(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 377 907 A2

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
19.10.2011 Bulletin 2011/42

(21) Application number: **09836312.0**

(22) Date of filing: **16.12.2009**

(51) Int Cl.:
C09K 11/06 *(2006.01)*

(86) International application number:
PCT/KR2009/007521

(87) International publication number:
WO 2010/076991 (08.07.2010 Gazette 2010/27)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR

(30) Priority: **30.12.2008 KR 20080137222**

(71) Applicant: **CHEIL INDUSTRIES INC.**
Kumi-city, Kyungsangbuk-do 730-030 (KR)

(72) Inventors:
- **IN, Kyu-Yeol**
  Uiwang-si
  Gyeonggi-do 437-711 (KR)
- **KANG, Myeong-Soon**
  Uiwang-si
  Gyeonggi-do 437-711 (KR)
- **JUNG, Ho-Kuk**
  Uiwang-si
  Gyeonggi-do 437-711 (KR)
- **KIM, Nam-Soo**
  Uiwang-si
  Gyeonggi-do 437-711 (KR)
- **KANG, Eui-Su**
  Uiwang-si
  Gyeonggi-do 437-711 (KR)
- **CHAE, Mi-Young**
  Uiwang-si
  Gyeonggi-do 437-711 (KR)
- **PARK, Jin-Seong**
  Uiwang-si
  Gyeonggi-do 437-711 (KR)

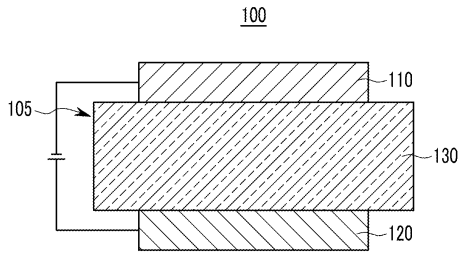
(74) Representative: **Michalski Hüttermann & Partner Patentanwälte**
Neuer Zollhof 2
40221 Düsseldorf (DE)

(54) NOVEL COMPOUNDS FOR AN ORGANIC PHOTOELECTRIC DEVICE, AND ORGANIC PHOTOELECTRIC DEVICE COMPRISING SAME

(57) A novel compound for an organic photoelectric device and an organic photoelectric device including the same are provided. The compound is represented by Chemical Formula 1.

The compound according to one embodiment of the present invention can act as a hole injection, hole transport, light emitting, or electron inject ion and/or transport material, and also as a light emitting host along with an appropriate dopant. The compound for an organic photoelectric device can improve thermal stability and decrease a driving voltage for improving life-span and efficiency characteristics of an organic photoelectric device when included in an organic thin layer.

FIG. 1



EP 2 377 907 A2

Description

[Technical Field]

[0001] The present invention relates to a novel compound for an organic photoelectric device and an organic photoelectric device including the same. More particularly, the present invention relates to a material for an organic photoelectric device that decreases a driving voltage of an organic photoelectric device due to excellent thermal stability and improves life-span and efficiency and an organic photoelectric device including the same.

[Background Art]

[0002] An organic photoelectric device transforms electrical energy into light by applying current to an organic light emitting material. It has a structure in which a functional organic material layer is interposed between an anode and a cathode.

[0003] The organic light emitting diode has similar electrical characteristics to those of light emitting diodes (LEDs) in which holes are injected from an anode and electrons are injected from a cathode, then the holes and electrons move to opposite electrodes and are recombined to form excitons having high energy. The formed excitons generate light having a certain wavelength while shifting to a ground state.

[0004] Light emission of an anthracene organic material was firstly found in 1960, but there is a demerit of a high driving voltage. In 1980, C.W Tang et al., of Eastman Kodak, Inc., firstly developed a device realizing a low driving voltage. Thereafter, in 1990, Cambridge University developed a polymer light emitting diode using poly(p-phenylenevinylene) (PPV). Research has been conducted on a low molecular light emitting element (SMOLED) and a polymer organic light emitting diode (PLED). The low molecular organic light emitting diode is manufactured as a thin film in a vacuum deposition method, and can have good efficiency and life-span performance. A polymer organic light emitting diode is manufactured in an Inkjet or spin coating method and has an advantage of low initial cost and being large-sized.

[0005] Both low molecular organic light emitting and polymer organic light emitting diodes have advantages of being self-light emitting and ultrathin, and having a high speed response, a wide viewing angle, high image quality, durability, a large driving temperature range, and the like. In particular, they have good visibility due to the self-light emitting characteristic compared with a conventional LCD (liquid crystal display) and have an advantage of decreasing thickness and weight of LCD by up to a third, because they do not need a backlight. In addition, since they have a response speed that is 1000 times faster per microsecond unit than an LCD, they can realize a perfect motion picture without an afterimage. Based on these advantages, they have been remarkably developed to have 80 times the efficiency and more than 100 times the life-span since they were first developed in the late 1980s. Recently, these diodes have been used in displays that are rapidly becoming larger, such as for a 40-inch organic light emitting diode panel.

[0006] These displays must simultaneously have improved luminous efficiency and life-span in order to be larger. In order to increase the luminous efficiency, smooth combination between holes and electrons in an emission layer is needed. However, since an organic material in general has slower electron mobility than hole mobility, it has a drawback of inefficient combination between holes and electrons. Accordingly, a novel compound that increases electron injection and mobility from a cathode and simultaneously prevents movement of holes is desperately required.

[0007] In addition, the device may have a decreased life-span since the material therein may be crystallized due to Joule heat generated when it is driven. In order to solve this problem, 2-(4-biphenylyl)-5-(4-t-butylphenyl)-1,3,4-oxadiazole (PBD) (Jpn. J. Appl. Phys., 27, L269 1988) with a rapid transfer speed has been suggested, but it lacks thermal stability and thereby still has a problem of crystallization when a device is driven. In addition, BCP and an aluminum mixed coordination complex (BAlq, bis(2-methyl-8-quinolinolate)-4-(phenylphenolate)aluminum), which is known to be excellent in lowering hole mobility, have been actively researched. However, these materials have excellent characteristic in lowering hole mobility but a problem of deteriorating the electron injection characteristic and being crystallized when a device is driven, and accordingly do not satisfy device characteristics.

[0008] Therefore, there is a strong need for an organic compound having excellent electron injection and mobility and high thermal stability and that prevents crystallization when a device is driven.

[DISCLOSURE]

[Technical Problem]

[0009] An exemplary embodiment of the present invention provides a novel material that can act as a hole injection, hole transport, light emitting, or electron injection and/or transport material, and also as a light emitting host along with an appropriate dopant.

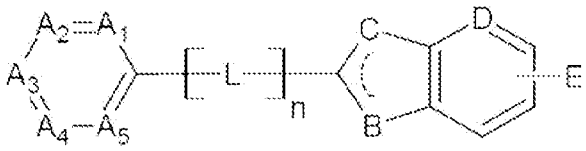
[0010] Another embodiment of the present invention provides an organic photoelectric device including the material

for an organic photoelectric device, and having decreased driving voltage and increased life-span and efficiency.

[Technical Solution]

[0011] According to one embodiment of the present invention, a compound represented by the following Chemical Formula 1 for an organic photoelectric device is provided.

[Chemical Formula 1]



[0012] In Chemical Formula 1,

A_1 to A_5 are the same or different, and CR_1 to CR_5 are N, provided that three or less of A_1 to A_5 are N,

When one of A_1 to A_5 is N, the remaining four of A_1 to A_5 are respectively selected from the group consisting of CR_1 to CR_5, provided that at least two of R_1 to R_5 are not hydrogen, and

when A_1 to A_5 are respectively CR_1 to CR_5, at least two of R_1 to R_5 are not hydrogen.

[0013] B is selected from the group consisting of O, S, Se, and NR".

[0014] C and D are the same or different, and are independently selected from the group consisting of CR' and N, provided that when B is not NR", C is N.

[0015] R_1 to R_5, R' and R" are independently selected from the group consisting of hydrogen, a halogen, a nitrile, a cyano, a nitro, an amide, a carbonyl, an ester, a substituted or unsubstituted alkyl, a substituted or unsubstituted alkoxy, a substituted or unsubstituted alkenyl, a substituted or unsubstituted cycloalkyl, a substituted or unsubstituted aryl, a substituted or unsubstituted arylamine, a substituted or unsubstituted heteroarylamine, a substituted or unsubstituted heterocycle, a substituted or unsubstituted amino, BR_6R_7, and $SiR_6R_7R_8$, and

[0016] R_6 to R_8 are the same or different, and are independently selected from the group consisting of a substituted or unsubstituted alkyl, and a substituted or unsubstituted aryl.

[0017] E is selected from the group consisting of hydrogen, a nitrile, a cyano, a nitro, an amide, a carbonyl, a substituted or unsubstituted alkyl, a substituted or unsubstituted fluoroalkyl, a substituted or unsubstituted cycloalkyl, a substituted or unsubstituted aryl, a substituted or unsubstituted heterocycle, and SO_2R_9, and

[0018] R_9 is selected from the group consisting of a nitrile, a cyano, a nitro, an amide, a carbonyl, a substituted or unsubstituted alkyl, a substituted or unsubstituted cycloalkyl, a substituted or unsubstituted aryl, and a substituted or unsubstituted heterocycle.

[0019] L is selected from the group consisting of a substituted or unsubstituted aryl and a substituted or unsubstituted heteroaryl, and

[0020] n is 0 or 1.

[0021] According to another embodiment of the present invention, an organic photoelectric device of the present invention is provided that includes an anode, a cathode, and at least one organic thin layer between the anode and cathode. The organic thin layer includes the compound for an organic photoelectric device.

[0022] According to a further of the present invention, a display device including the organic photoelectric device is provided.

[0023] Hereinafter, further embodiments of the present invention will be described in detail.

[Advantageous Effects]

[0024] According to one embodiment of the present invention, a compound for an organic photoelectric device is largely asymmetric. The asymmetric structure reinforces an amorphous characteristic and thereby suppresses crystallization, improving thermal stability of the compound for an organic photoelectric device. Accordingly, when an organic photoelectric device is driven, the compound can decrease its driving voltage and improve life-span and efficiency.

[0025] The novel compound according to one embodiment of the present invention can act as a hole injection, hole transport, light emitting, or electron inject ion and/or transport material, and also as a light emitting host along with an appropriate dopant.

[Description of the Drawings]

[0026]

FIGS. 1 to 5 are cross-sectional views showing organic photoelectric devices including organic compounds according to various embodiments of the present invention.

FIG. 6 shows a ^{1}H NMR spectrum of the compound according to Example 1 according to the present invention.

FIG. 7 shows a ^{1}H NMR spectrum of the compound according to Example 2 according to the present invention.

FIG. 8 shows a ^{1}H NMR spectrum of the compound according to Example 3 according to the present invention.

FIG. 9 shows a ^{1}H NMR spectrum of the compound according to Example 4 according to the present invention.

FIG. 10 shows a ^{1}H NMR spectrum of the compound according to Example 5 according to the present invention.

FIG. 11 shows a ^{1}H NMR spectrum of the compound according to Example 6 according to the present invention.

FIG. 12 shows a ^{1}H NMR spectrum of the compound according to Example 7 according to the present invention.

FIG. 13 shows a ^{1}H NMR spectrum of the compound according to Example 8 according to the present invention.

FIG. 14 shows a ^{1}H NMR spectrum of the compound according to Example 9 according to the present invention.

FIG. 15 shows voltage-luminescence characteristics of the organic light emitting diodes according to Examples 10 to 13 and Comparative Example 2.

FIG. 16 shows voltage-luminescence characteristics of the organic light emitting diodes according to Examples 14 to 16 and Comparative Example 2.

FIG. 17 shows electrical power efficiency of the organic light emitting diodes according to Examples 10 to 13 and Comparative Example 2.

FIG. 18 shows electrical power efficiency of the organic light emitting diodes according to Examples 14 to 16 and Comparative Example 2.

FIG. 19 shows thermal properties of the compound according to Example 5.

FIG. 20 shows thermal properties of the compound according to Comparative Example 1.

<Description of Reference Numerals Indicating Primary Elements in the Drawings>

[0027]

100 : organic photoelectric device
110 : cathode
120 : anode
105 : organic thin layer
130 : emission layer
140 : hole transport layer (HTL)
150 : electron transport layer (ETL)
160 : electron injection layer (EIL)
170 : hole injection layer (HIL)
230 : emission layer + electron transport layer (ETL)

[Mode for Invention]

[0028] Exemplary embodiments of the present invention will hereinafter be described in detail. However, these embodiments are only exemplary, and the present invention is not limited thereto but rather is defined by scope of the appended claims.

[0029] As used herein, when specific definition is not provided, the term "alkyl" may refer to a C1 to C30 alkyl, and preferably a C1 to C15 alkyl; the term "alkoxy" may refer to a C1 to 30 alkoxy, and preferably a C1 to C15 alkoxy; the term "alkenyl" may refer to a C 2 to C30 alkenyl, and preferably a C2 to C15 alkenyl; the term "cycloalkyl" may refer to a C 3 to C30 cycloalkyl, and preferably a C3 to C15 cycloalkyl; the term "aryl" may refer to a C 6 to C50 aryl, and preferably a C6 to C25 aryl; the term "arylamine" may refer to a C 7 to C50 arylamine, and preferably a C7 to C25 arylamine; the term "heteroarylamine" may refer to a C7 to C50 heteroarylamine, and preferably a C7 to C25 hetero arylamine; the term "heterocycle" may refer to a C5 to C50 heterocycle, and preferably a C5 to C25 heterocycle; and the term "fluoroalkyl" may refer to a C 1 to C10 fluoroalkyl.

[0030] As used herein, when a definition is not otherwise provided, the term "ester" may refer to-COOR; and the term "carbonyl" may refer to -COR'. Herein R and R' are each independently hydrogen, a C1 to C10 alkyl, a C 6 to C20 aryl, a C3 to C20 cycloalkyl, a C2 to C10 alkenyl, a C2 to C10 alkynyl, or a combination thereof.

[0031] As used herein, when specific definition is not otherwise provided, the term "substituted" refers to one substituted

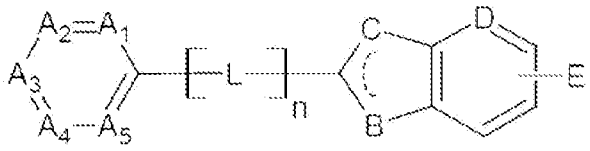
with at least a substituent selected from the group consisting of a halogen, a nitrile, a cyano, a nitro, an amide, a carbonyl, an acetylene, a substituted or unsubstituted alkyl, a substituted or unsubstituted alkenyl, a substituted or unsubstituted alkoxy, a substituted or unsubstituted arylamine, a substituted or unsubstituted aryl, a substituted or unsubstituted arylalkyl, a substituted or unsubstituted arylalkenyl, a substituted or unsubstituted heterocycle, a substituted or unsubstituted amine, a substituted or unsubstituted cycloalkyl, BR_6R_7, and $SiR_6R_7R_8$, where R_6 to R_8 are the same or different and are independently selected from the group consisting of a substituted or unsubstituted C1 to C30 alkyl and a substituted or unsubstituted C6 to C50 aryl.

[0032] As used herein, when a definition is not otherwise provided, the prefix "hetero" refers to one including 1 to 3, including N, O, S, or P, in one ring.

[0033] As used herein, when specific definition is not provided, the term "heterocycle" refers to one selected from the group consisting of a C5 to C50 heteroaryl, a C5 to C50 heterocycloalkyl, a C5 to C50 heterocycloalkenyl, a C5 to C50 heterocycloalkynyl, and fused rings thereof. The heterocycle preferably includes 1 to 20 heteroatoms, and more preferably 1 to 15 heteroatoms.

[0034] One embodiment of the present invention provides a compound for an organic photoelectric device, represented by the following Formula 1:

[Chemical Formula 1]



[0035] In Chemical Formula 1,

A_1 to A_5 are the same or different, and CR_1 to CR_5 are N, provided that three or less of A_1 to A_5 are N.

[0036] When one of A_1 to A_5 is N, the remaining four of A_1 to A_5 are respectively selected from the group consisting of CR_1 to CR_5, provided that at least two of R_1 to R_5 are not hydrogen, and

when A_1 to A_5 are respectively CR_1 to CR_5, at least two of R_1 to R_5 are not hydrogen.

[0037] B is selected from the group consisting of O, S, Se, and NR".

[0038] C and D are the same or different, and are independently selected from the group consisting of CR' and N, provided that when B is not NR", C is N.

[0039] R_1 to R_5, R', and R" are independently selected from the group consisting of hydrogen, a halogen, a nitrile, a cyano, a nitro, an amide, a carbonyl, an ester, a substituted or unsubstituted alkyl, a substituted or unsubstituted alkoxy, a substituted or unsubstituted alkenyl, a substituted or unsubstituted cycloalkyl, a substituted or unsubstituted aryl, a substituted or unsubstituted arylamine, a substituted or unsubstituted heteroarylamine, a substituted or unsubstituted heterocycle, a substituted or unsubstituted amino, BR_6R_7, and $SiR_6R_7R_8$,

[0040] R_6 to R_8 are the same or different, and are independently selected from the group consisting of a substituted or unsubstituted alkyl, and a substituted or unsubstituted aryl.

[0041] E is selected from the group consisting of hydrogen, a nitrile, a cyano, a nitro, an amide, a carbonyl, a substituted or unsubstituted alkyl, a substituted or unsubstituted fluoroalkyl, a substituted or unsubstituted cycloalkyl, a substituted or unsubstituted aryl, a substituted or unsubstituted heterocycle, and SO_2R_9,

[0042] R_9 is selected from the group consisting of a nitrile, a cyano, a nitro, an amide, a carbonyl, a substituted or unsubstituted alkyl, a substituted or unsubstituted cycloalkyl, a substituted or unsubstituted aryl, and a substituted or unsubstituted heterocycle.

[0043] L is selected from the group consisting of a substituted or unsubstituted aryl, and a substituted or unsubstituted heteroaryl, and

n is 0 or 1.

[0044] The novel compound for an organic photoelectric device of the above Chemical Formula 1 includes a part including A_1 to A_5, a linking group of L including an aryl group or a heteroaryl group, and a functional substitutents including a five-member ring.

[0045] In the above Formula 1 A_1 to A_5 are the same or different, and CR_1 to CR_5 are N, provided that three or less of A_1 to A_5 are N. When any one among A_1 to A_5 is at least N, it can lower the LUMO (lowest unoccupied molecular orbital) energy level and increase electron affinity of a molecule, and thereby improve injection and transport character-

istics of electrons. Accordingly, it can reduce voltage required for driving an organic light emitting diode and improve electrical power efficiency. However, when more than four among A_1 to A_5 are N, it can generate too low LUMO energy level, such that it is hard to inject electrons.

[0046] In particular, when any one among A_1 to A_5 is at least N, more than four among A_1 to A_5 are respectively selected from the group consisting of CR_1 to CR_5. Herein, at least two of the R_1 to R_5 are not hydrogen. When at least one of the R_1 to R_5 is not hydrogen but is a substituent, it can increase rigidity of the compound and easily cause crystallization. When the R_1 to R_5 are all hydrogen, it may decrease thermal stability, and it may also be hard to inject electrons.

[0047] When A_1 to A_5 is all substituted with N, A_1 to A_5 are selected from the group consisting of CR_1 to CR_5. Herein, at least two of the R_1 to R_5 are not hydrogen. When at least one of the R_1 to R_5 is not hydrogen but is a substituent, it may increase rigidity of the compound. When the R_1 to R_5 are all hydrogen, it may decrease thermal stability, and it may also be hard to inject electrons.

[0048] In particular, when at least two of the R_1 to R_5 are not hydrogen but are a substituent, it can increase the amorphous characteristic by introducing a different substituent into a position of the substituent. Accordingly, it can suppress crystallization caused by the Joule heat generated from a device during the operation, and thereby improve the life-span characteristic of an organic light emitting diode.

[0049] In a compound for an organic photoelectric device, A_1 and A_5 may be different from each other, and A_2 and A_4 may be different from each other. The compound according to one embodiment of the present invention has an asymmetric structure where upper and lower substituents are different from each other with respect to the axis including A_3. This asymmetric structure can fortify the amorphous characteristic and suppress its crystallization, and thereby improve the life-span characteristic when an organic photoelectric device is driven. In addition, it can decrease the driving voltage of the organic photoelectric device and can provide an organic photoelectric device having excellent effects in terms of efficiency and thermal stability.

[0050] The linking group, L, including an aryl group or a heteroaryl group, can increase intermolcular interaction, and thereby improve thermal stability. In addition, it can adjust the π-conjugation length and also light emitting in a visual region. Accordingly, a compound for an organic photoelectric device according to the present invention can be usefully applied to an emission layer.

[0051] In addition, B in a functional substituent including a five-member ring is selected from the group consisting of O, S, Se, and NR", and C and D are different or the same each other. They are independently selected from the group consisting of CR' and N. However, when B is not NR", C is N. The functional substituent including a five-member ring may make the structure a compound for an organic photoelectric device generally asymmetric and can thereby endow the compound with thermal stability.

[0052] In Chemical Formula 1, R_1 to R_5, R' and R" are independently aryls, and it is preferable that the aryls are substituted or unsubstituted C6 to C40 aryls. When the aryls are monocyclic aryls such as phenyl, biphenyl, terphenyl, styrene, and so on, or polycyclic aryls such as naphthyl, anthracenyl, phenanthrenyl, pyrenyl, peryenyl, and so on, the compound may be useful for a material of an emission layer.

[0053] In Chemical Formula 1, R_1 to R_5, R', and R" are independently an arylamine. The arylamine is preferably selected from the group consisting of diphenyl amine, dinaphthyl amine, dibiphenyl amine, phenyl naphthyl amine, phenyl diphenyl amine, ditolyl amine, phenyl tolyl amine, carbazolyl, and triphenyl amine.

[0054] In Chemical Formula 1, R_1 to R_5, R' and R" are independently a substituted or unsubstituted heterocycle, and the heterocycle is selected from the group consisting of thiophenyl, furanyl, pyrrolyl, imidazolyl, thiazolyl, oxazolyl, oxadiazolyl, triazolyl, pyridinyl, pyridazinyl, quinolinyl, isoquinolinine, acridyl, imidazopyridinyl, and imidazopyrimidinyl.

[0055] When the substituted or unsubstituted heterocycle is imidazolyl or triazolyl, the substituent linked to nitrogen (N) of the imidazolyl or triazolyl is selected from the group consisting of a substituted or unsubstituted alkyl such as a substituted or unsubstituted methyl, a substituted or unsubstituted ethyl, a substituted or unsubstituted propyl, a substituted or unsubstituted isopropyl, a substituted or unsubstituted butyl, a substituted or unsubstituted t-butyl, a substituted or unsubstituted pentyl, a substituted or unsubstituted hexyl, and a substituted or unsubstituted heptyl; a substituted or unsubstituted cycloalkyl such as a substituted or unsubstituted cyclopentyl, a substituted or unsubstituted cyclohexyl, and so on; a substituted or unsubstituted aryl such as a substituted or unsubstituted phenyl, a substituted or unsubstituted biphenyl, a substituted or unsubstituted naphthyl, and so on; and a substituted or unsubstituted heterocycle. The heterocycle is preferably a heteroaryl such as pyridyl, bipyridyl, quinolyl, isoquinolyl, and so on.

[0056] In Chemical Formula 1, R_1 to R_5, R' and R" are functional groups having excellent electron injection characteristics or functional groups being capable of improving thermal stability. The functional groups can selectively endow the compounds with hole injection/transport capabilities and electron injection/transport capabilities, and thus enable efficient hole-electron combination in an emission layer.

[0057] For example, when one selected from R_1 to R_5, R', and R" includes a substituent selected from the group consisting of an amine-substituted alkyl, an amine-substituted cycloalkyl, an amine-substituted aryl, and an amine-substituted heterocycle, the compound is useful for a material of a hole injection layer (HIL) and a hole transport layer

(HTL).

[0058] When one selected from R_1 to R_5, R', and R" includes a substituent having excellent electron affinity selected from the group consisting of a nitrile, a nitro, an amide, a carbonyl, and a heterocycle, the compound is useful for a material of an electron injection layer (EIL) or an electron transport layer (ETL).

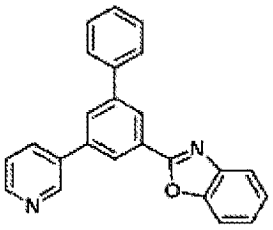
[0059] In Chemical Formula 1, when one selected from R_1 to R_5, R', and R" includes a substituent selected from the group consisting of an amine-substituted alkyl, an amine-substituted cycloalkyl, an amine-substituted aryl, and an amine-substituted heterocycle, one selected from R_1 to R_5, R', and R' of B includes a substituent having excellent electron affinity selected from the group consisting of a nitrile, a nitro, an amide, a carbonyl, and a heterocycle, the compound has both hole transport and electron transport capabilities. A preferable amine-substituted heterocycle is an amine-substituted heteroaryl, and a preferable heterocycle is a heteroaryl.

