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

(11) EP 2 436 751 B1

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
07.01.2015 Bulletin 2015/02

(21) Application number: **09845286.5**

(22) Date of filing: **16.11.2009**

(51) Int Cl.:
C09K 11/06 *(2006.01)* ***C07F 9/572*** *(2006.01)*
H01L 51/54 *(2006.01)* ***H01L 27/32*** *(2006.01)*
H05B 33/14 *(2006.01)* ***H01L 51/00*** *(2006.01)*
H01L 51/50 *(2006.01)*

(86) International application number:
PCT/KR2009/006717

(87) International publication number:
WO 2010/137779 (02.12.2010 Gazette 2010/48)

(54) **CARBAZOLE-BASED PHOSPHINE OXIDE COMPOUND, AND ORGANIC ELECTROLUMINESCENT DEVICE INCLUDING THE SAME**

CARBAZOLBASIERTE PHOSPHINOXIDVERBINDUNG UND ORGANISCHES ELEKTROLUMINESZENZELEMENT DAMIT

COMPOSÉ D'OXYDE DE PHOSPHINE À BASE DE CARBAZOLE ET DISPOSITIF ÉLECTROLUMINESCENT ORGANIQUE EN CONTENANT

(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: **27.05.2009 KR 20090046425**
30.10.2009 KR 20090104025

(43) Date of publication of application:
04.04.2012 Bulletin 2012/14

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Description

Technical Field

[0001] The present invention relates to a carbarzole-based phosphine oxide compound, which is capable of improving thermal stability of a conventional organic electroluminescent device and increasing efficiency characteristics of the organic electroluminescent device, in particular, a pure blue phosphorescent device, and to an organic electroluminescent device including the same.

Background Art

[0002] Organic electroluminescent devices have a simpler structure, various processing advantages, higher luminance, superior viewing angle, quicker response rate, and a lower operating voltage than other flat panel display devices such as liquid crystal displays (LCDs), plasma display panels (PDPs), field emission displays (FEDs), etc., and thus many attempts are being made to use them as a light source of flat panel displays such as wall-mountable TVs and so on or of the backlight units of displays, illuminators, advertisement boards and the like.

[0003] Typically, when direct-current voltage is applied to an organic electroluminescent device, holes injected from an anode and electrons injected from a cathode recombine to form electron-hole pairs, namely, excitons, after which the excitons return to a stable ground state and the corresponding energy is transferred to a light-emitting material and is thereby converted into light.

[0004] In the effort to increase efficiency and stability of an organic electroluminescent device, an organic electroluminescent device operating at low voltage was reported to be made by forming a tandem thin organic film between two opposite electrodes by C. W. Tang et al. in Eastman Kodak (C. W. Tang, S. A. Vanslyke, Applied Physics Letters, vol. 51, pp. 913, 1987), and thorough research into organic materials for organic electroluminescent devices with multilayered thin-film structures is ongoing. The lifetime of such a tandem organic electroluminescent device is closely related to the stability of the thin film and the material. For example, when the thermal stability of the material is lowered, the material may crystallize at high temperature or the operating temperature, undesirably shortening the lifetime of the device.

[0005] A variety of known compounds function as the conventional host materials of organic electroluminescent devices. These include triazine-based compounds, oxadiazole-based compounds, benzimidazole-based compounds, phenyl pyridine-based compounds, and silicon-based compounds. However, such compounds are problematic because superior efficiency characteristics cannot be achieved in the organic electroluminescent devices, and host materials able to exhibit superior characteristics in blue phosphorescent devices are considerably limited. Hence, the development of novel compounds to solve such problems is required.

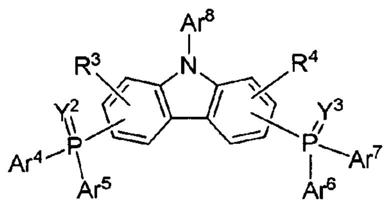
[0006] As a novel host material, a novel phosphine oxide based compound has been reported. With this compound, however, it is difficult to attain high efficiency.

[0007] Korean Patent Publication No. 10-2006-0109524 discloses an arylphosphine oxide-based compound, an arylphosphine sulfide-based compound or an arylphosphine selenide-based compound and an organic electroluminescent device using the same, but is problematic because high efficiency cannot be obtained in a pure blue phosphorescent device.

[0008] Applied Physics Letter (Appl. Phys. Lett. 92, 083308, 2008) discloses a blue phosphorescent device using a phosphine oxide compound having a fluorene structure, but the quantum efficiency of the device is only about 9%, undesirably resulting in low device efficiency.

[0009] Accordingly, the present invention has been made keeping in mind the above problems occurring in the related art and the present invention is intended to develop a novel host material, namely, a phosphine oxide compound having a carbazole structure, and apply it as the host material of an organic electroluminescent device.

[0010] Sapochak et al., Proceeding of SPIE, 6655 (2007) 665506, describes heteroaromatic-based phosphine oxide (PO) compounds as emitter materials in organic light emitting devices (OLEDs). One of said PO compounds is 3,6-bis(diphenylphosphoryl)-9-phenylcarbazole (PO9). PO9 is a compound of Chemical Formula 2



Chemical Formula 2

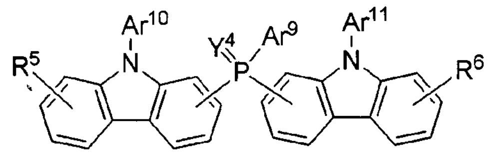
wherein Y^2 and Y^3 are identical and each represent an oxygen atom,

[0011] Ar^4 to Ar^7 are identical and each represent a phenyl group, and R^3 and R^4 represent a hydrogen atom.

[0012] Sapochak et al., J. Phys. Chem., 112 (2008) 7989-7996 is a journal article that also relates to OLEDs and carbazole materials that contain diphenylphosphoryl moieties. It also discloses the compound PO9.

[0013] Chen et al., Organic Electronics, 10 (2009) 939-947 discloses a compound DPPOC, a 3,6-bis(diphenylphosphoryl) compound containing an N-(4'-t-butoxy-phenyl) moiety.

[0014] WO 2010/079051 discloses in its Example 5 a compound of Chemical Formula 3 below, wherein R^5 and R^6 are both triphenylsilyl moieties.



Chemical Formula 3

[0015] In Example 3 a 3-diphenyl-phosphoryl-9-phenylcarbazole compound containing a triphenylsilyl substituent on the 6-position is shown.

Disclosure

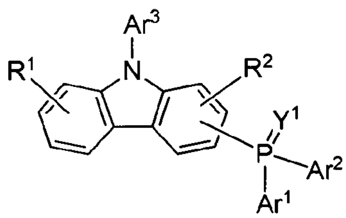
Technical Problem

[0016] In order to solve problems of thermal instability and low efficiency of conventional organic electroluminescent devices, the present invention adopts a carbazole-based phosphine oxide compound, which exhibits high thermal stability and superior hole transport characteristics and thereby may be applied to a hole transport layer and also may be applied as a host material for any light-emitting layer from red to blue phosphorescence, and furthermore may achieve high efficiency characteristics in a pure blue phosphorescent device, and thus an object of the present invention is to provide a carbazole-based phosphine oxide compound and an organic electroluminescent device including the same.

Technical Solution

[0017] Accordingly, the present invention provides a compound for an organic electroluminescent device, represented by Chemical Formula 1 below:

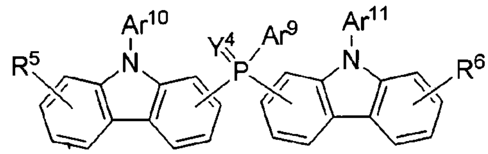
[Chemical Formula 1]



wherein Y^1 represents an oxygen atom,
Ar^1 and Ar^2 are identical and each represent a phenyl group,
Ar^3 represents a phenyl group, and
R^1 and R^2 each represent a phenyl group.

[0018] In addition, the present invention provides a compound for an organic electroluminescent device, represented by Chemical Formula 3 below:

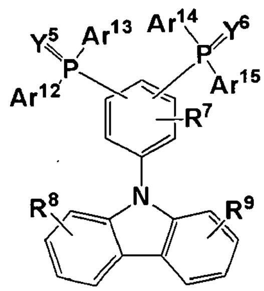
[Chemical Formula 3]



wherein Y^4 represents an oxygen atom,
Ar^9 represents a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group,
Ar^{10} and Ar^{11} are identical or different substituents and each represent a substituted or unsubstituted phenyl group, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, and
part or all of R^5 and R^6 are independently a hydrogen atom, or R^5 and R^6 are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted aryl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, wherein the substituted or unsubstituted aryl group having 6 to 34 carbons, the substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, the substituted or unsubstituted anthryl group, or the substituted or unsubstituted pyrenyl group forms a saturated or unsaturated ring independently or with an adjacent group,
wherein the group suitable for substitution on the Ar^9 to Ar^{11}, R^5 or R^6 is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 34 carbons, a heteroaryl group having 5 to 34 ring atoms, an alkyl group having 1 to 34 carbons, a cycloalkyl group having 3 to 34 carbons, a thio group having 1 to 34 carbons, or a silyl group having 1 to 34 carbons.

[0019] In addition, the present invention provides a compound for an organic electroluminescent device, represented by Chemical Formula 4 below:

[Chemical Formula 4]

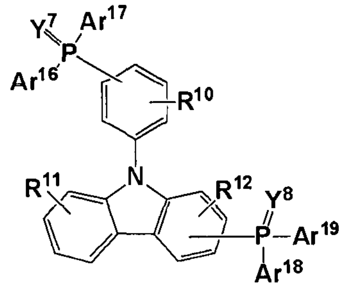


wherein Y^5 and Y^6 are identical or different substituents and each represent an oxygen atom, a sulfur atom or a selenium atom,
Ar^{12} to Ar^{15} are identical or different substituents and each represent a substituted or unsubstituted aryl group having 6 to 50 ring carbons, or a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, and
part or all of R^7 to R^3 are independently a hydrogen atom, or R^7 to R^9 are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted aryl group having 6 to 50 ring carbons, a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbons, a substituted or unsubstituted cycloalkyl group having 3 to 50 carbons, a substituted or unsubstituted thio group having 1 to 50 carbons, or a substituted or unsubstituted silyl group having 1 to 50 carbons, wherein the substituted or unsubstituted aryl group having 6 to 50 ring carbons, the substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, or the substituted or unsubstituted cycloalkyl group having 3 to 50 carbons forms a saturated or unsaturated ring independently or with an adjacent group,

wherein a group suitable for substitution on the Ar^{12} to Ar^{15} and R^7 to R^9 is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 50 ring carbons, a heteroaryl group having 5 to 50 ring atoms, an alkyl group having 1 to 50 carbons, a cycloalkyl group having 3 to 50 carbons, a thio group having 1 to 50 carbons, or a silyl group having 1 to 50 carbons.

[0020] In addition, the present invention provides a compound for an organic electroluminescent device, represented by Chemical Formula 5 below:

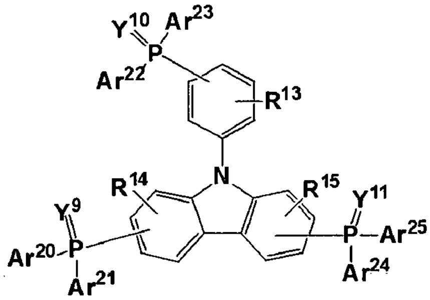
[Chemical Formula 5]



wherein Y^7 and Y^8 are identical or different substituents and each represent an oxygen atom, a sulfur atom or a selenium atom,
Ar^{16} to Ar^{19} are identical or different substituents and each represent a substituted or unsubstituted aryl group having 6 to 50 ring carbons, or a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, and
part or all of R^{10} to R^{12} are independently a hydrogen atom, or R^{10} to R^{12} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted aryl group having 6 to 50 ring carbons, a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbons, a substituted or unsubstituted cycloalkyl group having 3 to 50 carbons, a substituted or unsubstituted thio group having 1 to 50 carbons, or a substituted or unsubstituted silyl group having 1 to 50 carbons, wherein the substituted or unsubstituted aryl group having 6 to 50 ring carbons, the substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, or the substituted or unsubstituted cycloalkyl group having 3 to 50 carbons forms a saturated or unsaturated ring independently or with an adjacent group,
wherein a group suitable for substitution on the Ar^{16} to Ar^{19} and R^{10} to R^{12} is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 50 ring carbons, a heteroaryl group having 5 to 50 ring atoms, an alkyl group having 1 to 50 carbons, a cycloalkyl group having 3 to 50 carbons, a thio group having 1 to 50 carbons, or a silyl group having 1 to 50 carbons.

[0021] In addition, the present invention provides a compound for an organic electroluminescent device, represented by Chemical Formula 6 below:

[Chemical Formula 6]



wherein Y^9 to Y^{11} are identical or different substituents and each represent an oxygen atom, a sulfur atom or a selenium atom,
Ar^{20} to Ar^{25} are identical or different substituents and each represent a substituted or unsubstituted aryl group having

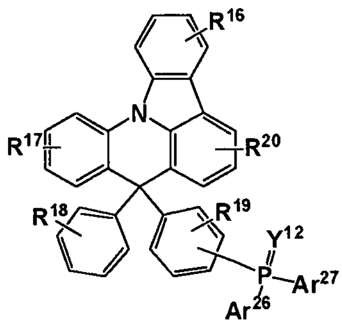
6 to 50 ring carbons, or a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, and

part or all of R^{13} to R^{15} are independently a hydrogen atom, or R^{13} to R^{15} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted aryl group having 6 to 50 ring carbons, a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbons, a substituted or unsubstituted cycloalkyl group having 3 to 50 carbons, a substituted or unsubstituted thio group having 1 to 50 carbons, or a substituted or unsubstituted silyl group having 1 to 50 carbons, wherein the substituted or unsubstituted aryl group having 6 to 50 ring carbons, the substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, or the substituted or unsubstituted cycloalkyl group having 3 to 50 carbons forms a saturated or unsaturated ring independently or with an adjacent group,

wherein a group suitable for substitution on the Ar^{20} to Ar^{25} and R^{13} to R^{15} is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 50 ring carbons, a heteroaryl group having 5 to 50 ring atoms, an alkyl group having 1 to 50 carbons, a cycloalkyl group having 3 to 50 carbons, a thio group having 1 to 50 carbons, or a silyl group having 1 to 50 carbons.

