1H and ^{13}C NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.14 (d, 1H), 7.94 (dd, 1H), 7.79 (dd, 1H), 7.66 (d, 1H), 7.45 (t, 1H), 7.28-7.20 (m, 5H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 139.1, 136.8, 133.2, 132.8, 132.1, 131.4, 130.4, 128.4, 127.8, 127.2, 126.3, 125.0, 123.5).

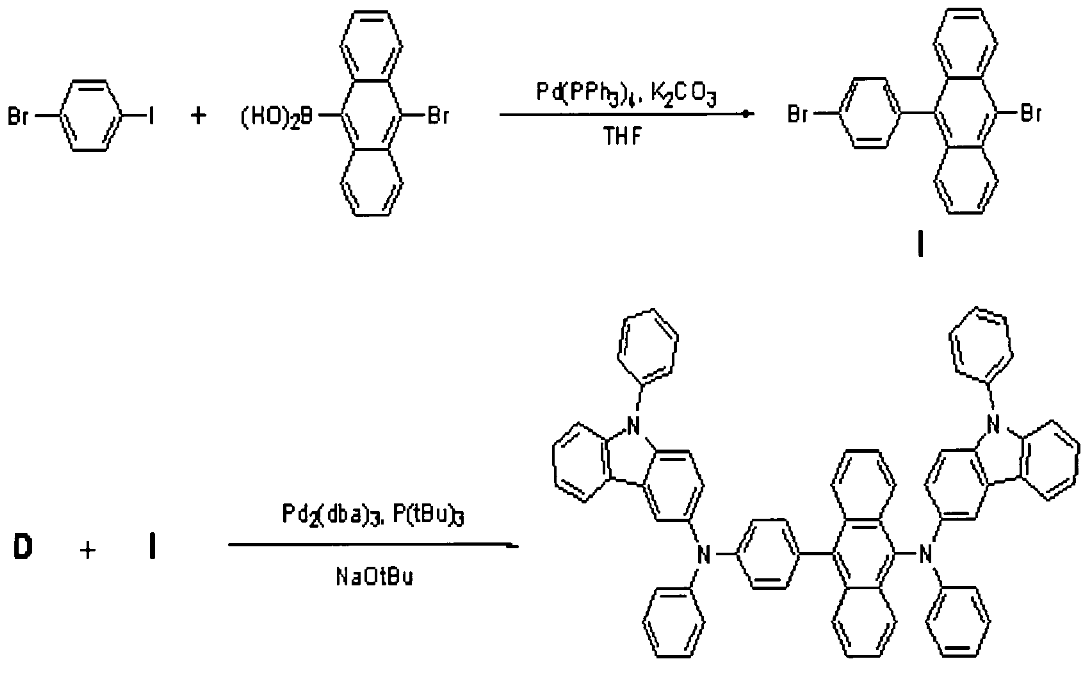
Synthesis of Compound 32

[0083] 7.66 g (22mmol) of Intermediate E, 3.62 g (10mmol) of Intermediate H, 2.9mg (30 mmol) of t-BuONa, 183 mg (0.2mmol) of $Pd_2(dba)_3$, and 40 mg (0.2 mmol) of $P(t\text{-}Bu)_3$ were dissolved in 40 ml of toluene, and stirred for 3 hours at 90°C. After the reaction was complete, the product was cooled to room temperature, and then extracted 3 times with deionized water and 40 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 7.62g of Compound 32 (yield 85%). The structure of the product was confirmed by ^1H and ^{13}C NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.52 (d, 1H), 8.19 (d, 1H), 7.93 (d, 2H), 7.66-7.42 (m, 23H), 7.36-7.32 (m, 4H), 7.05 (d, 4H), 6.42 (d, 2H), 6.25 (t, 4H), 6.17 (s, 1H), 2.27 (s, 6H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 153.3, 151.4, 151.3, 149.8, 146.1, 142.5, 137.8, 137.7, 136.4, 134.8, 134.6, 133.9, 132.7, 131.4, 129.8, 129.7, 129.2, 128.7, 127.4, 127.1, 126.3, 123.6, 122.6, 122.3, 121.2, 121.0, 120.4, 118.1, 117.9, 117.3, 116.9, 116.7, 116.3, 116.2, 114.4, 111.9, 111.7, 111.5, 20.4).

Synthesis Example 5: Preparation of Compound 105

[0084] Compound 105 was synthesized through the reaction pathway represented by Reaction Scheme 5 below.

Reaction Scheme 5



105

Synthesis of Intermediate I

[0085] 3g (10 mmol) of 9-bromoanthracene-10-boric acid, 4.24g (15mmol) of 4-bromoiodobenzene, 580mg (0.5mmol) of $Pd(PPh_3)_4$, and 6.9g (50mmol) of K_2CO_3 were dissolved in 50 ml of a THF/H_2O (2:1) mixed solution, and stirred for 5 hours at 80°C. The reactant solution was extracted 3 times with 50 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was recrystallized with dichloromethane and normal hexane to obtain 2.47 g of Intermediate I (yield:60%). The structure of the product was confirmed by ^1H and ^{13}C NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.61 (d, 2H), 7.72 (d, 2H), 7.62-7.57 (m, 4H), 7.41-7.37 (m, 2H), 7.29-7.25 (m, 2H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 137.3, 136.2, 132.8, 131.7, 130.8, 130.2, 128.0, 127.0, 125.8, 123.2, 122.1).

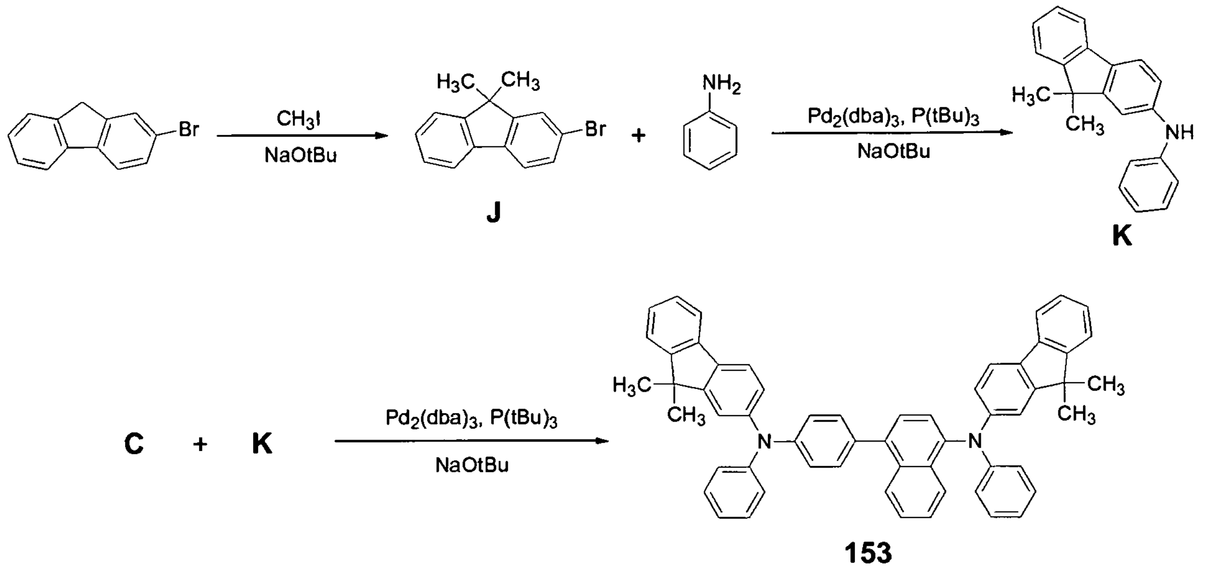
Synthesis of Compound 105

[0086] 2.06 g (5 mmol) of Intermediate I, 3.68 g (11 mol) of Intermediate C, 1.44 g (15 mmol) of t-BuONa, 183 mg (0.2 mmol) of $Pd_2(dba)_3$, and 40 mg (0.2 mmol) of $P(t\text{-}Bu)_3$ were dissolved in 40 ml of toluene, and stirred for 3 hours at 90°C. After the reaction was complete, the product was cooled to room temperature, and then extracted 3 times with deionized water and 40 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 3.9g of Compound 105 (yield:85%). The structure of the product was confirmed by ^1H and ^{13}C NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.55 (d, 2H), 8.04 (d, 2H), 7.93 (d, 2H), 7.63-7.23 (m, 32H), 6.64-6.59 (m, 2H), 6.41-6.38 (m, 2H), 5.69 (dd, 2H), 5.64 (dd, 2H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 154.1, 153.2, 149.8, 148.3, 142.5, 137.9, 137.7, 137.6, 136.7, 136.4, 133.4, 133.2, 131.7, 130.7, 129.8, 129.4, 127.4, 127.1, 126.3, 126.2, 124.6, 124.3, 124.1, 123.6, 123.4, 123.2, 122.9, 121.7, 120.4, 118.1, 117.5, 117.4, 117.0, 116.8, 114.4, 111.9, 111.5, 108.4).

Synthesis Example 6: Preparation of Compound 153

[0087] Compound 153 was synthesized through the reaction pathway represented by Reaction Scheme 6 below.

Reaction Scheme 6



Synthesis of Intermediate J

[0088] 27.3g (100mmol) of 1-bromofluorene was dissolved in 300 ml of tetrahydrofuran, and maintained at 0°C. 31.4g (110mmol) of NaOtBu was slowly added to the solution, and 14 ml (220 mmol) of iodomethane was added at the same temperature. After the addition, the mixture was incubated for 5 hours at room temperature. After the reaction was complete, an aqueous solution was added to the solution to extract the organic layer. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 24.6 g of Intermediate J (yield 90%). The structure of the product was confirmed by ^1H and ^{13}C NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) - 7.88 (d, 1H), 7.73 (d, 1 H), 7.58 (d, 1H), 7.49-7.46 (m, 1H), 7.40 (d, 1H), 7.24-7.20 (m, 1H), 6.97-6.93 (m, 1H), 1.85 (s, 6H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 151.6, 150.2, 142.6, 141.1, 132.2, 129.2, 127.8, 127.3, 126.8, 121.2, 119.9, 48.4, 24.5).

Synthesis of Intermediate K

[0089] 8.2g (30mmol) of Intermediate J, 4.1mL (45mmol) of aniline, 4.3g (45mmol) of t-BuONa, 0.55g (0.6mmol) of $Pd_2(dba)_3$, and 0.12g (0.6mmol) of $P(t\text{-}Bu)_3$ were dissolved in 100 ml of toluene, and stirred for 3 hours at 90°C. After the reaction was complete, the product was cooled to room temperature, and then extracted 3 times with deionized water and 100 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 7.87g of Intermediate K (yield:92%). The structure of the product was confirmed by ^1H and ^{13}C NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) - 7.82 (d, 1H), 7.54-7.49 (m, 2H), 7.27-7.21 (m, 3H), 7.12-7.08 (m, 3H), 6.97-6.93 (m, 1H), 6.90-6.86 (m, 1H), 6.59-6.56 (m, 1H), 5.44(NH), 1.85(s, 6H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 149.1, 146.8, 142.2, 140.0, 134.6, 133.5, 129.4, 127.8, 127.1, 126.8, 120.4, 119.7, 119.1, 117.4, 109.0, 107.5, 44.9, 24.5).

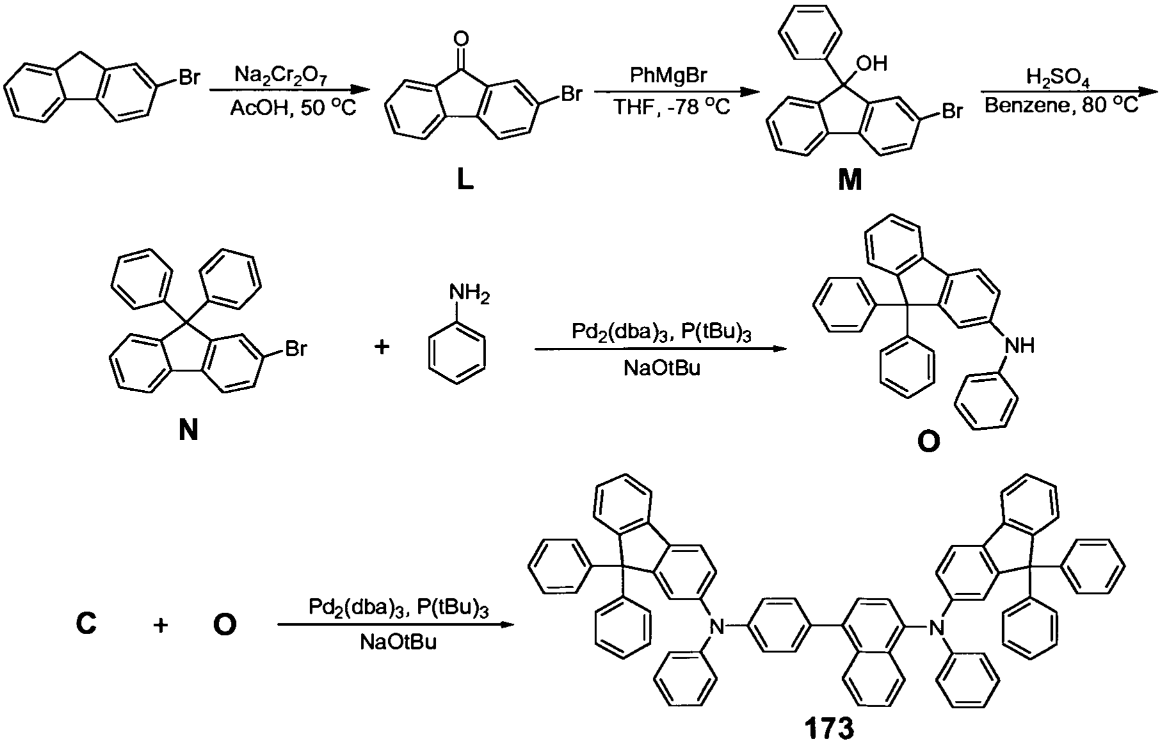
Synthesis of Compound 153

[0090] 3.62g (10mmol) of Intermediate C, 6.28g (22mmol) of Intermediate K, 2.9g (30mmol) of t-BuONa, 366mg (0.4mmol) of $Pd_2(dba)_3$, and 80mg (0.4mmol) of $P(t\text{-}Bu)_3$ were dissolved in 60ml of toluene, and stirred for 3 hours at 90°C. After the reaction was complete, the product was cooled to room temperature, and then extracted 3 times with deionized water and 50 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 6.55 g of Compound 153 (yield:85%). The structure of the product was confirmed by ^1H and ^{13}C NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.19 (d, 2H), 7.98 (d, 1H), 7.69-7.57 (m, 5H), 7.49-7.08 (m, 14H), 6.97-6.93 (m, 2H), 6.64-6.60 (m, 2H), 6.43-6.39 (m, 2H), 6.34-6.32 (m, 2H), 5.68-5.61 (m, 4H), 1.85 (s, 6H), 1.77 (s, 6H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 158.4, 154.5, 150.4, 148.9, 148.1, 147.9, 147.1, 145.8, 141.3, 140.9, 139.0, 138.0, 136.5, 134.8, 133.9, 131.6, 130.9, 130.8, 129.4, 129.2, 128.1, 127.8, 126.8, 126.5, 126.1, 125.9, 125.6, 124.7, 124.1, 124.0, 123.6, 123.2, 122.9, 121.7, 119.9, 118.7, 117.9, 117.8, 117.4, 117.3, 116.7, 45.3, 44.9, 25.3, 24.5).