[0060] In Chemical Formula 1, when one selected from E and R" of B includes a substituent selected from the group consisting of an amine-substituted alkyl, an amine-substituted cycloalkyl, an amine-substituted aryl, and an amine-substituted heterocycle, and the other of E and R" of B includes a nitrile, a nitro, an amide, a carbonyl, and a heterocycle, amorphous characteristics are more improved, and hole and electron transport characteristics can be finely controlled. A preferable amine-substituted heterocycle is an amine-substituted heteroaryl, and a preferable heterocycle is a heteroaryl.

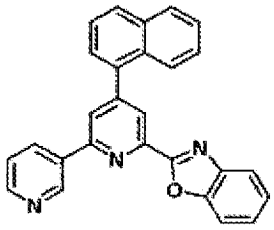
[0061] L is preferably selected from the group consisting of a substituted or unsubstituted C6 to C30 aryl and a substituted or unsubstituted C5 to C30 heteroaryl.

[0062] The various substituents of the above-described compound represented by the above Chemical Formula 1 does not change principal properties of the compound for an organic photoelectric device according to one embodiment.

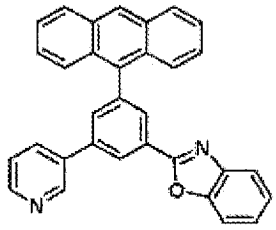
[0063] Examples of the compounds for an organic photoelectric device according to one embodiment of the present invention include the compounds represented by the following Formulae 2 to 111, but are not limited thereto.