[0022] In addition, the present invention provides a compound for an organic electroluminescent device, represented by Chemical Formula 7 below:

[Chemical Formula 7]



wherein Y^{12} represents an oxygen atom, a sulfur atom or a selenium atom,

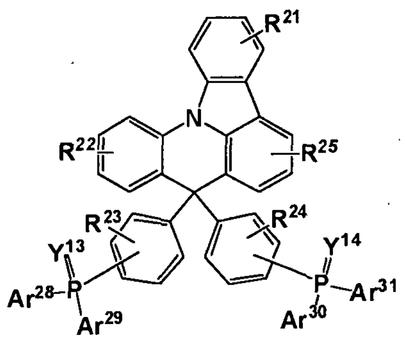
Ar^{26} and Ar^{27} are identical or different substituents and each represent a substituted or unsubstituted aryl group having 6 to 50 ring carbons, or a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, and

part or all of R^{16} to R^{20} are independently a hydrogen atom, or R^{16} to R^{20} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted aryl group having 6 to 50 ring carbons, a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbons, a substituted or unsubstituted cycloalkyl group having 3 to 50 carbons, a substituted or unsubstituted thio group having 1 to 50 carbons, or a substituted or unsubstituted silyl group having 1 to 50 carbons, wherein the substituted or unsubstituted aryl group having 6 to 50 ring carbons, the substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, or the substituted or unsubstituted cycloalkyl group having 3 to 50 carbons forms a saturated or unsaturated ring independently or with an adjacent group,

wherein the group suitable for substitution on the Ar^{26}, A^{27} and R^{16} to R^{20} is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 50 ring carbons, a heteroaryl group having 5 to 50 ring atoms, an alkyl group having 1 to 50 carbons, a cycloalkyl group having 3 to 50 carbons, a thio group having 1 to 50 carbons, or a silyl group having 1 to 50 carbons.

[0023] In addition, the present invention provides a compound for an organic electroluminescent device, represented by Chemical Formula 8 below:

[Chemical Formula 8]



wherein Y^{13} and Y^{14} are identical or different substituents and each represent an oxygen atom, a sulfur atom or a selenium atom,
Ar^{28} to Ar^{31} are identical or different substituents and each represent a substituted or unsubstituted aryl group having 6 to 50 ring carbons, or a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, and
part or all of R^{21} to R^{25} are independently a hydrogen atom, or R^{21} to R^{25} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted aryl group having 6 to 50 ring carbons, a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbons, a substituted or unsubstituted cycloalkyl group having 3 to 50 carbons, a substituted or unsubstituted thio group having 1 to 50 carbons, or a substituted or unsubstituted silyl group having 1 to 50 carbons, wherein the substituted or unsubstituted aryl group having 6 to 50 ring carbons, the substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, or the substituted or unsubstituted cycloalkyl group having 3 to 50 carbons forms a saturated or unsaturated ring independently or with an adjacent group,
wherein a group suitable for substitution on the Ar^{28} to Ar^{31} and R^{21} to R^{25} is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 50 ring carbons, a heteroaryl group having 5 to 50 ring atoms, an alkyl group having 1 to 50 carbons, a cycloalkyl group having 3 to 50 carbons, a thio group having 1 to 50 carbons, or a silyl group having 1 to 50 carbons.

[0024] In addition, the present invention provides an organic electroluminescent device, comprising:

a first electrode;
a second electrode; and
a single organic layer or a plurality of organic layers having at least one light-emitting layer,
formed between the first electrode and the second electrode,
wherein the organic layer includes the compound for an organic electroluminescent device as above.

[0025] As such, the light-emitting layer may include the compound for an organic electroluminescent device according to the present invention. Furthermore, the organic layer may include a hole transport layer including the compound for an organic electroluminescent device according to the present invention.

Description of Drawings

[0026]

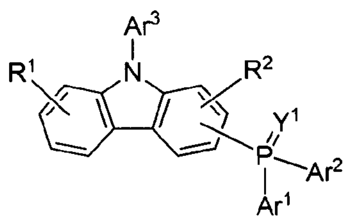
FIG. 1 is a schematic view showing the structure of an organic electroluminescent device according to the present invention;
FIG. 4 is a graph showing the efficiency characteristics of the organic electroluminescent device of Example 3 according to the present invention;
FIG. 6 is a graph showing the efficiency characteristics of the organic electroluminescent device of Example 5 according to the present invention;
FIG. 7 is a graph showing the efficiency characteristics of the organic electroluminescent device of Example 6 according to the present invention;
FIG. 8 is a graph showing the efficiency characteristics of the organic electroluminescent device of Example 7 according to the present invention;
FIG. 9 is a graph showing the efficiency characteristics of the organic electroluminescent device of Example 8 according to the present invention;
FIG. 10 is a graph showing the efficiency characteristics of the organic electroluminescent device of Example 9

according to the present invention;
FIG. 11 is a graph showing the efficiency characteristics of the organic electroluminescent device of Comparative Example 1 according to the present invention; and
FIG. 12 is a graph showing the efficiency characteristics of the organic electroluminescent device of Comparative Example 2 according to the present invention.

Best Mode

[0027] Hereinafter, a detailed description will be given of a carbazole-based phosphine oxide compound and an organic electroluminescent (EL) device including the same according to preferred embodiments of the present invention with reference to the following chemical formulas or the appended drawings.
[0028] In the present invention, with the goal of overcoming the problems of the low efficiency of conventional organic EL devices, phosphine oxide compounds having a carbazole structure were developed and applied to the host material for a light-emitting layer of an organic EL device.
[0029] The carbazole structure has a triplet energy gap of 3.2 eV and may be applied to any light-emitting layer from red phosphorescence to blue phosphorescence, and also has very superior thermal stability and is thus advantageous in terms of stability of the device. Furthermore, the carbazole structure may have very good hole transport characteristics and may thus be utilized as a material for a hole transport layer.
[0030] The phosphine oxide structure has superior electron transport characteristics and is advantageous in terms of stability of the device.
[0031] Thus, a combination of the carbazole structure and the phosphine oxide structure, which are both units having superior electron and hole transport characteristics and high triplet energy, achieves superior characteristics that are adapted to a host material for a light-emitting layer.
[0032] In the present invention, the carbazole-based phosphine oxide compound having the phosphine oxide structure and the carbazole structure was used as a host for a light-emitting layer of an organic EL device. The carbazole structure functions to adjust the triplet energy of an organic material, and the phosphine oxide structure plays a role in improving electron transport characteristics. Hence, the compound according to the present invention is applied to the host of a phosphorescent material by the use of high triplet energy of the carbazole structure, and can be employed as a host material having high charge mobility thanks to the hole transport characteristics of the carbazole structure and the electron transport characteristics of the phosphine oxide structure
[0033] Below is a description of the carbazole-based phosphine oxide according to the present invention and the organic EL device including the same.
[0034] The present invention provides a compound for an organic EL device, including a carbazole-based phosphine oxide compound, a carbazole-based phosphine sulfide compound or a carbazole-based phosphine selenide compound (hereinafter which is simply referred to as a carbazole-based phosphine oxide compound), as represented by Chemical Formula 1 below.

[Chemical Formula 1]



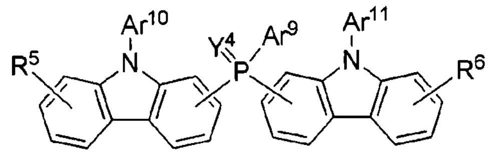
[0035] In Chemical Formula 1, Y^1 represents an oxygen atom,

Ar^1 and Ar^2 are identical and each represent a phenyl group,
Ar^3 represents a phenyl group, and
R^1 and R^2 each represent a phenyl group.

[0036] Also, according to the present invention, a compound for an organic EL device may be provided, wherein in Chemical Formual 1, Y^1 represents an oxygen atom, Ar^1 and Ar^2 each represent a phenyl group, Ar^3 represents a phenyl group, and R^1 and R^2 each represent a phenyl group.
[0037] In addition, the present invention provides a compound for an organic EL device represented by Chemical

Formula 3 below.

[Chemical Formula 3]



[0038] According to the present invention, a compound for an organic EL device is provided, wherein in Chemical Formula 3, Y^4 represents an oxygen atom,

Ar^9 represents a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group,

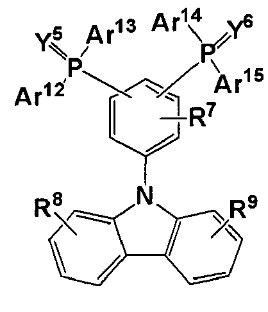
Ar^{10} and Ar^{11} are identical or different substituents and each represent a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, and

part or all of R^5 and R^6 are independently a hydrogen atom, or R^5 and R^6 are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, wherein the substituted or unsubstituted phenyl group having 6 to 34 carbons, the substituted or unsubstituted biphenyl group, the substituted or unsubstituted terphenyl group, the substituted or unsubstituted naphthyl group, the substituted or unsubstituted anthryl group, or the substituted or unsubstituted pyrenyl group forms a saturated or unsaturated ring independently or with an adjacent group,

wherein the group suitable for substitution on the Ar^9 to Ar^{11}, R^5 and R^6 is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 34 ring carbons, a heteroaryl group having 5 to 34 ring atoms, an alkyl group having 1 to 34 carbons, a cycloalkyl group having 3 to 34 carbons, a thio group having 1 to 34 carbons, or a silyl group having 1 to 34 carbons.

[0039] In addition, the present invention provides a compound for an organic EL device represented by Chemical Formula 4 below.

[Chemical Formula 4]



[0040] In Chemical Formula 4, Y^5 and Y^6 are identical or different substituents and each represent an oxygen atom, a sulfur atom or a selenium atom,

Ar^{12} to Ar^{15} are identical or different substituents and each represent a substituted or unsubstituted aryl group having 6 to 50 ring carbons, or a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, and

part or all of R^7 to R^9 are independently a hydrogen atom, or R^7 to R^9 are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted aryl group having 6 to 50 ring carbons, a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, a substituted or unsub-

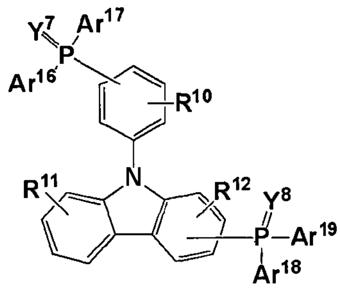
stituted alkyl group having 1 to 50 carbons, a substituted or unsubstituted cycloalkyl group having 3 to 50 carbons, a substituted or unsubstituted thio group having 1 to 50 carbons, or a substituted or unsubstituted silyl group having 1 to 50 carbons, wherein the substituted or unsubstituted aryl group having 6 to 50 ring carbons, the substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, or the substituted or unsubstituted cycloalkyl group having 3 to 50 carbons forms a saturated or unsaturated ring independently or with an adjacent group,
wherein the group suitable for substitution on the Ar^{12} to Ar^{15} and R^7 to R^9 is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 50 ring carbons, a heteroaryl group having 5 to 50 ring atoms, an alkyl group having 1 to 50 carbons, a cycloalkyl group having 3 to 50 carbons, a thio group having 1 to 50 carbons, or a silyl group having 1 to 50 carbons.

[0041] According to the present invention, a compound for an organic EL device may be provided, wherein in Chemical Formula 4, Y^5 and Y^6 represent an oxygen atom,

Ar^{12} to Ar^{15} are identical or different substituents and each represent a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, and
part or all of R^7 to R^9 are independently a hydrogen atom, or R^7 to R^9 are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, wherein the substituted or unsubstituted phenyl group having 6 to 34 carbons, the substituted or unsubstituted biphenyl group, the substituted or unsubstituted terphenyl group, the substituted or unsubstituted naphthyl group, the substituted or unsubstituted anthryl group, or the substituted or unsubstituted pyrenyl group forms a saturated or unsaturated ring independently or with an adjacent group,
wherein the group suitable for substitution on the Ar^{12} to Ar^{15} and R^7 to R^9 is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 34 ring carbons, a heteroaryl group having 5 to 34 ring atoms, an alkyl group having 1 to 34 carbons, a cycloalkyl group having 3 to 34 carbons, a thio group having 1 to 34 carbons, or a silyl group having 1 to 34 carbons.

[0042] In addition, the present invention provides a compound for an organic EL device represented by Chemical Formula 5 below.

[Chemical Formula 5]



[0043] In Chemical Formula 5, Y^7 and Y^8 are identical or different substituents and each represent an oxygen atom, a sulfur atom or a selenium atom,

Ar^{16} to Ar^{19} are identical or different substituents and each represent a substituted or unsubstituted aryl group having 6 to 50 ring carbons, or a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, and
part or all of R^{10} to R^{12} are independently a hydrogen atom, or R^{10} to R^{12} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted aryl group having 6 to 50 ring carbons, a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbons, a substituted or unsubstituted cycloalkyl group having 3 to 50 carbons, a substituted or unsubstituted thio group having 1 to 50 carbons, or a substituted or unsubstituted silyl group having 1 to 50 carbons, wherein the substituted or unsubstituted aryl group having 6 to 50 ring carbons, the substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, or the substituted or unsubstituted cycloalkyl group having

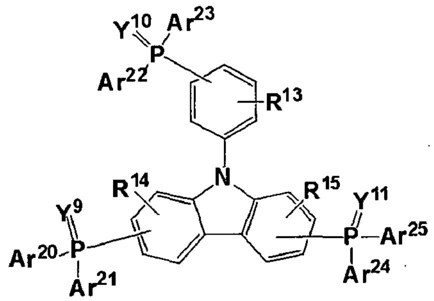
3 to 50 carbons forms a saturated or unsaturated ring independently or with an adjacent group,
wherein the group suitable for substitution on the Ar^{16} to Ar^{19} and R^{10} to R^{12} is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 50 ring carbons, a heteroaryl group having 5 to 50 ring atoms, an alkyl group having 1 to 50 carbons, a cycloalkyl group having 3 to 50 carbons, a thio group having 1 to 50 carbons, or a silyl group having 1 to 50 carbons.