Synthesis Example 7: Preparation of Compound 173

[0091] Compound 173 was synthesized through the reaction pathway represented by Reaction Scheme 7 below.

Reaction Scheme 7



Synthesis of Intermediate L

[0092] 13g (53mmol) of 2-bromofluorene was dissolved in 60ml of acetic acid, and 60g (200mmol) of sodium dichromate was slowly added to the solution at 0°C. After 12 hours, 200 ml of deionized water was added to the mixture, and stirred thoroughly. The resulting yellow solid product was filtered and dried to obtain 10 g of Intermediate L (yield: 78%).

Synthesis of Intermediate M

[0093] 8g (31.6 mmol) of Intermediate L was dissolved in 60 ml of THF, and 38 ml (38 mmol) of 1M phenyl magnesium bromide was slowly added to the solution at - 78°C. After 2 hours, the temperature was raised to room temperature, and the mixture was stirred for 5 hours. The mixture was diluted with 50 ml ammonium chloride solution, and extracted 3 times with ethyl acetate (40ml). The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 10 g of Intermediate M (yield:95%). The structure was confirmed by ^1H NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) 7.64 (d, 1H), 7.54-7.47 (m, 2H), 7.44 (d, 1H), 7.39-7.33 (m, 3H), 7.30-7.23 (m, 5H), 2.46 (s, 1H)).

Synthesis of Intermediate N

[0094] 10 g (30 mmol) of Intermediate M was dissolved in 60 ml of benzene, and 2.4ml (45 mmol) of concentrated sulfuric acid diluted with a small amount of benzene was added to the solution. The mixture was stirred for 5 hours at 80°C, and after evaporating the benzene, 1 N sodium hydroxide solution was added to the remaining solution to a pH of around 7. The mixture was extracted 3 times with ethyl acetate (40 ml). The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 6 g of Intermediate N (yield: 50%).

Synthesis of Intermediate O

[0095] 3.97 g (10mmol) of Intermediate N, 1.37 ml (15 mmol) of aniline, 1.4 g (15mmol) of t-BuONa, 0.183 g (0.2mmol) of $Pd_2(dba)_3$, and 40 mg (0.2mmol) of $P(t\text{-}Bu)_3$ were dissolved in 30 ml of toluene, and stirred for 3 hours at 90°C. After the reaction was complete, the product was cooled to room temperature, and then extracted 3 times with deionized water and 30 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 3.68g of Intermediate O (yield:90%). The structure of the product was confirmed by ^1H and ^{13}C NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.05 (d, 1H), 7.90 (d, 1H), 7.69 (d, 1H), 7.58 (d, 1H), 7.48-7.46 (m, 4H), 7.35-7.31 (m, 1H), 7.27-6.98 (m, 10H), 6.90-6.86 (m, 1H), 6.69-6.67 (m, 2H), 5.44(NH); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 150.0, 147.7, 141.8, 141.2, 137.7, 135.8, 134.6, 130.2, 129.4, 128.7, 128.1, 128.0, 126.0, 125.1, 120.8, 119.1, 117.4, 108.7, 108.4, 68.3).

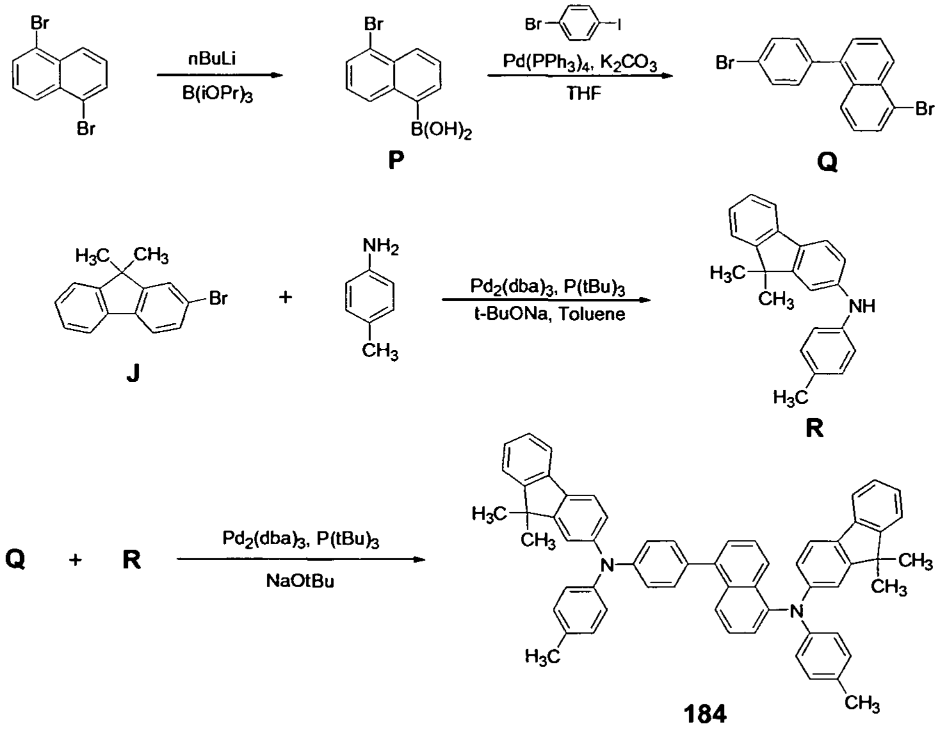
Synthesis of Compound 173

[0096] 3.62 g (10 mmol) of Intermediate C, 9.0 g (22 mmol) of Intermediate O, 2.9 g (30 mmol) of t-BuONa, 366 mg (0.4 mmol) of $Pd_2(dba)_3$, and 80 mg (0.4 mmol) of $P(t\text{-}Bu)_3$ were dissolved in 60 ml of toluene, and were stirred for 3 hours at 90°C. After the reaction was complete, the product was cooled to room temperature, and then extracted 3 times with deionized water and 50 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 7.95g of Compound 173 (yield:78%). The structure of the product was confirmed by ^1H and ^{13}C NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.21 (m, 2H), 8.06 (d, 2H), 7.74-7.60 (m, 10H), 7.53-6.98 (m, 28H), 6.64-6.60 (m, 4H), 6.45-6.38 (m, 4H), 5.68-5.64 (m, 4H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 152.7, 150.9, 150.4, 149.1, 149.0, 148.5, 148.0, 147.6, 145.3, 139.3, 137.8, 135.7, 134.5, 133.9, 131.6, 131.4, 129.4, 129.2, 128.7, 128.1, 127.0, 126.1, 126.0, 125.9, 125.1, 124.8, 124.7, 124.2, 124.0, 123.6, 122.9, 122.8, 121.3, 119.8, 117.9, 117.7, 117.5, 117.1, 113.8, 113.6).

Synthesis Example 8: Preparation of Compound 184

[0097] Compound 184 was synthesized through the reaction pathway represented by Reaction Scheme 8 below.

Reaction Scheme 8



Synthesis of Intermediate P

[0098] 14.3 g (50 mmol) of 1,5-dibromonaphthalene was dissolved in 150 ml diethyl ether, and held at -78 °C while adding 20 ml (2.5M in hexane) of normal butyl lithium. The temperature was slowly raised to room temperature after 30 minutes. After another 30 minutes, a solution of 23 ml of triisopropylborate (100 mmol) dissolved in 50ml of diethyl ether was maintained at -78°C and slowly added to the 1,5-dibromonaphthalene solution. The mixture was stirred for 5 hours at room temperature, and water was added thereto. The mixture was then washed with 200 ml of diethyl ether 3 times. The washed diethyl ether layer was dried with $MgSO_4$, and dried under reduced pressure to obtain a product which was recrystallized with normal hexane to obtain 9.15g of white solid Intermediate P (yield 73%). The product was confirmed by ^1H and ^{13}C NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.06-8.00 (m, 2H), 7.85 (dd, 1H), 7.65 (dd, 1H), 7.52-7.48 (t, 1H), 7.35 (s, OH), 7.20 (t, 1H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 141.4, 140.1, 139.6, 139.4, 138.6, 138.4, 137.9, 137.3, 137.1, 136.4, 136.2, 135.6, 130.8, 130.6, 130.4, 129.8, 129.7, 126.2, 101.0).

Synthesis of Intermediate Q

[0099] 7.53 g (30 mmol) of Intermediate P, 17 g (60 mmol) of 4-bromoiodobenzene, 1.7 g (1.5 mmol) of $Pd(PPh_3)_4$ and 20 g of K_2CO_3 were dissolved in 100 ml of a THF/H_2O (2:1) mixed solution, and then stirred for 5 hours at 80 °C. The reaction solution was extracted 3 times with 600 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was recrystallized with dichloromethane and normal hexane to obtain 7.06 g of Intermediate Q (yield: 65%). The product was confirmed by ^1H and ^{13}C NMR. (^1H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.14 (d, 1H), 7.94 (dd, 1H), 7.79 (dd, 1H), 7.66 (d, 1H), 7.45 (t, 1H), 7.28-7.20 (m, 5H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 139.1, 136.8, 133.2, 132.8, 132.1, 131.4, 130.4, 128.4, 127.8, 127.2, 126.3, 125.0, 123.5).

Synthesis of Intermediate R

[0100] 2.73 g (10 mmol) of Intermediate C, 1.65ml (15mmol) of para-toluidine, 14 g (15 mmol) of t-BuONa, 183 mg (0.2 mmol) of $Pd_2(dba)_3$, and 40 mg (0.2mmol) of $P(t-Bu)_3$ were dissolved in 30 ml of toluene, and stirred for 3 hours at 90°C. After the reaction was complete, the product was cooled to room temperature, and then extracted 3 times with deionized water and 30 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 2.84g of Intermediate R (yield:95%). The product was confirmed by ^{1}H and ^{13}C NMR. (^{1}H NMR ($CDCl_3$, 400MHz) δ (ppm) - 7.83-7.81 (m, 1H), 7.54-7.49 (m, 2H), 7.24-7.21 (m, 1H), 7.12 (d, 1H), 7.02-6.93 (m, 3H), 6.87 (d, 2H), 6.58 (dd, 2H), 5.44 (NH), 2.25 (s, 3H), 1.85 (s, 6H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 149.1, 146.8, 140.0, 137.7, 134.6, 133.5, 129.7, 127.8, 127.1, 126.8, 120.4, 119.7, 119.3, 109.0, 107.5, 44.9, 24.5, 20.4).

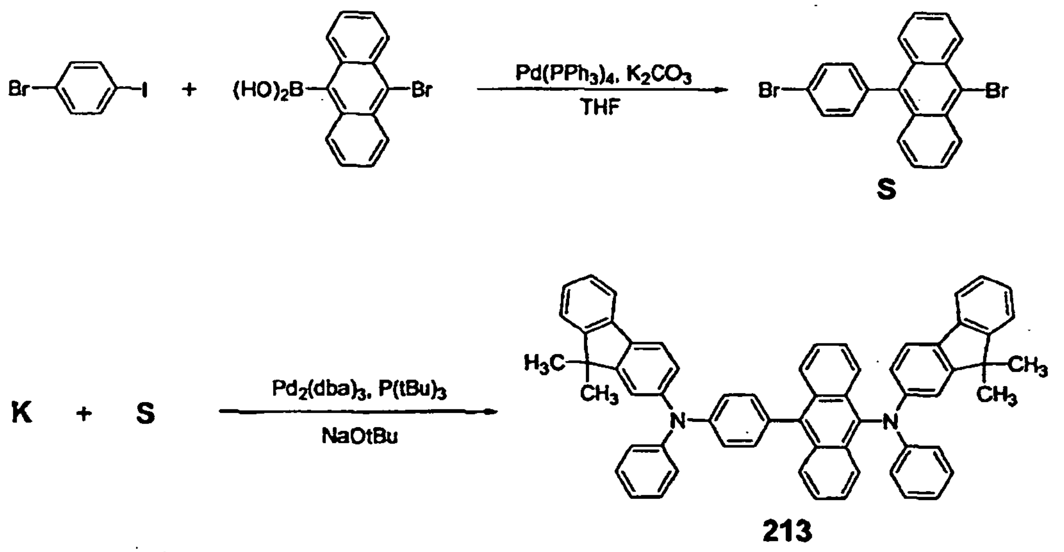
Synthesis of Compound 184

[0101] 3.62 g (10 mmol) of Intermediate Q, 6.59 g (22 mmol) of Intermediate R, 2.9g (30 mmol) of t-BuONa, 366mg(0.4 mmol) of $Pd_2(dba)_3$, and 80 mg (0.4mmol) of $P(t\text{-}Bu)_3$ were dissolved in 60 ml of toluene, and stirred for 3 hours at 90°C. After the reaction was complete, the product was cooled to room temperature, and then extracted 3 times with deionized water and 50 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 7.03g of Compound 184 (yield 88%). The product was confirmed by ^{1}H and ^{13}C NMR. (^{1}H NMR ($CDCl_3$, 400MHz) δ (ppm) - 8.51 (d, 1H), 8.19 (d, 1H), 7.98 (d, 2H), 7.69-7.44 (m, 9H), 7.24-6.93 (m, 10H), 6.43-6.15 (m, 9H), 2.27 (s, 6H), 1.85 (s, 12H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 151.6, 150.8, 150.0, 149.0, 148.9, 148.1, 147.9, 147.1, 145.4, 138.0, 136.5, 134.8, 134.6, 133.9, 132.7, 131.4, 129.7, 129.2, 128.7, 127.8, 126.8, 126.1, 123.6, 123.5, 122.6, 121.9, 121.7, 121.3, 120.4, 118.7, 118.0, 117.9, 117.8, 116.9, 112.9, 112.7, 44.9, 24.5, 20.4).