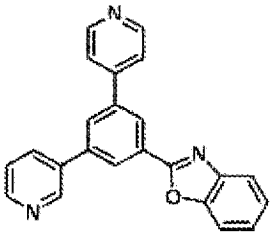
2



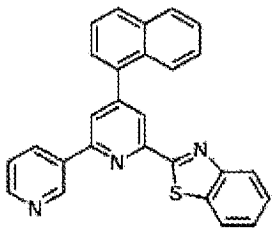
3



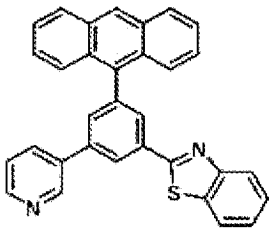
4



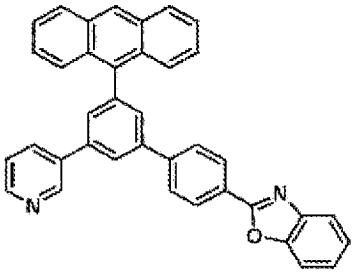
5



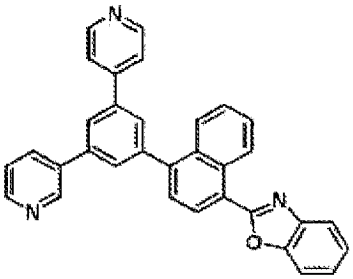
6



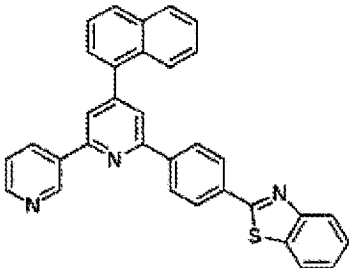
7



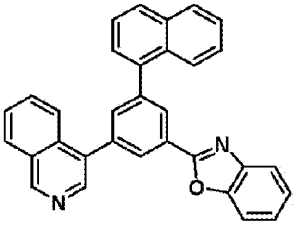
8



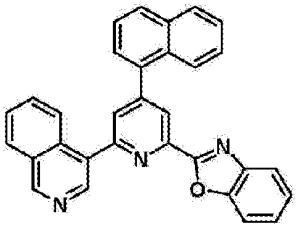
9



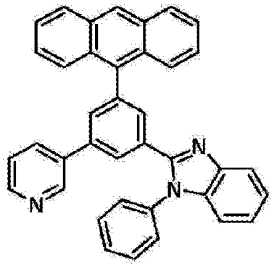
10



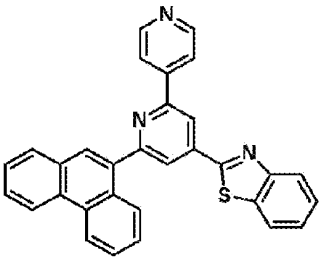
11



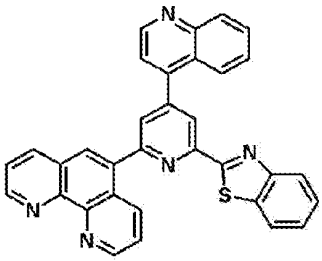
12



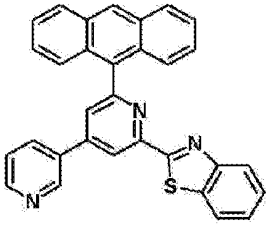
13



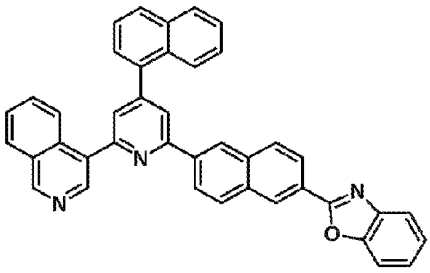
14



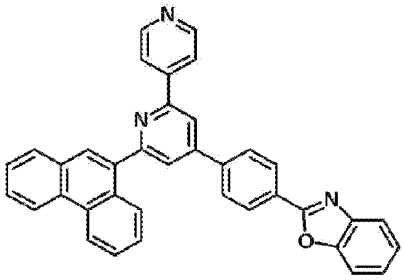
15



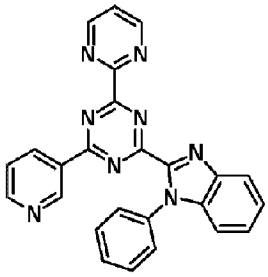
16



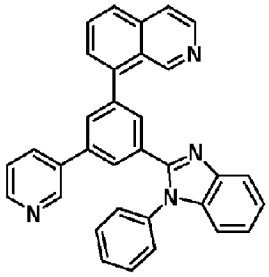
17



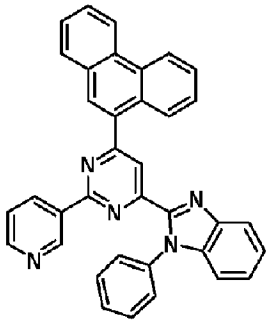
18



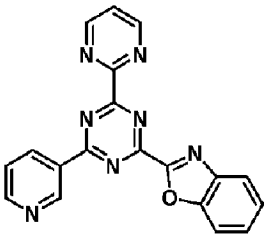
19



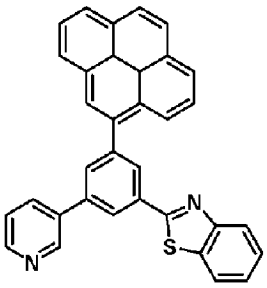
20



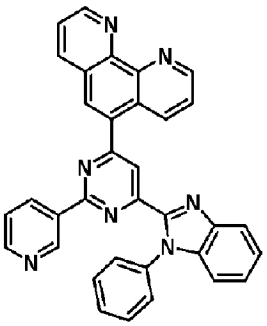
21



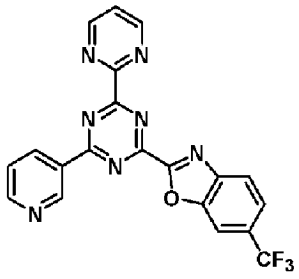
22



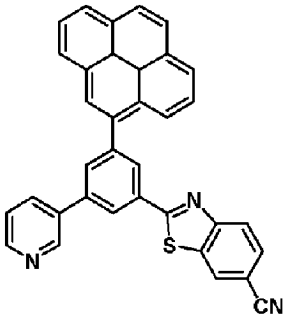
23



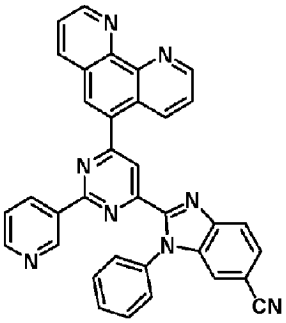
24



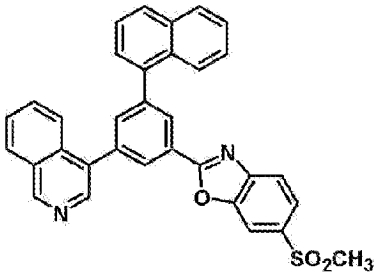
25



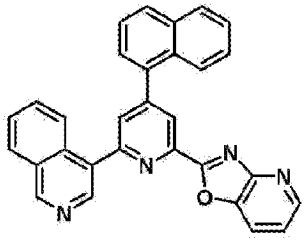
26



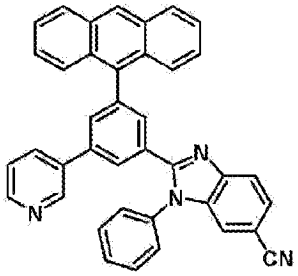
27



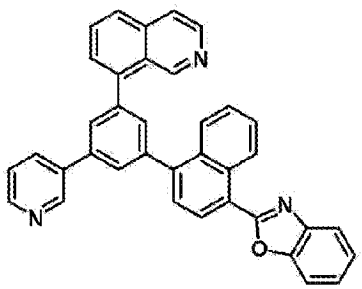
28



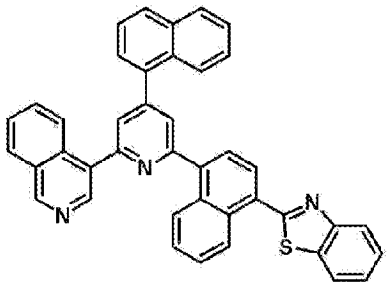
29



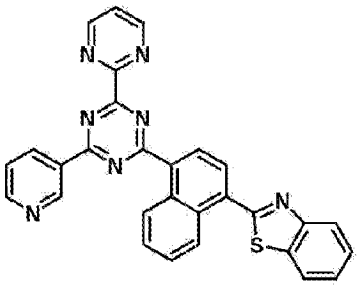
30



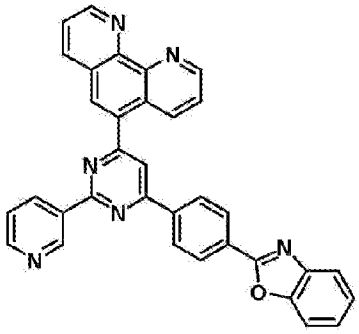
31



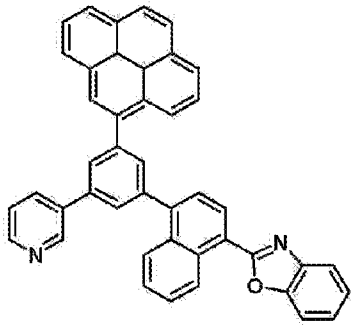
32



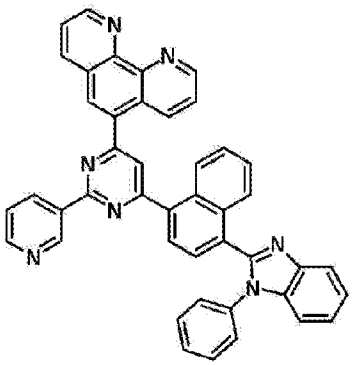
33



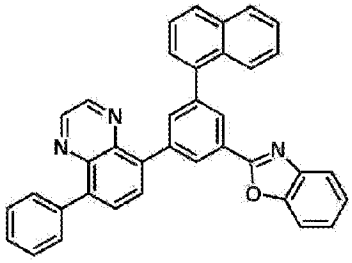
34



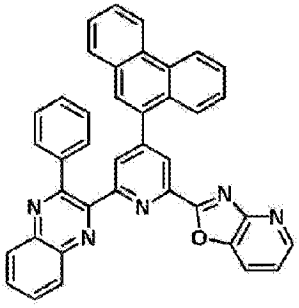
35



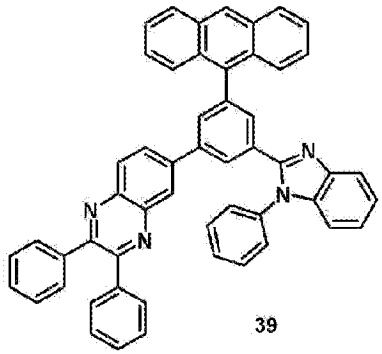
36



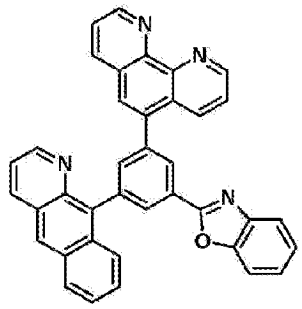
37



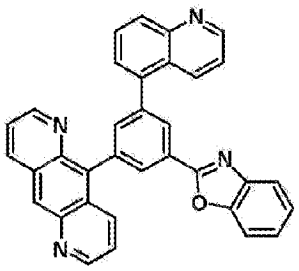
38



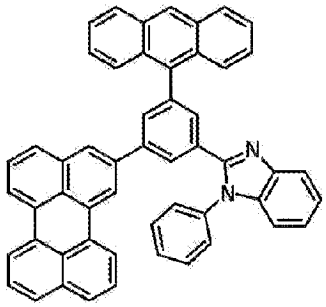
39



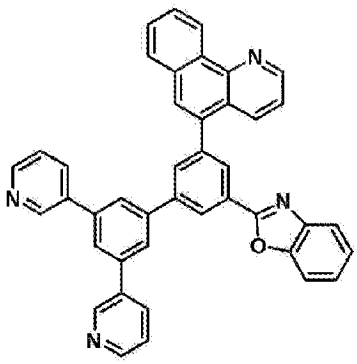
40



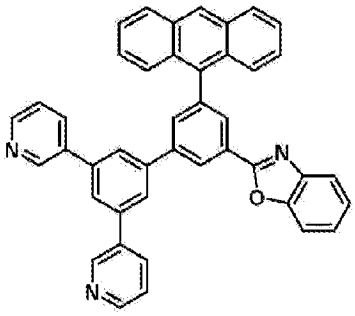
41



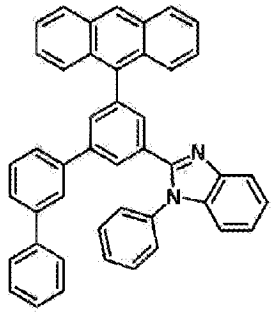
42



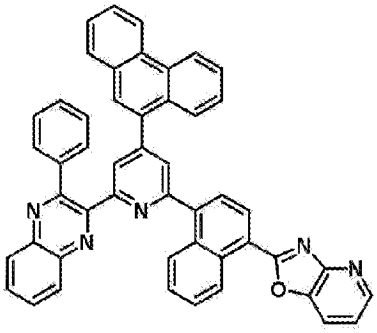
43



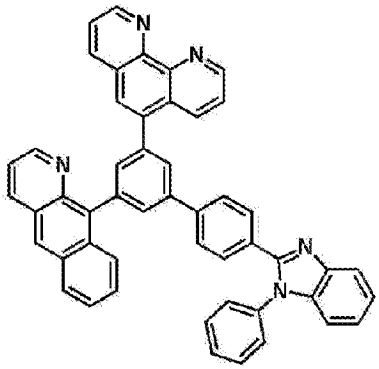
44



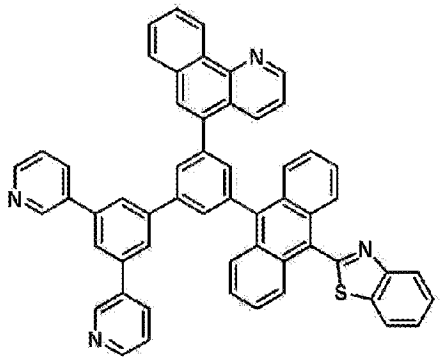
45



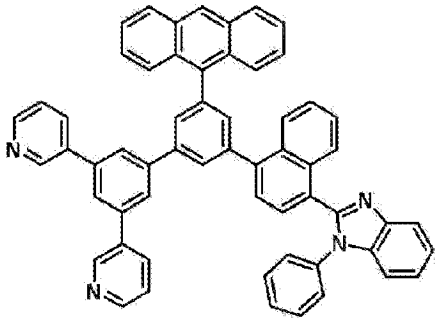
46



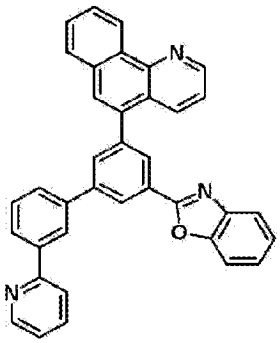
47



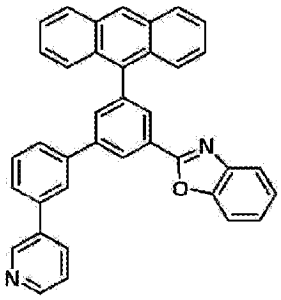
48



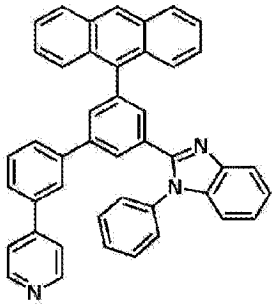
49



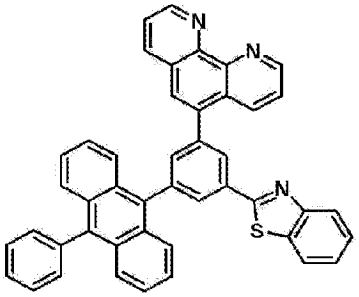
50



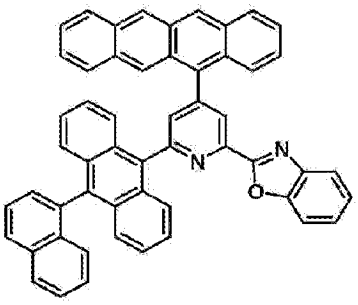
51



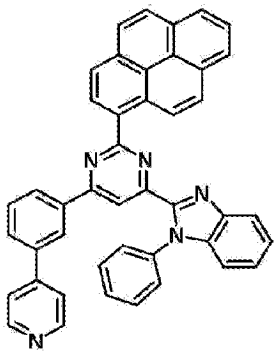
52



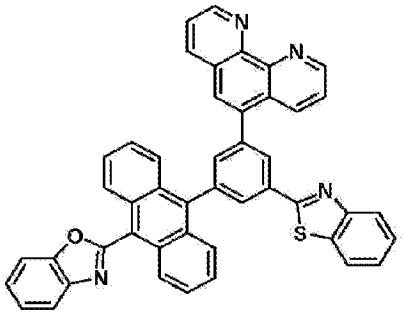
53



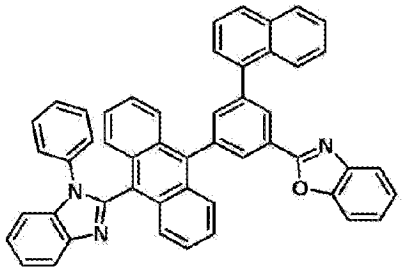
54



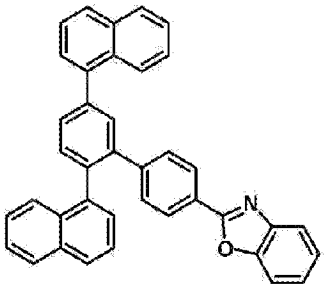
55



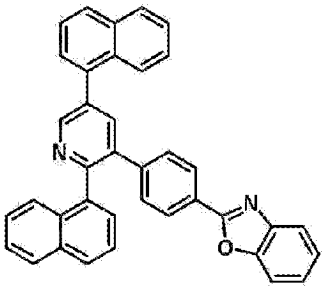
56



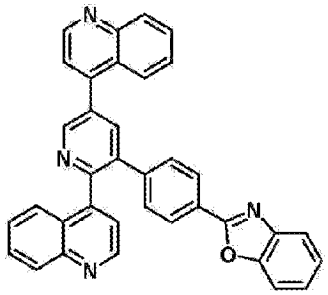
57



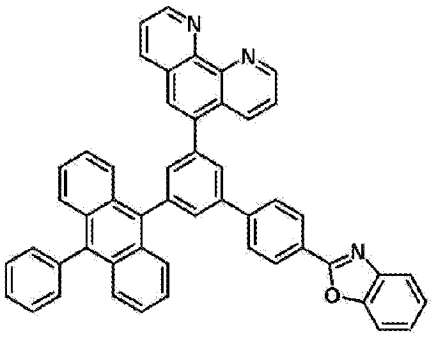
58



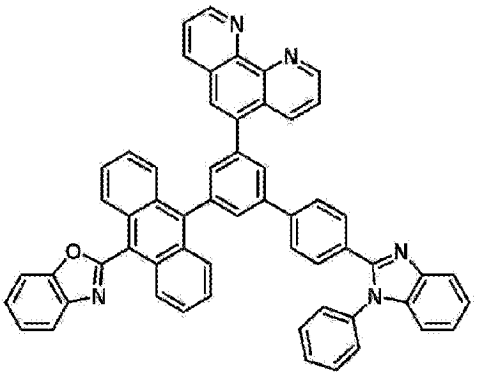
59



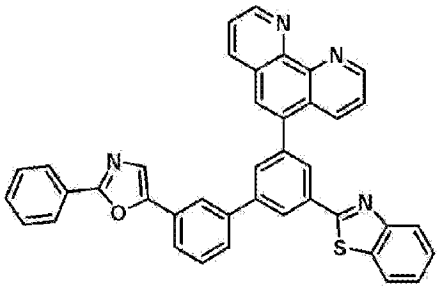
60



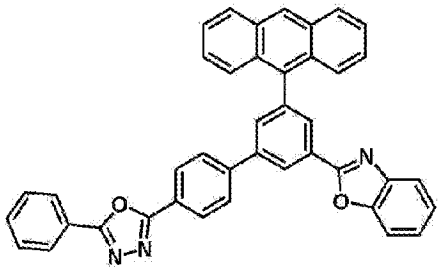
61



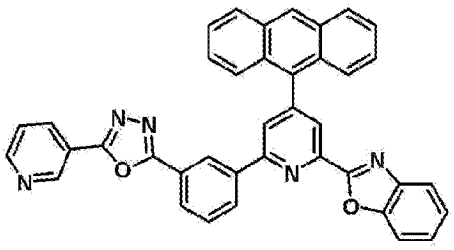
62



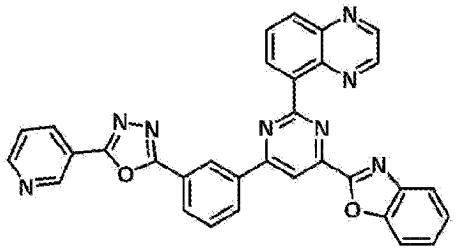
63



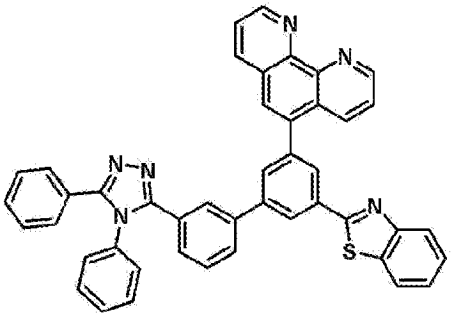
64



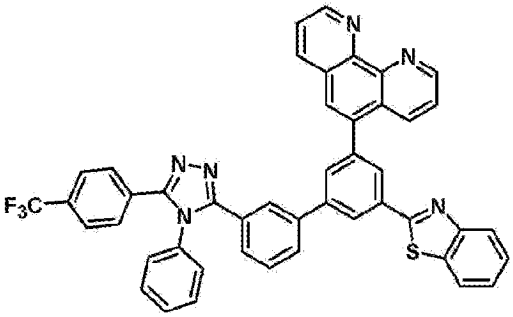
65



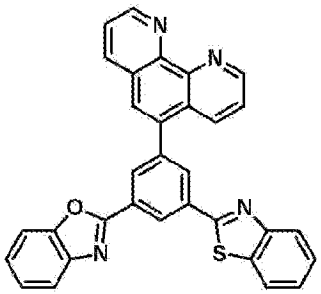
66



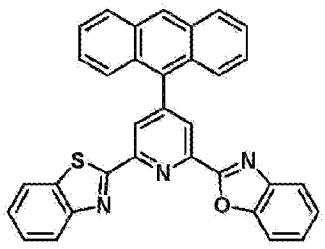
67



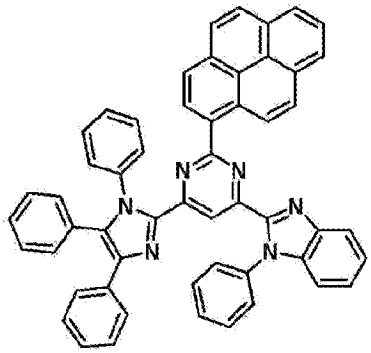
68



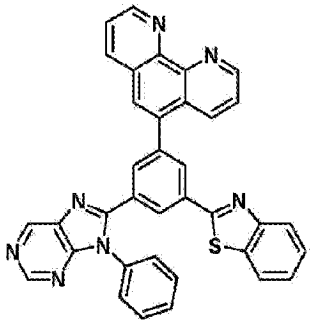
69



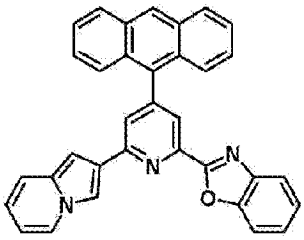
70



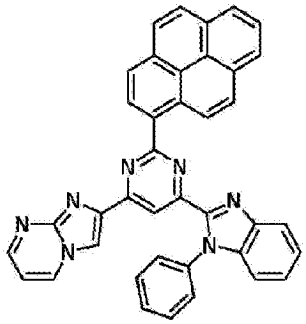
71



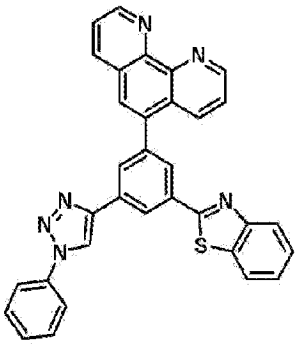
72



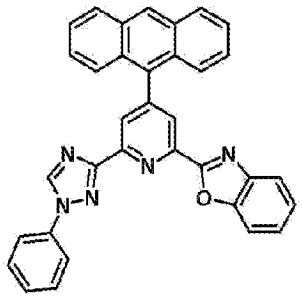
73



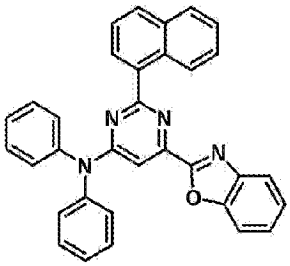
74



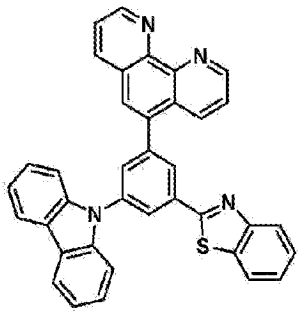
75



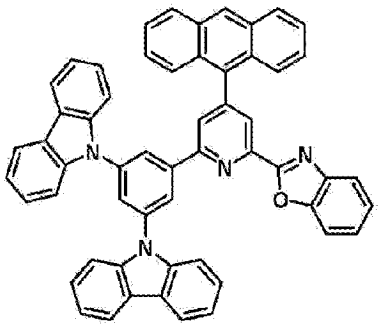
76



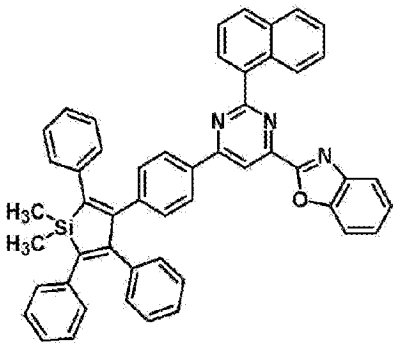
77



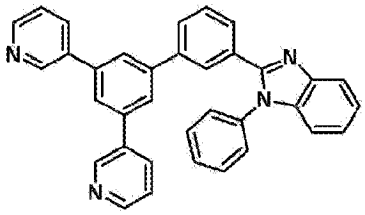
78



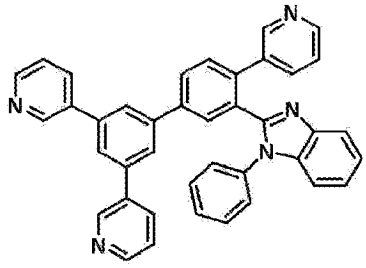
79



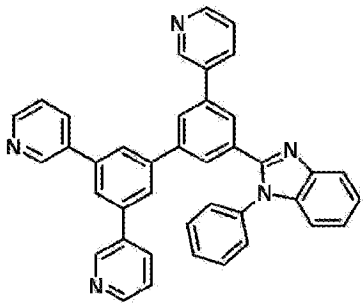
80



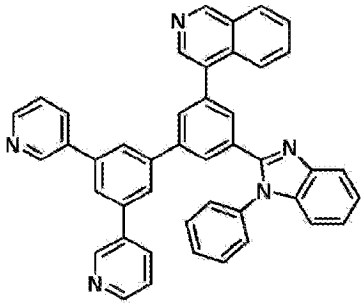
81



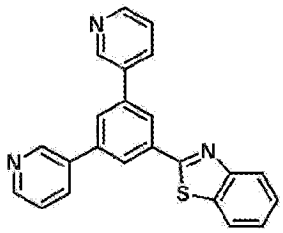
82



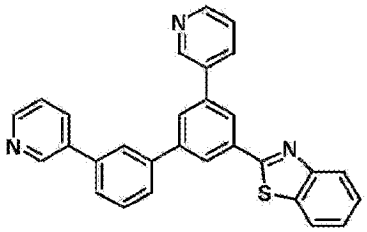
83



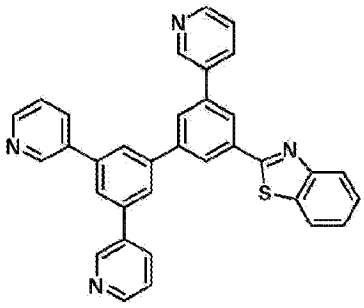
84



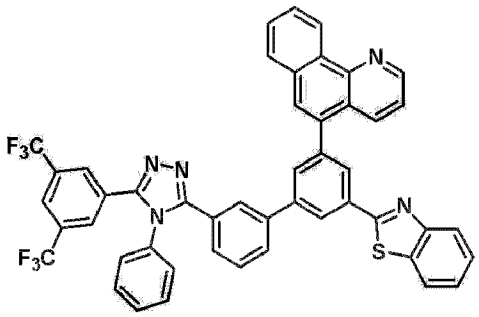
85



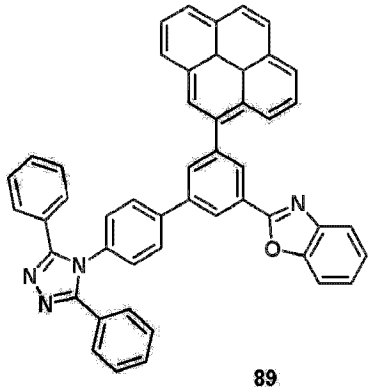
86



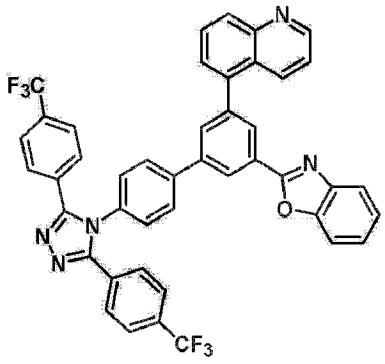
87



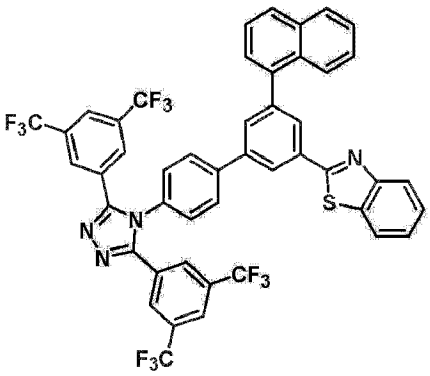
88



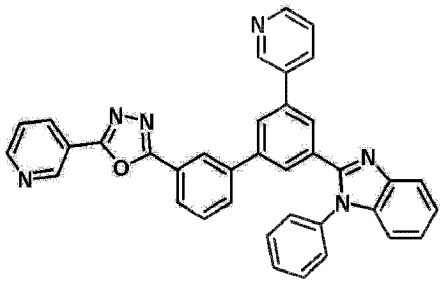
89



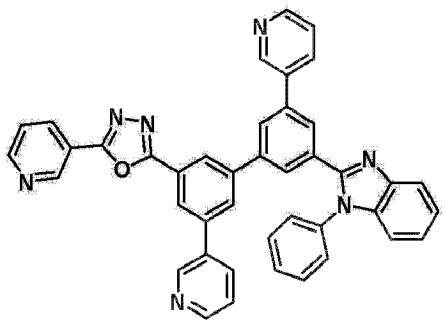
90



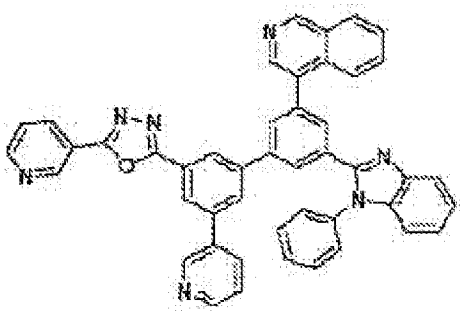
91



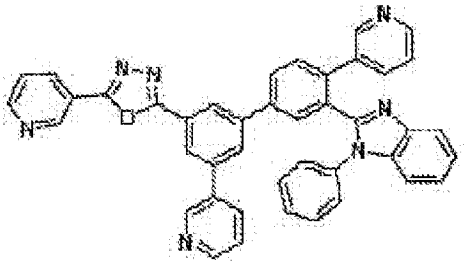
92



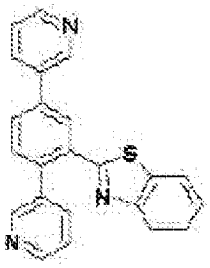
93



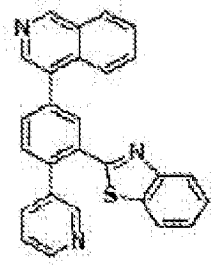
94



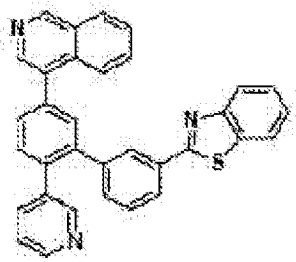
95



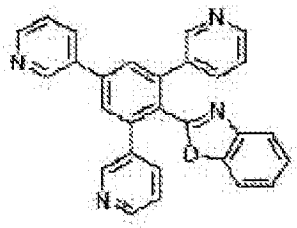
96



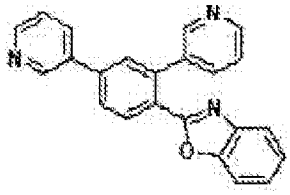
97



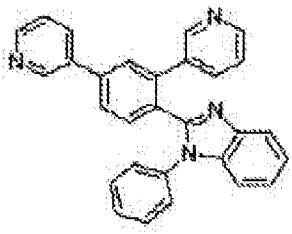
98



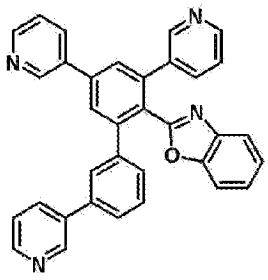
99



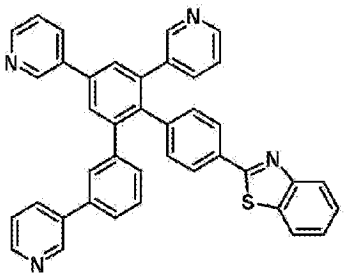
100



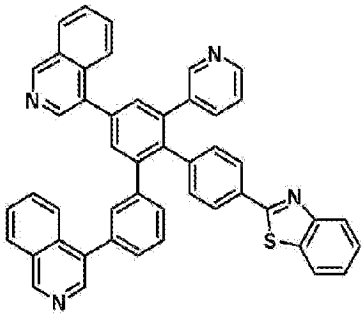
101



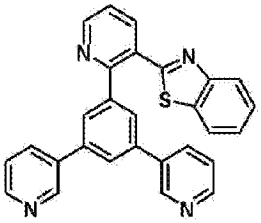
102



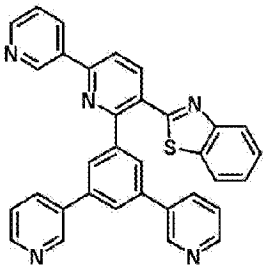
103



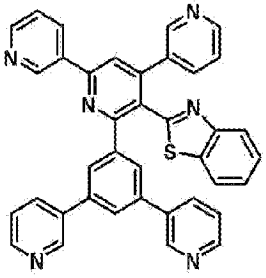
104



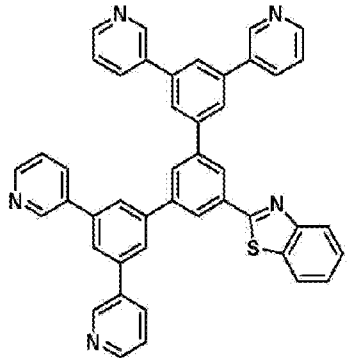
105



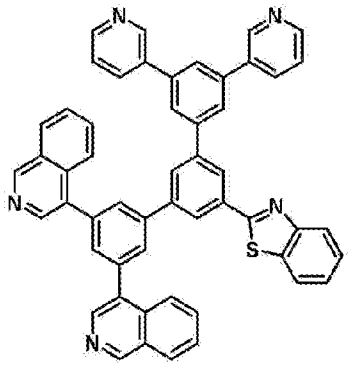
106



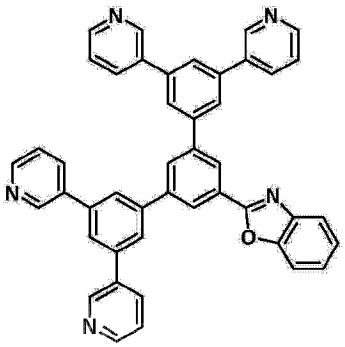
107



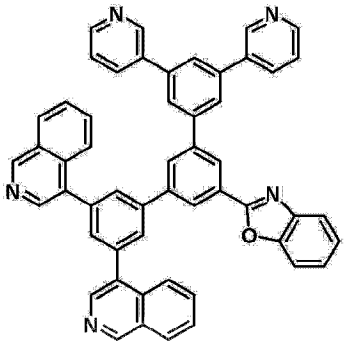
108



109



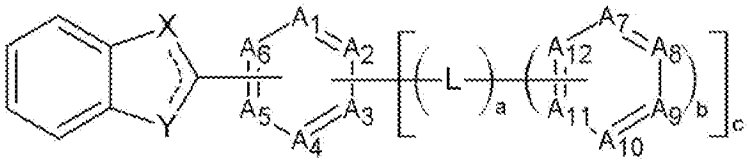
110



111

[0064] In one embodiment of the present invention, the compound for an organic photoelectric device represented by the following Chemical Formula 112 includes sequentially repeated aryls and heterocycles.

[Chemical Formula 112]



[0065] In Chemical Formula 112, A_1 to A_{12} are the same or different, and independently selected from the group consisting of CR_1 to CR_{12} and N, provided that at least one of A_7 to A_{12} is N, and R_1 to R_6 adjacent to each other can form a fused ring, and R_7 to R_{12} adjacent to each other can form a fused ring.

[0066] X is selected from the group consisting of O, S, Se and NR_{13}, Y is CR_{14} or N, provided that when X is selected from the group consisting of O, S, and Se, and Y is N,

[0067] L is a substituted or unsubstituted C6 to C50 arylene,

a is 0 or 1, provided that when a is 0, A_1 to A_6 are each independently CR_1 to CR_6, and when a is 1, at least one of A_1 to A_6 is N,

b and c are the same or different, and independently an integer ranging from 1 to 3, and

R_1 to R_{14} are the same or different, and independently selected from the group consisting of hydrogen, a halogen, a nitrile, a cyano, a nitro, an amide, a carbonyl, an ester, a substituted or unsubstituted alkyl, a substituted or unsubstituted alkylene, a substituted or unsubstituted alkoxy, a substituted or unsubstituted alkenyl, a substituted or unsubstituted alkenylene, a substituted or unsubstituted alkynyl, a substituted or unsubstituted alkynylene, a substituted or unsubstituted cycloalkyl, a substituted or unsubstituted cycloalkylene, a substituted or unsubstituted aryl, a substituted or unsubstituted arylene, a substituted or unsubstituted arylamine, a substituted or unsubstituted heteroan arylamine, a substituted or unsubstituted heterocycle, a substituted or unsubstituted amino, BRR', or SiRR'R", wehrein R, R' and R"are the same or different, and each independently a substituted or unsubstituted alkyl, or a substituted or unsubstituted aryl.

[0068] When at least adjacent two of R_1 to R_6 form a fused ring, or at least adjacent two of R_7 to R_{12} form a fused ring, a fused ring including A_1 to A_6 and a fused ring including A_7 to A_{12} may be polycyclic aryls such as naphthyl, anthracenyl, phenanthrenyl, pyrenyl, peryenyl, pyrenyl, fluorenyl, and the like. Particularly, when at least one of A_7 to A_{12} is N, one or more carbons of the polycyclic aryls may be substituted with N.

[0069] When R_7 to R_{12} are each independently substituted or unsubstituted aryl or substituted or unsubstituted arylene, the compound may be usefully applicable to an emission layer.

[0070] When X is selected from the group consisting of O, S and Se, Y is N. That is to say, at least one of X and Y is essentially N. In this case, it can lower the LUMO (lowest unoccupied molecular orbital) energy level and increase electron affinity of a molecule, and thereby improve injection and transport characteristics of electrons. Accordingly, it can reduce voltage required for driving an organic light emitting diode and improve electrical power efficiency.

[0071] The functional substitutents including X and Y provide the compound with a predetermined rigidity and thus increase intermolecular interaction. The compound for an organic photoelectric device according to one embodiment has thermal stability due to a high glass transition temperature, and thereby improves life-span of an organic light emitting diode.

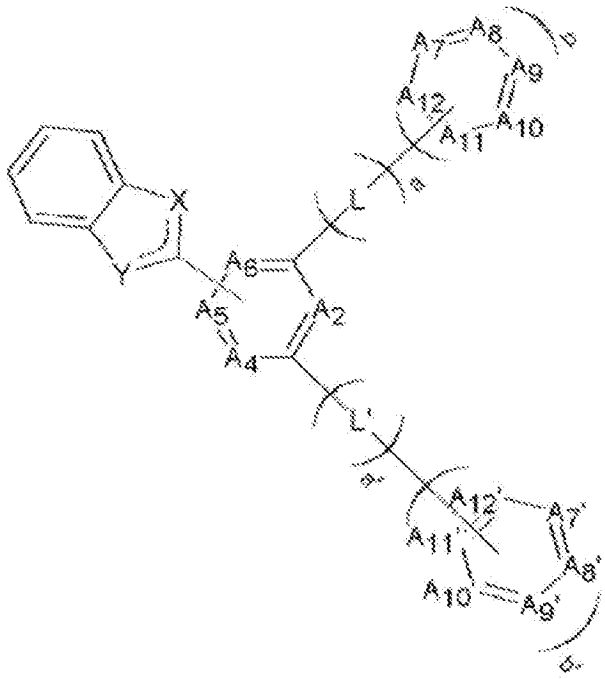
[0072] L is a substituted or unsubstituted C6 to C50 arylene. More particularly, aryls of R_7 to R_{12} and L is a C6 to C50 aryl, and the aryl may be monocyclic aryls such as phenyl; or or polycyclic aryls such as naphthyl, anthracenyl, phenanthrenyl, pyrenyl, peryenyl, and so on. The compound may be useful for a material of an emission layer.

[0073] The linking group, L can increase intermolcular interaction, and thereby improve thermal stability. In addition, it can adjust the π-conjugation length and also light emitting in a visual region. Accordingly, a compound for an organic photoelectric device according to the present invention can be usefully applied to an emission layer.

[0074] b and c are integers ranging from 1 to 3, and when b and c are 2 or more, each repeating unit may be different.

[0075] Particularly, when c is 2, two repeating units are linked to each other at a meta position of the benzene ring including A_1 to A_6. The compound for an organic photoelectric device according to one embodiment may include the compound represented by the following Chemical Formula 113:

[Chemical Formula 113]



[0076] In Chemical Formula 113,

A_2, A_4 to A_{12} and A_7' to A_{12}' are the same or different, and are each independently selected from the group consisting of CR_2, CR_4 to CR_{12}, CR_7' to CR_{12}' and N, provided at least one of A_7 to A_{12} is N, and east one of A_7' to A_{12}' is N, wherein R_4 to R_6 adjacent to each other can form a fused ring, R_7 to R_{12} adjacent to each other can form a fused ring, and R_7' to R_{12}' adjacent to each other can form a fused ring,

X is selected from the group consisting of O, S, Se and NR_{13}, Y is CR_{14} or N, provided that when X is selected from the group consisting of O, S, and Se, and Y is N,

L and L' are the same or different, and are each independently is a substituted or unsubstituted C6 to C50 arylene,

a and a' are the same or different, and are each independently 0 or 1, provided that when a and a' are each independently 0, A_2, A_4 to A_6 are each independently CR_2, and CR_4 to CR_6, and when a and a' are each independently 1, at least one of A_2, and A_4 to A_6 is N,

b and b' are the same or different, and independently an integer ranging from 1 to 3, and

R_2, R_4 to R_{14}, and R_7' to R_{12}' are the same or different, and independently hydrogen, a halogen, a nitrile, a cyano, a nitro, an amide, a carbonyl, an ester, a substituted or unsubstituted alkyl, a substituted or unsubstituted alkylene, a substituted or unsubstituted alkoxy, a substituted or unsubstituted alkenyl, a substituted or unsubstituted alkenylene, a substituted or unsubstituted alkynyl, a substituted or unsubstituted alkynylene, a substituted or unsubstituted cycloalkyl, a substituted or unsubstituted cycloalkylene, a substituted or unsubstituted aryl, a substituted or unsubstituted arylene, a substituted or unsubstituted arylamine, a substituted or unsubstituted hetero arylamine, a substituted or unsubstituted heterocycle, a substituted or unsubstituted amino, BRR', or SiRR'R", wehrein R, R' and R"are the same or different, and each independently a substituted or unsubstituted alkyl, or a substituted or unsubstituted aryl.

[0077] At least adjacent two of R_4 to R_6 can form a fused ring, at least adjacent two of R_7 to R_{12} can form a fused ring, and at least adjacent two of R_7' to R_{12}' can form a fused ring. The fused ring may be polycyclic aryls such as naphthyl, anthracenyl, phenanthrenyl, pyrenyl, peryenyl, pyrenyl, fluorenyl, and the like. Particularly, when at least one of A_7 to A_{12} is N, and at least one of A_7' to A_{12}' is N, one or more carbons of the polycyclic aryls may be substituted with N.

[0078] L and L' are the same or different, and are each independently a substituted or unsubstituted C6 to C50 arylene. More particularly, the aryl may be a C6 to C50 aryl, and the aryl may be monocyclic aryls such as phenyl; or or polycyclic aryls such as naphthyl, anthracenyl, phenanthrenyl, pyrenyl, peryenyl, and so on. The compound may be useful for a material of an emission layer.

[0079] b and b' are the same or different, and are each independently integers ranging from 1 to 3, and when b and b' are 2 or more, each repeating unit may be different.

[0080] When R_1 to R_{14} in Chemical Formula 112 and R_2, R_4 to R_{14}, and R_7' to R_{12}' in Chemical Formula 113 are a

substituted or unsubstituted aryl, a substituted or unsubstituted arylene, or a substituted or unsubstituted arylamine, the aryl may be a C6 to C50 aryl. Particularly, when the aryls are monocyclic aryls such as phenyl, biphenyl, terphenyl, styrene, and so on, or polycyclic aryls such as naphthyl, anthracenyl, phenanthrenyl, pyrenyl, peryenyl, and so on, the compound may be useful for a material of an emission layer.

[0081] When R_1 to R_{14} in Chemical Formula 112 and R_2, R_4 to R_{14}, and R_7' to R_{12}' in Chemical Formula 113 are a substituted or unsubstituted heteroarylamine, or a substituted or unsubstituted heteroaryl, the aryl may be the same as described above. The heteroaryl may refer to an aryl including 1 to 3 heteroatoms of N, O, S, or P, and remaining carbons.

[0082] R_1 to R_{14} in Chemical Formula 112 and R_2, R_4 to R_{14}, and R_7' to R_{12}' in Chemical Formula 113 is a substituted or unsubstituted arylamine, the arylamine may be selected from the group consisting of diphenyl amine, dinaphthyl amine, dibiphenyl amine, phenyl naphthyl amine, phenyl diphenyl amine, ditolyl amine, phenyl tolyl amine, carbazolyl, and triphenyl amine, which provides balance between electron and hole mobility characteristics.

[0083] When R_1 to R_{14} in Chemical Formula 112 and R_2, R_4 to R_{14}, and R_7' to R_{12}' in Chemical Formula 113 are a substituted or unsubstituted heterocycle, the heterocycle the heterocycle is selected from the group consisting of thiophenyl, furanyl, pyrrolyl, imidazolyl, thiazolyl, oxazolyl, oxadiazolyl, triazolyl, pyridinyl, pyridazinyl, quinolinyl, isoquinolinine, acridyl, imidazopyridinyl, and imidazopyrimidinyl.