[0044] According to the present invention, a compound for an organic EL device may be provided, wherein in Chemical Formula 5, Y^7 and Y^8 each represent an oxygen atom,

Ar^{16} to Ar^{19} are identical or different substituents and each represent a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, and
part or all of R^{10} to R^{12} are independently a hydrogen atom, or R^{10} to R^{12} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, wherein the substituted or unsubstituted phenyl group having 6 to 34 carbons, the substituted or unsubstituted biphenyl group, the substituted or unsubstituted terphenyl group, the substituted or unsubstituted naphthyl group, the substituted or unsubstituted anthryl group, or the substituted or unsubstituted pyrenyl group forms a saturated or unsaturated ring independently or with an adjacent group,
wherein the group suitable for substitution on the Ar^{16} to Ar^{19} and R^{10} to R^{12} is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 34 ring carbons, a heteroaryl group having 5 to 34 ring atoms, an alkyl group having 1 to 34 carbons, a cycloalkyl group having 3 to 34 carbons, a thio group having 1 to 34 carbons, or a silyl group having 1 to 34 carbons.

[0045] In addition, the present invention provides a compound for an organic EL device represented by Chemical Formula 6 below.

[Chemical Formula 6]



[0046] In Chemical Formula 6, Y^9 to Y^{11} are identical or different substituents and each represent an oxygen atom, a sulfur atom or a selenium atom,

Ar^{20} to Ar^{25} are identical or different substituents and each represent a substituted or unsubstituted aryl group having 6 to 50 ring carbons, or a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, and
part or all of R^{13} to R^{15} are independently a hydrogen atom, or R^{13} to R^{15} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted aryl group having 6 to 50 ring carbons, a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbons, a substituted or unsubstituted cycloalkyl group having 3 to 50 carbons, a substituted or unsubstituted thio group having 1 to 50 carbons, or a substituted or unsubstituted silyl group having 1 to 50 carbons, wherein the substituted or unsubstituted aryl group having 6 to 50 ring carbons, the substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, or the substituted or unsubstituted cycloalkyl group having 3 to 50 carbons forms a saturated or unsaturated ring independently or with an adjacent group,
wherein the group suitable for substitution on the Ar^{20} to Ar^{25} and R^{13} to R^{15} is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 50 ring carbons, a heteroaryl group having 5 to 50 ring atoms, an alkyl group

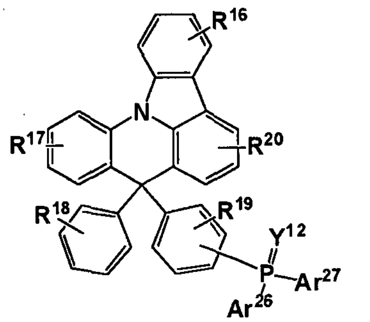
having 1 to 50 carbons, a cycloalkyl group having 3 to 50 carbons, a thio group having 1 to 50 carbons, or a silyl group having 1 to 50 carbons.

[0047] According to the present invention, a compound for an organic EL device may be provided, wherein in Chemical Formula 6, Y^9 to Y^{11} each represent an oxygen atom,

Ar^{20} to Ar^{25} are identical or different substituents and each represent a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, and
part or all of R^{13} to R^{15} are independently a hydrogen atom, or R^{13} to R^{15} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, wherein the substituted or unsubstituted phenyl group having 6 to 34 carbons, the substituted or unsubstituted biphenyl group, the substituted or unsubstituted terphenyl group, the substituted or unsubstituted naphthyl group, the substituted or unsubstituted anthryl group, or the substituted or unsubstituted pyrenyl group forms a saturated or unsaturated ring independently or with an adjacent group,
wherein the group suitable for substitution on the Ar^{20} to Ar^{25} and R^{13} to R^{15} is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 34 carbons, a heteroaryl group having 5 to 34 ring atoms, an alkyl group having 1 to 34 carbons, a cycloalkyl group having 3 to 34 carbons, a thio group having 1 to 34 carbons, or a silyl group having 1 to 34 carbons.

[0048] In addition, the present invention provides a compound for an organic EL device represented by Chemical Formula 7 below.

[Chemical Formula 7]



[0049] In Chemical Formula 7, Y^{12} represents an oxygen atom, a sulfur atom or a selenium atom,

Ar^{26} and Ar^{27} are identical or different substituents and each represent a substituted or unsubstituted aryl group having 6 to 50 ring carbons, or a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, and
part or all of R^{16} to R^{20} are independently a hydrogen atom, or R^{16} to R^{20} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted aryl group having 6 to 50 ring carbons, a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbons, a substituted or unsubstituted cycloalkyl group having 3 to 50 carbons, a substituted or unsubstituted thio group having 1 to 50 carbons, or a substituted or unsubstituted silyl group having 1 to 50 carbons, wherein the substituted or unsubstituted aryl group having 6 to 50 ring carbons, the substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, or the substituted or unsubstituted cycloalkyl group having 3 to 50 carbons forms a saturated or unsaturated ring independently or with an adjacent group,
wherein the group suitable for substitution on the Ar^{26}, A^{27} and R^{16} to R^{20} is a hallogen atom, a cyano group, a nitro group, an aryl group having 6 to 50 ring carbons, a heteroaryl group having 5 to 50 ring atoms, an alkyl group having 1 to 50 carbons, a cycloalkyl group having 3 to 50 carbons, a thio group having 1 to 50 carbons, or a silyl group having 1 to 50 carbons.

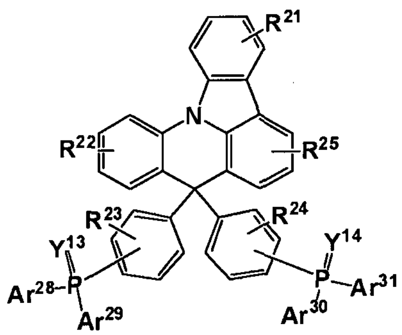
[0050] According to the present invention, a compound for an organic EL device may be provided, wherein in Chemical

Formula 7, Y^{12} represents an oxygen atom,

Ar^{26} and Ar^{27} are identical or different substituents and each represent a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, and
part or all of R^{16} to R^{20} are independently a hydrogen atom, or R^{16} to R^{20} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or u-nsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, wherein the substituted or unsubstituted phenyl group having 6 to 34 carbons, the substituted or unsubstituted biphenyl group, the substituted or unsubstituted terphenyl group, the substituted or unsubstituted naphthyl group, the substituted or unsubstituted anthryl group, or the substituted or unsubstituted pyrenyl group forms a saturated or unsaturated ring independently or with an adjacent group,
wherein the group suitable for substitution on the Ar^{26}, A^{27} and R^{16} to R^{20} is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 34 carbons, a heteroaryl group having 5 to 34 ring atoms, an alkyl group having 1 to 34 carbons, a cycloalkyl group having 3 to 34 carbons, a thio group having 1 to 34 carbons, or a silyl group having 1 to 34 carbons.

[0051] In addition, the present invention provides a compound for an organic EL device represented by Chemical Formula 8 below.

[Chemical Formula 8]



[0052] In Chemical Formula 8, Y^{13} and Y^{14} are identical or different substituents and each represent an oxygen atom, a sulfur atom or a selenium atom,

Ar^{28} to Ar^{31} are identical or different substituents and each represent a substituted or unsubstituted aryl group having 6 to 50 carbons, or a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, and
part or all of R^{21} to R^{25} are independently a hydrogen atom, or R^{21} to R^{25} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted aryl group having 6 to 50 ring carbons, a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbons, a substituted or unsubstituted cycloalkyl group having 3 to 50 carbons, a substituted or unsubstituted thio group having 1 to 50 carbons, or a substituted or unsubstituted silyl group having 1 to 50 carbons, wherein the substituted or unsubstituted aryl group having 6 to 50 ring carbons, the substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, or the substituted or unsubstituted cycloalkyl group having 3 to 50 carbons forms a saturated or unsaturated ring independently or with an adjacent group,
wherein the group suitable for substitution on the Ar^{28} to Ar^{31} and R^{21} to R^{25} is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 50 ring carbons, a heteroaryl group having 5 to 50 ring atoms, an alkyl group having 1 to 50 carbons, a cycloalkyl group having 3 to 50 carbons, a thio group having 1 to 50 carbons, or a silyl group having 1 to 50 carbons.

[0053] According to the present invention, a compound for an organic EL device may be provided, wherein in Chemical Formula 8, Y^{13} and Y^{14} each represent an oxygen atom,

Ar^{28} to Ar^{31} are identical or different substituents and each represent a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, and

part or all of R^{21} to R^{25} are independently a hydrogen atom, or R^{21} to R^{25} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, wherein the substituted or unsubstituted phenyl group having 6 to 34 carbons, the substituted or unsubstituted biphenyl group, the substituted or unsubstituted terphenyl group, the substituted or unsubstituted naphthyl group, the substituted or unsubstituted anthryl group, or the substituted or unsubstituted pyrenyl group forms a saturated or unsaturated ring independently or with an adjacent group,

wherein the group suitable for substitution on the Ar^{28} to Ar^{31} and R^{21} to R^{25} is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 34 ring carbons, a heteroaryl group having 5 to 34 ring atoms, an alkyl group having 1 to 34 carbons, a cycloalkyl group having 3 to 34 carbons, a thio group having 1 to 34 carbons, or a silyl group having 1 to 34 carbons.

[0054] Specific examples of the substituted or unsubstituted aryl group having 6 to 50 ring carbons on the Ar^9 to Ar^{31} and R^5 to R^{25} include phenyl, 1-naphthyl, 2-naphthyl, 1-anthryl, 2-anthryl, 9-anthryl, 1-phenanthryl, 2-phenanthryl, 3-phenanthryl, 4-phenanthryl, 9-phenanthryl, 1-naphthacenyl, 2-naphthacenyl, 9-naphthacenyl, 1-pyrenyl, 2-pyrenyl, 4-pyrenyl, 2-biphenylyl, 3-biphenylyl, 4-biphenylyl, p-terphenyl-4-yl, p-terphenyl-3-yl, p-terphenyl-2-yl, m-terphenyl-4-yl, m-terphenyl-3-yl, m-terphenyl-2-yl, o-tolyl, m-tolyl, p-tolyl, p-tert-butylphenyl, p-(2-phenylpropyl)phenyl, 3-methyl-2-naphthyl, 4-methyl-1-naphthyl, 4-methyl-1-anthryl, 4-methylbiphenylyl or 4-tert-butyl-p-terphenyl-4-yl.

[0055] Specific examples of the aromatic heterocyclic group having 5 to 50 ring atoms on the Ar^{12} to Ar^{31} and R^7 to R^{25} include 1-pyrolyl, 2-pyrolyl, 3-pyrolyl, pyrazinyl, pyrimidyl, pyridazyl, 2-pyridinyl, 3-pyridinyl, 4-pyridinyl, 1-indolyl, 2-indolyl, 3-indolyl, 4-indolyl, 5-indolyl, 6-indoly], 7-indolyl, 1-isoindolyl, 2-isoindolyl, 3-isoindolyl, 4-isoindolyl, 5-isoindolyl, 6-isoindolyl, 7-isoindolyl, 2-furyl, 3-furyl, 2-benzofuranyl, 3-benzofuranyl, 4-benzofuranyl, 5-benzofuranyl, 6-benzofuranyl, 7-benzofuranyl, 1-isobenzofuranyl, 3-isobenzofuranyl, 4-isobenzofuranyl, 5-isobenzofuranyl, 6-isobenzofuranyl, 7-isobenzofuranyl, qunolyl, 3-qunolyl, 4-qunolyl, 5-qunolyl, 6-qunolyl, 7-qunolyl, 8-qunolyl, 1-isoqunolyl, 3-isoqunolyl, 4-isoqunolyl, 5-isoqunolyl, 6-isoqunolyl, 7-isoqunolyl, 8-isoqunolyl, 2-quinoxalinyl, 5-quinoxalinyl, 6-quinoxalinyl, 1-phenanthridinyl, 2-phenanthridinyl, 3-phenanthridinyl, 4-phenanthridinyl, 6-phenanthridinyl, 7-phenanthridinyl, 8-phenanthridinyl, 9-phenanthridinyl, 10-phenanthridinyl, 1-acridinyl, 2-acridinyl, 3-acridinyl, 4-acridinyl, 9-acridinyl, 1,7-phenanthrolin-2-yl, 1,7-phenanthrolin-3-yl, 1,7-phenanthrolin-4-yl, 1,7-phenanthrolin-5-yl, 1,7-phenanthrolin-6-yl, 1,7-phenanthrolin-8-yl, 1,7-phenanthrolin-9-yl, 1,7-phenanthrolin-10-yl, 1,8-phenanthrolin-2-yl, 1,8-phenanthrolin-3-yl, 1,8-phenanthrolin-4-yl, 1,8-phenanthrolin-5-yl, 1,8-phenanthrolin-6-yl, 1,8-phenanthrolin-7-yl, 1,8-phenanthrolin-9-yl, 1,8-phenanthrolin-10-yl, 1,9-phenanthrolin-2-yl, 1,9-phenanthrolin-3-yl, 1,9-phenanthrolin-4-yl, 1,9-phenanthrolin-5-yl, 1,9-phenanthrolin-6-yl, 1,9-phenanthrolin-7-yl, 1,9-phenanthrolin-8-yl, 1,9-phenanthrolin-10-yl, 1,10-phenanthrolin-2-yl, 1,10-phenanthrolin-3-yl, 1,10-phenanthrolin-4-yl, 1,10-phenanthrolin-5-yl, 2,9-phenanthrolin-1-yl, 2,9-phenanthrolin-3-yl, 2,9-phenanthrolin-4-yl, 2,9-phenanthrolin-5-yl, 2,9-phenanthrolin-6-yl, 2,9-phenanthrolin-7-yl, 2,9-phenanthrolin-8-yl, 2,9-phenanthrolin-10-yl, 2,8-phenanthrolin-1-yl, 2,8-phenanthrolin-3-yl, 2,8-phenanthrolin-4-yl, 2,8-phenanthrolin-5-yl, 2,8-phenanthrolin-6-yl, 2,8-phenanthrolin-7-yl, 2,8-phenanthrolin-9-yl, 2,8-phenanthrolinyl, 2,7-phenanthrolin-1-yl, 2,7-phenanthrolin-3-yl, 2,7-phenanthrolin-4-yl, 2,7-phenanthrolin-5-yl, 2,7-phenanthrolin-6-yl, 2,7-phenanthrolin-8-yl, 2,7-phenanthrolin-9-yl, 2,7-phenanthrolin-10-yl, 1-phenazinyl, 2-phenazinyl, 1-phenothiazinyl, 2-phenothiazinyl, 3-phenothiazinyl, 4-phenothiazinyl, 10-phenothiazinyl, 1-phenoxazinyl, 2-phenoxazinyl, 3-phenoxazinyl, 4-phenoxazinyl, 10-phenoxazinyl, 2-oxazolyl, 4-oxazolyl, 5-oxazolyl, 2-oxadiazolyl, 5-oxadiazolyl, 3-furazanyl, 2-thienyl, 3-thienyl, 2-methylpyrol-1-yl, 2-methylpyrol-3-yl, 2-methylpyrol-4-yl, 2-methylpyrol-5-yl, 3-methylpyrol-1-yl, 3-methylpyrol-2-yl, 3-methopyrol-4-yl, 3-methylpyrol-5-yl, 2-tert-butylpyrol-4-yl, 3-(2-phenylpropo)pyrol-1-yl, 2-methyl-1-indolyl, 4-methyl-1-indolyl, 2-methyl-3-indolyl, 4-methyl-3-indolyl, 2-tert-butyl-1-indolyl, 4-tert-butyl-1-indolyl, 2-tert-butyl-3-indolyl or 4-tert-butyl-3-indolyl.