Synthesis Example 9: Preparation of Compound 213

[0102] Compound 213 was synthesized through the reaction pathway represented by Reaction Scheme 9 below.

Reaction Scheme 9



Synthesis of Intermediate S

[0103] 3 g (10 mmol) of 9-bromoanthracene-10-boric acid, 4.24 g (15 mmol) of 4-bromoiodobenzene, 580 mg (0.5 mmol) of $Pd(PPh_3)_4$, and 6.9g (50 mmol) of K_2CO_3 were dissolved in 50 ml of a THF/H_2O (2:1) mixed solution, and stirred for 5 hours at 80°C. The reactant solution was extracted 3 times with 50 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was recrystallized with dichloromethane and normal hexane to obtain 2.47 g of Intermediate S (yield:60%). The product was confirmed by ^{1}H and ^{13}C NMR. (^{1}H NMR ($CDCl_3$,400MHz) δ (ppm) - 8.61 (d, 2H), 7.72 (d, 2H), 7.62-7.57 (m, 4H), 7.41-7.37 (m, 2H), 7.29-7.25 (m, 2H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 137.3, 136.2, 132.8, 131.7, 130.8, 130.2, 128.0, 127.0, 125.8, 123.2, 122.1).

Synthesis of Compound 213

[0104] 4.12 g (10 mmol) of Intermediate S, 6.28 g (22 mmol) of Intermediate K, 2.9g (30mmol) of t-BuONa, 366 mg (0.4mmol) of $Pd_2(dba)_3$, and 80 mg (0.4 mmol) of $P(t\text{-}Bu)_3$ were dissolved in 60 ml of toluene, and stirred for 3 hours at 90°C. After the reaction was complete, the product was cooled to room temperature, and then extracted 3 times with deionized water and 50 ml of diethyl ether. The collected organic layer was dried with magnesium sulfate, and the residue obtained by evaporating the solvent was separated and purified by silica gel column chromatography to obtain 5.99g of Compound 213 (yield:73%). The product was confirmed by ^{1}H and ^{13}C NMR. (^{1}H NMR (CDCh, 400MHz) δ (ppm) - 8.55 (d, 2H), 8.01 (dd, 4H), 7.68 (d, 2H), 7.63-7.53 (m, 7H), 7.33-7.21 (m, 7H), 7.15-7.10 (m, 2H), 6.97-6.93 (m, 2H), 6.62 (t, 2H), 6.40-6.27 (m, 4H), 5.68-5.62 (m, 4H), 1.85 (s, 12H); ^{13}C NMR ($CDCl_3$, 100MHz) δ (ppm) - 155.2, 151.8, 151.7, 150.8, 148.1, 147.9, 147.1, 145.8, 138.0, 137.6, 136.5, 134.3, 133.4, 133.2, 131.7, 130.7, 129.4, 127.8, 126.8, 126.3, 126.2, 126.1, 125.4, 125.0, 124.6, 124.0, 123.6, 123.2, 122.9, 121.7, 118.7, 118.2, 118.1, 117.8, 113.1, 112.7, 44.9, 24.5).

Example 1

[0105] An anode was prepared by cutting a Coming 15Ωcm^2 (1200Å) ITO glass substrate to a size of 50 mm×50 mm×0.7 mm, sonicating for 5 minutes using isopropyl alcohol and deionized water, and then irradiating with UV light for 30 minutes and exposing to ozone to clean. Then, the prepared anode was installed on a vacuum deposition apparatus.

[0106] Compound 1 was vacuum deposited on the anode to a thickness of 600 Å to form an HIL, and 4,4'-bis[N-(1-naphthyl)-N-phenylamino]biphenyl (NPB) as a hole transporting compound was vacuum deposited on the HIL to a thickness of 300Å to form a HTL.

[0107] Then, a blue fluorescent host (IDE215 from Idemitsu Co.) and a blue fluorescent dopant (IDE118 from Idemitsu Co.) were deposited simultaneously (at a weight ratio of 98:2) on the HTL to form an EML with a thickness of 200 Å.

[0108] Next, Alq_3 was deposited on the EML to a thickness of 300 Å to form an ETL, and a halogenated alkaline metal LiF was deposited to a thickness of 10Å on the ETL to form an EIL. Finally, A1 was vacuum deposited on the EIL to a thickness of 3000 Å (cathode), thereby completing the manufacture of an organic light emitting device.

[0109] The device had a driving voltage of 6.68 V, a high emission brightness of 7,898 cd/m^2, color coordinates of (0.144, 0.232), and an emission efficiency of 7.9 cd/A, at a current density of 100 mA/cm^2,

Example 2

[0110] An organic light-emitting device was prepared as in Example 1, except that Compound 2 was used instead of Compound 1 when forming the HIL. The device had a driving voltage of 6.72 V, a high emission brightness of 7,733 cd/m^2, color coordinates of (0.144, 0.236), and an emission efficiency of 7.73cd/A, at a current density of 100 mA/cm^2.

Example 3

[0111] An organic light-emitting device was prepared as in Example 1, except that Compound 3 was used instead of Compound 1 when forming the HIL. The device had a driving voltage of 6.79 V, a high emission brightness of 7,490 cd/m^2, color coordinates of (0.143, 0.237), and an emission efficiency of 7.49 cd/A, at a current density of 100 mA/cm^2.

Example 4

[0112] An organic light-emitting device was prepared as in Example 1, except that Compound 32 was used instead of Compound 1 when forming the HIL. The device had a driving voltage of 6.64 V, a high emission brightness of 7,289 cd/m^2, color coordinates of (0.145, 0.241), and an emission efficiency of 7.29 cd/A, at a current density of 100 mA/cm^2.

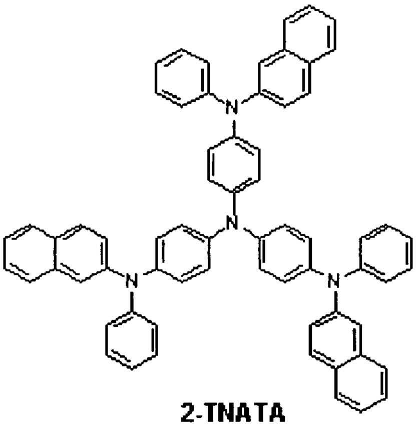
Example 5

[0113] An organic light-emitting device was prepared as in Example 1, except that Compound 105 was used instead of Compound 1 when forming the HIL. The device had a driving voltage of 6.75 V, a high emission brightness of 7,406 cd/m^2, color coordinates of (0.145, 0.236), and an emission efficiency of 7.41 cd/A, at a current density of 100 mA/cm^2.

Example 6

[0114] An anode was prepared by cutting a Corning 15Ωcm^2 (1200 Å) ITO glass substrate to a size of 50 mm×50 mm×0.7 mm, sonicating for 5 minutes using isopropyl alcohol and deionized water, and then irradiating with UV light for 30 minutes and exposing to ozone to clean. Then, the prepared anode was installed on a vacuum deposition apparatus.

[0115] First, 2-TNATA (shown below) was vacuum deposited on the anode to a thickness of 600 Å to form a HIL, and then Compound 153 was vacuum deposited on the HIL to a thickness of 300Å to form a HTL.



2-TNATA

[0116] Then, a blue fluorescent host (IDE215 from Idemitsu Co.) and a blue fluorescent dopant (IDE118 from Idemitsu Co.) were deposited simultaneously (at a weight ratio of 98:2) on the HTL to form an EML with a thickness of 200 Å.

[0117] Next, Alq_3 was deposited on the EML to a thickness of 300Å to form an ETL, and a halogenated alkaline metal LiF was deposited on the ETL to a thickness of 10Å to form an EIL. Finally, A1 was vacuum deposited on the EIL to a thickness of 3000 Å (cathode), thereby completing the manufacture of an organic light-emitting device.

[0118] The device had a driving voltage of 6.57 V, a high emission brightness of 8,340 cd/m^2, color coordinates of (0.144, 0.233), and an emission efficiency of 8.34 cd/A, at a current density of 100mA/cm^2.

Example 7

[0119] An organic light-emitting device was prepared as in Example 6, except that Compound 173 was used instead of Compound 153 when forming the HTL. The device had a driving voltage of 6.72 V, a high emission brightness of 7,950 cd/m^2, color coordinates of (0.143, 0.231), and an emission efficiency of 7.95 cd/A, at a current density of 100 mA/cm^2.

Example 8

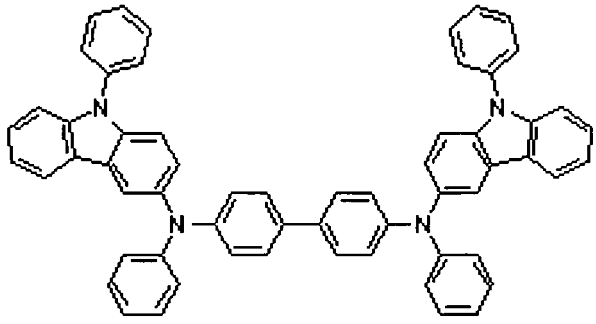
[0120] An organic light emitting device was prepared as in Example 6, except that Compound 184 was used instead of Compound 153 when forming the HTL. The device had a current density of 100 mA/cm^2, a driving voltage of 6.83 V, a high emission brightness of 7,890 cd/m^2, color coordinates of (0.144, 0.229), and an emission efficiency of 7.89 cd/A at a current density of 100 mA/cm^2.

Example 9

[0121] An organic light emitting device was prepared as in Example 6, except that Compound 213 was used instead of Compound 153 when forming the HTL. The device had a driving voltage of 7.05 V, a high emission brightness of 7,896 cd/m^2, color coordinates of (0.145, 0.234), and an emission efficiency of 7.90 cd/A at a current density of 100 mA/cm^2.

Comparative Example 1

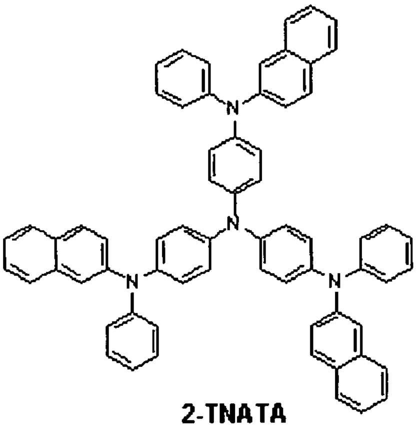
[0122] An organic light emitting device was prepared as in Example 1, except that a material represented by the structure below was used instead of Compound 1 when forming the HIL.



[0123] The device had a driving voltage of 6.18 V, an emission brightness of 7,134cd/m^2, color coordinates of (0.144, 0.237), and an emission efficiency of 7.13 cd/A at a current density of 100 mA/cm^2.

Comparative Example 2

[0124] An organic light emitting device was prepared as in Example 1, except that 2-TNATA (shown below) was used instead of Compound 1 when forming the HIL.



2-TNATA

[0125] The device had a driving voltage of 7.45 V, an emission brightness of 6,102cd/m^2, color coordinates of (0.144, 0.232), and an emission efficiency of 6.1 cd/A at a current density of 100 mA/cm^2.

[0126] The compounds represented by Formula 1 according to embodiments of the present invention had superior device properties than the compounds used in the Comparative Examples. In particular, when compared to the compound used in Comparative Example 1 (which had a structure similar to Compound 1, the device prepared with Compound 1 had a lower driving voltage, improved efficiency, and a life span 1.5 times longer (see FIG. 2). This is due to an effect caused by the naphthyl group located in the core structure of Compound 1 (as opposed to a phenyl group), which functions to stabilize the radicals produced during hole injection or transportation.

[0127] Moreover, as can be seen from the results above, when used as hole injection or hole transportation materials of organic light emitting devices, the compounds represented by Formula 1 according to embodiments of the present invention have lower driving voltages compared to the conventional material, 2-TNATA. In particular, based on their superior hole injection and hole transportation characteristics, the compounds represented by Formula 1 according to embodiments of the present invention showed excellent I-V-L properties with 30% or more improved efficiency (See FIG. 3), and can be used to prepare organic light emitting devices with low voltage, high efficiency, high brightness, and long life span.

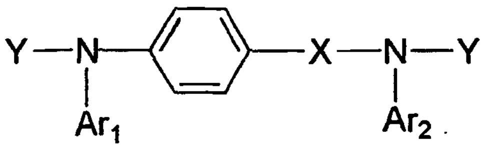
[0128] The compounds represented by Formula 1 according to embodiments of the present invention have excellent electrical properties and charge transporting characteristics, and are therefore useful as materials for hole injection layers, hole transport layers, and emission layers of phosphorescent and fluorescent devices for emitting light of all colors, including red, green, blue, and white. Using these compounds, an organic light-emitting device with high efficiency, low driving voltage, and high brightness can be prepared.

[0129] While the present invention has been illustrated and described with reference to certain exemplary embodiments, it is understood by those of ordinary skill in the art that various changes and modifications may be made to the described embodiments without departing from the scope of the present invention as defined by the following claims.