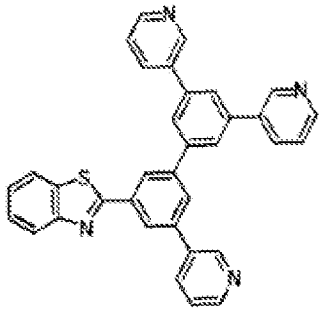
[0084] Particularly, a substituent linked to nitrogen (N) of the imidazolyl or triazolyl is selected from the group consisting of a substituted or unsubstituted alkyl such as a substituted or unsubstituted methyl, a substituted or unsubstituted ethyl, a substituted or unsubstituted propyl, a substituted or unsubstituted isopropyl, a substituted or unsubstituted butyl, a substituted or unsubstituted t-butyl, a substituted or unsubstituted pentyl, a substituted or unsubstituted hexyl, and a substituted or unsubstituted heptyl; a substituted or unsubstituted cycloalkyl such as a substituted or unsubstituted cyclopentyl, a substituted or unsubstituted cyclohexyl, and so on; a substituted or unsubstituted aryl such as a substituted or unsubstituted phenyl, a substituted or unsubstituted biphenyl, a substituted or unsubstituted naphthyl, and so on; and a substituted or unsubstituted heterocycle. The heterocycle is preferably a heteroaryl such as pyridyl, bipyridyl, quinolyl, isoquinolyl, and so on.

[0085] At least one of R_1 to R_{12} in Chemical Formula 112 and at least one of R_2, R_4 to R_{12}, and R_7' to R_{12}' in Chemical Formula 113 are substituted with at least one of substituent selected from an amine-substituted alkyl, an amine-substituted cycloalkyl, an amine-substituted aryl, and an amine-substituted heterocycle, which makes the compound be applicable to a hole injection layer (HIL) or a hole transport layer (HTL).

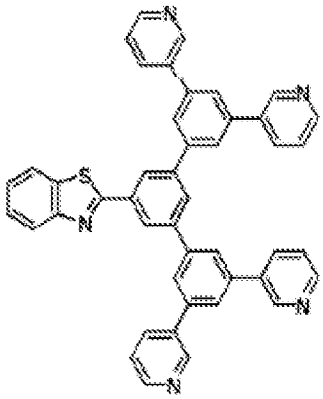
[0086] At least one R_1 to R_{12} in Chemical Formula 112 and at least one of R_2, R_4 to R_{12}, R_7' to R_{12}' in Chemical Formula 113 is substituted with a substituent selected from the group consisting of a nitrile, a nitro, an amide, a carbonyl, and a substituted or unsubstituted heterocycle, which reinsforces an electron injection or transport capability and thereby makes the compound be applicable to an electron injection layer (EIL) or an electron transport layer (ETL). Accordingly, hole transport and electron transport capibilties may be simultaneously improved.

[0087] The various substituents of the above-described compound represented by the above Formulae 112 and 113 do not change principal properties of the compound for an organic photoelectric device according to one embodiment.

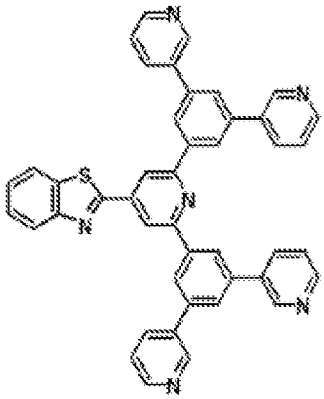
[0088] Examples of the compounds for an organic photoelectric device according to one embodiment of the present invention include the compounds represented by the following Formulae 114 to 183, but are not limited thereto.