[0056] On the R^7 to R^{25}, specific examples of the substituted or unsubstituted alkyl group having 1 to 50 carbons and the substituted or unsubstituted cycloalkyl group having 3 to 50 carbons include methyl, ethyl, n-propyl, n-pentyl, n-butyl, n-hexyl, n-heptyl, n-octyl, n-decanyl, n-eicosanyl isopropyl, sec-butyl, isobutyl, tert-butyl, hydroxymethyl, 1-hydroxyethyl, 2-hydroxyethyl, 2-hydroxyisobutyl, 1,2-dihydroxyethyl, 1,3-dihydroxyisopropyl, 2,3-dihydroxy-tert-butyl, 1,2,3-trihydroxypropyl, chloromethyl, 1-chloroethyl, 2-chloroethyl, 2-chloroisobutyl, 1,2-dichloroethyl, 1,3-dichloroisopropyl, 2,3-dichloro-tert-butyl, 1,2,3-trichloropropyl, bromomethyl, 1-bromoethyl, 2-bromoethyl, 2-bromoisobutyl, 1,2-dibromoethyl, 1,3-dibromoisopropyl, 2,3-dibromo-tert-butyl, 1,2,3-tribromopropyl, iodomethyl, 1-iodoethyl, 2-iodoethyl, 2-iodoisobutyl, 1,2-diiodoethyl, 1,3-diiodoisopropyl, 2,3-diiodo-tert-butyl, 1,2,3-triiodopropyl, aminomethyl, 1-aminoethyl, 2-aminoethyl, 2-aminoisobutyl, 1,2-diaminoethyl, 1,3-diaminoisopropyl, 2,3-diamino-tert-butyl, 1,2,3-triaminopropyl, cyanomethyl, 1-cyanoethyl, 2-cyanoethyl, 2-cyanoisobutyl, 1,2-dicyanoethyl, 1,3-dicyanoisopropyl, 2,3-dicyano-tert-butyl, 1,2,3-tricyanopropyl, nitromethyl, 1-nitroethyl, 2-nitroethyl, 2-nitroisobutyl, 1,2-dinitroethyl, 1,3-dinitroisopropyl, 2,3-dinitro-tert-butyl, 1,2,3-trinitropropyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, 4-methylcyclohexyl, 1-adamantyl, 2-adamantyl, 1-norbornyl, 2-norbornyl, etc.

[0057] On the R^7 to R^{25}, specific examples of the substituted or unsubstituted thio group having 1 to 50 carbons include methylthio, ethylthio, propylthio, butylthio, pentylthio, hexylthio, tri(isopropyl)thio, tri(isobutyl)thio, tri(tert-butyl)thio, tri(2-butyl)thio, phenylthio, naphthylthio, biphenylthio, (3-methylphenyl)thio, (4-methylnaphthyl)thio, (2-methylbiphenyl)thio, etc.

[0058] On the R^7 to R^{25}, specific examples of the substituted or unsubstituted silyl group having 1 to 50 carbons include trimethylsilyl, triethylsilyl, tributylsilyl, tri(isopropyl)silyl, tri(isobutyl)silyl, tri(tert-butyl)silyl, tri(2-butyl)silyl, triphenylsilyl, trinaphthylsilyl, tribiphenylsilyl, tri(3-methylphenyl)silyl, tri(4-methylnaphthyl)silyl, tri(2-methylbiphenyl)silyl, phenylmethylsilyl, phenylethylsilyl, naphthylmethylsilyl, naphthylethylsilyl, biphenylmethylsilyl, 3-methyl-phenylmethylsilyl, phenyl(isopropyl)silyl, naphthyl(isopropyl)silyl or biphenyl(isopropyl)silyl.

[0059] Below the structural formulas of Compounds 3 to 194 which are examples of the compound for an organic EL device according to the present invention are shown in Tables 1 to 22, but the present invention is not limited to such compounds.

TABLE 1

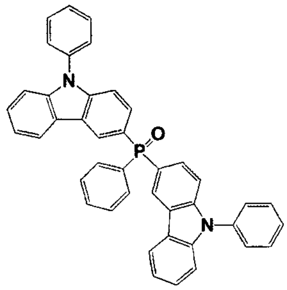
Compound	Structural Formula
3	

TABLE 3

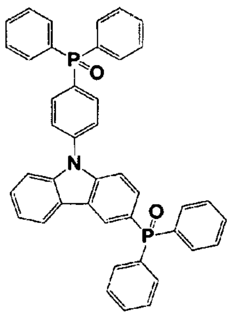
Compound	Structural Formula
28	

TABLE 4

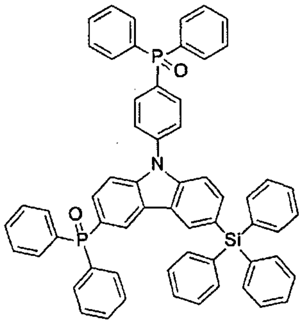
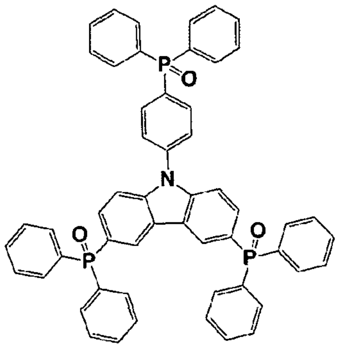
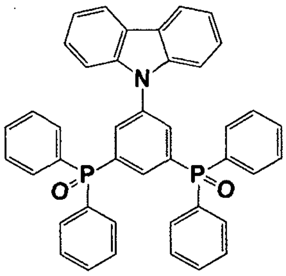
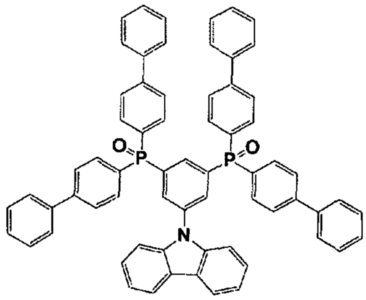
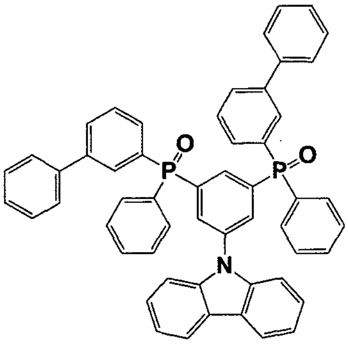
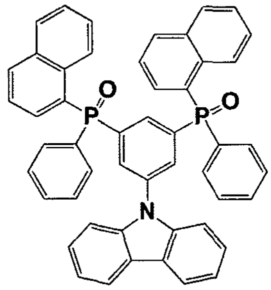
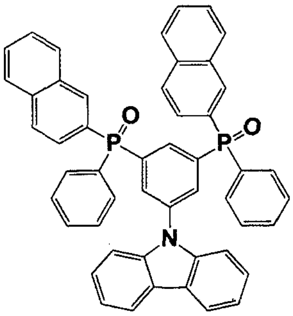
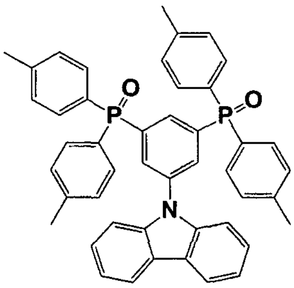
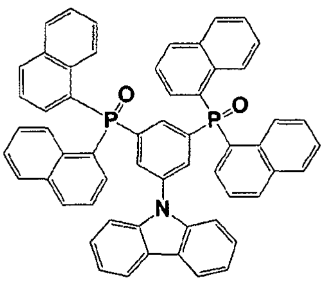
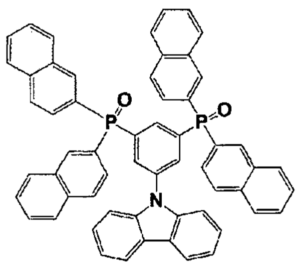
Compound	Structural Formula	Compound	Structural Formula
29		30	
31		32	
33		34	
35		36	
37		38	

TABLE 5

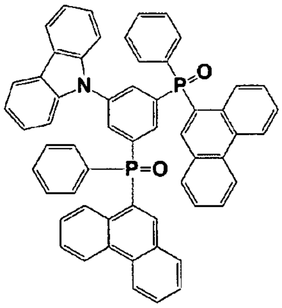
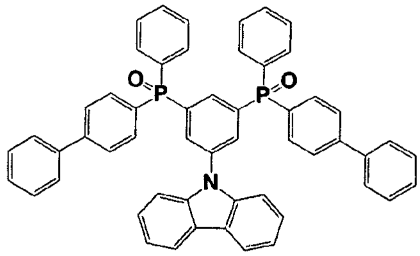
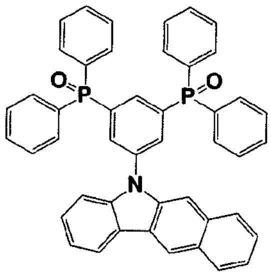
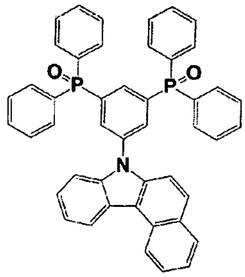
Compound	Structural Formula	Compound	Structural Formula
39		40	
87		88	

TABLE 10

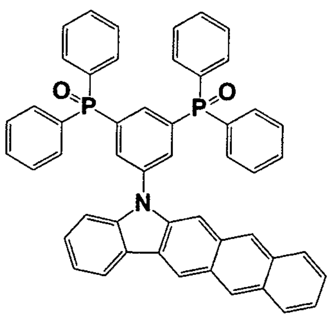
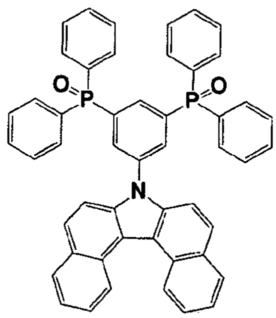
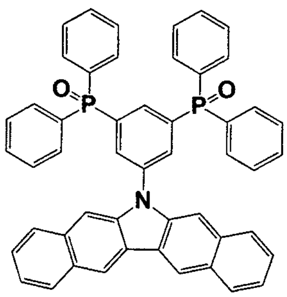
Compound	Structural Formula	Compound	Structural Formula
89		90	
91			

TABLE 11

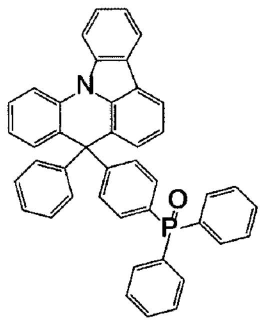
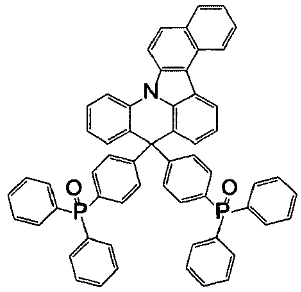
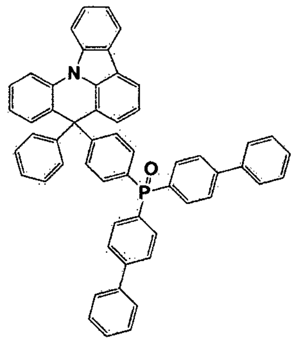
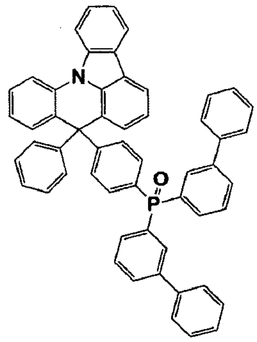
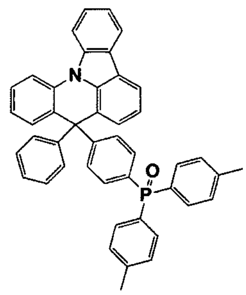
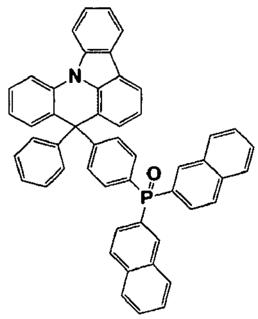
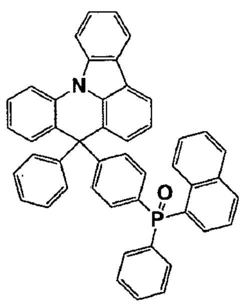
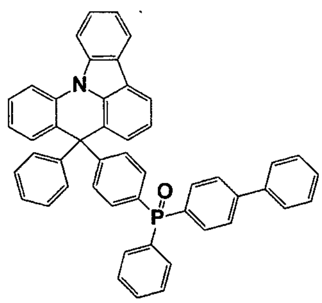
Compound	Structural Formula	Compound	Structural Formula
103		104	
105		106	
107		108	