Claims

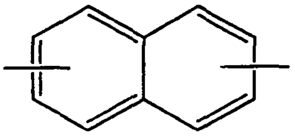
1. A compound represented by Formula 1:

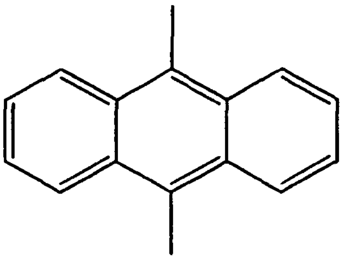
Formula 1

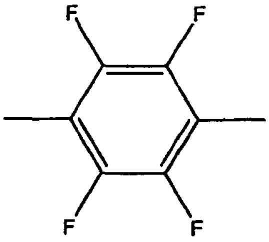


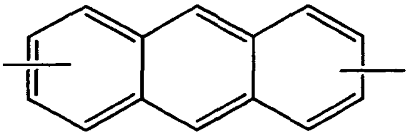
wherein:

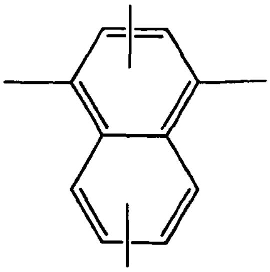
X is selected from the group consisting of substituted and unsubstituted structures represented by:

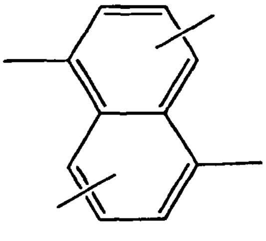


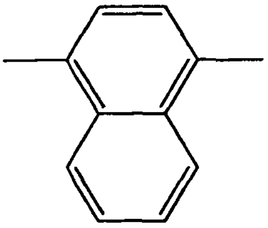


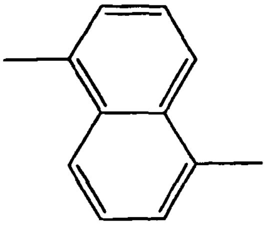












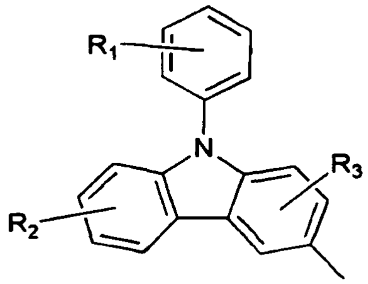
, and substituted and unsubstituted C_4-C_{20} condensed polycyclic groups;

each of Ar_1 and Ar_2 is independently selected from the group consisting of substituted and unsubstituted phenyl, biphenyl, naphthyl and anthracenyl groups, wherein for substituted Ar_1 and Ar_2 groups the aromatic ring(s) of

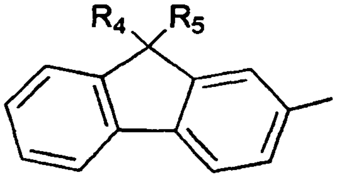
Ar_1 and Ar_2 is/are substituted with one to three groups selected from the group consisting of C_1-C_4 alkyl groups, C_1-C_5 alkoxy groups, cyano group, amino group, phenoxy group, phenyl group, N,N-diphenylamino group, and halogen atoms; and

Y is selected from the group consisting of materials represented by Formulae 2 and 3

Formula 2



Formula 3

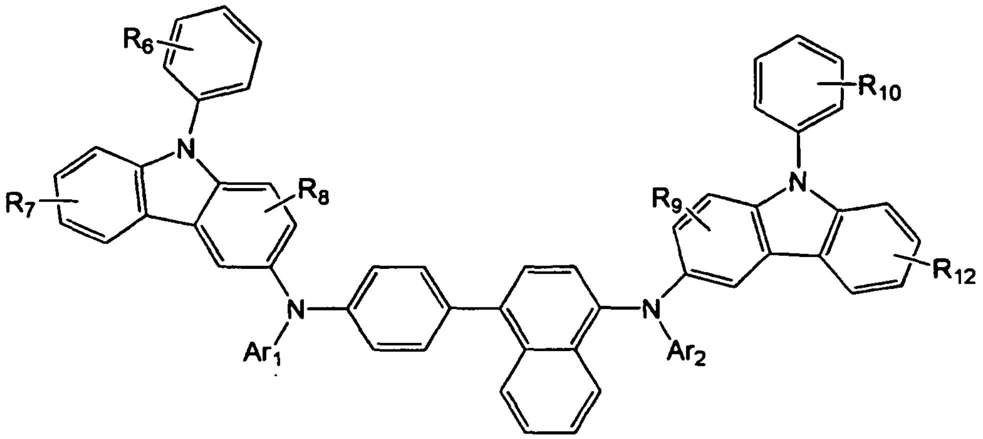


;

wherein each of R_1, R_2, R_3, R_4 and R_5 is independently selected from the group consisting of hydrogen, substituted and unsubstituted C_1-C_{10} alkyl groups, substituted and unsubstituted C_6-C_{20} aryl groups, substituted and unsubstituted C_1-C_{10} alkoxy groups, fluorine, cyano group, and amino group; or at least two adjacent R groups selected from the group consisting of R_1, R_2, R_3, R_4 and R_5 may bond with one another to form a saturated or unsaturated carbon ring.

2. A compound according to claim 1, which is represented by Formula 4:

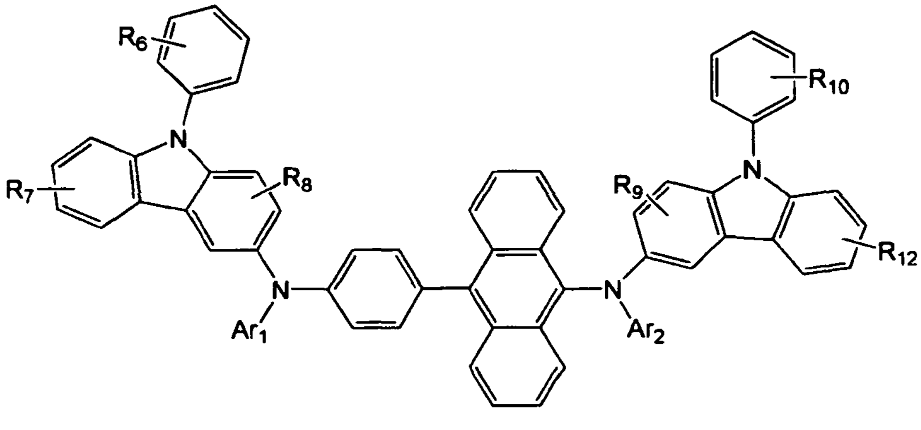
Formula 4



wherein each of R_6, R_7, R_8, R_9, R_{10}, R_{11} and R_{12} is independently selected from the group consisting of hydrogen, substituted and unsubstituted C_1-C_{10} alkyl groups, substituted and unsubstituted C_6-C_{20} aryl groups, substituted and unsubstituted C_1-C_{10} alkoxy groups, fluorine, cyano group, and amino group; or at least two adjacent R groups selected from the group consisting of R_6, R_7, R_8, R_9, R_{10}, R_{11} and R_{12} may bond with one another to form a saturated or unsaturated carbon ring, and

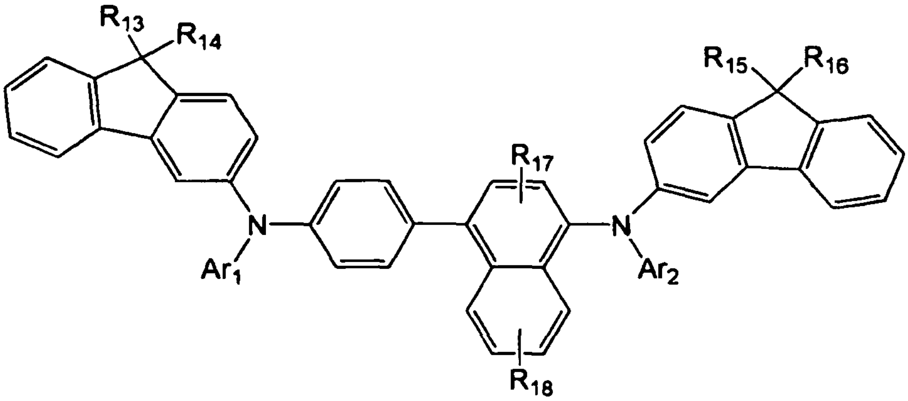
wherein each of Ar_1 and Ar_2 is as defined in claim 1.

3. A compound according to claim 1, which is represented by Formula 5: Formula 5



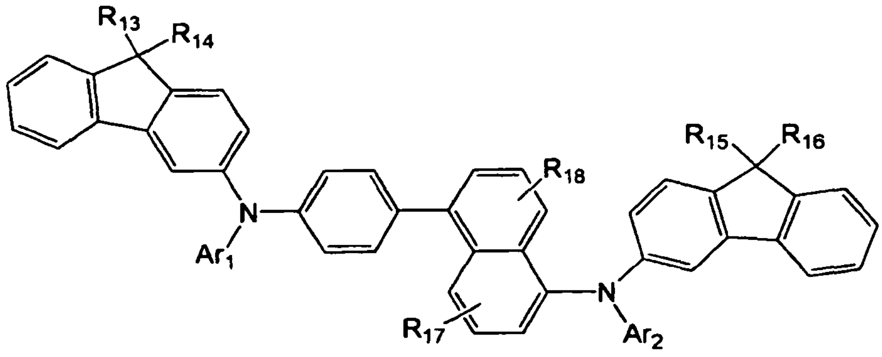
wherein each of R_6, R_7, R_8, R_9, R_{10}, R_{11} and R_{12} is independently selected from the group consisting of hydrogen, substituted and unsubstituted C_1-C_{10} alkyl groups, substituted and unsubstituted C_6-C_{20} aryl groups, substituted and unsubstituted C_1-C_{10} alkoxy groups, fluorine, cyano group, and amino group; or at least two adjacent R groups selected from the group consisting of R_6, R_7, R_8, R_9, R_{10}, R_{11} and R_{12} may bond with one another to form a saturated or unsaturated carbon ring; and
each of Ar_1 and Ar_2 is as defined in claim 1.

4. A compound according to claim 1, which is represented by Formula 6: Formula 6



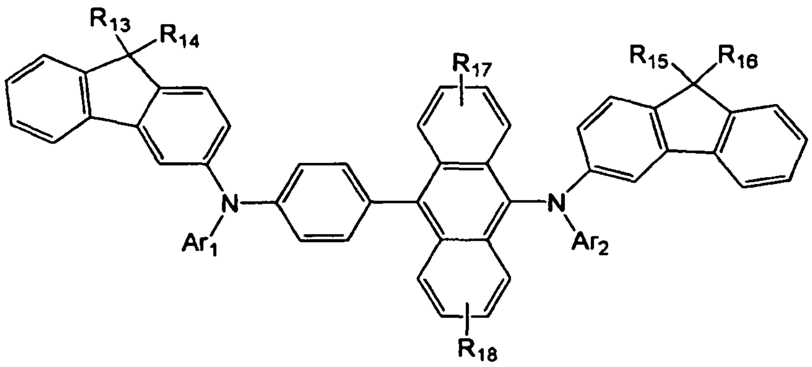
wherein each of R_{13}, R_{14}, R_{15}, R_{16}, R_{17} and R_{18} is independently selected from the group consisting of hydrogen, substituted and unsubstituted C_1-C_{10} alkyl groups, substituted and unsubstituted C_6-C_{20} aryl groups, substituted and unsubstituted C_1-C_{10} alkoxy groups, fluorine, cyano group, and amino group; or at least two adjacent R groups selected from the group consisting of R_{13}, R_{14}, R_{15}, R_{16}, R_{17} and R_{18} may bond with one another to form a saturated or unsaturated carbon ring; and
each of Ar_1 and Ar_2 is as defined in claim 1.

5. A compound according to claim 1, which is represented by Formula 7: Formula 7



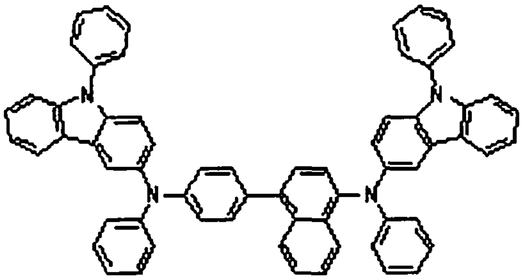
wherein each of R_{13}, R_{14}, R_{15}, R_{16}, R_{17} and R_{18} is independently selected from the group consisting of hydrogen, substituted and unsubstituted C_1-C_{10} alkyl groups, substituted and unsubstituted C_6-C_{20} aryl groups, substituted and unsubstituted C_1-C_{10} alkoxy groups, fluorine, cyano group, and amino group; or at least two adjacent R groups selected from the group consisting of R_{13}, R_{14}, R_{15}, R_{16}, R_{17} and R_{18} may bond with one another to form a saturated or unsaturated carbon ring; and
each of Ar_1 and Ar_2 is as defined in claim 1.

6. A compound according to claim 1, which is represented by Formula 8: Formula 8



wherein each of R_{13}, R_{14}, R_{15}, R_{16}, R_{17} and R_{18} is independently selected from the group consisting of hydrogen, substituted and unsubstituted C_1-C_{10} alkyl groups, substituted and unsubstituted C_6-C_{20} aryl groups, substituted and unsubstituted C_1-C_{10} alkoxy groups, fluorine, cyano groups, and amino groups; or at least two adjacent R groups selected from the group consisting of R_{13}, R_{14}, R_{15}, R_{16}, R_{17} and R_{18} may bond with one another to form a saturated or unsaturated carbon ring; and
each of Ar_1 and Ar_2 is as defined in claim 1.