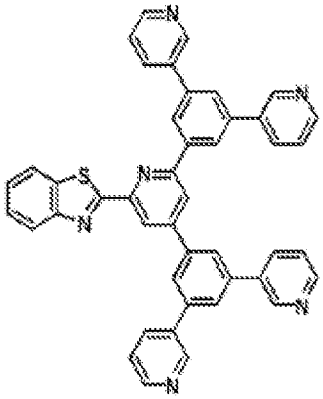
114



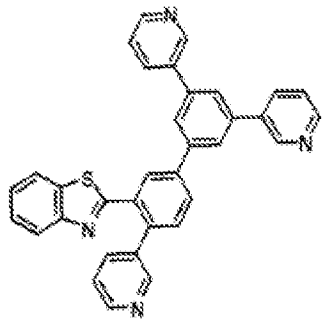
115



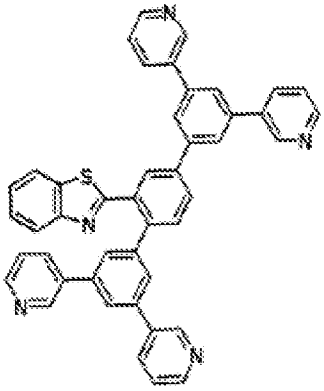
116



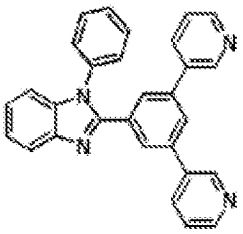
117



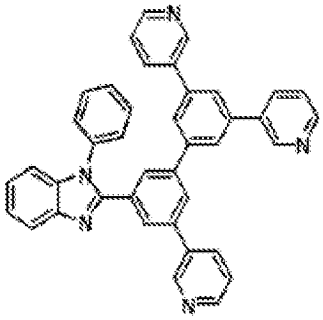
118



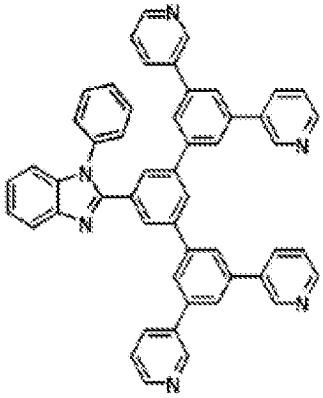
119



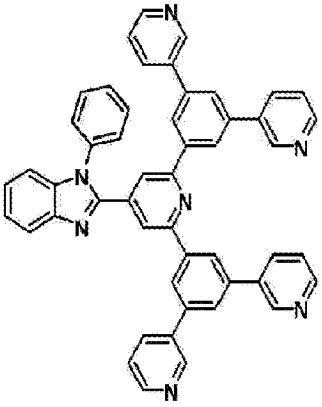
120



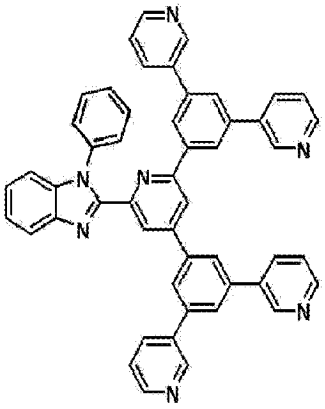
121



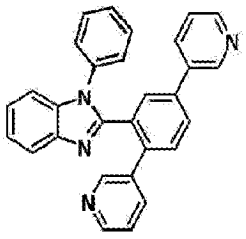
122



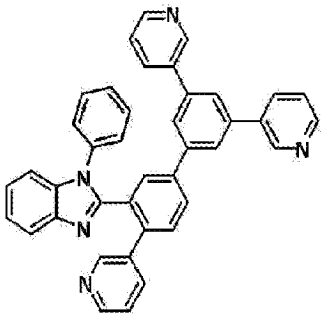
123



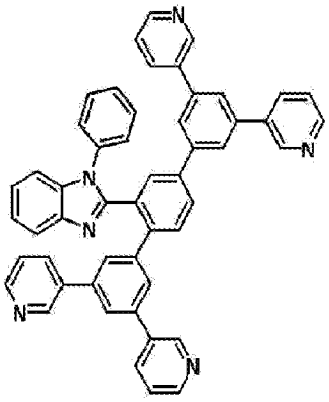
124



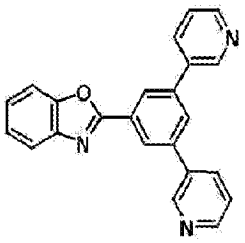
125



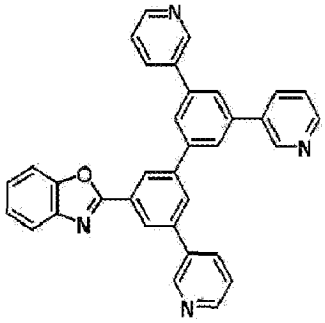
126



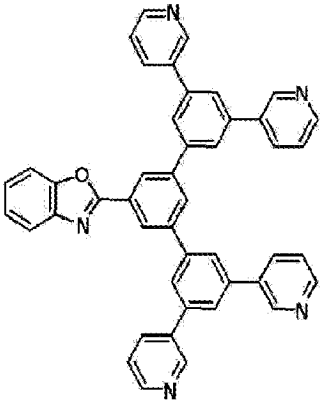
127



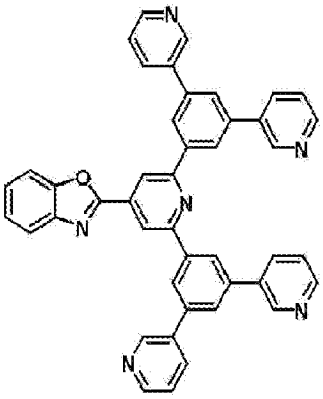
128



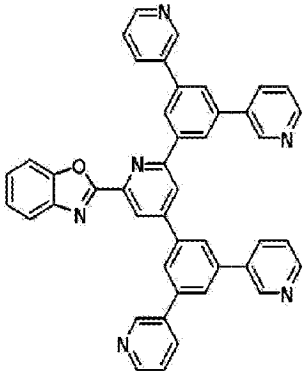
129



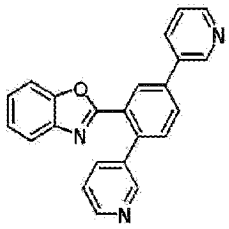
130



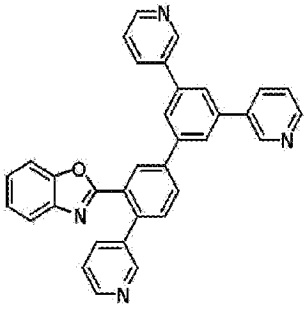
131



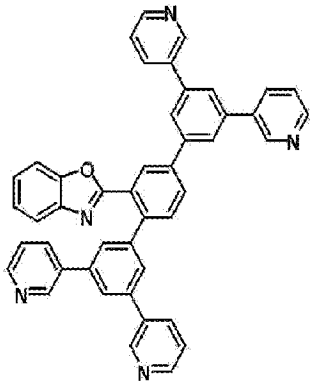
132



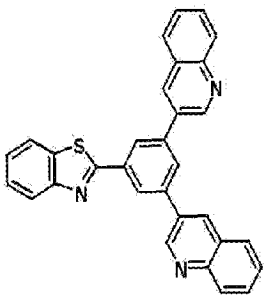
133



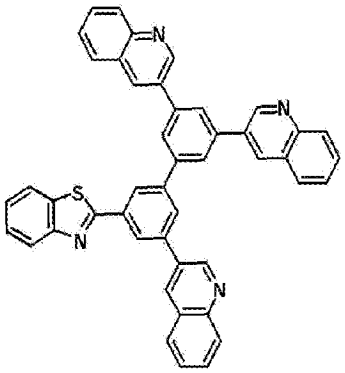
134



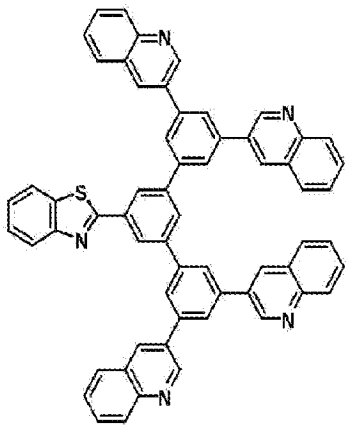
135



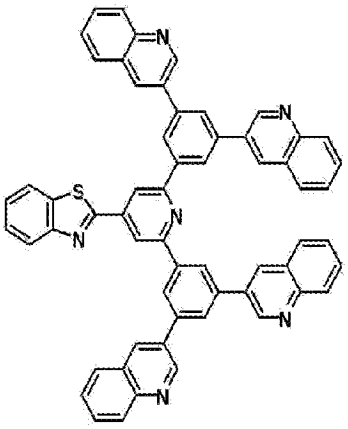
136



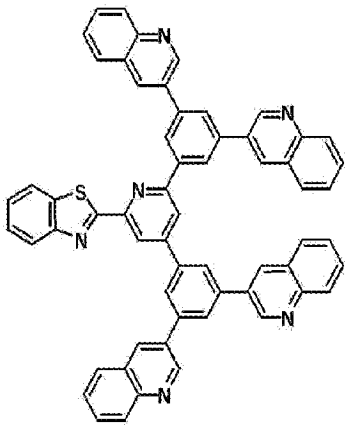
137



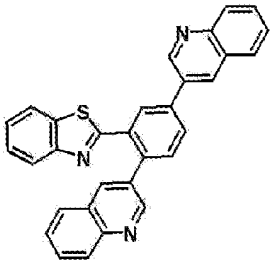
138



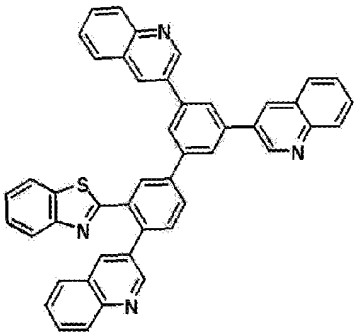
139



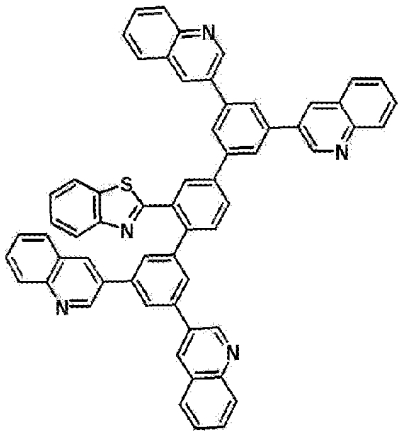
140



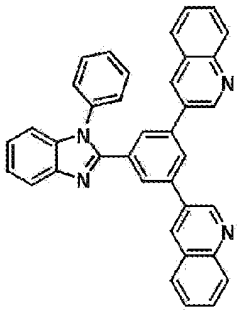
141



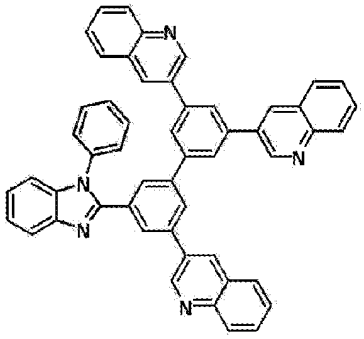
142



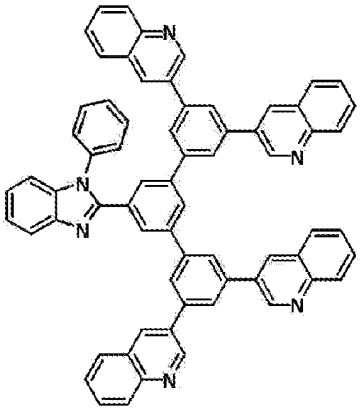
143



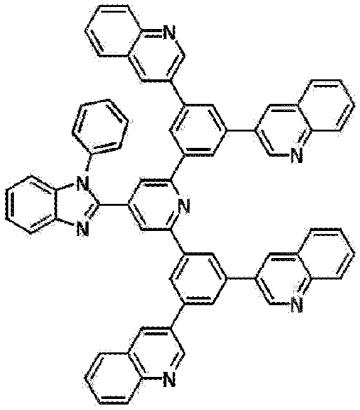
144



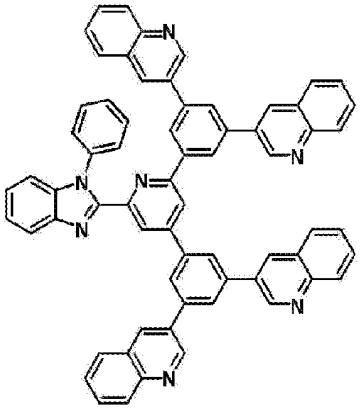
145



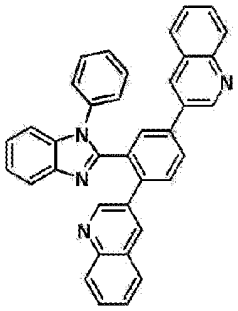
146



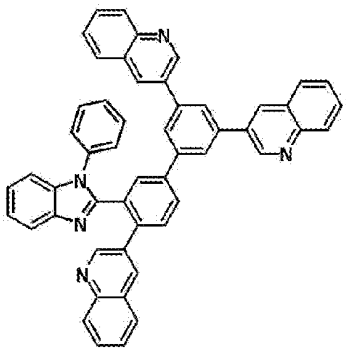
147



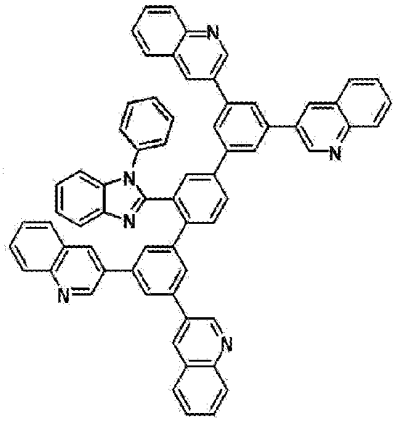
148



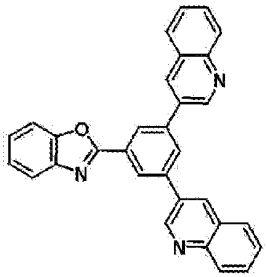
149



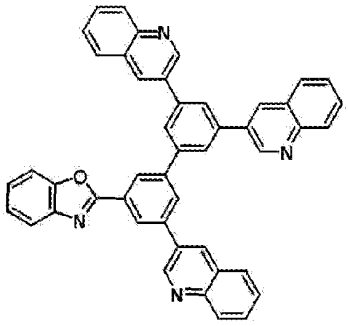
150



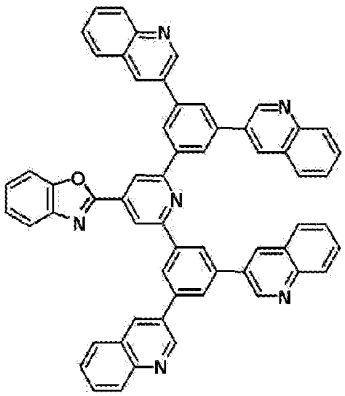
151



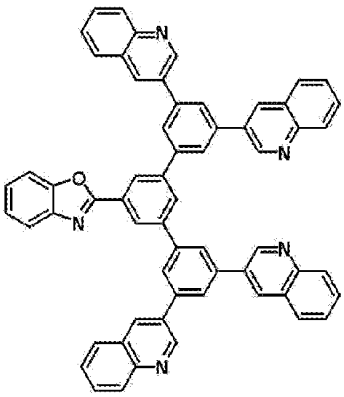
152



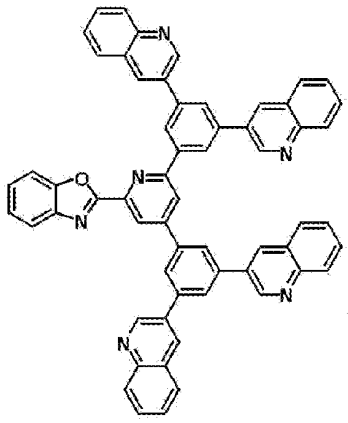
153



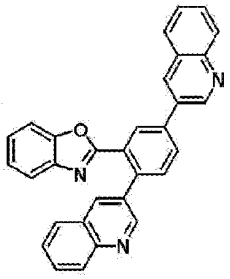
154



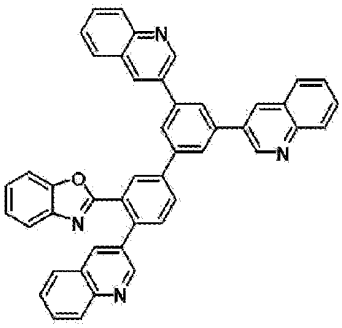
155



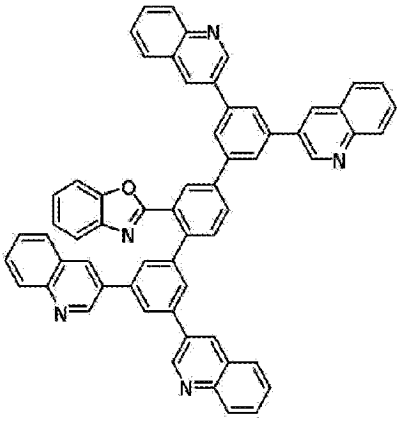
156



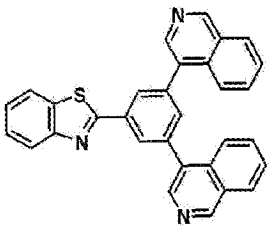
157



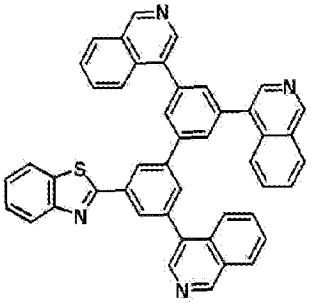
158



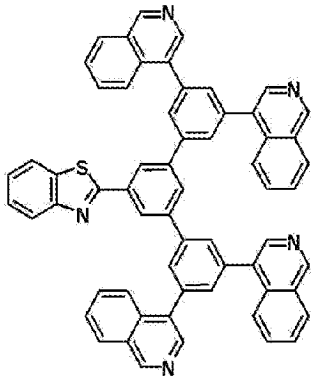
159



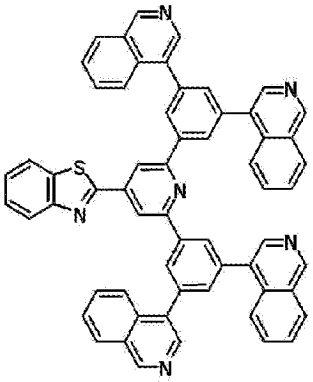
160



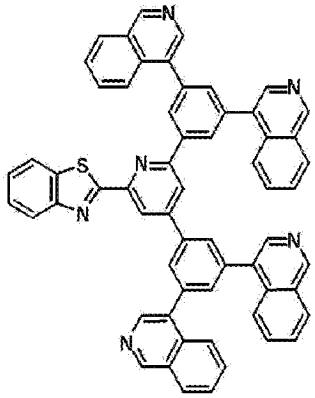
161



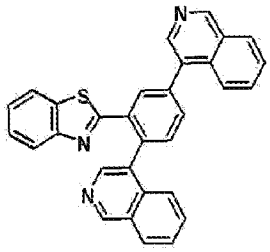
162



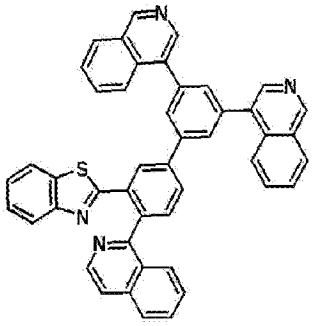
163



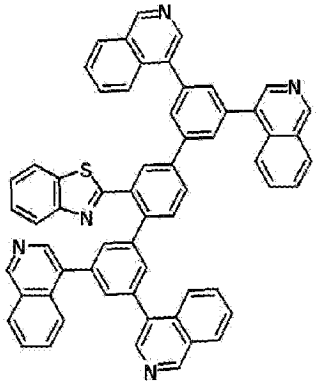
164



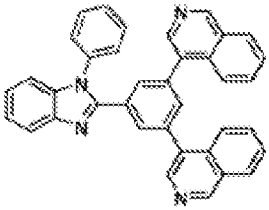
165



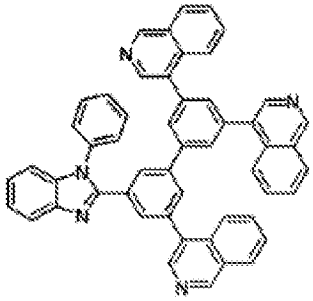
166



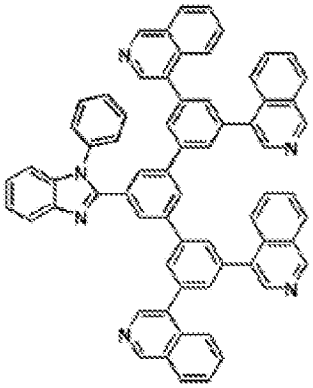
167



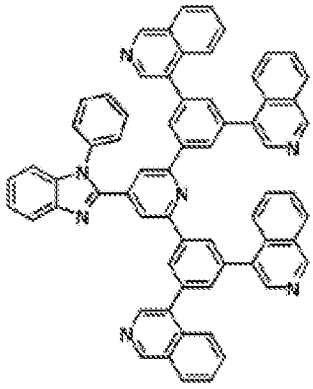
168



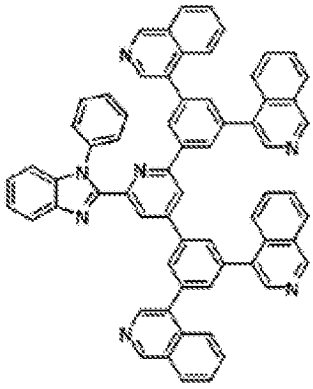
169



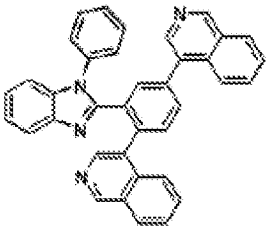
170



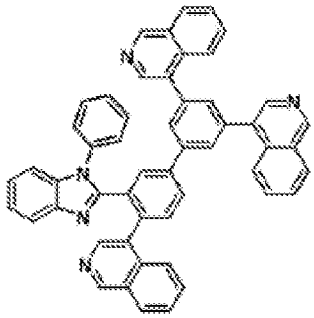
171



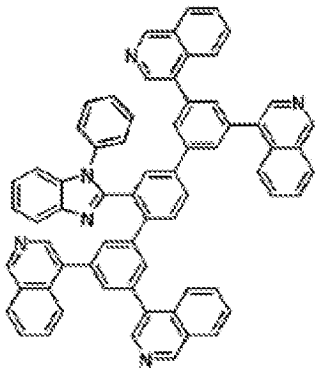
172



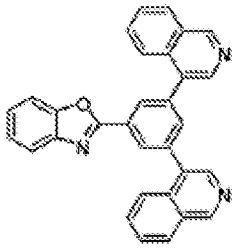
173



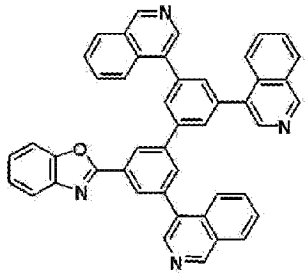
174



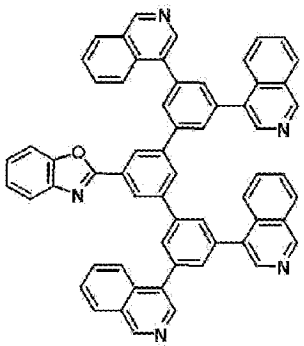
175



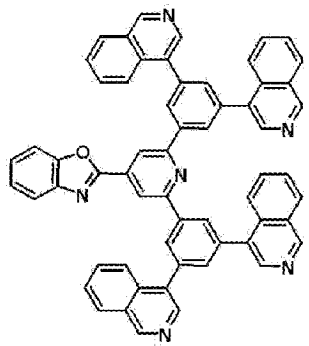
176



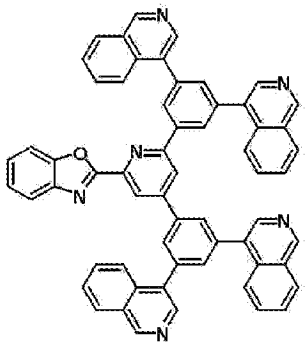
177



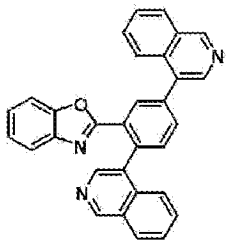
178



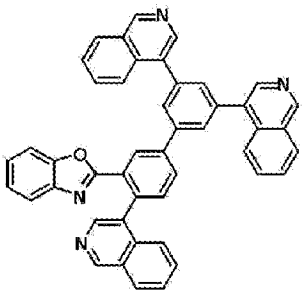
179



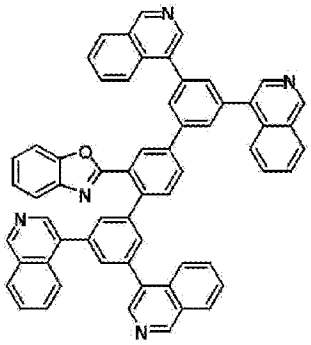
180



181



182



183

[0089] A compound for an organic photoelectric device including the above compound can play a role of hole injection, hole transport, light emitting, or electron injection and/or transport, and also as a light emitting host with an appropriate dopant. The compound for an organic photoelectric device can improve thermal stability and decrease a driving voltage for improving life-span and efficiency characteristics of an organic photoelectric device when included in an organic thin layer.

[0090] The compound for an organic photoelectric device including the above compound can play a role of hole and electron transport, and also as a light emitting host with an appropriate dopant. Particularly, the dopant may be a reducing dopant. The reducing dopant is selected from the group consisting of an alkaline metal, an alkaline earth metal, a rare earth element metal, an oxide of an alkaline metal, a halide of an alkaline metal, an organic complex of an alkaline metal, an oxide of an alkaline earth metal, a halide of an alkaline earth metal, an organic complex of an alkaline earth metal, an oxide of an alkaline earth metal, a halide of an alkaline earth metal, an organic complex of an alkaline earth metal, an oxide of a rare earth element metal, a halide of a rare earth element metal, and an organic complex of a rare earth element metal.

[0091] The new compound for an organic photoelectric device can be usefully used for a host material or a charge transfer material. Herein, the organic photoelectric device may include an organic light emitting diode, an organic solar cell, an organic transistor, an organic memory device, and the like.

[0092] As for an organic solar cell, the new compound of the present invention is included in an electrode or an electrode buffer layer and can thereby improve quantum efficiency. As for an organic transistor, it can be used as an electrode material in a gate, a source-drain electrode, and the like.

[0093] Hereinafter, an organic light emitting diode is illustrated in more detail. An organic photoelectric device according to another embodiment of the present invention includes the compound for an organic photoelectric device in at least one layer among organic thin layers, when an organic photoelectric device in general includes an anode, a cathode, and at least one organic thin layer disposed between the anode and cathode.

[0094] An organic light emitting diode includes a new compound having various energy band gaps, and thereby satisfies various conditions required for a hole injection layer (HIL), a hole transport layer (HTL), an emission layer, an electron injection layer (EIL), an electron transport layer (ETL), and the like. Accordingly, the organic light emitting diode can realize a low driving voltage and high luminous efficiency.

[0095] The organic thin layer can include one selected from the group consisting of an emission layer, an electron transport layer (ETL), an electron injection layer (EIL), a hole transport layer (HTL), a hole injection layer (HIL), and a hole blocking layer. At least one layer includes a compound for an organic photoelectric device according to the present invention.

[0096] FIGS. 1 to 5 are cross-sectional views showing organic photoelectric devices including the novel organic compounds according to various embodiments of the present invention.

[0097] Referring to FIGS. 1 to 5, the organic photoelectric devices 100, 200, 300, 400, and 500 according to one embodiment includes at least one organic thin layer 105 interposed between an anode 120 and a cathode 110.

[0098] The anode 120 includes an anode material laving a large work function to help hole injection into an organic thin layer. The anode material includes a metal such as nickel, platinum, vanadium, chromium, copper, zinc, and gold, or alloys thereof; a metal oxide such as zinc oxide, indium oxide, indium tin oxide (ITO), and indium zinc oxide (IZO); a combined metal and oxide such as ZnO:Al or SnO_2:Sb; or a conductive polymer such as poly(3-methylthiophene), poly [3,4-(ethylene-1,2-dioxy)thiophene] (PEDT), polypyrrole, and polyaniline, but is not limited thereto.

[0099] The cathode 110 includes a cathode material having a small work function to help electron injection into an organic thin layer. The cathode material includes a metal such as magnesium, calcium, sodium, potassium, titanium, indium, yttrium, lithium, gadolinium, aluminum, silver, tin, and lead, or alloys thereof; or a multi-layered material such as LiF/Al, Liq/Al, LiO_2/Al, LiF/Ca, LiF/Al, and BaF_2/Ca, but is not limited thereto.

[0100] Referring to FIG. 1, the organic photoelectric device 100 includes an organic thin layer 105 including only an emission layer 130.

[0101] Referring to FIG. 2, a double-layered organic photoelectric device 200 includes an organic thin layer 105 including an emission layer 230 including an electron transport layer (ETL), and a hole transport layer (HTL) 140. The emission layer 130 also functions as an electron transport layer (ETL), and the hole transport layer (HTL) 140 layer has an excellent binding property with a transparent electrode such as ITO or an excellent hole transporting property.

[0102] Referring to FIG. 3, a three-layered organic photoelectric device 300 includes an organic thin layer 105 including an electron transport layer (ETL) 150, an emission layer 130, and a hole transport layer (HTL) 140. The emission layer 130 is independently installed, and layers having an excellent electron transporting property or an excellent hole transporting property are separately stacked.

[0103] As shown in FIG. 4, a four-layered organic photoelectric device 400 includes an organic thin layer 105 including an electron injection layer (EIL) 160, an emission layer 130, a hole transport layer (HTL) 140, and a hole injection layer (HIL) 170 for binding with the cathode of ITO.

[0104] As shown in FIG. 5, a five layered organic photoelectric device 500 includes an organic thin layer 105 including an electron transport layer (ETL) 150, an emission layer 130, a hole transport layer (HTL) 140, and a hole injection layer (HIL) 170, and further includes an electron injection layer (EIL) 160 to achieve a low voltage.

[0105] The light emitting diode can be fabricated by forming an anode on a substrate, forming an organic thin layer, and forming a cathode thereon. The organic thin layer can be formed by a dry coating method such as evaporation, sputtering, plasma plating, and ion plating, or a wet coating method such as spin coating, dipping, and flow coating.

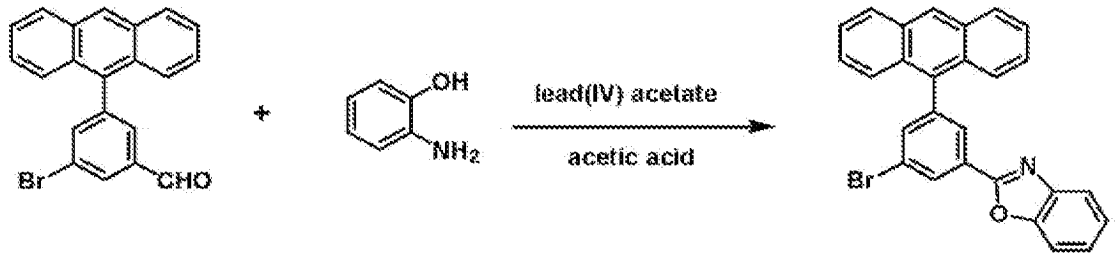
[0106] Another embodiment of the present invention provides a display device including the organic photoelectric device according to the above embodiment.

[0107] Hereinafter, the embodiments are illustrated in more detail with reference to examples. However, it is understood that the present invention is not limited by these examples.

Synthesis Example 1: Synthesis of 2-(3-(anthracen-9-yl)-5-bromophenyl)benzo[d]oxazole

[0108]

[Reaction Scheme 1]

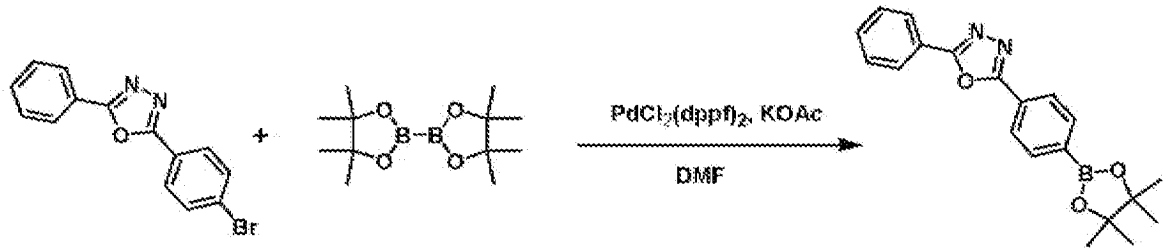


[0109] 10 g (27.7 mmol) of 3-(anthracen-9-yl)-5-bromobenzaldehyde and 3.6 g (33.2 mmol) of 2-aminophenol were dissolved in 100 ml of acetic acid, and then agitated at room temperature for 30 minutes. Next, 14.7 g (33.2 mmol) of lead (IV) acetate was added thereto. The resulting mixture was agitated at 50°C for 1 hour. Then, water was poured therein. The resulting product was treated with ethylacetate to perform extraction, and then the solvent was removed under a reduced pressure. The extract was separated through a column and dried, obtaining 4.5 g (Y=33 %) of a white solid.

Synthesis Example 2: Synthesis of 2-(4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl)-5-phenyl-1,3,4-oxadiaz ole

[0110]

[Reaction Scheme 2]

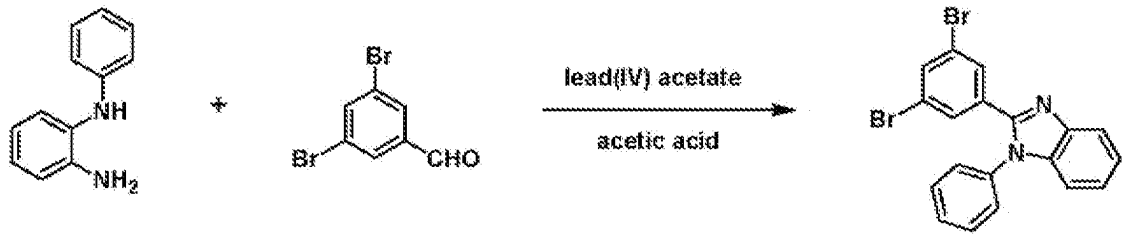


[0111] 5 g (16.6 mmol) of 2-(4-bromophenyl)-5-phenyl-1,3,4-oxadiazole, 5.1 g (19.9 mmol) of bis(pinacolato)diboron, 0.41 g (3 mol%) of a complex of [1,1'-bis(diphenylphosphino)ferrocene]dichloro-palladium (II) with dichloromethane, and 4.9 g (49.8 mmol) of potassium acetate were dissolved in 100 ml of dimethylformaimde (DMF). The solution was reacted at 80°C for 12 hours. The reactant was extracted with ethylacetate. The extract was treated under a reduced pressure to remove the solvent and separated through a column, obtaining 3.1 g (Y=53 %) of a light yellow solid.

Synthesis Example 3: Synthesis of 2-(3,5-dibromopheny)-1-phenyl-1H-benzo[d]imidazole

[0112]

[Reaction Scheme 3]



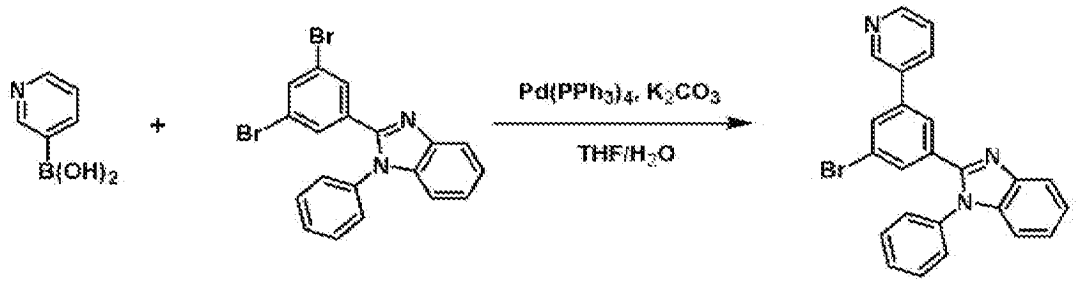
[0113] 20 g (75.8 mmol) of 3,5-dibromobenzaldehyde and 16.8 g (90.9 mmol) of N-phenyl-o-phenylenediamine were dissolved in 150 mL of acetic acid. The solution was agitated at room temperature for 30 minutes. Next, 37 g (83.4 mmol) of lead(IV) acetate was added thereto. The resulting product was agitated at 50°C for 1 hour. Then, water was poured into the obtained reactant.

The resulting product was treated with ethylacetate to perform extraction and the solvent was removed under a reduced pressure. The extract was separated through a column and dried, obtaining 9.5 g (Y=29 %) of a yellow solid.

Synthesis Example 4: Synthesis of 2-(3-bromo-5-(pyridin-3-yl)phenyl)-1-phenyl-1H-benzo[d]imidazole

[0114]

[Reaction Scheme 4]

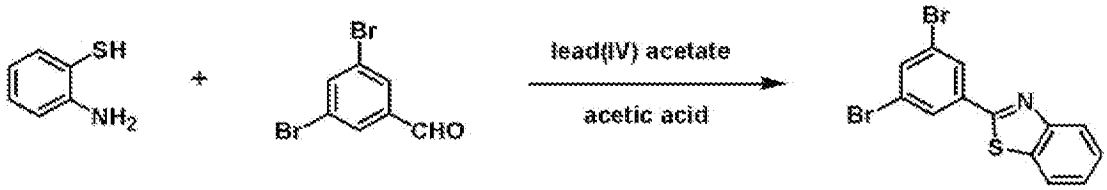


[0115] 9.4 g (22.0 mmol) of 2-(3,5-dibromophenyl)-1-phenyl-1H-benzo[d]imidazole according to Synthesis Example 3, 2.7 g (22.0 mmol) of pyridine-3-boronic acid, 0.76 g (3 mol%) of tetrakis(triphenylphosphine)palladium (0), and 6.1 g (44.0 mmol) of potassium carbonate were dissolved in 300 ml of tetrahydrofuran/ H_2O mixed in a volume ratio of 2/1. The solution was reacted at 80°C for 12 hours. The obtained reactant was extracted with ethylacetate and treated under a reduced pressure to remove the solvent therein. The reactant was separated through a column and dried, obtaining 5.15 g (Y=54 %) of a yellow solid.

Synthesis Example 5: Synthesis of 2-(3,5-dibromophenyl)benzo[d]thiazole

[0116]

[Reaction Scheme 5]

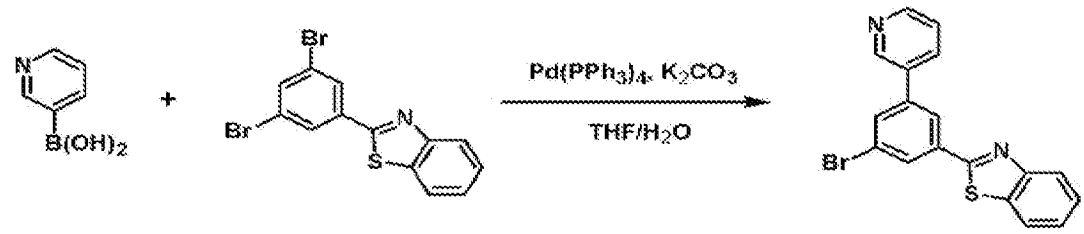


[0117] 5.03 g (19.1 mmol) of 3,5-dibromobenzaldehyde and 3.1 mL (28.6 mmol) of 2-aminothiophenol were dissolved in 60 mL of acetic acid. The solution was agitated at room temperature for 30 minutes. 9.78 g (21.0 mmol) of lead(IV) acetate was added thereto. The resulting mixture was agitated at 50°C for 1 hour. Then, water was poured into the reactant. It was extracted with ethylacetate. The extract was separated through a column and dried, obtaining 4.74 g (Y=67 %) of a white solid.

Synthesis Example 6: Synthesis of 2-(3-bromo-5-(pyridin-3-yl)phenyl)benzo[d]thiazole

[0118]

[Reaction Scheme 6]

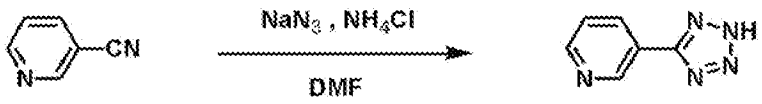


[0119] 4.74 g (12.8 mmol) of 2-(3,5-dibromophenyl)benzo[d]thiazole) according to Synthesis Example 5, 1.89 g (15.4 mmol) of pyridine-3-boronic acid, 0.44 g (3 mol%) of tetrakis(triphenylphosphine)palladium (0), and 5.31 g (38.4 mmol) of potassium carbonate were dissolved in 50 ml of tetrahydrofuran/H_2O mixed in a volume ratio of 4/1. The solution was reacted at 80°C for 12 hours. The obtained reactant was extracted with ethylacetate and treated under a reduced pressure to remove the solvent. The extract was separated through a column and dried, obtaining 2.54 g (Y=54 %) of a white solid.

Synthesis Example 7: Synthesis of 3-(2H-tetrazol-5-yl)pyridine

[0120]

[Reaction Scheme 7]

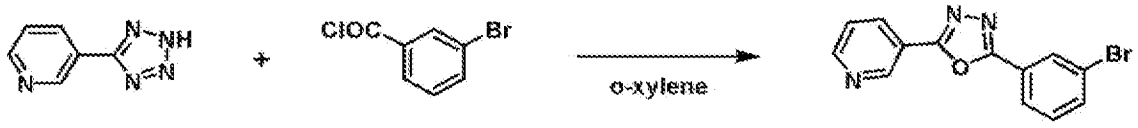


[0121] 30 g (288 mmol) of 3-pyridinecarbonitrile, 28.1 g (432 mmol) of sodium azide (NaN_3), and 23.1 g (432 mmol) of ammonium chloride were dissolved in 200 mL of DMF. The solution was reacted at 100°C for 24 hours. Then, water was added to the obtained reactant. The resulting product was neutralized with hydrochloric acid and then fitered, obtaining 19.6 g (Y=46 %) of a white solid.

Synthesis Example 8: Synthesis of 3-(5-(3-bromophenyl)-1,3,4-oxadiazol-2-yl)pyridine

[0122]

[Reaction Scheme 8]

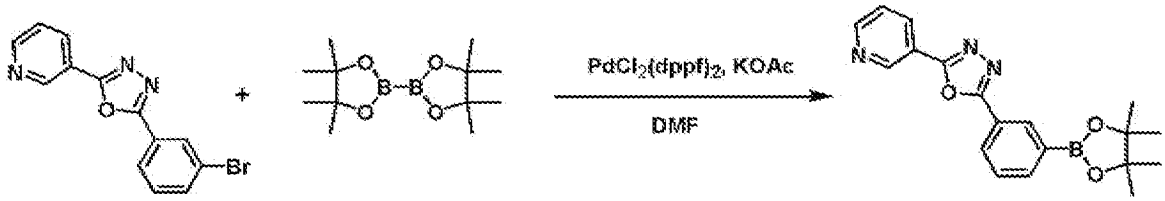


[0123] 16.8 g (114 mmol) of 3-(2H-tetrazol-5-yl)pyridine) according to Synthesis Example 7 and 25 g (114 mmol) of 3-bromobenzoylchloride were dissolved in 180 mL of o-xylene. The solution was reacted at 150°C for 8 hours. The obtained reactant was purified under a reduced pressure and washed with methanol, obtaining 30 g (Y=87 %) of a white solid.

Synthesis Example 9: Synthesis of 3-(5-(3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl)-1,3,4-oxadiazol-2-yl)py ridine

[0124]

[Reaction Scheme 9]

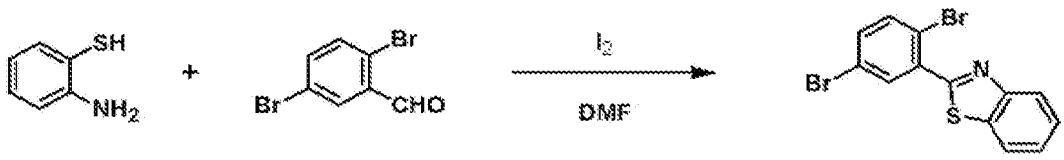


[0125] 12 g (40 mmol) of 3-(5-(3-bromophenyl)-1,3,4-oxadiazol-2-yl)pyridine according to Synthesis Example 8, 12.2 g (48 mmol) of bis(pinacolato)diboron, 0.98 g (3 mol%) of a complex of [1,1'-bis(diphenylphosphino)ferrocene]dichloropalladium(II) with dichloromethane, 5.9 g (60 mmol) of potassium acetate were dissolved in 250 ml of dimethylformaimde (DMF). The solution was reacted at 80 °C for 12 hours. The obtained reactant was extracted with ethylacetate and treated under a reduced pressure to remove the solvent. The extract was separated through a column and dried, obtaining 10 g (Y=71 %) of a white solid.

Synthesis Example 10: Synthesis of 2-(2,5-dibromophenyl)benzo[d]thiazole

[0126]

[Reaction Scheme 10]



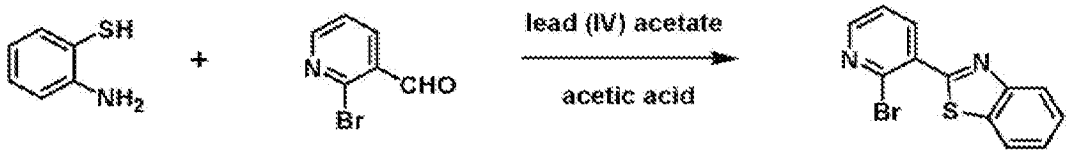
[0127] 5 g (18.5 mmol) of 2,5-dibromobenzaldehyde, 3 mL (27.7 mmol) of 2-aminothiophenol, and 2.35 g (9.25 mmol)

of iodine were dissolved in 100 mL of DMF. The solution was reacted at 100°C for 1 hour. The obtained reactant was purified through a column, obtaining 4.64 g (Y=68 %) of a white solid.