TABLE 12

Compound	Structural Formula	Compound	Structural Formula
109		110	

(continued)

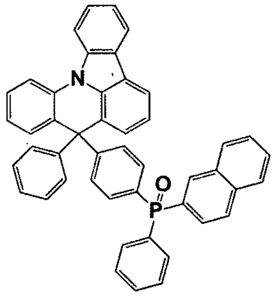
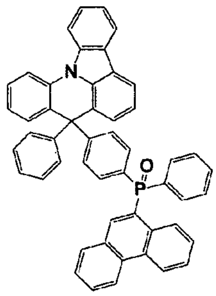
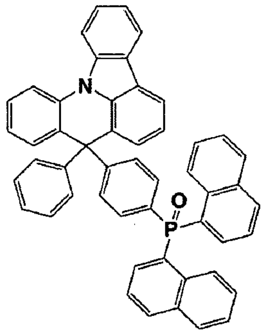
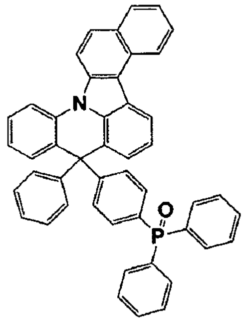
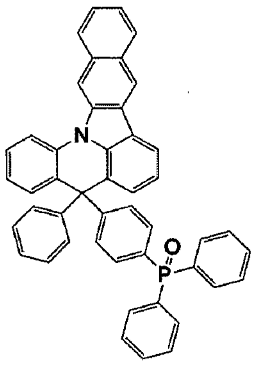
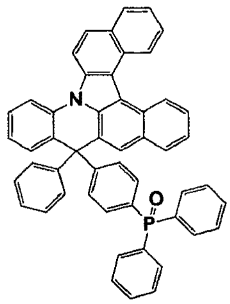
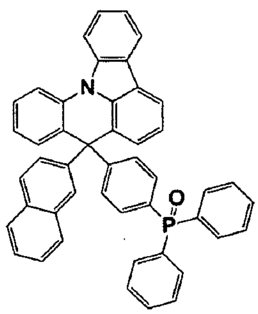
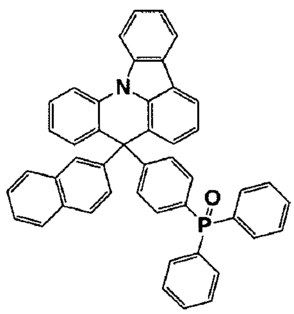
Compound	Structural Formula	Compound	Structural Formula
111		112	
113		114	
115		116	

TABLE 13

Compound	Structural Formula	Compound	Structural Formula
117		118	

(continued)

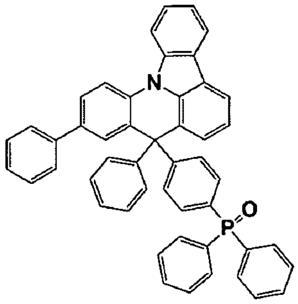
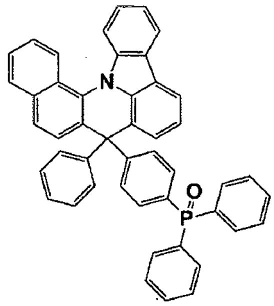
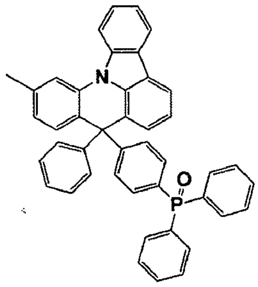
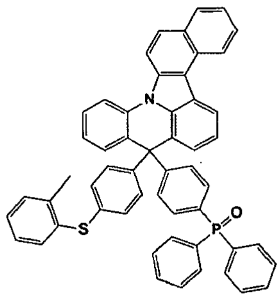
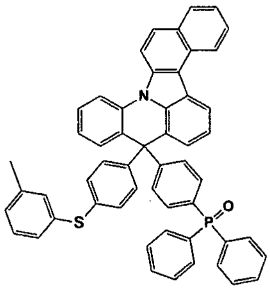
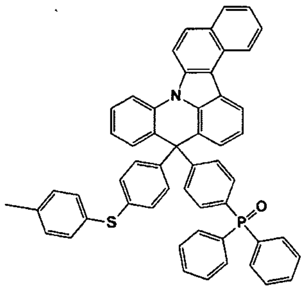
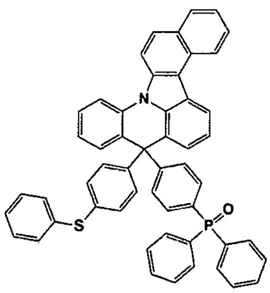
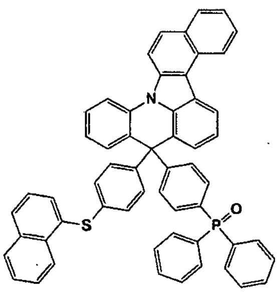
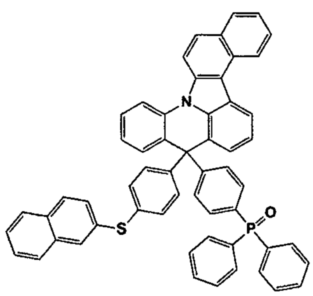
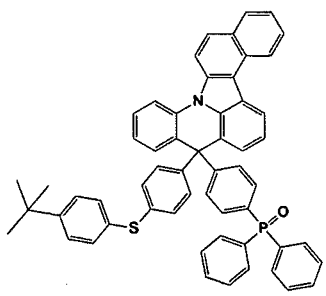
Compound	Structural Formula	Compound	Structural Formula
119		120	
121		122	
121		122	

TABLE 14

Compound	Structural Formula	Compound	Structural Formula
123		124	
125		126	

(continued)

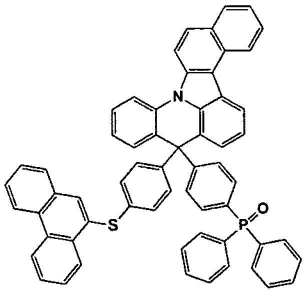
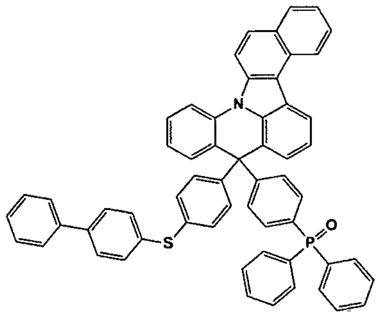
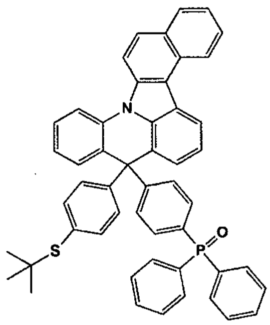
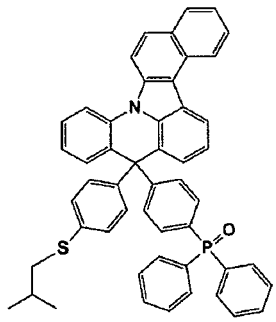
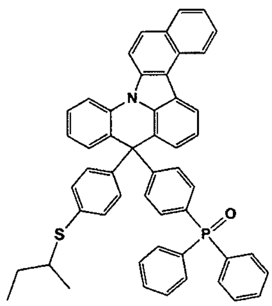
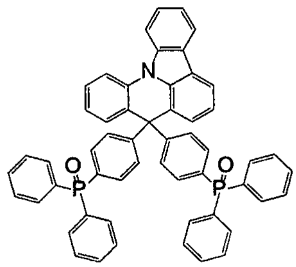
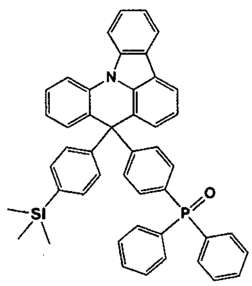
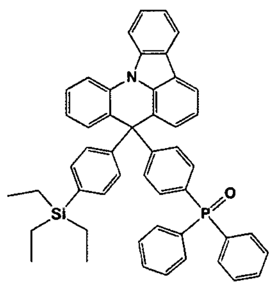
Compound	Structural Formula	Compound	Structural Formula
127		128	
129		130	

TABLE 15

Compound	Structural Formula	Compound	Structural Formula
131		132	
133		134	

(continued)

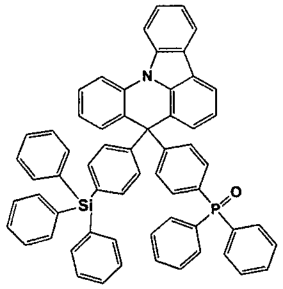
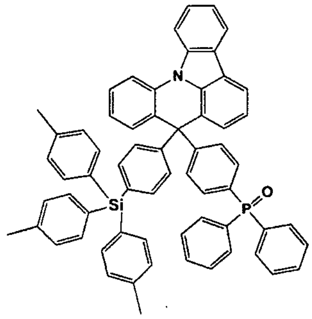
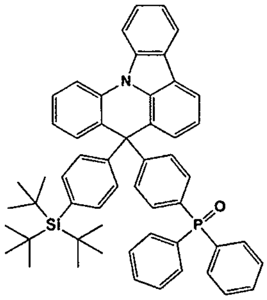
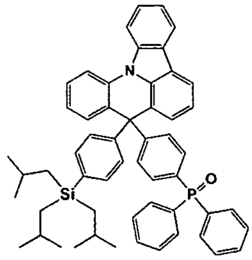
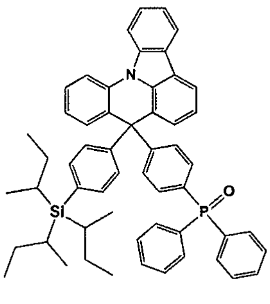
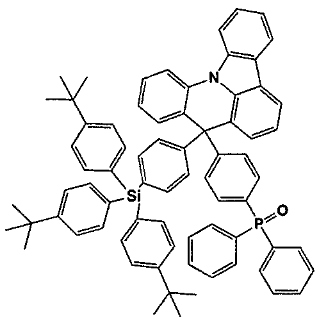
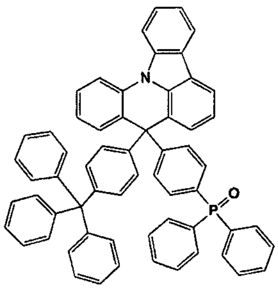
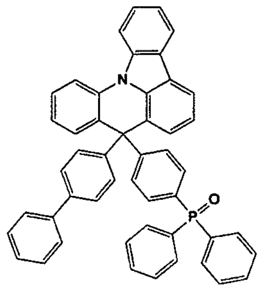
Compound	Structural Formula	Compound	Structural Formula
135		136	
137		138	

TABLE 16

Compound	Structural Formula	Compound	Structural Formula
139		140	
141		142	

(continued)

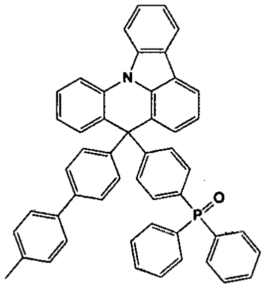
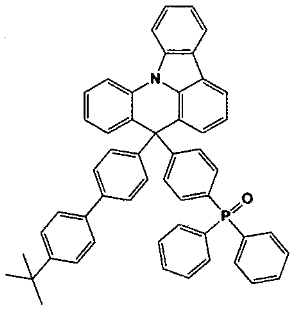
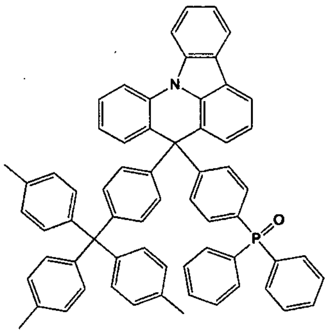
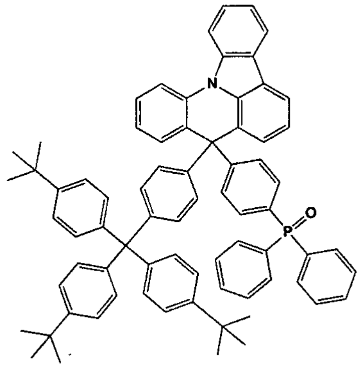
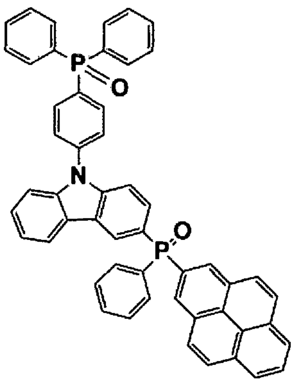
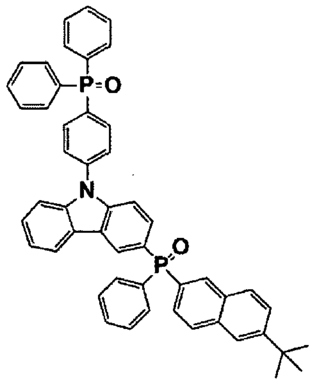
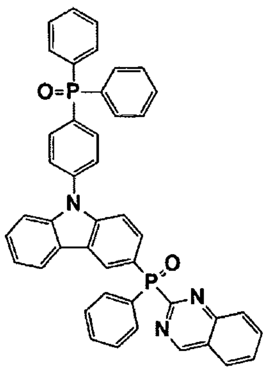
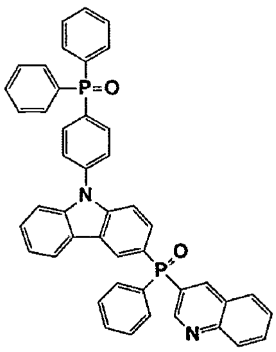
Compound	Structural Formula	Compound	Structural Formula
143		144	
145		146	

TABLE 18

Compound	Structural Formula	Compound	Structural Formula
155		156	
157		158	

(continued)