7. A compound according to any of claims 1 to 6, selected from the group consisting of Compounds 1, 2, 3, 32, 105, 153, 157, 159, 173, 184 and 213:



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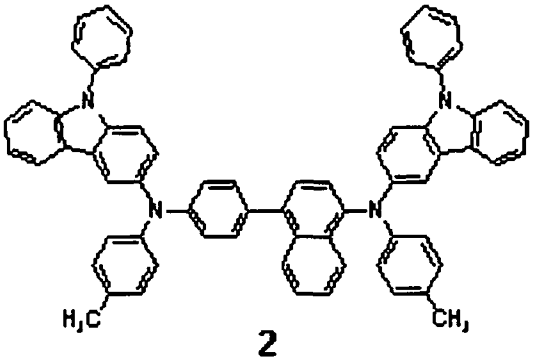

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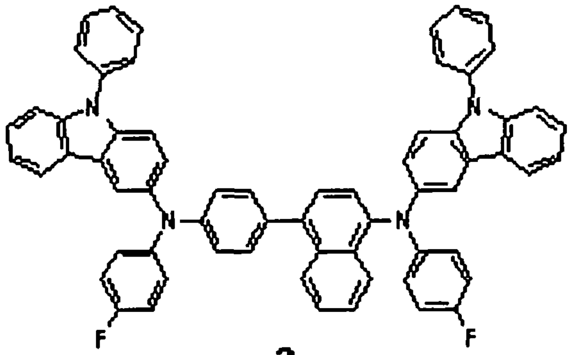

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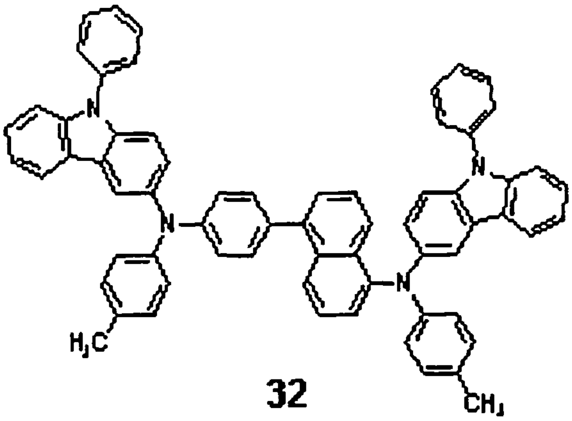

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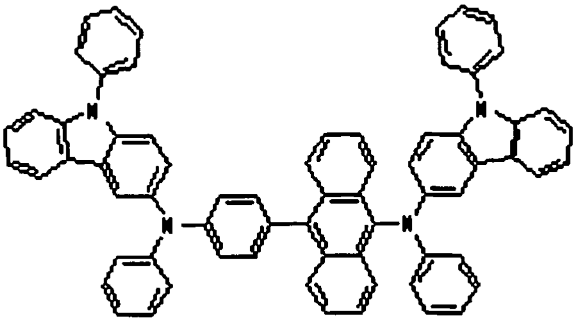

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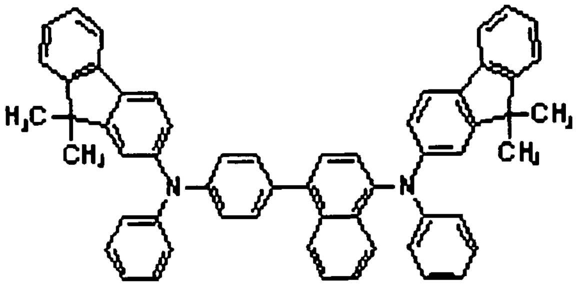

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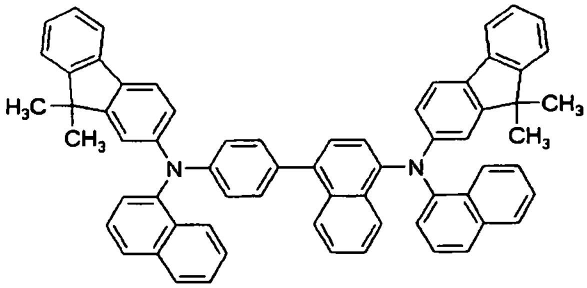

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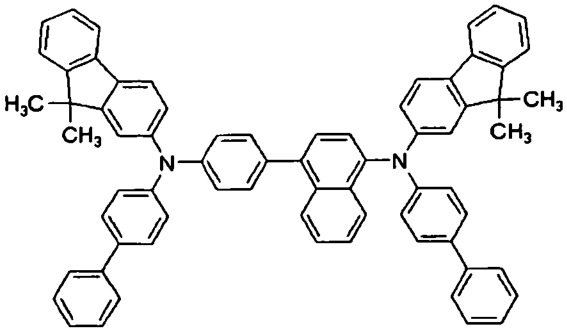

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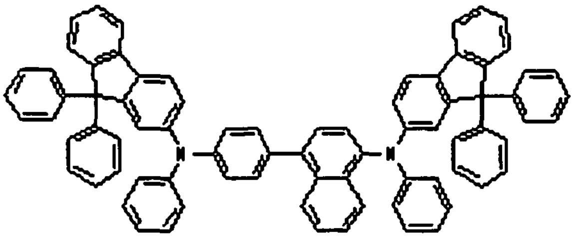

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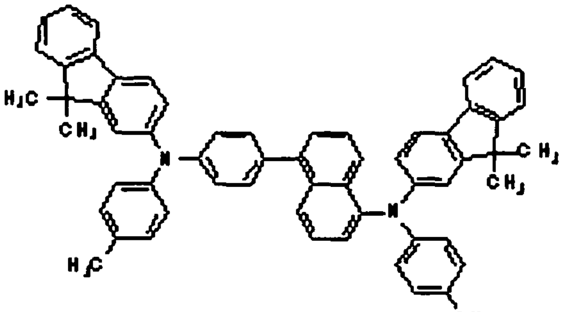

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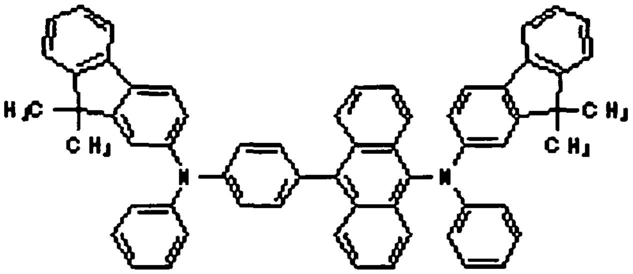


213

8. An organic light emitting device comprising a first electrode, a second electrode, and an organic film between the first electrode and the second electrode, wherein the organic film comprises a compound according to any of claims 1 to 7.

9. An organic light emitting device of claim 8, wherein the organic film comprises a layer selected from the group consisting of hole injection layers and hole transport layers.

10. An organic light emitting device according to claim 8 or claim 9, wherein the organic film comprises a single film comprising a hole injection layer and a hole transport layer.

11. An organic light emitting device according to any of claims 8 to 10, wherein the organic film comprises an emissive layer.

12. An organic light emitting device according to claim 11, wherein the emissive layer comprises the compound of claim

1 as a host, and further comprises a dopant selected from the group consisting of phosphorescent and fluorescent dopants.

13. An organic light emitting device according to any of claims 8 to 12, wherein the device comprises a structure selected from the group consisting of first electrode/hole injection layer/emissive layer/second electrode structures, first electrode/hole injection layer/hole transport layer/emissive layer/electron transport layer/second electrode structures, and first electrode/hole injection layer/hole transport layer/emissive layer/electron transport layer/electron injection layer/second electrode structures.

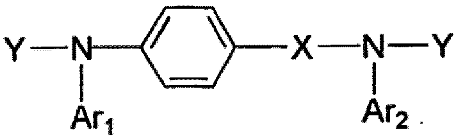
14. An organic light emitting device according to claim 13, further comprising at least one of a hole blocking layer and an electron blocking layer.

15. A flat panel display device comprising an organic light emitting device according to any of claims 8 to 14, wherein the first electrode of the organic light emitting device is electrically connected to a source electrode or a drain electrode of a thin film transistor.

Patentansprüche

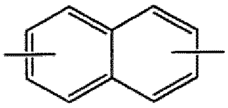
1. Verbindung, dargestellt durch Formel 1:

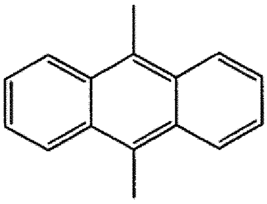
Formel 1

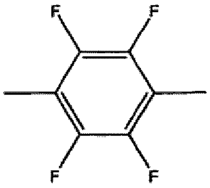


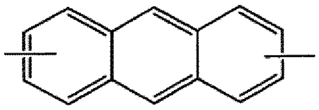
wobei:

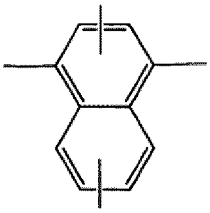
X ausgewählt ist aus der Gruppe, bestehend aus substituierten und unsubstituierten Strukturen, dargestellt durch:

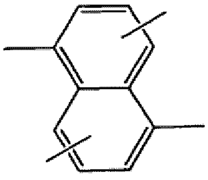


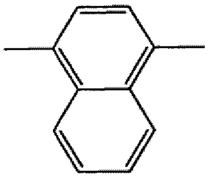


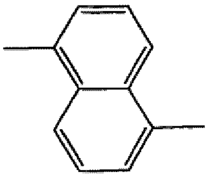




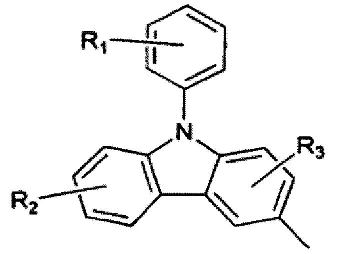


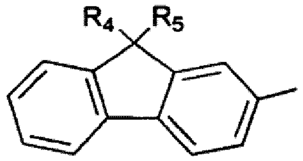






und substituierten und unsubstituierten kondensierten polycyclischen C_4-C_{20}-Gruppen;
jedes von Ar_1 und Ar_2 unabhängig ausgewählt ist aus der Gruppe, bestehend aus substituierten und unsubstituierten Phenyl-, Biphenyl-, Naphthyl- und Anthracenylgruppen, wobei, für substituierte Ar_1- und Ar_2-Gruppen, der/die aromatische(n) Ring(e) von Ar_1 und Ar_2 substituiert ist/sind mit einer bis drei Gruppen, ausgewählt aus der Gruppe, bestehend aus C_1-C_4-Alkylgruppen, C_1-C_5-Alkoxygruppen, Cyanogruppe, Aminogruppe, Phenoxygruppe, Phenylgruppe, N,N-Diphenylaminogruppe und Halogenatomen; und
Y ausgewählt ist aus der Gruppe, bestehend aus Materialien, dargestellt durch Formeln 2 und 3



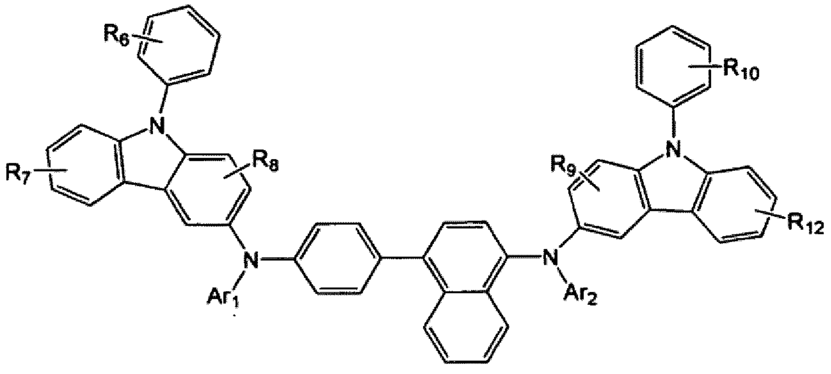


;

wobei jedes von R_1, R_2, R_3, R_4 und R_5 unabhängig ausgewählt ist aus der Gruppe, bestehend aus Wasserstoff, substituierten und unsubstituierten C_1-C_{10}-Alkylgruppen, substituierten und unsubstituierten C_6-C_{20}-Arylgruppen, substituierten und unsubstituierten C_1-C_{10}-Alkoxygruppen, Fluor, Cyanogruppe und Aminogruppe; oder zumindest zwei benachbarte R-Gruppen, ausgewählt aus der Gruppe, bestehend aus R_1, R_2, R_3, R_4 und R_5, aneinander binden können unter Bildung eines gesättigten oder ungesättigten Kohlenstoffrings.

2. Verbindung nach Anspruch 1, die dargestellt ist durch Formel 4:

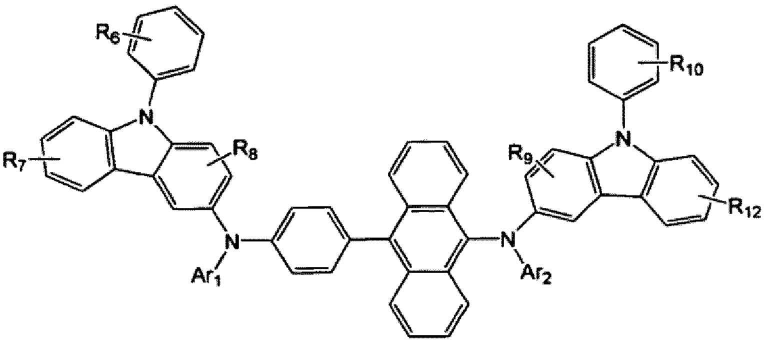
Formel 4



wobei jedes von R_6, R_7, R_8, R_9, R_{10}, R_{11} und R_{12} unabhängig ausgewählt ist aus der Gruppe, bestehend aus Wasserstoff, substituierten und unsubstituierten C_1-C_{10}-Alkylgruppen, substituierten und unsubstituierten C_6-C_{20}-Arylgruppen, substituierten und unsubstituierten C_1-C_{10}-Alkoxygruppen, Fluor, Cyanogruppe und Aminogruppe; oder zumindest zwei benachbarte R-Gruppen, ausgewählt aus der Gruppe, bestehend aus R_6, R_7, R_8, R_9, R_{10}, R_{11} und R_{12}, aneinander binden können unter Bildung eines gesättigten oder ungesättigten Kohlenstoffrings, und
wobei jedes von Ar_1 und Ar_2 so ist, wie in Anspruch 1 definiert.