Synthesis Example 11: Synthesis of 2-(2-bromopyridin-3-yl)benzo[d]thiazole

[0128]

[Reaction Scheme 11]

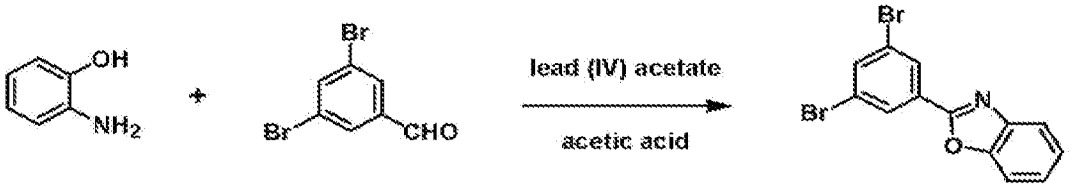


[0129] 6.58 g (34.0 mmol) of 2-bromo-3-pyrdinecarboxaldehyde and 5.5 mL (50.9 mmol) of 2-aminothiophenol were dissolved in 150 mL of acetic acid. The solution was agitated at room temperature for 30 minutes. Next, 19.0 g (40.8 mmol) of lead (IV) acetate was added thereto. The resulting product was agitated at 50°C for 1 hour. Then, water was added to the obtained reactant.
The mixture was extracted with ethylacetate and treated under a reduced pressure to remove the solvent, obtaining 5.55 g (Y=55 %) of a white solid.

Synthesis Example 12: Synthesis of 2-(3,5-dibromophenyl)benzo[d]oxazole

[0130]

[Reaction Scheme 12]

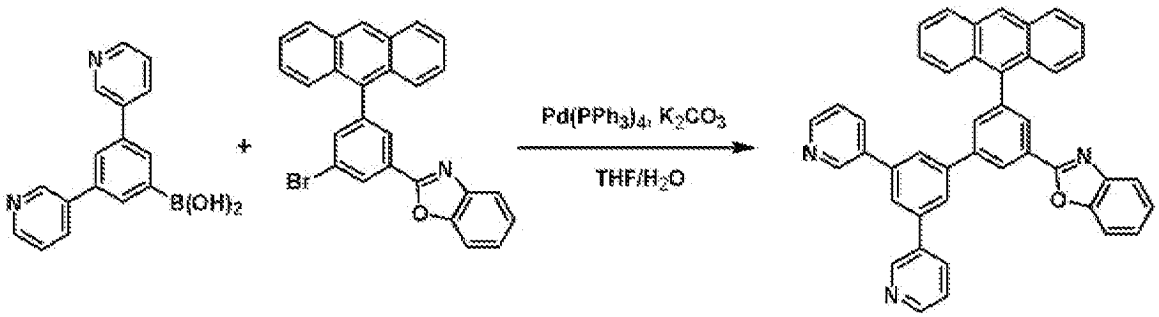


[0131] 10 g (37.9 mmol) of 3,5-dibromobenzaldehyde and 5 g (45.5 mmol) of 2-aminophenol were dissolved in 200 mL of acetic acid. The solution was agitated at room temperature for 30 minutes. Next, 20.2 g (45.5 mmol) of lead(IV) acetate was added thereto. The resulting product was agitated at 50°C for 1 hour. Then, water was added to the obtained reactant. The mixture was extracted with ethylacetate and treated under a reduced pressure to remove the solvent, obtaining 5.7 g (Y=42 %) of a white solid.

Example 1: Synthesis of a compound of Chemical Formula 44

[0132]

[Reaction Scheme 13]

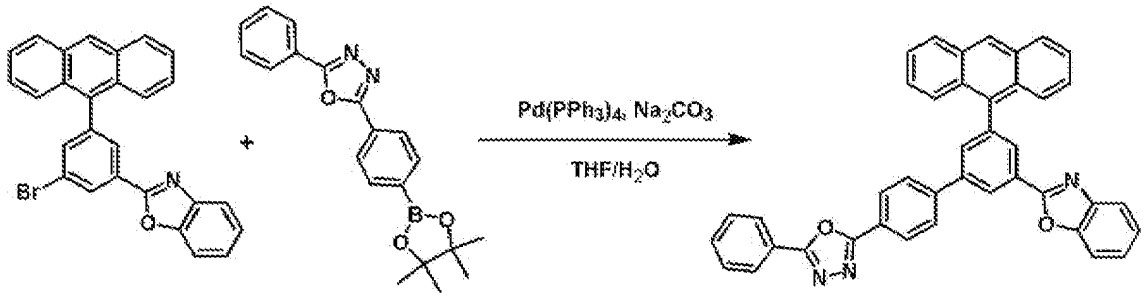


[0133] 5 g (18.1 mmol) of 3,5-di-(3-pyridinyl)-benzene boronic acid), 8.16 g (18.1 mmol) of 2-(3-(anthracen-9-yl)-5-bromophenyl)benzo[d]oxazole according to Synthesis Example 1, 0.63 g (3 mol%) of tetrakis(triphenylphosphine)palladium (0), and 5 g (36.2 mmol) of potassium carbonate were dissolved in 450 ml of a solvent of tetrahydrofuran/H_2O mixed in a volume ratio of 2/1. The solution was reacted at 80°C for 12 hours. The obtained reactant was extracted with ethylacetate and treated under a reduced pressure to remove the solvent. The extract was separated through a column and dried, obtaining 6 g (Y=55 %) of a white solid.

Example 2: Synthesis of a compound of Chemical Formula 64

[0134]

[Reaction Scheme 14]

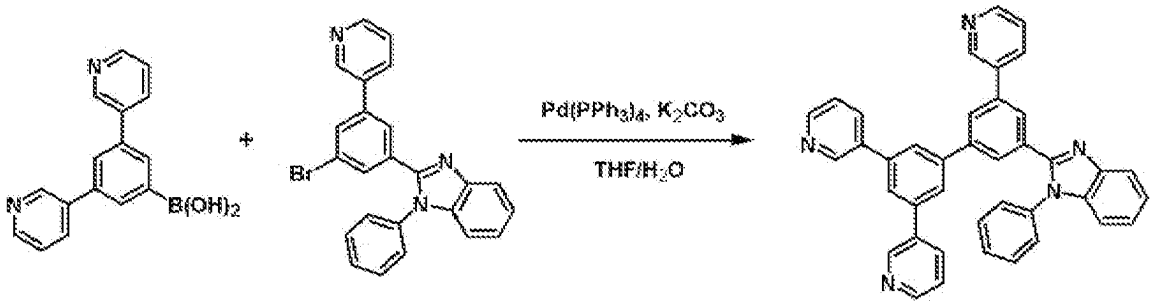


[0135] 2.32 g (6.7 mmol) of (2-(4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl)-5-phenyl-1,3,4-oxadia zole according to Synthesis Example 2, 2.5 g (5.5 mmol) of 2-(3-(anthracen-9-yl)-5-bromophenyl)benzo[d]oxazole according to Synthesis Example 1, 0.19 g (3 mol%) of tetrakis(triphenylphosphine)palladium (0), and 1.2 g (11.1 mmol) of sodium carbonate were dissolved in 90 ml of a solvent of tetrahydrofuran/H_2O mixed in a volume ratio of 2/1. The solution was reacted at 80°C for 12 hours. The obtained reactant was extracted with ethylacetate and treated under a reduced pressure to remove the solvent. The extract was separated through a column and dried, obtaining 2.6 g (Y=79 %) of a white solid.

Example 3: Synthesis of a compound of Chemical Formula 83

[0136]

[Reaction Scheme 15]

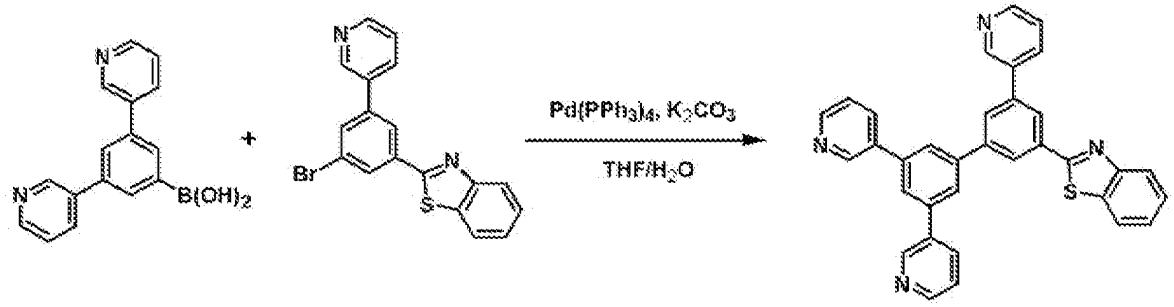


[0137] 4.14 g (15.0 mmol) of 3,5-di-(3-pyridinyl)-benzene boronic acid, 6.4 g (15.0 mmol) of 2-(3-bromo-5-(pyridin-3-yl)phenyl)-1-phenyl-1H-benzo[d]imidazole according to Synthesis Example 4, 0.52 g (3 mol%) of tetrakis(triphenylphosphine)palladium (0), and 4.15 g (30.0 mmol) of potassium carbonate were dissolved in 300 ml of a solvent of tetrahydrofuran/H_2O mixed in a volume ratio of 2/1. The solution was reacted at 80°C for 12 hours. The obtained reactant was extracted with ethylacetate and treated under a reduced pressure to remove the solvent. The extract was separated through a column and dried, obtaining 1.2 g (Y=13 %) of a white solid.

Example 4: Synthesis of a compound of Chemical Formula 87

[0138]

[Reaction Scheme 16]

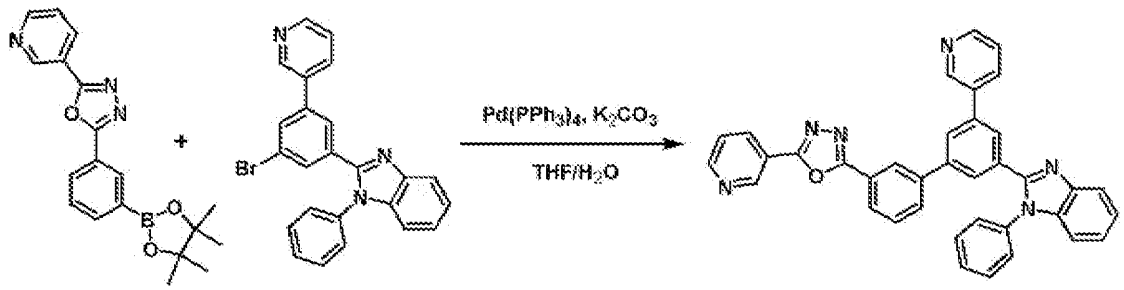


[0139] 0.84 g (3.1 mmol) of 3,5-di-(3-pyridinyl)-benzene boronic acid), 1.0 g (2.8 mmol) of 2-(3-bromo-5-(pyridin-3-yl) phenyl)benzo[d]thiazole according to Synthesis Example 6, 0.14 g (5 mol%) of tetrakis(triphenylphosphine)palladium (0), and 1.15 g (8.34 mmol) of potassium carbonate were dissolved in 25 mL of a solvent of tetrahydrofuran/H_2O mixed in a volume ratio of 4/1. The solution was reacted at 80°C for 12 hours. The obtained reactant was extracted with ethylacetate and treated under a reduced pressure to remove the solvent. The extract was separated through a column and dried, obtaining 1.35 g (Y=92 %) of a white solid.

Example 5: Synthesis of a compound of Chemical Formula 92

[0140]

[Reaction Scheme 17]

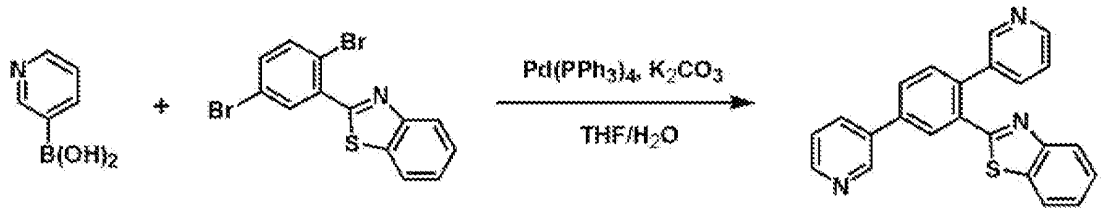


[0141] 4.63 g (13.3 mmol) of 3-(5-(3-(4,4,5,5-tetramethyl-1,3,2-d ioxaborolan-2-yl)phenyl)-1,3,4-oxadiazol-2-yl)pyridine according to Synthesis Example 9, 5.15 g (12.1 mmol) of 2-(3-bromo-5-(pyridin-3-yl)phenyl)-1-phenyl-1H-benzo[d] imidazole) according to Synthesis Example 4, 0.47 g (3 mol%) of tetrakis(triphenylphosphine)palladium (0), and 3.3 g (24.2 mmol) of potassium carbonate were dissolved in 300 mL of a solvent tetrahydrofuran/H_2O mixed in a volume ratio of 4/1. The solution was reacted at 80°C for 12 hours. The obtained reactant was extracted with ethylacetate and treated under a reduced pressure to remove the solvent. The extract was separated through a column and dried, obtaining 2 g (Y=33 %) of a white solid.

Example 6: Synthesis of a compound of Chemical Formula 96

[0142]

[Reaction Scheme 18]

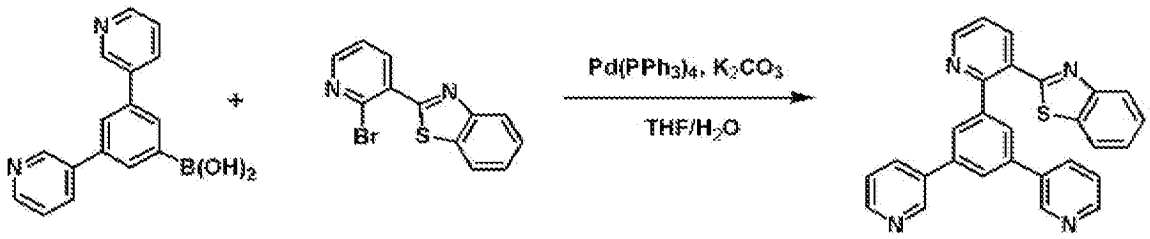


[0143] 1 g (2.76 mmol) of 2-(2,5-dibromophenyl)benzo[d]thiazole according to Synthesis Example 10, 0.85 g (6.9 mmol) of pyridine-3-boronic acid, 0.28 g (10 mol%) of tetrakis(triphenylphosphine)palladium (0), and 2.3 g (16.6 mmol) of potassium carbonate were dissolved in 25 mL of a solvent of tetrahydrofuran/H_2O mixed in a volume ratio of 4/1. The solution was reacted at 80°C for 12 hours. The obtained reactant was extracted with ethylacetate and treated under a reduced pressure to remove the solvent. The extract was separated through a column and dried, obtaining 0.8 g (Y=79 %) of a white solid.

Example 7: Synthesis of a compound of Chemical Formula 105

[0144]

[Reaction Scheme 19]

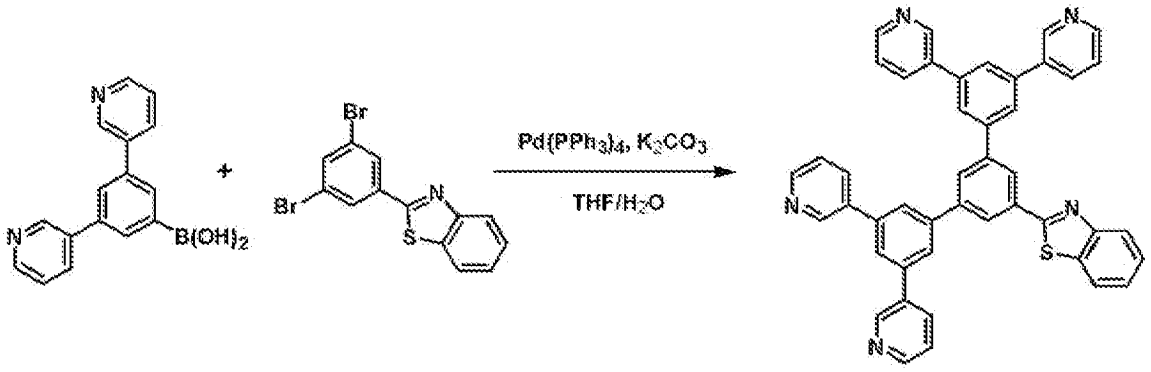


[0145] 1.33 g (4.8mmol) of 3,5-di-(3-pyridinyl)-benzene boronic acid, 1.7 g (5.8 mmol) of 2-(2-bromopyridine-3-yl) benzo[d]thiazole according to Synthesis Example 11, 0.28 g (5 mol%) of tetrakis(triphenylphosphine)palladium (0), and 2.0 g (14.4 mmol) of potassium carbonate were dissolved in 30 mL of a solvent of tetrahydrofuran/H_2O mixed in a volume ratio of 4/1. The solution was reacted at 80°C for 12 hours. The obtained reactant was extracted with ethylacetate and treated under a reduced pressure to remove the solvent. The extract was separated through a column and dried, obtaining 2.28 g (Y=88 %) of a white solid.

Example 8: Synthesis of a compound of Chemical Formula 108

[0146]

[Reaction Scheme 20]

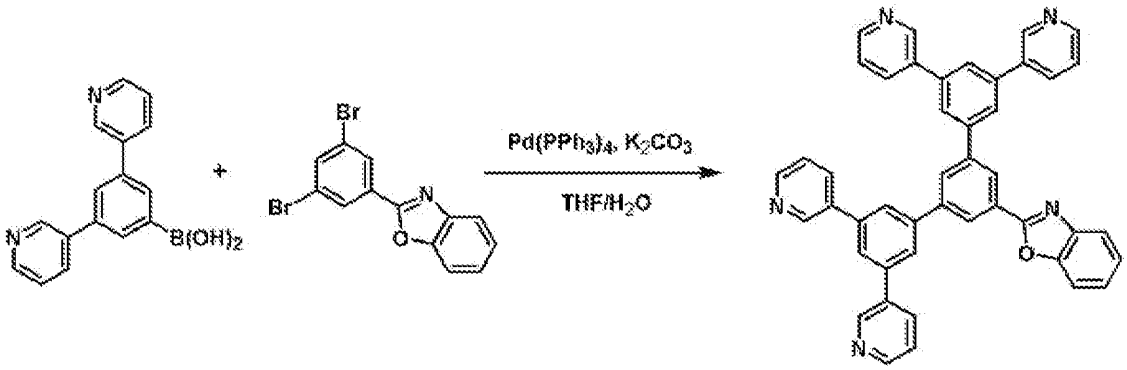


[0147] 2.3 g (8.4 mmol) of 3,5-di-(3-pyridinyl)-benzene boronic acid, 1.5 g (4.0 mmol) of 2-(3,5-dibromophenyl)benzo [d]thiazole according to Synthesis Example 5, 0.46 g (10 mol%) of tetrakis(triphenylphosphine)palladium (0), and 3.3 g (23.9 mmol) of potassium carbonate were dissolved in 50 mL of a solvent of tetrahydrofuran/H_2O mixed in a volume ratio of 4/1. The solution was reacted at 80°C for 12 hours. The obtained reactant was extracted with ethylacetate and treated under a reduced pressure to remove the solvent. The extract was separated through a column and dried, obtaining 2.04 g (Y=75 %) of a white solid.

Example 9 : Synthesis of a compound of Chemical Formula 110

[0148]

[Reaction Scheme 21]



[0149] 4.3 g (15.6 mmol) of 3,5-di-(3-pyridinyl)-benzene boronic acid, 2.5 g (7.1 mmol) of 2-(3,5-dibromophenyl)benzo [d]oxazole according to Synthesis Example 12, 0.82 g (10 mol%) of tetrakis(triphenylphosphine)palladium (0), and 5.9 g (42.7 mmol) of potassium carbonate were dissolved in 100 mL of a solvent of tetrahydrofuran/H_2O mixed in a volume ratio of 4/1. The solution was reacted at 80°C for 12 hours. The obtained reactant was extracted with ethylacetate and treated under a reduced pressure to remove the solvent. The extract was separated through a column and dried, obtaining 3.37 g (Y=72 %) of a white solid.

[0150] The compounds according to Examples 1 to 9 were analyzed through ^1H NMR (nuclear magnetic resonance spectroscopy). The results are respectively provided in FIGS. 6 to 14.

Comparative Example 1: 2-(4-biphenylyl)-5- (4-t-butylphenyl)-1,3,4-oxadiazole (PBD)

[0151] 2-(4-biphenylyl)-5-(4-t-butylphenyl)-1,3,4-oxadiazole (PBD), which is conventionally known to have an excellent charge transport capability (Jpn. J. Appl. Phys., 27, L269 1988), was prepared.

Example 10 : Fabrication of an organic light emitting diode

[0152] A 15 Ω/cm^2 (120 nm) ITO glass substrate (Corning Inc.) was prepared to have a size of 25 mm x 25 mm x 0.7 mm, and was respectively washed in isopropyl alcohol and pure water for 5 minutes, and was then cleaned again with UV and ozone.

[0153] Next, a 40 nm-thick N,N'-di(4-(N,N'-diphenyl-amino)-phenyl)-N,N'-diphenylbenzidine (DNTPD) hole injection layer (HIL) was formed on the substrate.

[0154] Then, N,N'-bis(naphthalen-1-yl)-N,N'-bis(phenyl)benzidine (NPB) was vacuum-deposited to form a 10 nm-thick hole transport layer (HTL) on the hole injection layer (HIL).

[0155] EB-46 and EB-512 (e-Ray Optoelectronics Technology Co., Ltd.) as a light emitting material were vacuum-deposited in a weight ratio of 94:6 to form a 40 nm-thick emission layer on the hole transport layer (HTL).

[0156] The compound according to Example 2 as an electron transport material was vacuum-deposited to form a 10 nm-thick electron transport layer (ETL) on the emission layer.

[0157] On the electron transport layer (ETL), LiF 0.5 nm/Al 100 nm were respectively and sequentially vacuum-deposited to form a cathode including LiF/Al, fabricating an organic light emitting diode of Example 10.

Example 11: Fabrication of an organic light emitting diode

[0158] An organic light emitting diode was fabricated according to the same method as in Example 10, except for using a compound according to Example 3 to form an electron transport layer (ETL).

Example 12: Fabrication of an organic light emitting diode

[0159] An organic light emitting diode was fabricated according to the same method as in Example 10, except for using a compound according to Example 4 to form an electron transport layer (ETL).

Example 13: Fabrication of an organic light emitting diode

[0160] An organic light emitting diode was fabricated according to the same method as in Example 10, except for

using a compound according to Example 5 to form an electron transport layer (ETL).

Example 14: Fabrication of an organic light emitting diode

[0161] An organic light emitting diode was fabricated according to the same method as in Example 10, except for using a compound according to Example 7 to form an electron transport layer (ETL).

Example 15: Fabrication of an organic light emitting diode

[0162] An organic light emitting diode was fabricated according to the same method as in Example 10, except for using a compound according to Example 8 to form an electron transport layer (ETL).

Example 16: Fabrication of an organic light emitting diode

[0163] An organic light emitting diode was fabricated according to the same method as in Example 10, except for using a compound according to Example 9 to form an electron transport layer (ETL).

Comparative Example 2: Fabrication of an organic light emitting diode

[0164] An organic light emitting diode was fabricated according to the same method as in Example 10, except for using an electron transportmaterial of Alq_3 to form an electron transport layer (ETL).

Property measurement and analysis

1) Driving voltage, luminance and luminous efficiency

[0165] The organic light emitting diodes of Examples 10 to 16 and Comparative Example 2 were measured regarding a driving voltage (V_d) required to produce luminance of 1000 nit, and current efficiency (cd/A) and electrical power efficiency (lm/W) at the same luminance. The results are shown in the following Table 1.

(Table 1)

Devices	At 1000 cd/m^2			V_{on}	Max.	
	V_d(V)	cd/A	lm/W		cd/A	lm/W
Comparative Example 2	7.40	4.68	1.99	3.60	4.72	2.88
Example 10	6.20	5.19	2.63	3.20	5.35	3.25
Example 11	7.20	5.29	2.31	3.80	5.32	2.77
Example 12	6.40	5.00	2.45	3.00	5.32	3.34
Example 13	7.40	4.99	2.12	3.20	5.32	3.37
Example 14	6.40	5.80	2.85	3.00	5.88	3.51
Example 15	7.20	5.56	2.43	3.40	5.66	3.54
Example 16	6.00	6.04	3.16	3.20	6.32	4.14

[0166] Referring to Table 1 and FIGS. 15 and 16, the organic light emitting diodes of Examples 10 to 16 had a sharply lower driving voltage than those of Comparative Example 2. In addition, referring to Table 1 and FIGS. 17 and 18, the organic light emitting diodes of Examples 10 to 16 had a sharply low driving voltage but superbly high current efficiency and electrical power efficiency.

[0167] These measurement results of the organic light emitting diodes come from combination balance of holes and electrons in the emission layer. The compounds of Examples 10 to 16 turned out to have excellent electron injection and transport characteristics compared with Alq_3, a general electron transport material.