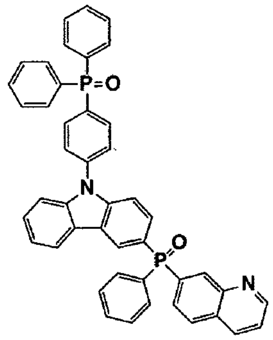
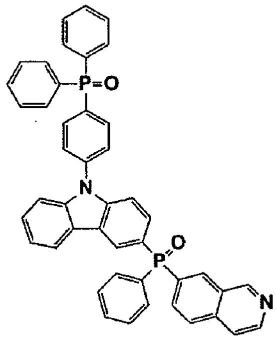
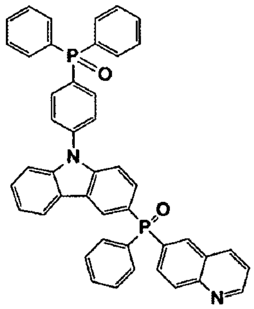
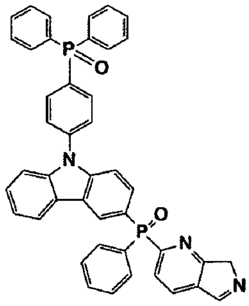
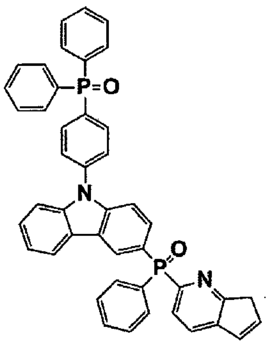
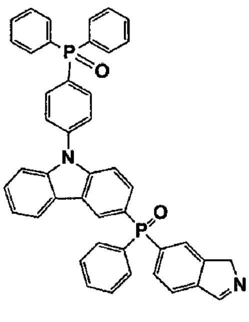
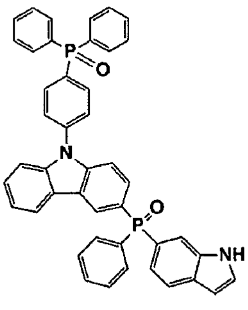
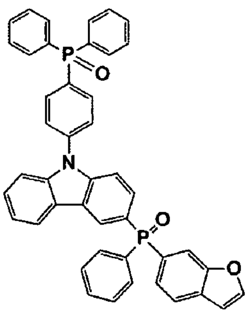
Compound	Structural Formula	Compound	Structural Formula
159		160	
161		162	

TABLE 19

Compound	Structural Formula	Compound	Structural Formula
163		164	
165		166	

(continued)

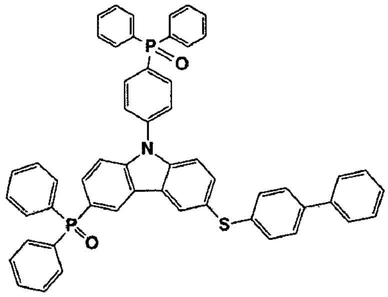
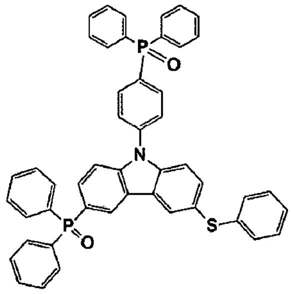
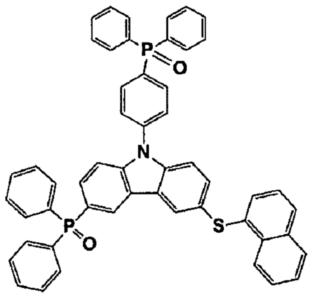
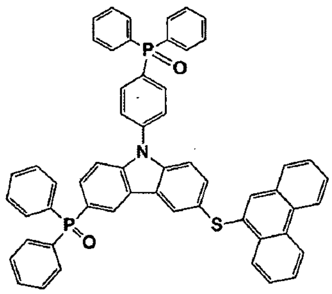
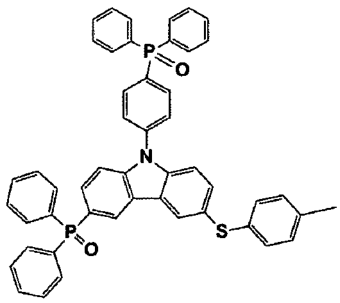
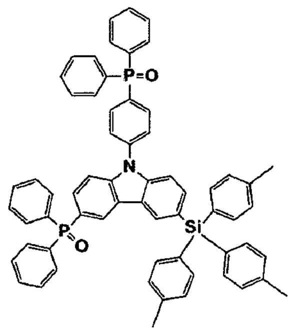
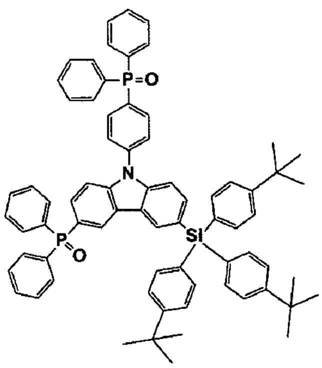
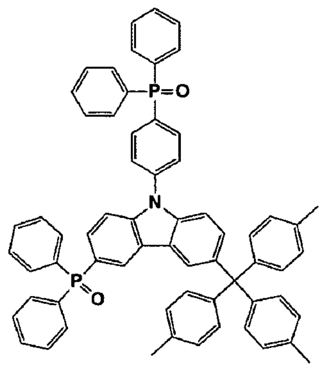
Compound	Structural Formula	Compound	Structural Formula
167		168	
169		170	

TABLE 20

Compound	Structural Formula	Compound	Structural Formula
171		172	
173		174	

(continued)

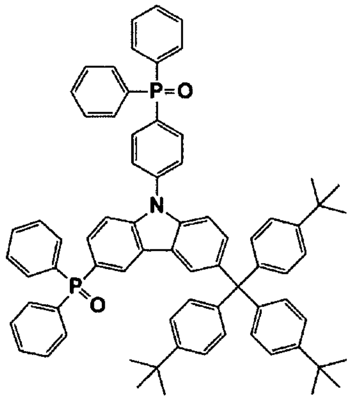
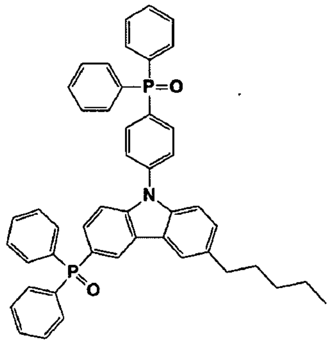
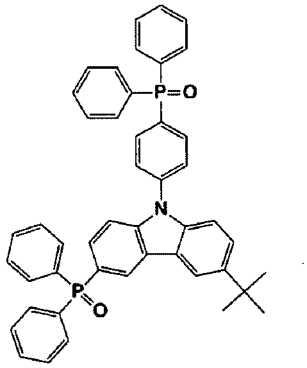
Compound	Structural Formula	Compound	Structural Formula
175		176	
177		178	

TABLE 21

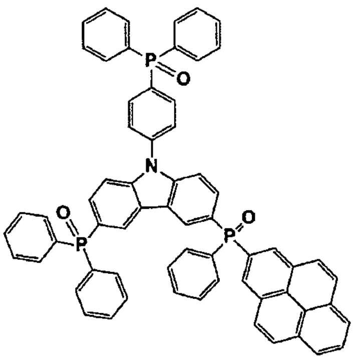
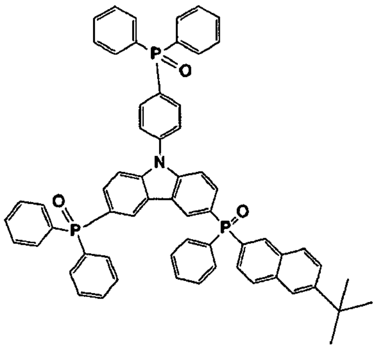
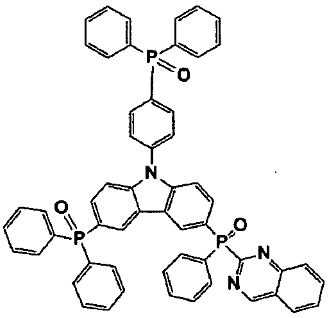
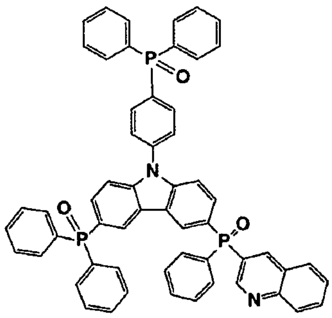
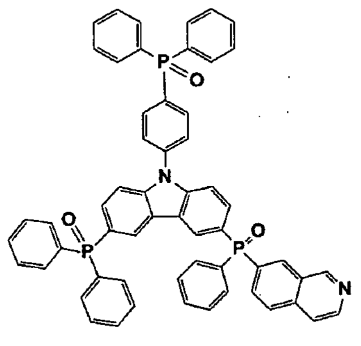
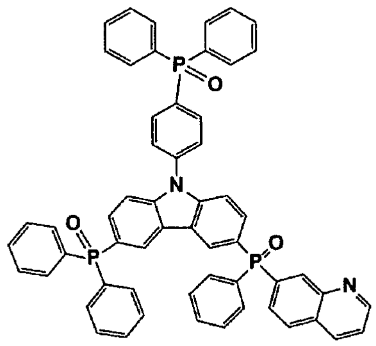
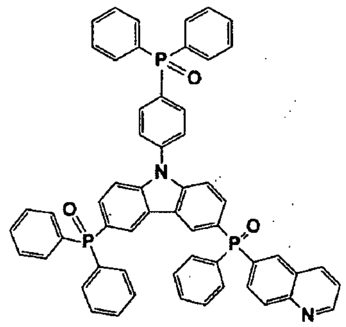
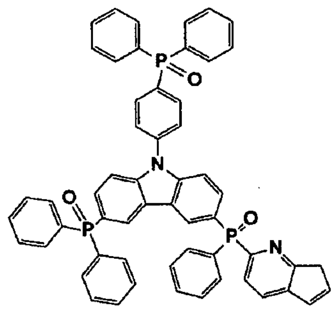
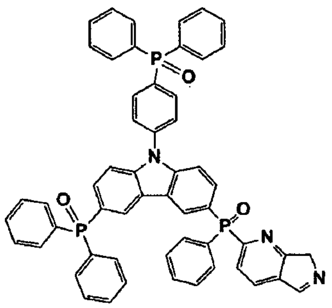
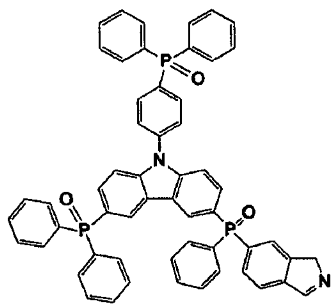
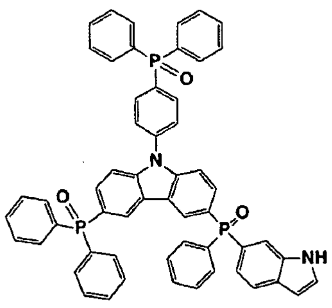
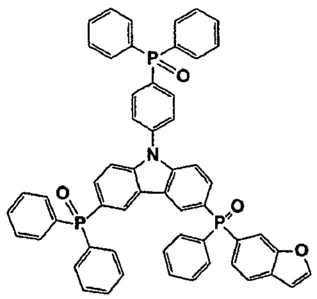
Compound	Structural Formula	Compound	Structural Formula
183		184	
185		186	

TABLE22

Compound	Structural Formula	Compound	Structural Formula
187		188	
189		190	
191		192	
193		194	

[0060] With reference to the appended drawings, the organic EL device according to the present invention is described below.

[0061] FIG. 1 schematically shows the structure of the organic EL device according to the present invention. The organic EL device including the compound represented by Chemical Formulas 1 to 8 may be embodied in a variety of structures.

[0062] As shown in FIG. 1, the organic EL device according to the present invention includes a first electrode 110; a second electrode 150; and a single organic layer or a plurality of organic layers 120, 130, 140 having at least one light-emitting layer 130 interposed between the first electrode and the second electrode, wherein the organic layers 120, 130, 140 may include part or all of the compounds of Chemcial Formulas 1 to 8 as described above.

[0063] The number of the plurality of organic layers may be 10 or less, and preferably 8 or less. If the number of organic layers exceeds 10, it is difficult to form organic layers of the organic EL device and economic benefits are negated.

[0064] As typically illustrated in FIG. 1, the organic EL device according to an embodiment of the present invention is configured such that a light-emitting layer 130, a hole transport layer 120 and an electron transport layer 140 are disposed between an anode 110 as the first electrode and a cathode 150 as the second electrode. In addition to the light-emitting layer 130, the hole transport layer 120 or the electron transport layer 140, part or all of an electron injection layer, a hole injection layer, a hole blocking layer, or an electron blocking layer may be separately formed, thus enabling the luminous efficiency of the organic EL device to increase.

[0065] The organic EL device is preferably supported on a transparent substrate. The material for the transparent substrate is not particularly limited so long as it has good mechanical strength, thermal stability and transparency. Specific examples thereof include glass, a transparent plastic film, etc.

[0066] The anode material of the organic EL device according to the present invention may include a metal having a work function of 4 eV or more, an alloy, an electrical conductive compound, or a mixture thereof. Specific examples thereof include Au metal or a transparent conductive material such as CuI, ITO (Indium Tin Oxide), SnO_2 and ZnO. The thickness of the anode film may be 10 to 200 nm.

[0067] The cathode material of the organic EL device according to the present invention may include a metal having a work function of less than 4 eV, an alloy, an electrical conductive compound, or a mixture thereof. Specific examples thereof include Na, Na-K alloy, Ca, Mg, Li, Li alloy, In, Al, Mg alloy, Al alloy, etc. In addition, Al/AlO_2, Al/Li, Mg/Ag or Mg/In may be used. The thickness of the cathode film may be 10 to 200 nm. In order to increase the luminous efficiency of the organic EL device, one or more electrodes should have a light transmittance of 10% or more. The sheet resistance of the electrodes is preferably hundreds of Ω/mm or less. The thickness of the electrodes may range from 10 nm to 1 μm, and preferably from 10 to 400 nm. Such electrodes may be obtained by forming the above electrode material into a thin film using vapor deposition such as chemical vapor deposition (CVD) or physical vapor deposition (PVD) or sputtering.