3. Verbindung nach Anspruch 1, die dargestellt ist durch Formel 5:

Formel 5

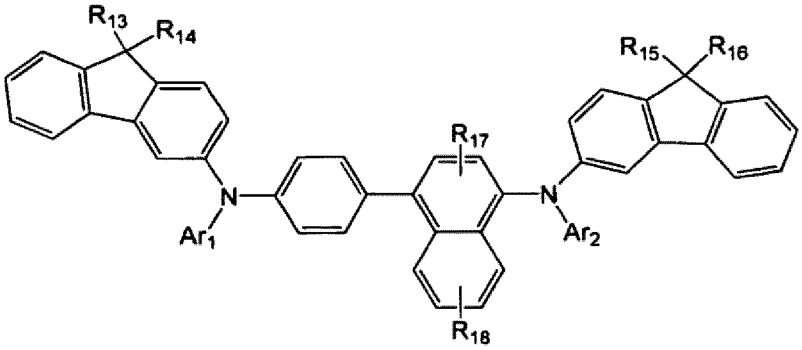


wobei jedes von R_6, R_7, R_8, R_9, R_{10}, R_{11} und R_{12} unabhängig ausgewählt ist aus der Gruppe, bestehend aus Wasserstoff, substituierten und unsubstituierten C_1-C_{10}-Alkylgruppen, substituierten und unsubstituierten C_6-C_{20}-Arylgruppen, substituierten und unsubstituierten C_1-C_{10}-Alkoxygruppen, Fluor, Cyanogruppe und Aminogruppe; oder zumindest zwei benachbarte R-Gruppen, ausgewählt aus der Gruppe, bestehend aus R_6, R_7, R_8, R_9, R_{10}, R_{11} und R_{12}, aneinander binden können unter Bildung eines gesättigten oder ungesättigten Kohlenstoffrings; und

jedes von Ar_1 und Ar_2 so ist, wie in Anspruch 1 definiert.

4. Verbindung nach Anspruch 1, die dargestellt ist durch Formel 6:

Formel 6

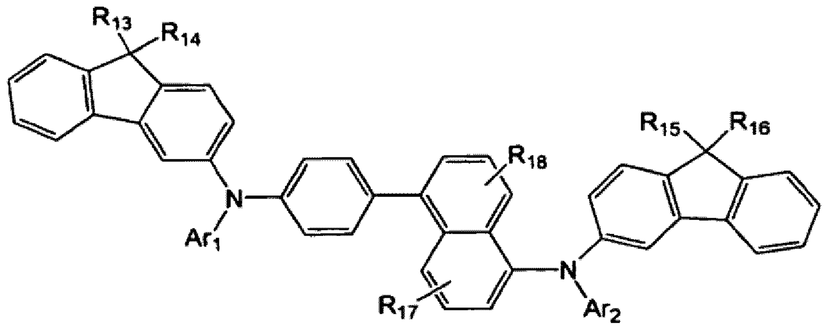


wobei jedes von R_{13}, R_{14}, R_{15}, R_{16}, R_{17} und R_{18} unabhängig ausgewählt ist aus der Gruppe, bestehend aus Wasserstoff, substituierten und unsubstituierten C_1-C_{10}-Alkylgruppen, substituierten und unsubstituierten C_6-C_{20}-Arylgruppen, substituierten und unsubstituierten C_1-C_{10}-Alkoxygruppen, Fluor, Cyanogruppe und Aminogruppe; oder zumindest zwei benachbarte R-Gruppen, ausgewählt aus der Gruppe, bestehend aus R_{13}, R_{14}, R_{15}, R_{16}, R_{17} und R_{18}, aneinander binden können unter Bildung eines gesättigten oder ungesättigten Kohlenstoffrings; und

jedes von Ar_1 und Ar_2 so ist, wie in Anspruch 1 definiert.

5. Verbindung nach Anspruch 1, die dargestellt ist durch Formel 7:

Formel 7

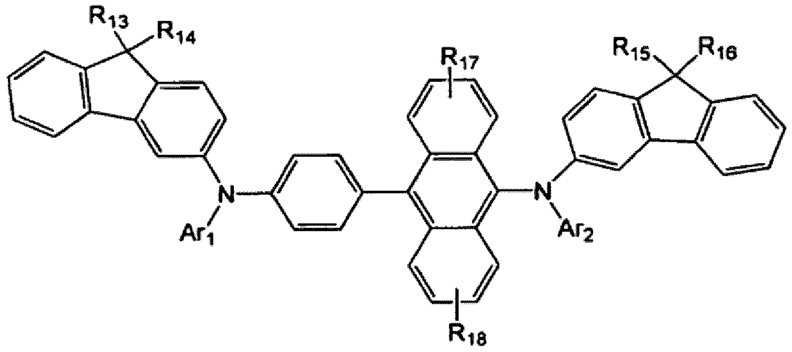


wobei jedes von R_{13}, R_{14}, R_{15}, R_{16}, R_{17} und R_{18} unabhängig ausgewählt ist aus der Gruppe, bestehend aus Wasserstoff, substituierten und unsubstituierten C_1-C_{10}-Alkylgruppen, substituierten und unsubstituierten C_6-C_{20}-Arylgruppen, substituierten und unsubstituierten C_1-C_{10}-Alkoxygruppen, Fluor, Cyanogruppe und Aminogruppe; oder zumindest zwei benachbarte R-Gruppen, ausgewählt aus der Gruppe, bestehend aus R_{13}, R_{14}, R_{15}, R_{16}, R_{17} und R_{18}, aneinander binden können unter Bildung eines gesättigten oder ungesättigten Kohlenstoffrings; und

jedes von Ar_1 und Ar_2 so ist, wie in Anspruch 1 definiert.

6. Verbindung nach Anspruch 1, die dargestellt ist durch Formel 8:

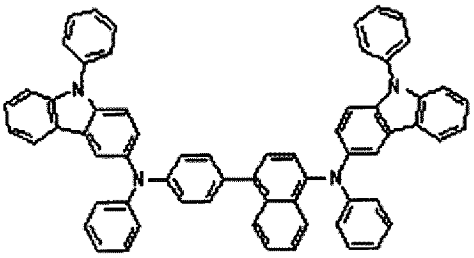
Formel 8



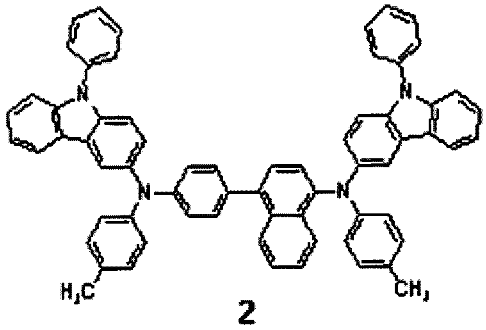
wobei jedes von R_{13}, R_{14}, R_{15}, R_{16}, R_{17} und R_{18} unabhängig ausgewählt ist aus der Gruppe, bestehend aus Wasserstoff, substituierten und unsubstituierten C_1-C_{10}-Alkylgruppen, substituierten und unsubstituierten C_6-C_{20}-Arylgruppen, substituierten und unsubstituierten C_1-C_{10}-Alkoxygruppen, Fluor, Cyanogruppen und Aminogruppen; oder zumindest zwei benachbarte R-Gruppen, ausgewählt aus der Gruppe, bestehend aus R_{13}, R_{14}, R_{15}, R_{16}, R_{17} und R_{18}, aneinander binden können unter Bildung eines gesättigten oder ungesättigten Kohlenstoffrings; und

jedes von Ar_1 und Ar_2 so ist, wie in Anspruch 1 definiert.

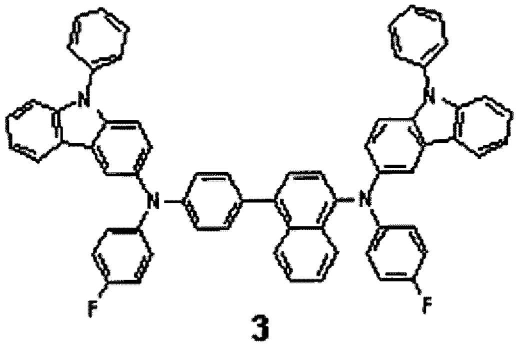
7. Verbindung nach einem der Ansprüche 1 bis 6, ausgewählt aus der Gruppe, bestehend aus Verbindungen 1, 2, 3, 32, 105, 153, 157, 159, 173, 184 und 213:



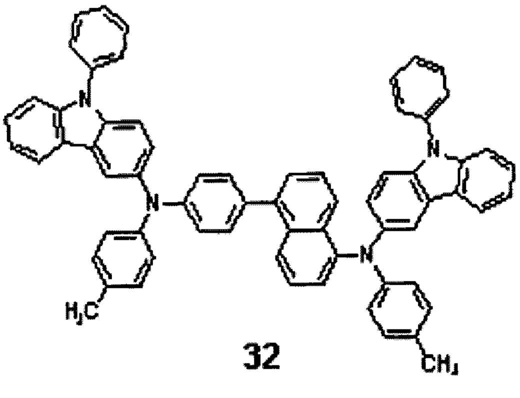
1



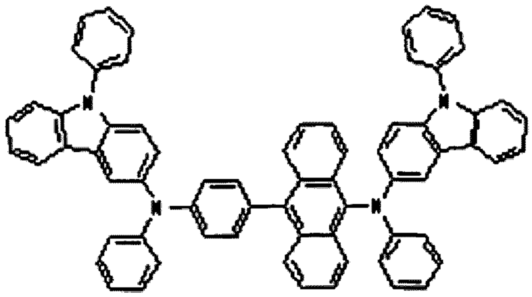
2



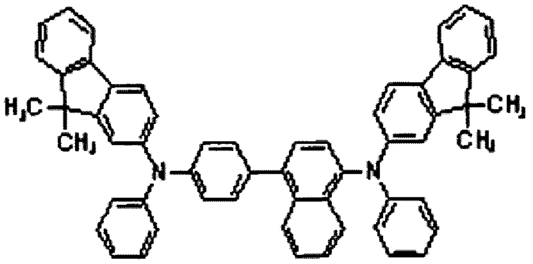
3



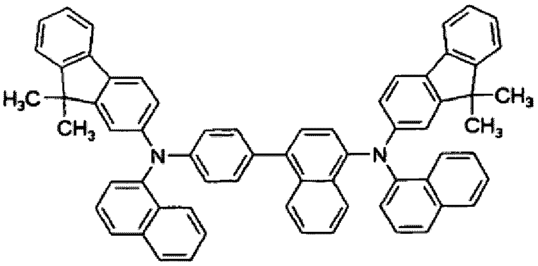
32



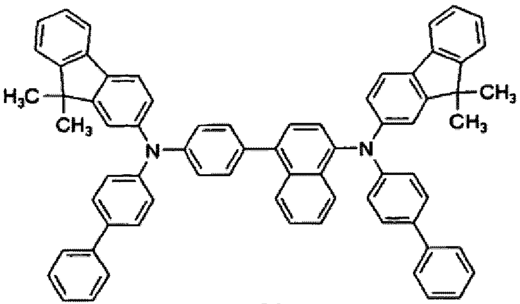
105



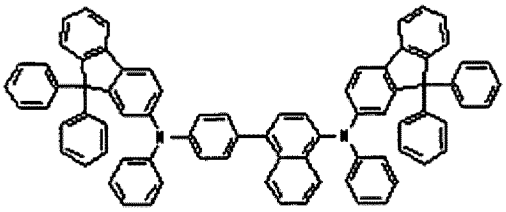
153



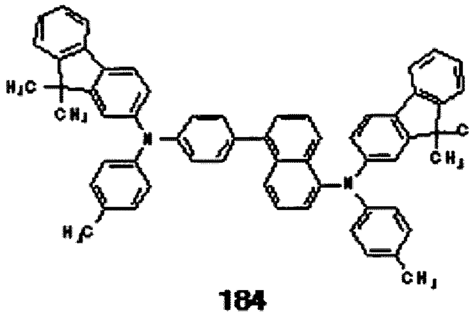
157



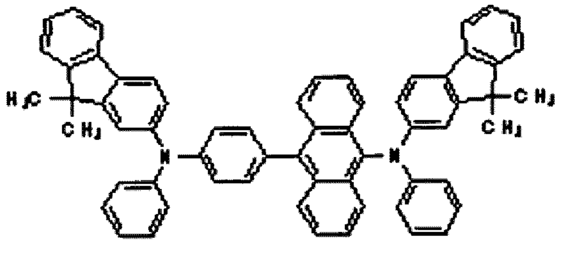
159



173



184



213

8. Organische lichtemittierende Vorrichtung, umfassend eine erste Elektrode, eine zweite Elektrode und einen organischen Film zwischen der ersten Elektrode und der zweiten Elektrode, wobei der organische Film eine Verbindung nach einem der Ansprüche 1 bis 7 umfasst.

9. Organische lichtemittierende Vorrichtung nach Anspruch 8, wobei der organische Film eine Schicht umfasst, die aus der Gruppe, bestehend aus Löcherinjektionsschichten und Löchertransportschichten, ausgewählt ist.

10. Organische lichtemittierende Vorrichtung nach Anspruch 8 oder Anspruch 9, wobei der organische Film einen Einzelfilm umfasst, der eine Löcherinjektionsschicht und eine Löchertransportschicht umfasst.

11. Organische lichtemittierende Vorrichtung nach einem der Ansprüche 8 bis 10, wobei der organische Film eine Emissionsschicht umfasst.

12. Organische lichtemittierende Vorrichtung nach Anspruch 11, wobei die Emissionsschicht die Verbindung nach Anspruch 1 als Wirt umfasst, und weiterhin ein Dotierungsmittel umfasst, das aus der Gruppe, bestehend aus phosphoreszierenden und fluoreszierenden Dotierungsmitteln, ausgewählt ist.

13. Organische lichtemittierende Vorrichtung nach einem der Ansprüche 8 bis 12, wobei die Vorrichtung eine Struktur umfasst, die ausgewählt ist aus der Gruppe, bestehend aus Strukturen erste Elektrode / Löcherinjektionsschicht /

Emissionsschicht / zweite Elektrode, Strukturen erste Elektrode / Löcherinjektionsschicht / Löchertransportschicht / Emissionsschicht / Elektronentransportschicht / zweite Elektrode, und Strukturen erste Elektrode / Löcherinjektionsschicht / Löchertransportschicht / Emissionsschicht / Elektronentransportschicht / Elektroneninjektionsschicht / zweite Elektrode.

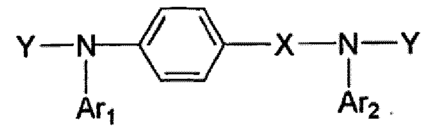
14. Organische lichtemittierende Vorrichtung nach Anspruch 13, weiterhin umfassend zumindest eine von einer Löcher blockierenden Schicht und einer Elektronen blockierenden Schicht.

15. Flachtafel-Anzeigevorrichtung, umfassend eine organische lichtemittierende Vorrichtung nach einem der Ansprüche 8 bis 14, wobei die erste Elektrode der organischen lichtemittierenden Vorrichtung elektrisch mit einer Source-Elektrode oder einer Drain-Elektrode eines Dünnschichttransistors verbunden ist.