2) Thermal stability

[0168] The compounds according to Examples 1 to 9 were analyzed in a differential scanning calorimetry method

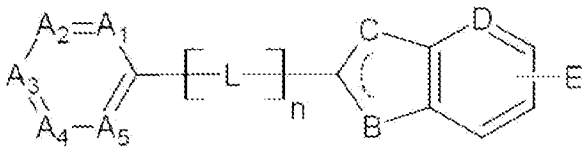
(DSC), and then secondarily analyzed in the same method. The analysis results of the compounds according to Example 5 and Comparative Example 1 are shown in FIGS. 19 and 20. Referring to FIGS. 19 and 20, the compound of Example 5 had melting point peaks in the primary analysis, but no melting point peak in the secondary analysis. On the contrary, 2-(4-biphenylyl)-5-(4-t-butylphenyl)-1,3,4-oxadiazole (PBD) according to Comparative Example 1 had a melting point peak at 138°C in both primary and secondary analyses and a crystallizing temperature at 65°C in the secondary analysis. The compounds of Example 5 were identified to stably exist as amorphous compared with the conventional material. Therefore, the organic light emitting diodes including the compound of the present invention turned out to reduce influence of Joule heat generated during the operation, and thereby can have an improved life-span characteristic compared with a conventional organic light emitting diode.

[0169] While this invention has been described in connection with what is presently considered to be practical exemplary embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

Claims

1. A compound for an organic photoelectric device, represented by the following Chemical Formula 1:

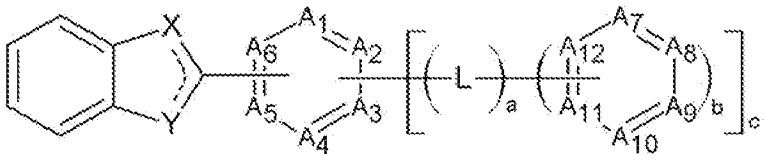
[Chemical Formula 1]



wherein, in Chemical Formula 1,
A_1 to A_5 are the same or different, and CR_1 to CR_5 are N, provided that three or less of A_1 to A_5 are N,
when one of A_1 to A_5 is N, the remaining four of A_1 to A_5 are respectively selected from the group consisting of CR_1 to CR_5, provided that at least two of R_1 to R_5 are not hydrogen,
when A_1 to A_5 are respectively CR_1 to CR_5, at least two of R_1 to R_5 are not hydrogen,
B is selected from the group consisting of O, S, Se, and NR",
C and D are the same or different, and are independently selected from the group consisting of CR' and N, provided that when B is not NR", C is N,
R_1 to R_5, R', and R" are independently selected from the group consisting of hydrogen, a halogen, a nitrile, a cyano, a nitro, an amide, a carbonyl, an ester, a substituted or unsubstituted alkyl, a substituted or unsubstituted alkoxy, a substituted or unsubstituted alkenyl, a substituted or unsubstituted cycloalkyl, a substituted or unsubstituted aryl, a substituted or unsubstituted arylamine, a substituted or unsubstituted heteroarylamine, a substituted or unsubstituted heterocycle, a substituted or unsubstituted amino, BR_6R_7, and $SiR_6R_7R_8$,
R_6 to R_8 are the same or different, and are independently selected from the group consisting of a substituted or unsubstituted alkyl, and a substituted or unsubstituted aryl,
E is selected from the group consisting of hydrogen, a nitrile, a cyano, a nitro, an amide, a carbonyl, a substituted or unsubstituted alkyl, a substituted or unsubstituted fluoroalkyl, a substituted or unsubstituted cycloalkyl, a substituted or unsubstituted aryl, a substituted or unsubstituted heterocycle, and SO_2R_9,
R_9 is selected from the group consisting of a nitrile, a cyano, a nitro, an amide, a carbonyl, a substituted or unsubstituted alkyl, a substituted or unsubstituted cycloalkyl, a substituted or unsubstituted aryl, and a substituted or unsubstituted heterocycle,
L is selected from the group consisting of a substituted or unsubstituted aryl, and a substituted or unsubstituted heteroaryl, and
n is 0 or 1.

2. The compound of claim 1, wherein the compound is represented by the following Chemical Formula 112:

[Chemical Formula 112]



wherein, in Chemical Formula 112,

A_1 to A_{12} are the same or different, and independently selected from the group consisting of CR_1 to CR_{12} and N, provided that at least one of A_7 to A_{12} is N, and R_1 to R_6 adjacent to each other optionally forms a fused ring, and R_7 to R_{12} adjacent to each other optionally forms a fused ring,

X is selected from the group consisting of O, S, Se and NR_{13}, Y is CR_{14} or N, provided that when X is selected from the group consisting of O, S, and Se, and Y is N,

L is a substituted or unsubstituted C6 to C50 arylene,

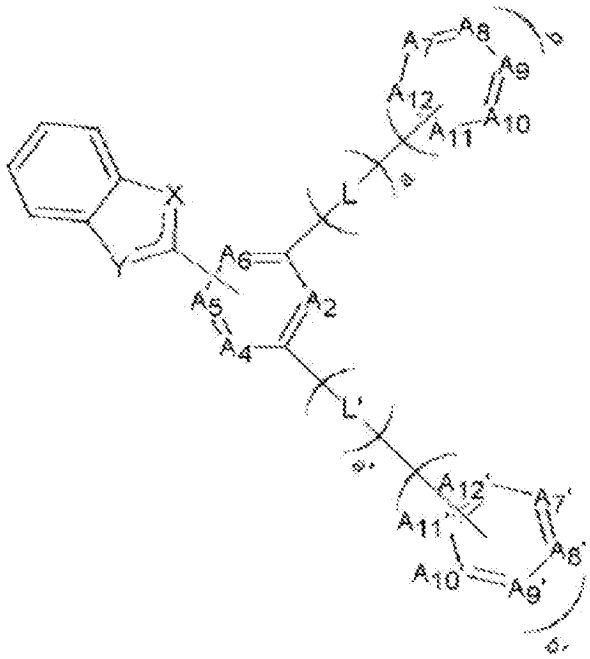
a is 0 or 1, provided that when a is 0, A_1 to A_6 are each independently CR_1 to CR_6, and when a is 1, at least one of A_1 to A_6 is N,

b and c are the same or different, and independently an integer ranging from 1 to 3, and

R_1 to R_{14} are the same or different, and independently selected from the group consisting of hydrogen, a halogen, a nitrile, a cyano, a nitro, an amide, a carbonyl, an ester, a substituted or unsubstituted alkyl, a substituted or unsubstituted alkylene, a substituted or unsubstituted alkoxy, a substituted or unsubstituted alkenyl, a substituted or unsubstituted alkenylene, a substituted or unsubstituted alkynyl, a substituted or unsubstituted alkynylene, a substituted or unsubstituted cycloalkyl, a substituted or unsubstituted cycloalkylene, a substituted or unsubstituted aryl, a substituted or unsubstituted arylene, a substituted or unsubstituted arylamine, a substituted or unsubstituted heteroan arylamine, a substituted or unsubstituted heterocycle, a substituted or unsubstituted amino, BRR', or SiRR'R", wehrein R, R' and R"are the same or different, and each independently a substituted or unsubstituted alkyl, or a substituted or unsubstituted aryl.

3. The compound of claim 1, wherein the compound is represented by the following Chemical Formula 113:

[Chemical Formula 113]



wherein, in Chemical Formula 113,

A_2, A_4 to A_{12} and A_7' to A_{12}' are the same or different, and are each independently selected from the group consisting of CR_2, CR_4 to CR_{12}, CR_7' to CR_{12}' and N, provided at least one of A_7 to A_{12} is N, and east one of A_7' to A_{12}' is N, wherein R_4 to R_6 adjacent to each other optionally forms a fused ring, R_7 to R_{12} adjacent to each other optionally forms a fused ring, and R_7' to R_{12}' adjacent to each other optionally forms a fused ring,

X is selected from the group consisting of O, S, Se and NR_{13}, Y is CR_{14} or N, provided that when X is selected from the group consisting of O, S, and Se, and Y is N,

L and L' are the same or different, and are each independently is a substituted or unsubstituted C6 to C50 arylene,

a and a' are the same or different, and are each independently 0 or 1, provided that when a and a' are each independently 0, A_2, A_4 to A_6 are each independently CR_2, and CR_4 to CR_6, and when a and a' are each independently 1, at least one of A_2, and A_4 to A_6 is N,

b and b' are the same or different, and are each independently an integer ranging from 1 to 3, and

R_2, R_4 to R_{14}, and R_7' to R_{12}' are the same or different, and independently hydrogen, a halogen, a nitrile, a cyano, a nitro, an amide, a carbonyl, an ester, a substituted or unsubstituted alkyl, a substituted or unsubstituted alkylene, a substituted or unsubstituted alkoxy, a substituted or unsubstituted alkenyl, a substituted or unsubstituted alkenylene, a substituted or unsubstituted alkynyl, a substituted or unsubstituted alkynylene, a substituted or unsubstituted cycloalkyl, a substituted or unsubstituted cycloalkylene, a substituted or unsubstituted aryl, a substituted or unsubstituted arylene, a substituted or unsubstituted arylamine, a substituted or unsubstituted hetero arylamine, a substituted or unsubstituted heterocycle, a substituted or unsubstituted amino, BRR', or SiRR'R", wehrein R, R' and R" are the same or different, and each independently a substituted or unsubstituted alkyl, or a substituted or unsubstituted aryl.

4. The compound of claim 1, wherein the compound has an asymmetric structure where upper and lower substituents are different from each other with respect to the axis including A_3.

5. The compound of claim 1, wherein the A_1 and A_5 are different from each other, and A_2 and A_4 are different from each other.

6. The compound of claim 1, wherein in Chemical Formula 1, R_1 to R_5, R' and R" are each independently a substituted or unsubstituted C6 to C40 aryl.

7. The compound of claim 1, wherein in Chemical Formula 1, R_1 to R_5, R' and R"are independently an arylamine

selected from the group consisting of diphenyl amine, dinaphthyl amine, dibiphenyl amine, phenyl naphthyl amine, phenyl diphenyl amine, ditolyl amine, phenyl tolyl amine, carbazolyl, and triphenyl amine.

8. The compound of claim 1, wherein in Chemical Formula 1, R_1 to R_5, R' and R" are independently a heterocycle selected from the group consisting of a substituted or unsubstituted heterocycle, the heterocycle is selected from the group consisting of thiophenyl, furanyl, pyrrolyl, imidazolyl, thiazolyl, oxazolyl, oxadiazolyl, triazolyl, pyridinyl, pyridazinyl, quinolinyl, isoquinolinine, acridyl, imidazopyridinyl, and imidazopyrimidinyl.

9. The compound of claim 1, wherein in Chemical Formula 1, R_1 to R_5, R' and R"are independently, a substituted imidazolyl, or a substituted triazolyl, the substituent linked to nitrogen (N) of the imidazolyl or triazolyl is selected from the group consisting of a substituted or unsubstituted alkyl, a substituted or unsubstituted cycloalkyl, a substituted or unsubstituted aryl, and a substituted or unsubstituted heterocycle.

10. The compound of claim 1, wherein in Chemical Formula 1, one selected from R_1 to R_5, R', and R' of B is substituted with a substituent selected from the group consisting of an amine-substituted alkyl, an amine-substituted cycloalkyl, an amine-substituted aryl, and an amine-substituted heterocycle, and
in Chemical Formula 1, one of R_1 to R_5, R' and R' of B is substituted with a substituent selected from the group consisting of a nitrile, a nitrile, a nitro, an amide, a carbonyl, and a heterocycle.

11. The compound of claim 2, wherein in Chemical Formula 112, one of R_7 to R_{12} is substituted with a substituent selected from the group consisting of an amine-substituted alkyl, an amine-substituted cycloalkyl, an amine substituted aryl, and an amine-substituted heterocycle, and
in Chemical Formula 112, one of R_1 to R_6 is substituted with a substituent selected from the group consisting of a nitrile, a nitro, an amide, a carbonyl, and a substituted or unsubstituted heterocycle.

12. An organic photoelectric device, comprising
an anode, a cathode, and at least one organic thin layer between the anode and cathode,
wherein at least one of the organic thin layer comprises the compound according to one of claims 1 to 11.

13. The organic photoelectric device of claim 12, wherein the compound is a host material or a charge transport material.

14. The organic photoelectric device of claim 12, wherein the organic thin layer is selected from the group consisting of an emission layer, an electron transport layer (ETL), an electron injection layer (EIL), a hole transport layer (HTL), a hole injection layer (HIL), and a hole blocking layer.

15. The organic photoelectric device of claim 12, wherein at least one of the organic thin layer comprises the compound and a reducing dopant.

16. The organic photoelectric device of claim 15, wherein the reducing dopant is selected from the group consisting of an alkaline metal, an alkaline earth metal, a rare earth element metal, an oxide of an alkaline metal, a halide of an alkaline metal, an organic complex of an alkaline metal, an oxide of an alkaline earth metal, a halide of an alkaline earth metal, an organic complex of an alkaline earth metal, an oxide of an alkaline earth metal, a halide of an alkaline earth metal, an organic complex of an alkaline earth metal, an oxide of a rare earth element metal, a halide of a rare earth element metal, and an organic complex of a rare earth element metal.