[0068] Also, the hole transport material and the hole injection material may be optionally selected from materials typically used as a hole transport material among light conductive materials and materials known to be useful for forming a hole transport layer or a hole injection layer of an organic EL device, in addition to the compounds of Chemical Formulas 1 to 8 according to the present invention. Examples thereof include porphyrin compound derivatives including N,N'-diphenyl-N,N'-di(3-methylphenyl)-4,4'-diaminobiphenyl (TPD), N,N'-diphenyl-N,N'-dinaphthyl-4,4'-diaminobiphenyl, N,N,N',N'-tetra-p-tolyl-4,4'-diaminobiphenyl, N,N,N',N'-tetraphenyl-4,4'-diaminobiphenyl, copper (II) 1,10,15,20-tetraphenyl-21H,23H-porphyrin, etc., triarylamine derivatives including polymers having aromatic tertiary amines on the main chains or side chains thereof, 1,1-bis(4-di-p-tolylaminophenyl)cyclohexane, N,N,N-tri(p-tolyl)amine, 4,4',4'-tris[N-(3-methylphenyl)-N-phenylamino]triphenylamine, etc., carbazole derivatives including N-phenylcarbazole and polyvinylcarbazole, phthalocyanine derivatives including nonmetallic phthalocyanine, copper phthalocyanine, etc., starbust amine derivatives, enamine stilbene derivatives, derivatives of aromatic tertiary amines and styryl amine compounds, and polysilane.

[0069] Known materials for the electron transport layer include, for example, AlQ_3, a 2,5-diaryl silole derivative (PyPySPyPy), a perfluorinated compound (PF-6P), octasubstituted cyclooctatetraene compounds (COTs), etc., which may be mixed.

[0070] In the organic EL device according to the present invention, the electron injection layer, the electron transport layer, the hole injection layer and the hole transport layer may be provided in the form of a single layer containing one or more kinds of the above compounds, or of a laminated plurality of layers containing different kinds of compounds.

[0071] Another light-emitting material employed in the organic EL device according to the present invention may include known light-emitting materials, for example, photoluminescent fluorescent materials, fluorescent brighteners, laser dyes, organic scintillators, and fluorescent analysis reagents. Specific examples thereof include polyaromatic compounds including AlQ_3, anthracene, phenanthrene, pyrene, crysene, perylene, coronene, rubrene and quinacridone, oligophenylene compounds including quaterphenyl, scintillators for liquid scintillation including 1,4-bis(2-methylstyryl)benzene, 1,4-bis(4-methylstyryl)benzene, 1,4-bis(4-methyl-5-phenyl-2-oxazolyl)benzene, 1,4-bis(5-phenyl-2-oxazolyl)benzene, 2,5-bis(5-t-butyl-2-benzoxazolyl)thiophene, 1,4-diphenyl-1,3-butadiene, 1,6-diphenyl-1,3,5-hexatriene, 1,1,4,4-tetraphenyl-1,3-butadiene, etc., metal complexes of oxine derivatives, coumarin dyes, dicyanomethylenepyrane dyes, dicyanomethylenethiopyrane dyes, polymethine dyes, oxobenzanthracene dyes, xanthene dyes, carbostyryl dyes, perylene dyes, oxazine compounds, stilbene derivatives, spiro compounds, oxadiazole compounds, etc.

[0072] Respective layers of the organic EL device according to the present invention may be provided in the form of a thin film using a known process such as vacuum deposition, spin coating or casting, or may be prepared using materials therefor. The film thickness of respective layers is not particularly limited, and may be appropriately determined depending on the properties of the materials, and may be typically set in the range of 2 nm to 5000 nm.

[0073] Because the compound of Chemical Formulas 1 to 8 according to the present invention may be subjected to vacuum deposition, a thin-film forming process is simple and a uniform thin film having almost no pin holes may be easily obtained.

[0074] In FIG. 1, according to another embodiment of the present invention, the light-emitting layer 130 may include the compound for an organic EL device as represented by Chemical Formulas 1 to 8.

[0075] In FIG. 1, according to a further embodiment of the present invention, an organic EL device may be provided, wherein the organic layers 120, 130, 140 may include a hole transport layer 120, in which the hole transport layer 120 may include the compound for an organic EL device as represented by Chemical Formulas 1 to 8.

[0076] The preparation of the compounds for an organic EL device according to the present invention and the organic EL devices including the same is described in more detail via the following examples, which are merely illustrative but the scope of the present invention is not limited thereto.

[Example]

[0077] According to the present invnetion, compounds for an organic EL device were prepared, and organic EL devices were manufactured using the same. The following preparation examples and examples are set to illustrate the present invention but are not construed to limit the present invention.

[Preparation Example]

<u>Preparation Example 1. Synthesis of Intermediate</u>

[0078] 2.5 g of carbazole, 2 g of bromobenzene and 0.064 g of a palladium acetate catalyst were dissolved in 40 mL of toluene, and the resulting solution was heated to 60 °C. Subsequently, a solution of 1.5 g of sodium butoxide and 0.385 g of tri-tert-butylphosphine dissolved in toluene was slowly added dropwise. The mixture was refluxed at a steady 100°C. After completion of the reaction, the reaction mixture was extracted with dichloromethane and distilled water, and the solvent was dried. The resulting solid was filtered and purified, yielding a 9-phenyl carbazole compound as an intermediate.

<u>Preparation Example 2. Synthesis of Intermediate</u>

[0079] 2 g of 9-phenyl carbazole and 1.46 g of N-bromosuccinic imide were dissolved in N,N-dimethylformamide, and the resulting solution was brominated, yielding a 3-bromo-9-phenyl carbazole comound as an intermediate. By the same method, a 3,6-dibromo-9-phenyl carbazole compound was synthesized.

<u>Preparation Example 3. Synthesis of Intermediate</u>

[0080] 1.4 g of carbazole, 2.2 g of 1,4-dibromobenzene and 0.042 g of a palladium acetate catalyst were dissolved in 30 mL of toluene, and the resulting solution was heated to 60°C. Subsequently, a solution of 0.977 g of sodium butoxide and 0.257 g of tri-tert-butylphosphine dissolved in toluene was slowly added dropwise. The mixture was refluxed at a steady 100°C. After completion of the reaction, the reaction mixture was extracted with dichloromethane and distilled water, and the solvent was dried. The resulting solid was filtered and purified, yielding a 4-bromophenyl-9-carbazole compound as an intermediate.

<u>Preparation Example 4. Synthesis of Intermediate</u>

[0081] To 4.58 g of 3,6-dibromo-9-phenyl carbazole as the intermediate of Preparation Example 2 was added 60 mL of tetrahydrofuran, and the temperature was adjusted to -78°C. Subsequently, 1.26 mL of butyllithium was slowly added dropwise. The mixture was stirred for 2 hours while maintaining its temperature, and 3.71 g of chlorotriphenylsilane was slowly added dropwise, after which the temperature of the mixture was raised to room temperature. After completion of the reaction, triethylamine and methanol were added at a ratio of 1:10, and the reaction mixture was stirred and extracted, followed by drying the solvent. The resulting solid was filtered and purified, yielding 3-bromo-9-phenyl-6-(triphenylsilyl)-9-carbazole as a white intermediate.

<u>Preparation Example 5. Synthesis of Intermediate</u>

[0082] 2 g of 4-bromophenyl-9-carbazole as the intermediate of Preparation Example 3, and 1.1 g of N-bromosuccinimide were dissolved in N,N-dimethylformamide, and the resulting solution was brominated, thus synthesizing a 3-bromo-9-(4-bromophenyl)carbazole compound as an intermediate.

Preparation Example 6. Synthesis of Intermediate

[0083] 2 g of 9-phenyl-carbazole as the intermediate of Preparation Example 1, and 5.12 g of N-bromosuccinimide were dissolved in N,N-dimethylformamide, and the resulting solution was brominated, thus synthesizing a 3,6-dibromo-9-(4-bromophenyl)carbazole compound as an intermediate.

Preparation Example 7. Synthesis of Intermediate

[0084] 0.5 g of iodo-3,5-dibromobenzene, 0.19 g of carbazole, a copper catalyst, 18-crown-6, and potassium carbonate were dissolved in dichlorobenzene, and the resulting solution was allowed to react while being heated to 150°C. After completion of the reaction, Cu powder was filtered, and the reaction mixture was extracted with distilled water and dichloromethane. The organic solvent was dried, and the resulting powder was purified using a column, thus synthesizing 9-(3,5-dibromophenyl)-9-carbazole as an intermediate.

Preparation Example 8. Synthesis of Intermediate

[0085] 1.672 g of carbazole, 1.6 mL of 1-bromo-2-iodobenzene, 2.7646 g of potassium carbonate, 95 mg of copper iodide and 25 mL of xylene were refluxed in a nitrogen atmosphere. The mixture was cooled to room temperature, extracted with ethyl acetate, and dried with anhydrous magnesium sulfate to remove moisture, and the solvent was removed under reduced pressure. Silica gel column separation using a hexane solvent was conducted, thus obtaining a compound from which the solvent was then removed under reduced pressure, followed by vacuum drying, yielding 9-(2-bromophenyl)-9H-carbazole as a desired white solid intermediate.

Preparation Example 9. Synthesis of Intermediate

[0086] 0.8 g of 9-(2-bromophenyl)-9H-carbazole as the intermediate of Preparation Example 8 was dissolved in 10 mL of purified tetrahydrofuran, and the resulting solution was cooled to -78 °C, and 0.99 mL of butyllithium was slowly added dropwise. The mixture was stirred at the same temperature for 40 min and then further stirred at room temperature for an additional 3 hours. The reaction was terminated with aqueous ammonium chloride, and the reaction mixture was extracted with ethyl ether. The organic layer was dewatered using anhydrous magnesium sulfate, and the organic solvent was then removed. The resulting solid was dispersed in ethanol, stirred for one day, filtered, and vacuum dried, thus obtaining an intermediate material. The solid thus obtained was dispersed in 10 mL of acetic acid, and 10 drops of concentrated sulfuric add were added, after which the mixture was refluxed for 4 hours. The resulting solid was filtered, washed with ethanol, and vacuum dried, yielding a 8-(4-bromophenyl)8-phenyl-8H-indolo-[3,2,1-de]acridine compound.

Preparation Example 10. Synthesis of Intermediate

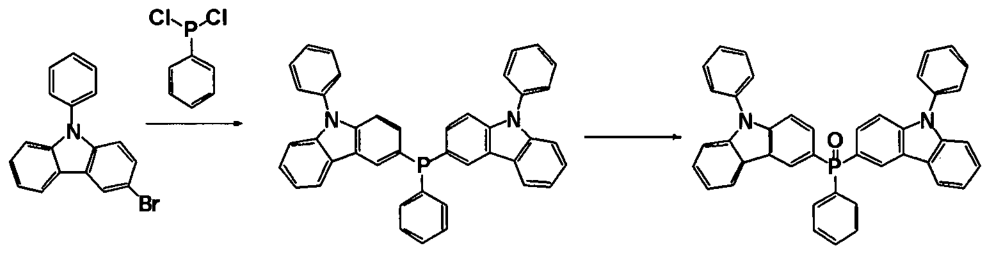
[0087] 1.0 g of 9-(2-bromophenyl)-9H-carbazole as the intermediate of Preparation Example 8 was dissolved in 10 mL of purified tetrahydrofuran, and the resulting solution was cooled to -78 °C, and 1.613 mL of butyllithium was slowly added dropwise. The mixture was stirred at the same temperature for 30 min, and 1.05 g of 4-bromobenzophenone was added. The mixture was stirred at the same temperature for 40 min and then further stirred at room temperature for an additional 3 hours. The reaction was terminated with aqueous ammonium chloride, and the reaction mixture was extracted with ethyl ether. The organic layer was dewatered using anhydrous magnesium sulfate, and the organic solvent was then removed. The resulting solid was dispersed in ethanol, stirred for one day, filtered, and vacuum dried, thus obtaining an intermediate material. The solid thus obtained was dispersed in 10 mL of acetic acid, and 10 drops of concentrated sulfuric acid were added, after which the mixture was refluxed for 4 hours. The resulting solid was filtered, washed with ethanol, and vacuum dried, yielding a 8-(4-bromophenyl)8-phenyl-8H-indolo-[3,2,1-de]acidine compound.

Preparation Example 11. Synthesis of Intermediate

[0088] 6.96 g of 9-(2-bromophenyl)-9H-carbazole as the intermediate of Preparation Example 8 was dissolved in 10 mL of purified tetrahydrofuran, and the resulting solution was cooled to -78 °C and 8.64 mL of butyllithium was slowly added dropwise. The mixture was stirred at the same temperature for 30 min, and 6.12 g of 4,4'-dibromobenzophenone was added. The mixture was stirred at the same temperature for 40 min and then further stirred at room temperature for an additional 3 hours. The reaction was terminated with aqueous ammonium chloride, and the reaction mixture was extracted with ethyl ether. The organic layer was dewatered using anhydrous magnesium sulfate, and the organic solvent was then removed. The resulting solid was dispersed in ethanol, stirred for one day, filtered, and vacuum dried, thus obtaining an intermediate material. The solid thus obtained was dispersed in 10 mL of acetic acid, and 10 drops of concentrated sulfuric acid were added, after which the mixture was refluxed for 4 hours. The resulting solid was filtered, washed with ethanol, and vacuum dried, yielding a 8,8-bis(4-bromophenyl)-8H-indolo [3,2,1-de]acridine compound.

Preparation Example 14. Synthesis of Compound 3

[0089]



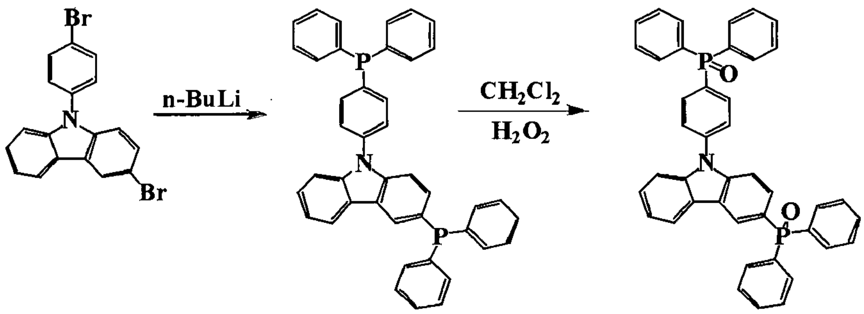
[0090] 30 mL of tetrahydrofuran was added to 2 g of 3-bromo-9-phenyl carbazole, and the temperature was adjusted to -78 °C. Subsequently, 1.6 mL of butyllithium was slowly added dropwise. While maintaining the temperature, the mixture was stirred for 2 hours, and 3.0 mL of dichlorophenylphosphine was slowly added dropwise, after which the temperature of the mixture was raised to room temperature. After completion of the reaction, methanol was added, and the reaction mixture was stirred and extracted, followed by drying the solvent. To the resulting solid was added dichloromethane, and while the mixture was being stirred, a small amount of hydrogen peroxide was added, yielding 3,3'-(phenylphosphonyl)bis(9-phenyl-9-carbazole) as white phosphine oxide corresponding to Compound 3 having the structure of the represented chemical formula.