Revendications

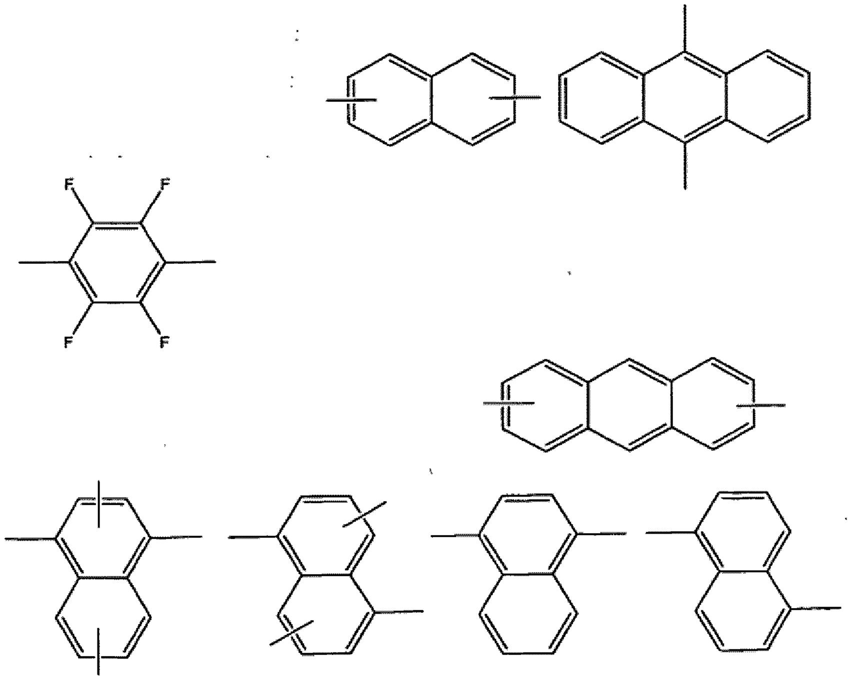
1. Composé représenté par la formule 1 :

Formule 1



dans laquelle :

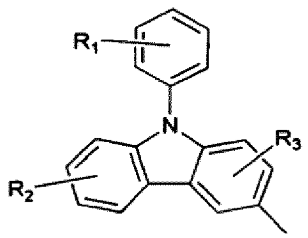
X est sélectionné parmi le groupe constitué de structures substituées et non substituées représentées par :



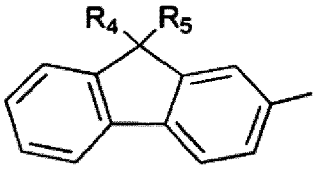
, et de groupes polycycliques condensés en C_4 à C_{20} substitués et non substitués ;
Ar_1 et Ar_2 sont respectivement sélectionnés indépendamment l'un de l'autre parmi le groupe constitué des groupes phényle, biphényle, naphtyle et anthracényle substitués et non substitués, où, pour des groupes Ar_1 et Ar_2 substitués, le ou les cycle(s) aromatique(s) de Ar_1 et Ar_2 est/sont substitué(s) par un à trois groupes

sélectionnés parmi le groupe constitué des groupes alkyle en C_1 à C_4, des groupes alcoxy en C_1 à C_5, du groupe cyano, du groupe amino, du groupe phénoxy, du groupe phényle, du groupe N,N-diphénylamino, et d'atomes d'halogène ; et
Y est sélectionné parmi le groupe constitué de matériaux représentés par les formules 2 et 3

Formule 2



Formule 3

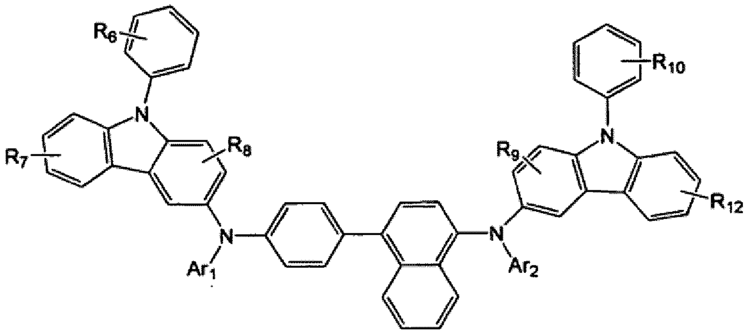


;

dans lesquelles R_1, R_2, R_3, R_4 et R_5 sont respectivement sélectionnés indépendamment les uns des autres parmi le groupe constitué de l'hydrogène, des groupes alkyle en C_1 à C_{10} substitués et non substitués, des groupes aryle en C_6 à C_{20} substitués et non substitués, des groupes alcoxy en C_1 à C_{10} substitués et non substitués, du fluor, du groupe cyano, et du groupe amino ; ou au moins deux groupes R adjacents sélectionnés parmi le groupe constitué de R_1, R_2, R_3, R_4 et R_5 peuvent se lier les uns aux autres pour former un cycle carbone saturé ou insaturé.

2. Composé selon la revendication 1, qui est représenté par la formule 4 :

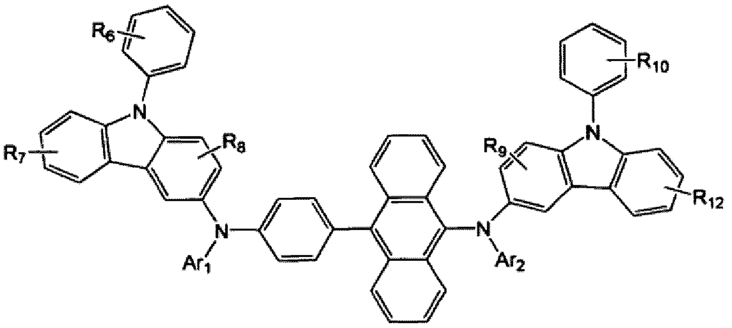
Formule 4



dans laquelle R_6, R_7, R_8, R_9, R_{10}, R_{11} et R_{12} sont respectivement sélectionnés indépendamment les uns des autres parmi le groupe constitué de l'hydrogène, des groupes alkyle en C_1 à C_{10} substitués et non substitués, les groupes aryle en C_6 à C_{20} substitués et non substitués, des groupes alcoxy en C_1 à C_{10} substitués et non substitués, du fluor, du groupe cyano, et du groupe amino ; ou au moins deux groupes R adjacents sélectionnés parmi le groupe constitué de R_6, R_7, R_8, R_9, R_{10}, R_{11} et R_{12} peuvent se lier les uns aux autres pour former un cycle carbone saturé ou insaturé, et
dans laquelle Ar_1 et Ar_2 sont respectivement tels que définis selon la revendication 1.

3. Composé selon la revendication 1, qui est représenté par la formule 5 :

Formule 5

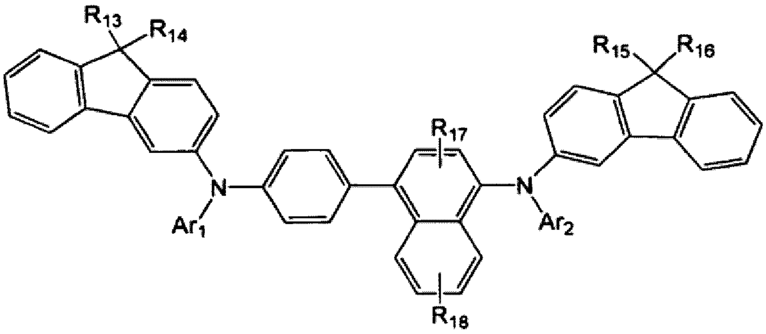


dans laquelle R_6, R_7, R_8, R_9, R_{10}, R_{11} et R_{12} sont respectivement sélectionnés indépendamment les uns des autres parmi le groupe constitué de l'hydrogène, des groupes alkyle en C_1 à C_{10} substitués et non substitués, des groupes aryle en C_6 à C_{20} substitués et non substitués, des groupes alcoxy en C_1 à C_{10} substitués et non substitués, du fluor, du groupe cyano, et du groupe amino, ou au moins deux groupes R adjacents sélectionnés parmi le groupe constitué de R_6, R_7, R_8, R_9, R_{10}, R_{11} et R_{12} peuvent se lier les uns aux autres pour former un cycle carbone saturé ou insaturé ; et

Ar_1 et Ar_2 sont respectivement tels que définis selon la revendication 1.

4. Composé selon la revendication 1, qui est représenté par la formule 6 :

Formule 6

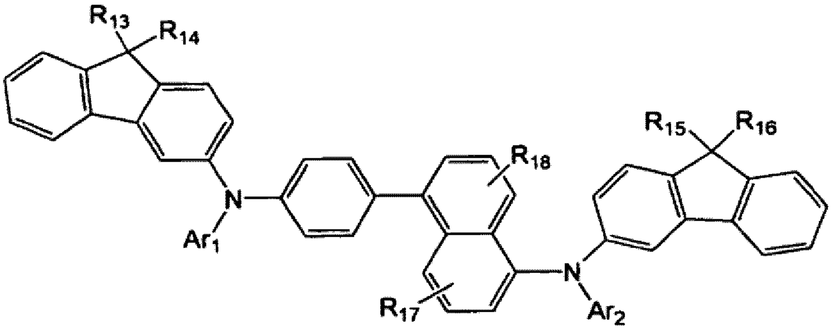


dans laquelle R_{13}, R_{14}, R_{15}, R_{16}, R_{17} et R_{18} sont respectivement sélectionnés indépendamment les uns des autres parmi le groupe constitué de l'hydrogène, des groupes alkyle en C_1 à C_{10} substitués et non substitués, des groupes aryle en C_6 à C_{20} substitués et non substitués, des groupes alcoxy en C_1 à C_{10} substitués et non substitués, du fluor, du groupe cyano, et du groupe amino ; ou au moins deux groupes R adjacents sélectionnés parmi le groupe constitué de R_{13}, R_{14}, R_{15}, R_{16}, R_{17} et R_{18} peuvent se lier les uns aux autres pour former un cycle carbone saturé ou insaturé ; et

Ar_1 et Ar_2 sont respectivement tels que définis selon la revendication 1.

5. Composé selon la revendication 1, qui est représenté par la formule 7 :

Formule 7

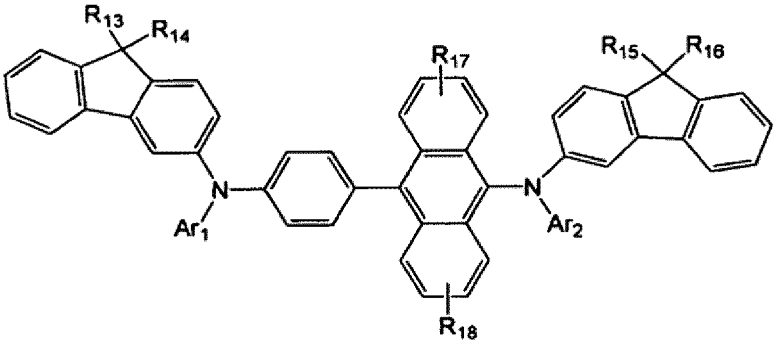


dans laquelle R_{13}, R_{14}, R_{15}, R_{16}, R_{17} et R_{18} sont respectivement sélectionnés indépendamment les uns des autres parmi le groupe constitué de l'hydrogène, des groupes alkyle en C_1 à C_{10} substitués et non substitués, des groupes aryle en C_6 à C_{20} substitués et non substitués, des groupes alcoxy en C_1 à C_{10} substitués et non substitués, du fluor, du groupe cyano, et du groupe amino ; ou au moins deux groupes R adjacents sélectionnés parmi le groupe constitué de R_{13}, R_{14}, R_{15}, R_{16}, R_{17} et R_{18} peuvent se lier les uns aux autres pour former un cycle carbone saturé ou insaturé ; et

Ar_1 et Ar_2 sont respectivement tels que définis selon la revendication 1.

6. Composé selon la revendication 1, qui est représenté par la formule 8 :

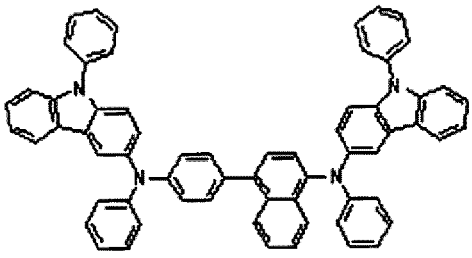
Formule 8



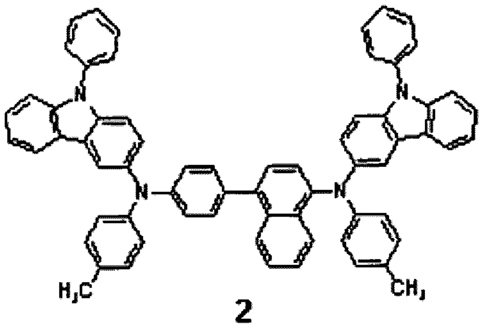
dans laquelle R_{13}, R_{14}, R_{15}, R_{16}, R_{17} et R_{18} sont respectivement sélectionnés indépendamment les uns des autres parmi le groupe constitué de l'hydrogène, des groupes alkyle en C_1 à C_{10} substitués et non substitués, des groupes aryle en C_6 à C_{20} substitués et non substitués, des groupes alcoxy en C_1 à C_{10} substitués et non substitués, du fluor, des groupes cyano, et des groupes amino ; ou au moins deux groupes R adjacents sélectionnés parmi le groupe constitué de R_{13}, R_{14}, R_{15}, R_{16}, R_{17} et R_{18} peuvent se lier les uns aux autres pour former un cycle carbone saturé ou insaturé ; et

Ar_1 et Ar_2 sont respectivement tels que définis selon la revendication 1.