17. A display device comprising an organic photoelectric device according to claim 12.

FIG. 1

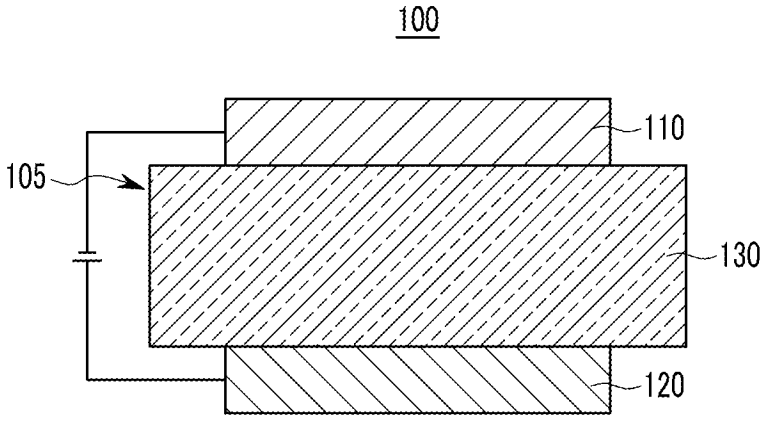


FIG. 2

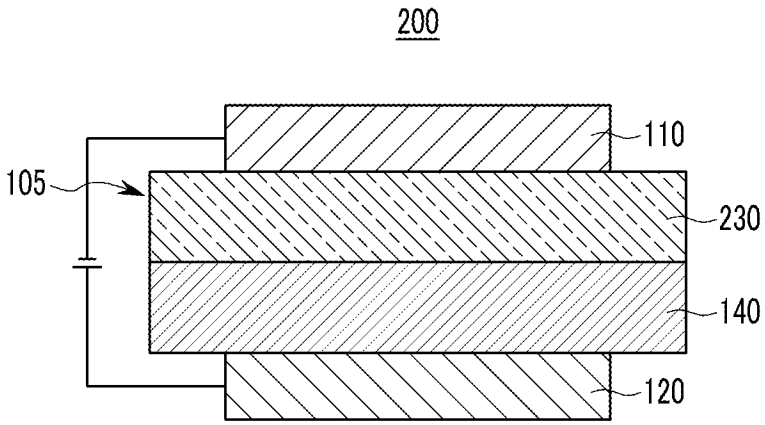


FIG. 3

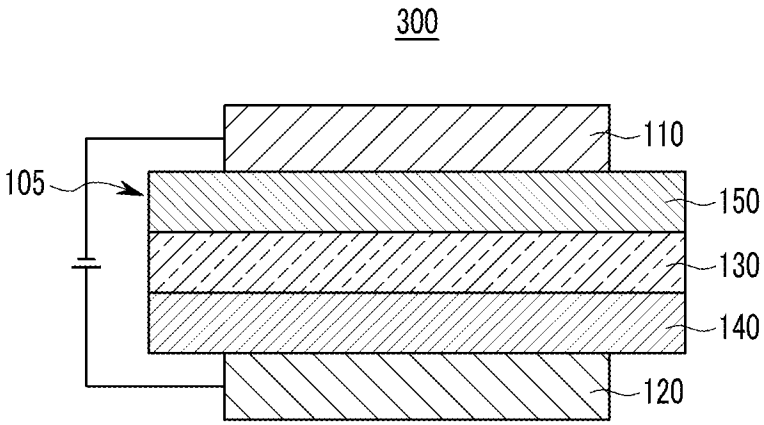


FIG. 4

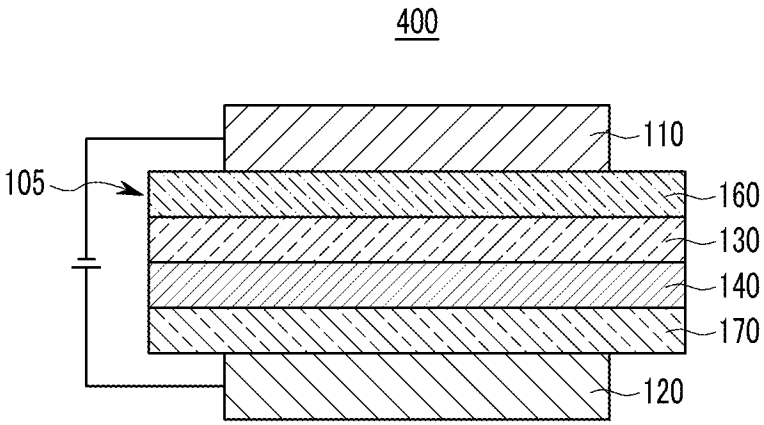


FIG. 5

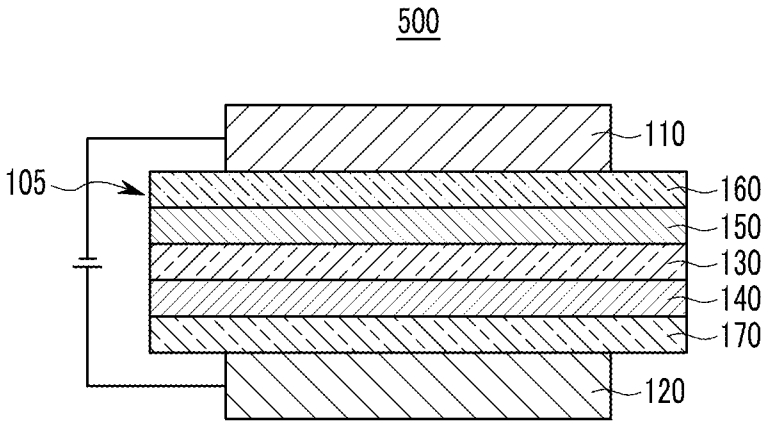


FIG. 6

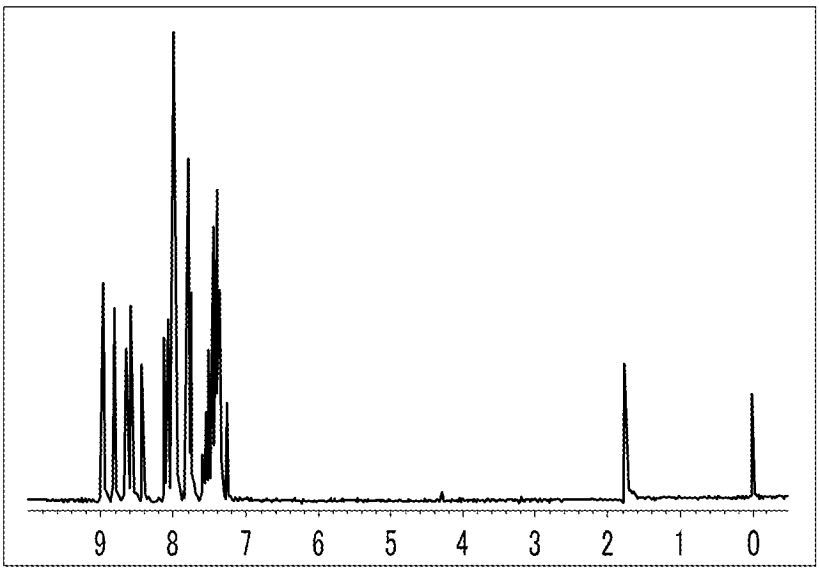


FIG. 7

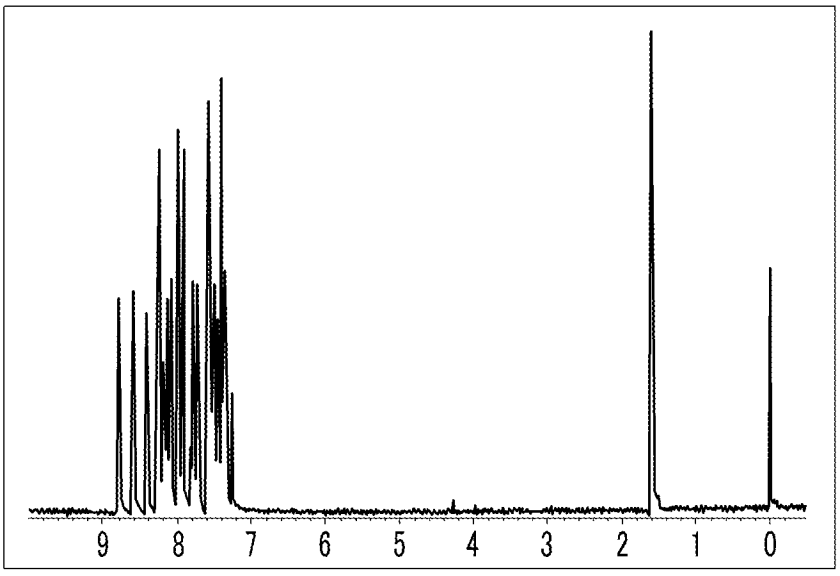


FIG. 8

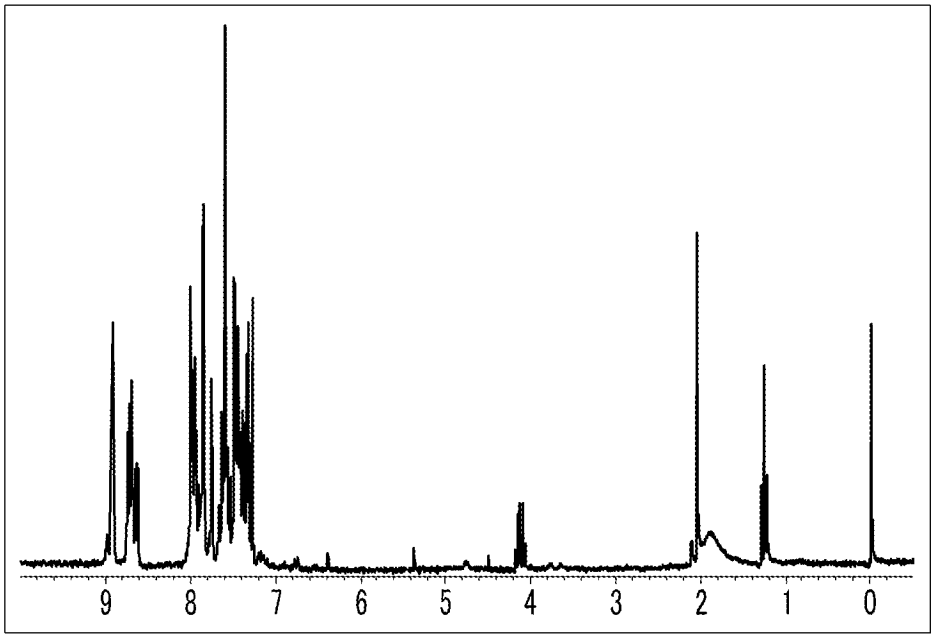


FIG. 9

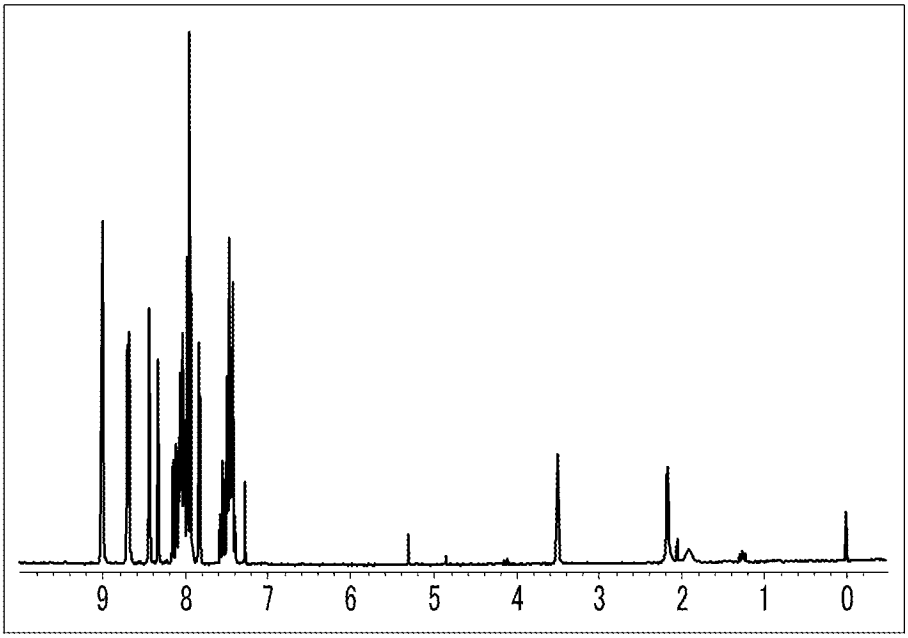


FIG. 10

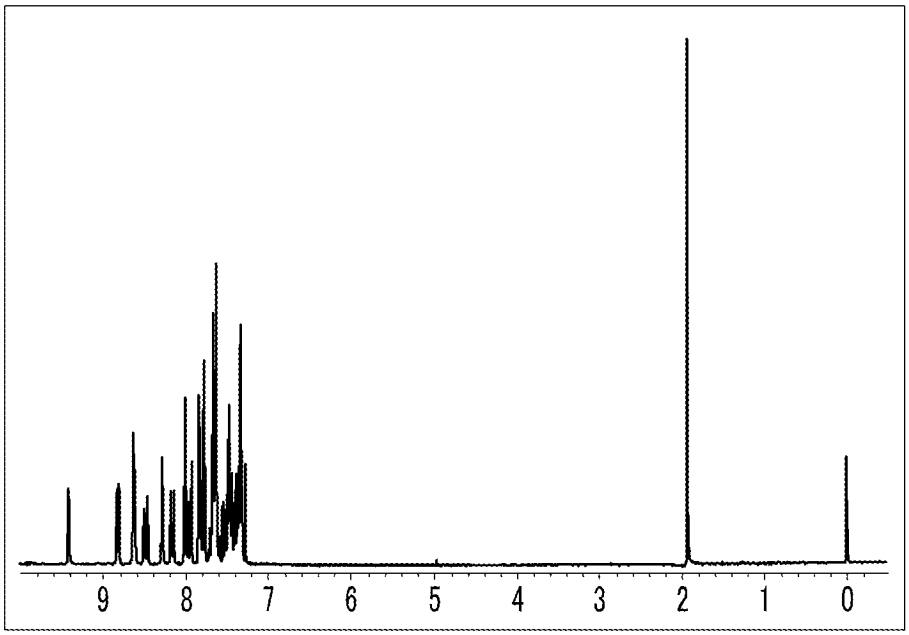


FIG. 11

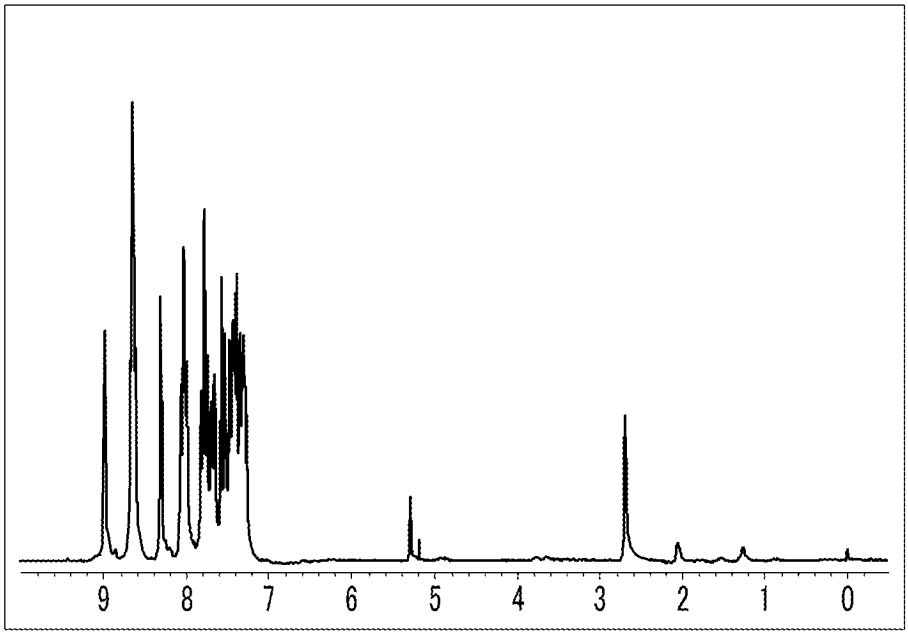


FIG. 12

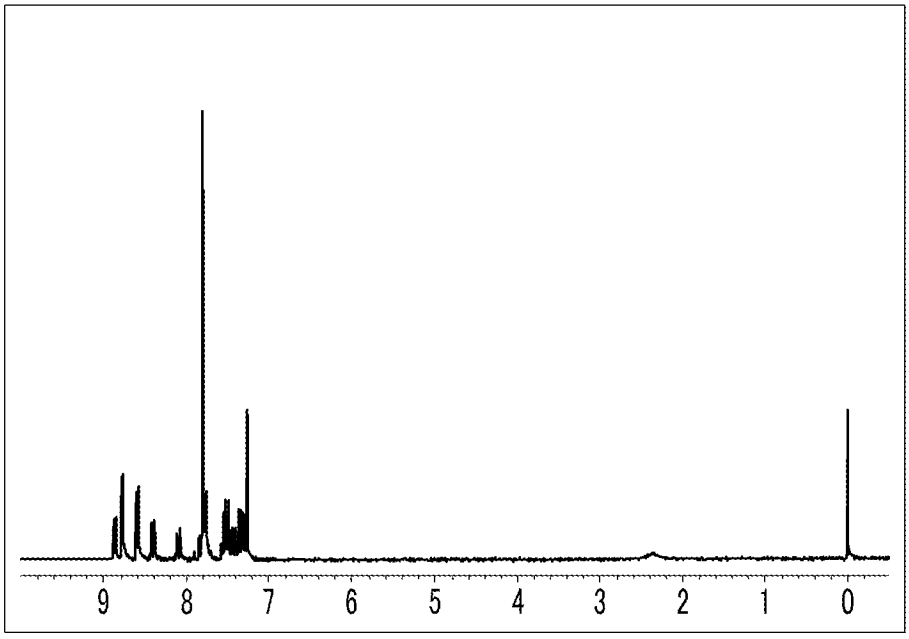


FIG. 13

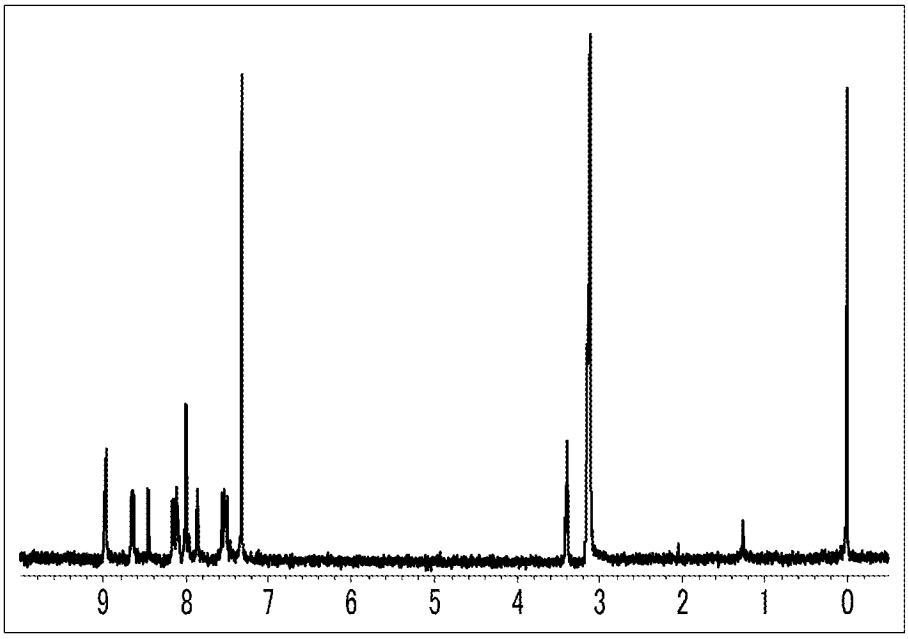


FIG. 14

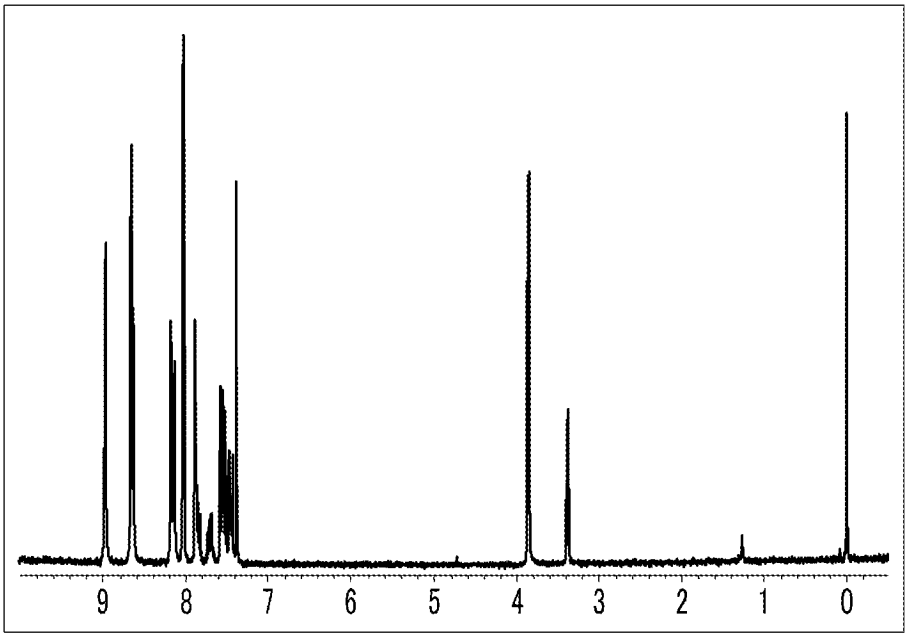


FIG. 15

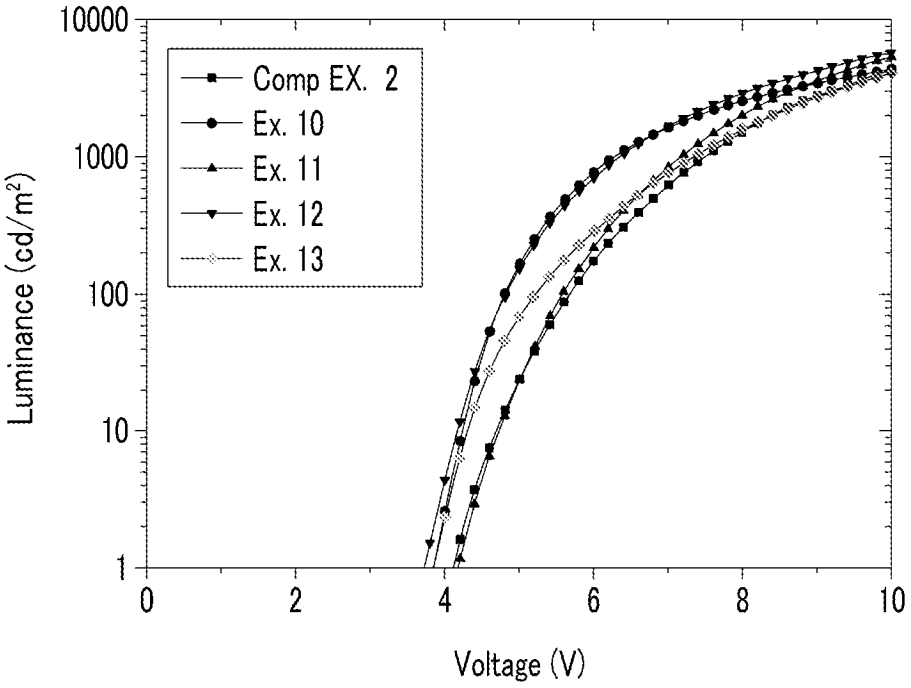

10000
1000
100
10
1
Luminance (cd/m²)
0
2
4
6
8
10
Voltage (V)
Comp EX. 2
Ex. 10
Ex. 11
Ex. 12
Ex. 13

FIG. 16

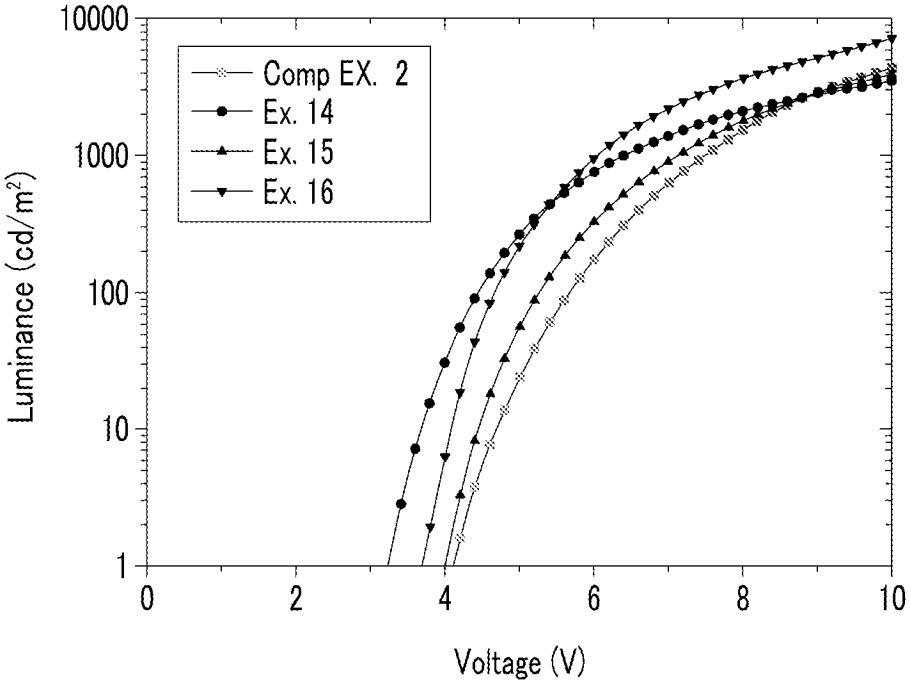

10000
1000
100
10
1
0
2
4
6
8
10
Luminance (cd/m²)
Voltage (V)
Comp EX. 2
Ex. 14
Ex. 15
Ex. 16

FIG. 17

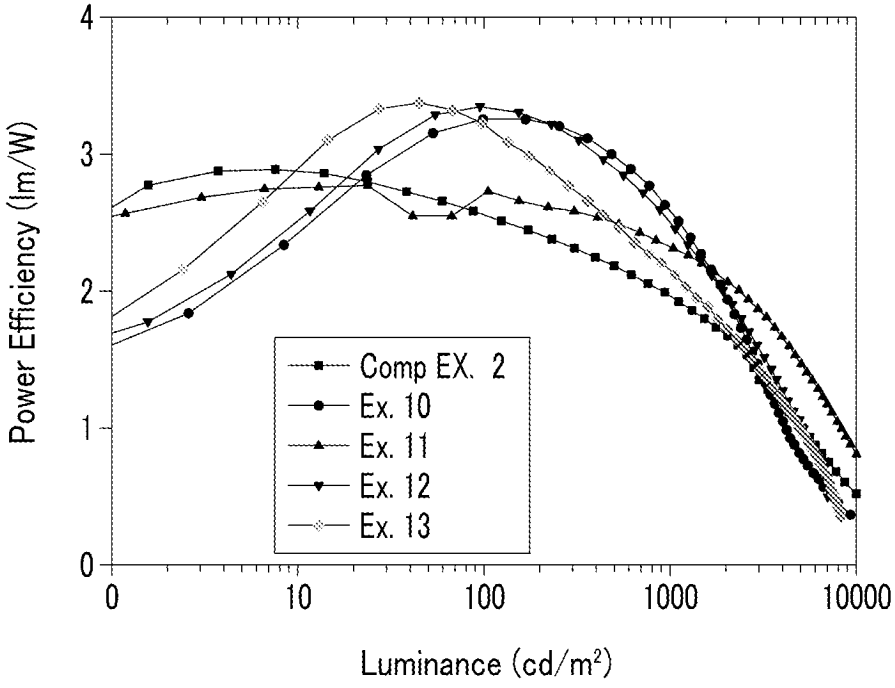

Power Efficiency (lm/W)
Luminance (cd/m²)
Comp EX. 2
Ex. 10
Ex. 11
Ex. 12
Ex. 13
0
1
2
3
4
0
10
100
1000
10000

FIG. 18

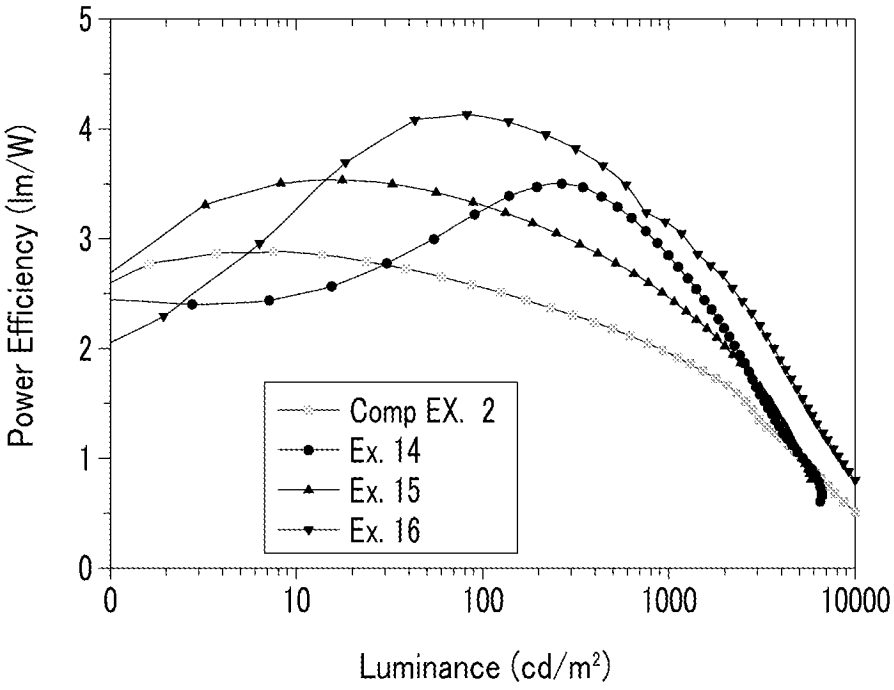

Power Efficiency (lm/W)
Luminance (cd/m²)
0
1
2
3
4
5
0
10
100
1000
10000
Comp EX. 2
Ex. 14
Ex. 15
Ex. 16

FIG. 19

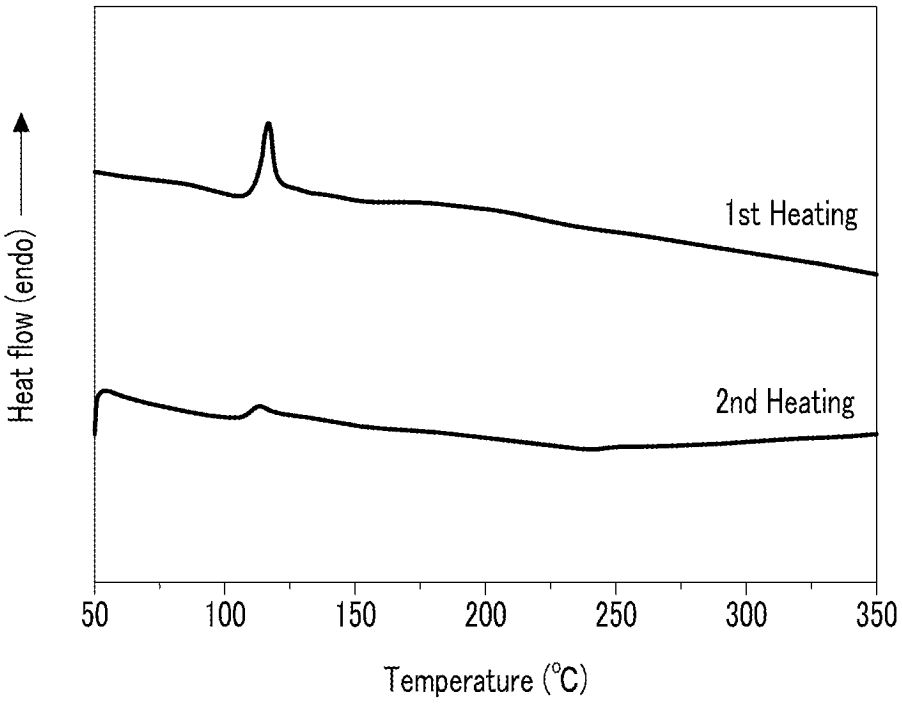
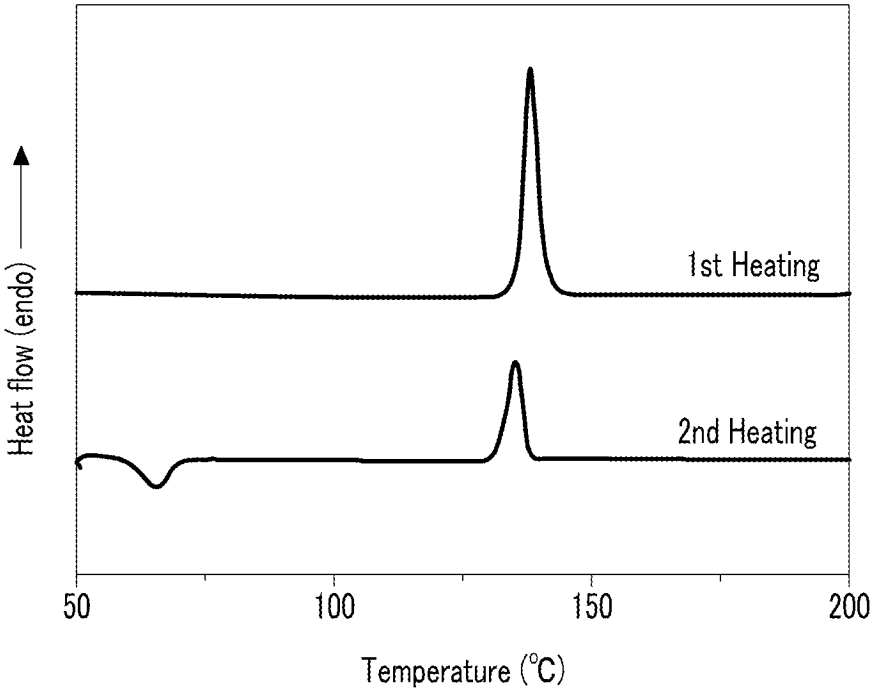

Heat flow (endo)
1st Heating
2nd Heating
50
100
150
200
250
300
350
Temperature (°C)

FIG. 20


Heat flow (endo)
1st Heating
2nd Heating
50
100
150
200
Temperature (°C)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Non-patent literature cited in the description

- *Jpn. J. Appl. Phys.,* 1988, vol. 27, L269 **[0007] [0151]**

专利名称(译)	用于有机光电器件的新型化合物和包含其的有机光电器件		
公开(公告)号	EP2377907A4	公开(公告)日	2012-07-18
申请号	EP2009836312	申请日	2009-12-16
[标]申请(专利权)人(译)	第一毛织株式会社		
申请(专利权)人(译)	第一毛织INC.		
当前申请(专利权)人(译)	第一毛织INC.		
[标]发明人	IN KYU YEOL KANG MYEONG SOON JUNG HO KUK KIM NAM SOO KANG EUI SU CHAE MI YOUNG PARK JIN SEONG		
发明人	IN, KYU-YEOL KANG, MYEONG-SOON JUNG, HO-KUK KIM, NAM-SOO KANG, EUI-SU CHAE, MI-YOUNG PARK, JIN-SEONG		
IPC分类号	C09K11/06 C07D263/56 C07D277/66 H01L51/00 H01L51/50 H05B33/10		
CPC分类号	H01L51/0054 C07D403/10 C07D413/10 C07D417/04 C07D417/10 C09B1/00 C09B57/00 C09B57/001 C09K11/06 C09K2211/1007 C09K2211/1011 C09K2211/1029 C09K2211/1033 C09K2211/1037 C09K2211/1044 C09K2211/1048 C09K2211/1059 C09K2211/1096 H01L51/0052 H01L51/0058 H01L51/0067 H01L51/007 H01L51/0071 H01L51/0072 H01L51/5012 H01L51/5072 H01L2251/308 H05B33/10		
代理机构(译)	MICHALSKIHÜTTERMANN & PARTNERPATENTANWÄLTE		
优先权	1020080137222 2008-12-30 KR		
其他公开文献	EP2377907A2 EP2377907B1		
外部链接	Espacenet		

摘要(译)

提供一种用于有机光电装置的新型化合物和包含该化合物的有机光电装置。该化合物由化学式1表示。根据本发明的一个实施方案的化合物可以用作空穴注入，空穴传输，发光或电子注入离子和/或传输材料，并且还可以用作发光主体。用适当的掺杂剂。当包含在有机薄层中时，用于有机光电装置的化合物可以改善热稳定性并降低驱动电压，以改善有机光电装置的寿命和效率特性。