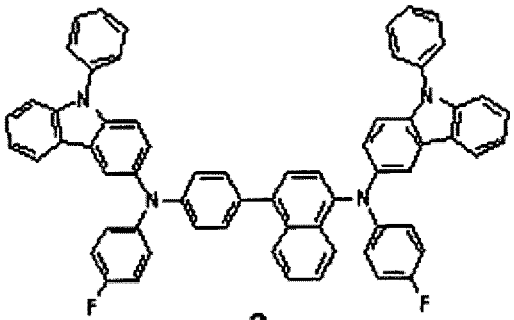
7. Composé selon l'une quelconque des revendications 1 à 6, sélectionné parmi le groupe constitué des composés 1, 2, 3, 32, 105, 153, 157, 159, 173, 184 et 213 :



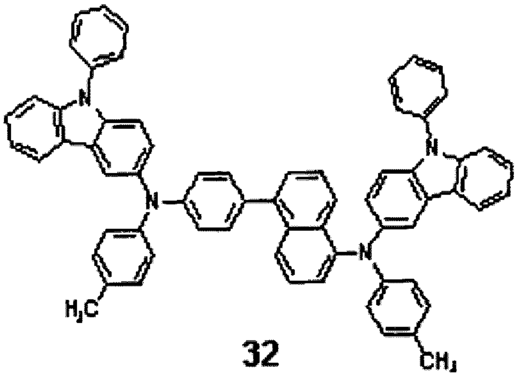
1



2

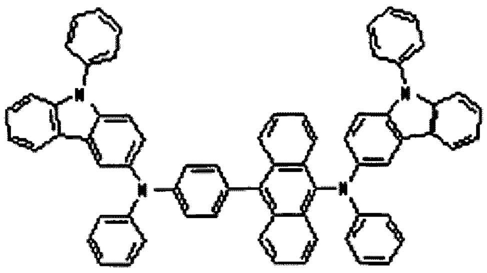


3

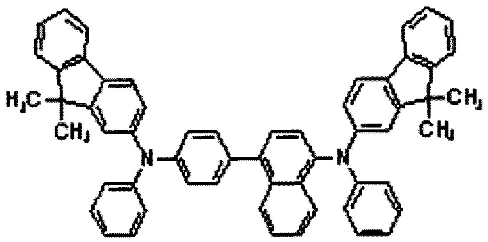


32

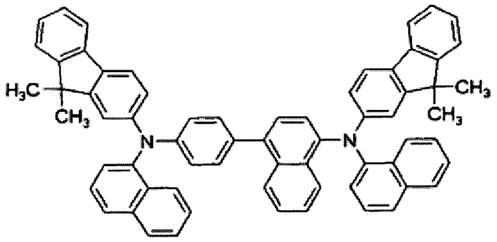
72



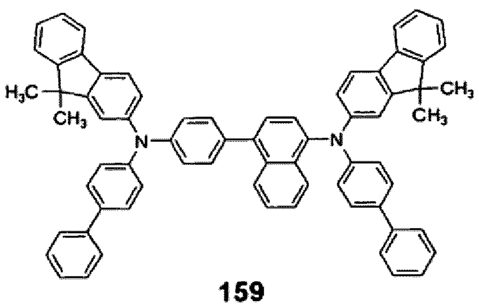
105



153

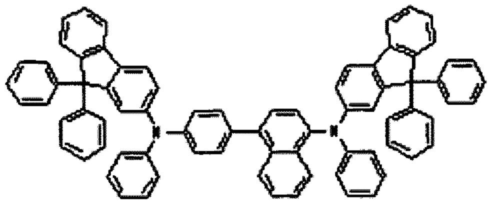


157

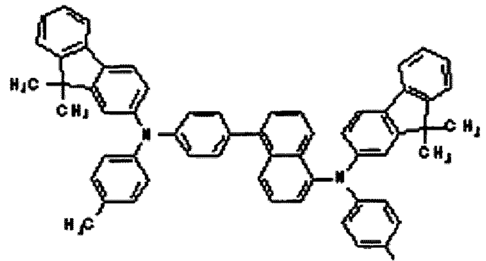


159

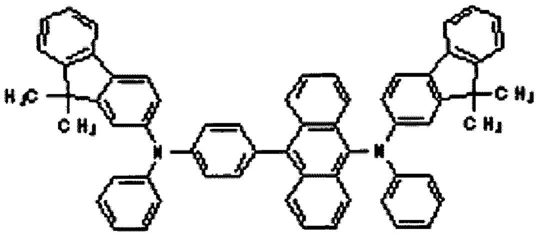
73



173



184



213

8. Dispositif électroluminescent organique comprenant une première électrode, une seconde électrode, et un film organique entre la première électrode et la seconde électrode,
dans lequel le film organique comprend un composé selon l'une quelconque des revendications 1 à 7.

9. Dispositif électroluminescent organique selon la revendication 8, dans lequel le film organique comprend une couche sélectionnée parmi le groupe constitué de couches d'injection de trous et de couches de transport de trous.

10. Dispositif électroluminescent organique selon la revendication 8 ou 9, dans lequel le film organique comprend un film unique comprenant une couche d'injection de trous et une couche de transport de trous.

11. Dispositif électroluminescent organique selon l'une quelconque des revendications 8 à 10, dans lequel le film organique comprend une couche émissive.

12. Dispositif électroluminescent organique selon la revendication 11, dans lequel la couche émissive comprend le composé selon la revendication 1 en tant qu'hôte, et comprend en outre un dopant sélectionné parmi le groupe constitué des dopants phosphorescents et fluorescents.

13. Dispositif électroluminescent organique selon l'une quelconque des revendications 8 à 12, dans lequel le dispositif comprend une structure sélectionnée parmi le groupe constitué des structures première électrode/couche d'injection de trous/couche émissive/seconde électrode, des structures première électrode/couche d'injection de trous/couche de transport de trous/couche émissive/couche de transport d'électrons/seconde électrode, et des structures première électrode/couche d'injection de trous/couche de transport de trous/couche émissive/couche de transport d'électrons/couche d'injection d'électrons/seconde électrode.

14. Dispositif électroluminescent organique selon la revendication 13, comprenant en outre au moins une couche parmi une couche de blocage de trous et une couche de blocage d'électrons.

15. Dispositif d'affichage à écran plat comprenant un dispositif électroluminescent organique selon l'une quelconque des revendications 8 à 14, dans lequel la première électrode du dispositif électroluminescent organique est électriquement raccordée à une électrode de source ou à une électrode de drain d'un transistor en couches minces.

FIG. 1

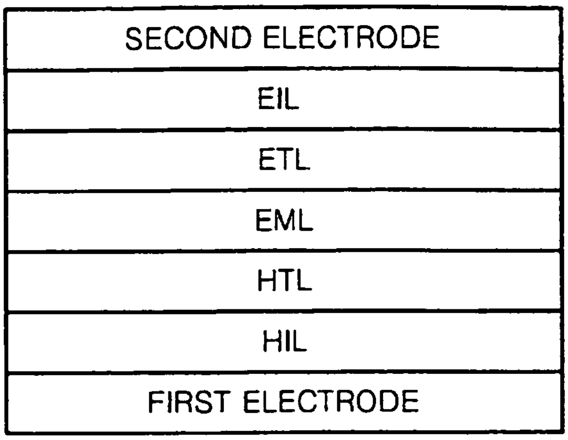

SECOND ELECTRODE
EIL
ETL
EML
HTL
HIL
FIRST ELECTRODE

FIG. 2

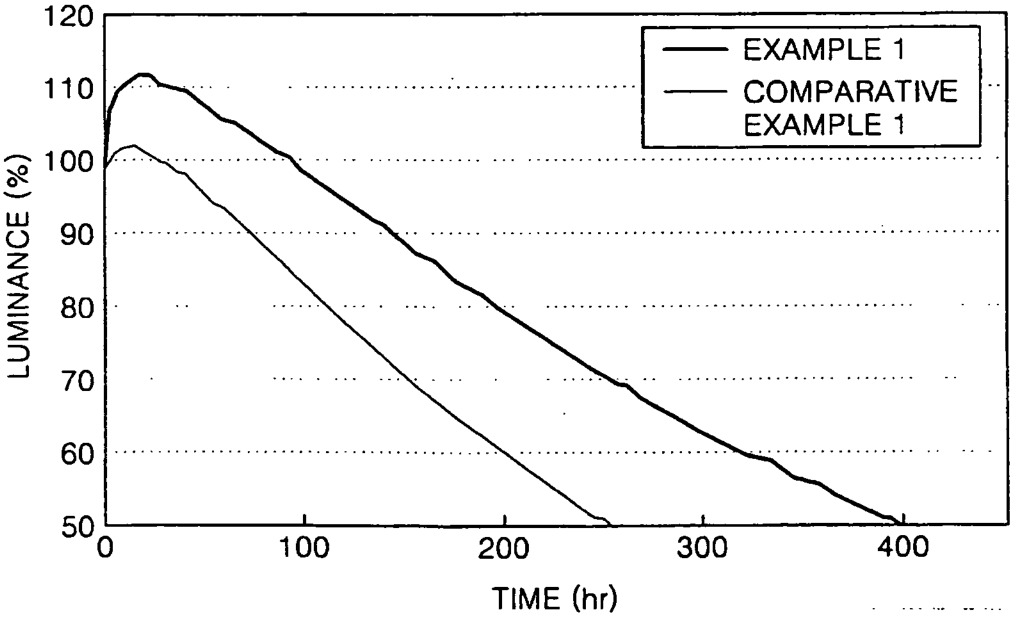
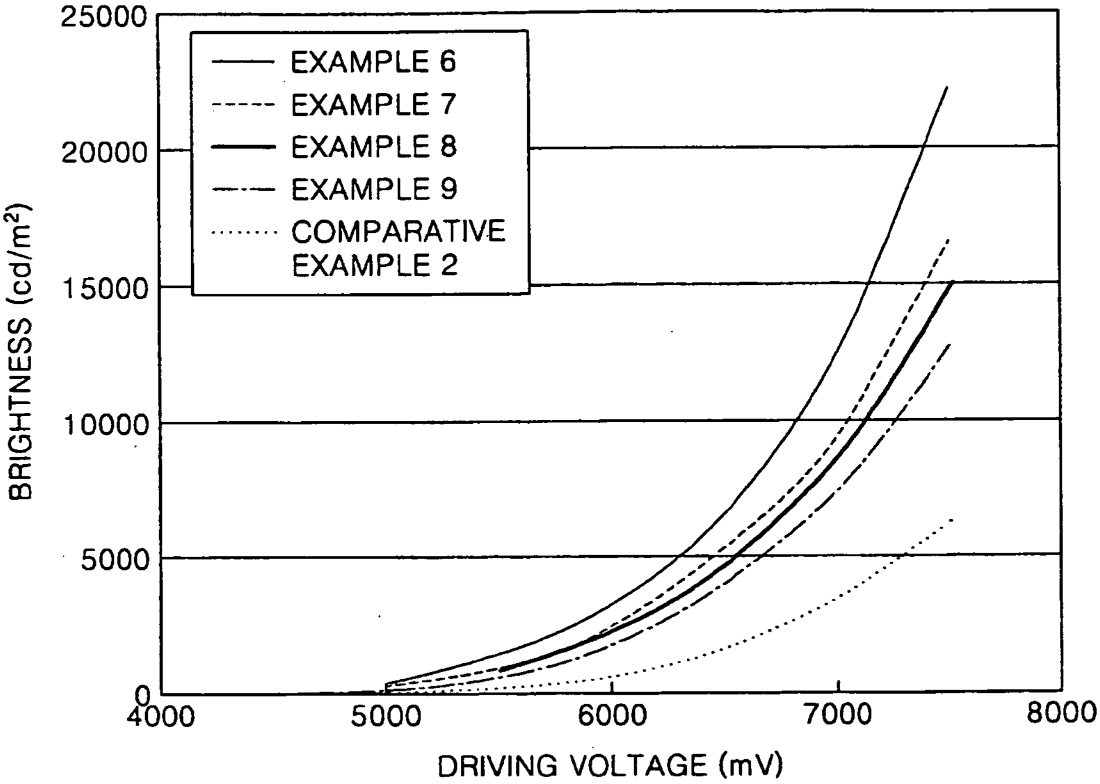

LUMINANCE (%)
120
110
100
90
80
70
60
50
0
100
200
300
400
TIME (hr)
EXAMPLE 1
COMPARATIVE EXAMPLE 1

FIG. 3


25000
20000
15000
10000
5000
0
4000
5000
6000
7000
8000
BRIGHTNESS (cd/m²)
DRIVING VOLTAGE (mV)
EXAMPLE 6
EXAMPLE 7
EXAMPLE 8
EXAMPLE 9
COMPARATIVE EXAMPLE 2

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- US 2005221124 A **[0004]**
- JP 2004087395 A **[0004]**
- US 2007231503 A **[0004]**
- EP 1862524 A **[0004]**
- EP 1661888 A **[0004]**
- JP 2007126439 B **[0004]**
- JP H1135532 B **[0004]**

专利名称(译)	用于形成有机膜的化合物，以及包括其的有机发光器件和平板显示装置		
公开(公告)号	EP2093271B1	公开(公告)日	2015-10-21
申请号	EP2009250339	申请日	2009-02-11
[标]申请(专利权)人(译)	三星显示有限公司		
申请(专利权)人(译)	三星移动显示器有限公司.		
当前申请(专利权)人(译)	三星DISPLAY CO.，LTD.		
[标]发明人	HWANG SEOK HWAN KIM YOUNG KOOK KWAK YOON HYUN YI JEONG IN		
发明人	HWANG, SEOK-HWAN KIM, YOUNG-KOOK KWAK, YOON-HYUN YI, JEONG-IN		
IPC分类号	H01L51/00 C09K11/06		
CPC分类号	C09K11/06 C07C211/61 C07C2603/18 C07D209/88 C09B1/00 C09B57/00 C09B57/008 C09B57/10 C09K2211/1011 C09K2211/1014 C09K2211/1022 C09K2211/1029 H01L51/0058 H01L51/006 H01L51/5012 H01L51/5016 H01L51/5056 H01L51/5088		
优先权	1020080012206 2008-02-11 KR		
其他公开文献	EP2093271A1		
外部链接	Espacenet		

摘要(译)

用于有机发光器件的化合物由式1表示。该化合物具有优异的电学性质和电荷传输特性，因此可用作空穴注入层，空穴传输层和磷光发光层的材料。用于发出所有颜色光的荧光装置，包括红色，绿色，蓝色和白色。使用这些化合物的有机发光器件具有高效率，低驱动电压和高亮度。

Formula 1