[0091] Nuclear magnetic resonance analysis and mass analysis were performed, and the analytical results were as follows.

[0092] 1 H NMR-1 H (200 MHz, $CDCl_3$): δ 8.59-8.53 (d, 2H), 8.12-8.08 (m, 4H), 7.89-7.80 (d, 2H), 7.62-7.42 (m, 15H), 7.35-7.31 (m, 4H). MS (FAB) m/z 608.67 [$(M + 1)^+$].

Preparation Example 16. Synthesis of Compound 28

[0093]



[0094] 30 mL of tetrahydrofuran was added to 2.5 g of 3-bromo-9-(4-bromophenyl)carbazole, and the temperature was adjusted to -78 °C. Subsequently, 1.44 mL of butyllithium was slowly added dropwise.

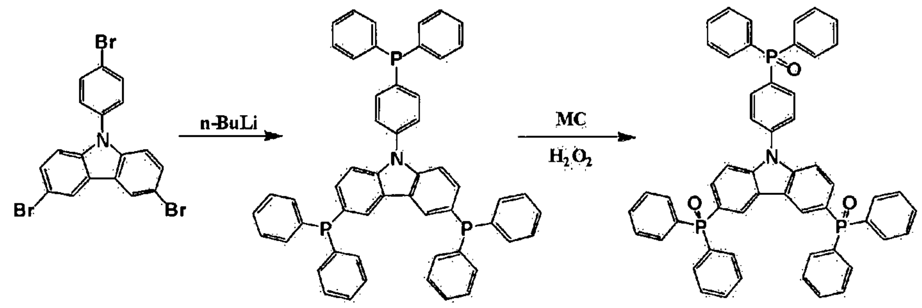
[0095] While maintaining the temperature, the mixture was stirred for 2 hours, and 2.66 mL of chlorodiphenylphosphine was slowly added dropwise, after which the temperature of the mixture was raised to room temperature. After completion of the reaction, methanol was added, and the reaction mixture was stirred and extracted, after which the solvent was dried. To the resulting solid was added dichloromethane, and while the mixture was being stirred, a small amount of hydrogen peroxide was added, yielding 3-(diphenylphosphonyl)9-(4diphenylphosphonyl)phenylcarbazole (PPO21) having the structure of Compound 28 as white phosphine oxide. The glass transition temperature was 111°C.

[0096] Nuclear magnetic resonance analysis and mass analysis were performed, and the analytical results were as follows.

[0097] NMR-1H (200 MHz, $CDCl_3$): δ 8.59-8.53 (d, 1H), 8.11-7.97 (d, 3H), 7.93-7.71 (m, 10H), 7.67 (m, 3H), 7.60-7.45 (m, 12H), 7.36-7.26 (m, 2H). MS (FAB) m/z 643 [$(M + 1)^+$].

Preparation Example 17. Synthesis of Compound 30

[0098]



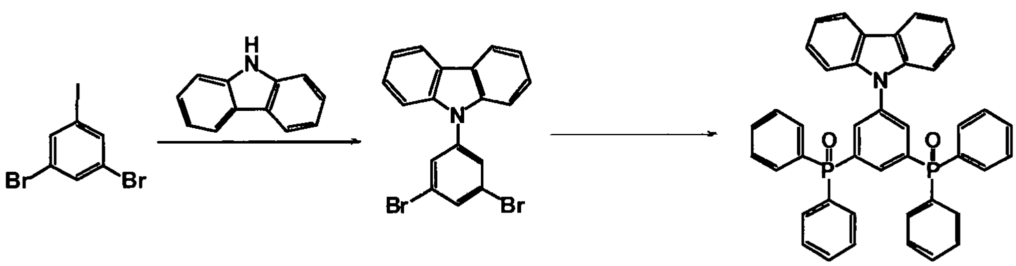
[0099] 30 mL of tetrahydrofuran was added to 2 g of 3,6-dibromo-9-(4-bromophenyl)carbazole, and the temperature was adjusted to -78°C. Subsequently, 2.5 mL of butyllithium was slowly added dropwise. While maintaining the temperature, the mixture was stirred for 2 hours, and 5.06 g of chlorodiphenylphosphine was slowly added dropwise, after which the temperature of the mixture was raised to room temperature. After completion of the reaction, methanol was added, and the reaction mixture was stirred and extracted, followed by drying the solvent. To the resulting solid was added dichloromethane, and while the mixture was being stirred, a small amount of hydrogen peroxide was added, yielding 3,6-bis(diphenylphosphonyl)-9-(4-diphenylphosphonyl)-9-carbazole (PPO3) having the above structure as white phosphine oxide.

[0100] Nuclear magnetic resonance analysis and mass analysis were performed, and the analytical results were as follows.

[0101] NMR-1 H (200 MHz, $CDCl_3$): δ 7.98-7.94 (d, 3H), 7.77-7.64 (m, 14H), 7.63-7.54 (m, 3H), 7.52-7.45 (m, 20H). MS (FAB) m/z 843.8 [(M + 1)$^+$].

Preparation Example 18. Synthesis of Compound 31

[0102]



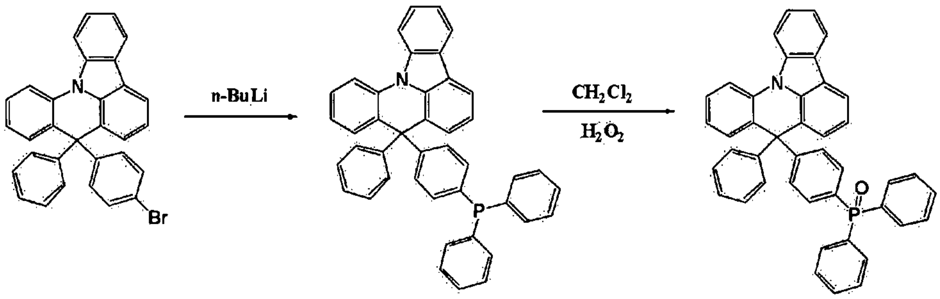
[0103] 30 mL of tetrahydrofuran was added to 2 g of 9-(3,5-dibromophenyl)-9-carbazole, and the temperature was adjusted to -78°C. Subsequently, 1.14 mL of butyllithium was slowly added dropwise. While maintaining the temperature, the mixture was stirred for 2 hours, and 2.32 g of chlorodiphenylphosphine was slowly added dropwise, after which the temperature of the mixture was raised to room temperature. After completion of the reaction, methanol was added, and the reaction mixture was stirred and extracted, followed by drying the solvent. To the resulting solid was added dichloromethane, and while the mixture was being stirred, a small amount of hydrogen peroxide was added, yielding 9-(3,5-bis(diphenylphosphonyl)phenyl-9-carbazole having the above structure as white phosphine oxide.

[0104] Nuclear magnetic resonance analysis and mass analysis were performed, and the analytical results were as follows.

[0105] NMR-1 H (200 MHz, $CDCl_3$): δ 8.55-8.52 (d, 1 H), 8.12-8.10 (d, 1 H), 7.94-7.95 (d, 1 H), 7.80-7.75 (m, 8H), 7.63-7.42 (m, 20H). MS (FAB) m/z 643.65 [(M + 1)$^+$].

Preparation Example 19. Synthesis of Compound 103

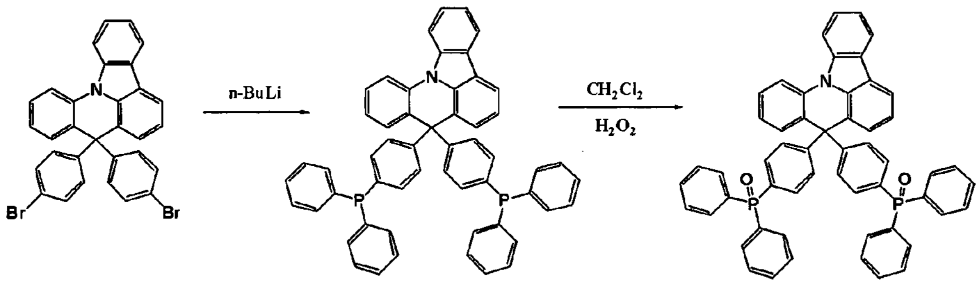
[0106]



[0107] 30 mL of tetrahydrofuran was added to 1 g of 8-(4-bromophenyl-8-phenyl-8H-indolo[3,2,1]acridine, and the temperature was adjusted to -78°C. Subsequently, 1.069 mL of butyllithium was slowly added dropwise. While maintaining the temperature, the mixture was stirred for 2 hours, and 0.589 g of chlorodiphenylphosphine was slowly added dropwise, after which the temperature of the mixture was raised to room temperature. After completion of the reaction, methanol was added, and the reaction mixture was stirred and extracted, followed by drying the solvent. To the resulting solid was added dichloromethane, and while the mixture was being stirred, a small amount of hydrogen peroxide was added, yielding 8-(4-diphenylphosphonyl)phenyl)-8H-indolo[3,2,1]acridine having the above structure as white phosphine oxide.
[0108] Nuclear magnetic resonance analysis and mass analysis were performed, and the analytical results were as follows.
[0109] NMR-1 H (200 MHz, $CDCl_3$): δ 8.48-8.46 (d, 1H), 8.21-8.18 (d, 1 H), 7.98-7.93 (m, 4H), 7.77-7.65 (m, 3H), 7.55-7.23 (m, 20H), 7.13-7.10 (d, 1 H).
[0110] MS (FAB) m/z 607.68 $[(M + 1)^+]$.

Preparation Example 20. Synthesis of Compound 132

[0111]



[0112] 30 mL of tetrahydrofuran was added to 1 g of 8,8-bis(4-bromophenyl)-8H-indolo[3,2,1]acridine, and the temperature was adjusted to -78°C. Subsequently, 1.627 mL of butyllithium was slowly added dropwise. While maintaining the temperature, the mixture was stirred for 2 hours, and 0.895 g of chlorodiphenylphosphine was slowly added dropwise, after which the temperature of the mixture was raised to room temperature. After completion of the reaction, methanol was added, and the reaction mixture was stirred and extracted, followed by drying the solvent. To the resulting solid was added dichloromethane, and while the mixture was being stirred, a small amount of hydrogen peroxide was added, yielding 8,8-bis(4-diphenylphosphonyl)phenyl)-8H-indolo[3,2,1]acridine having the above structure as white phosphine oxide.
[0113] Nuclear magnetic resonance analysis and mass analysis were performed, and the analytical results were as follows.
[0114] NMR-1 H (200 MHz, $CDCl_3$): δ 8.48-8.46 (d, 1 H), 8.21-8.18 (d, 1 H), 7.98-7.93 (m, 13H), 7.55-7.10 (m, 23H), 7.13-7.10 (d, 1H). MS (FAB) m/z 807.85 $[(M + 1)^+]$.

Example 3

[0115] A blue phosphorescent device including Compound 3 synthesized in the present invention was formed using FCNIr which is a known blue dopant. The present compound exhibited a triplet energy of 3.0 eV, a HOMO energy level of 5.92 eV, and a LUMO energy level of 2.4 eV. The structure of the device was ITO/DNTPD(60nm)/NPD(20nm)/mCP(10nm)/Compound 3:FCNIr(30nm, 15%)/Bphen(20nm)/LiF/Al. The device was manufactured in the following manner. Specifically, an ITO substrate was washed using ultrasound for 30 min in pure water and isopropyl alcohol, and the surface of the ITO substrate was treated using short-wavelength UV light, after which an organic material was vapor-deposited thereon at a pressure of 1.3 mPa ($1x10^{-6}$ torr). DNTPD, NPD, mCP, and Bphen were vapor-deposited at a rate of 0.1 nm/s, thus forming respective films having the corresponding thicknesses, and Compound 3 was vapor-deposited together with a FCNIr dopant. As such, Compound 3 was vapor-deposited at a rate of 0.1 nm/s, and FCNIr was vapor-deposited at a rate of 0.015 nm/s. LiF was formed to a thickness of 1 nm at a rate of 0.01 nm/s, and Al was formed to a thickness of 100 nm at a deposition rate of 0.5 nm/s. The device thus obtained was sealed using a CaO desiccant and a cover glass.

[0116] The quantum efficiency and the color coordinates of the blue organic EL device thus manufactured are shown in Table 23. The quantum efficiency of Examples 1 to 9 and Comparative Examples 1 and 2 was measured in accordance with the description of literature by Forrest (G. Gu and S. R. Forrest, IEEE Journal of Selected Topics in Quantum Electronics, Vol. 4, No. 1, January / February 1998, p. 83 - 99).

[0117] The blue organic EL device manufactured in the present invention manifested a maximum quantum efficiency of 7.95%. The quantum efficiency is graphed in FIG. 4. The color coordinates were (0.14, 0.17).

Example 5

[0118] A blue phosphorescent device including Compound 28 (PPO21) synthesized in the present invention was formed using FCNIr which is a known blue dopant. The present compound exhibited a triplet energy of 3.01 eV, a HOMO energy level of 6.18 eV, and a LUMO energy level of 2.61 eV. The structure of the device was ITO/DNTPD(60nm)/NPD(20nm)/mCP(10nm)/Compound 28:FCNIr(30nm, 15%)/Bphen(20nm)/LiF/Al. The device was manufactured in the same manner as in Example 3, with the exception that Compound 28 was used in lieu of Compound 3.

[0119] The blue organic EL device manufactured in the present invention manifested a maximum quantum efficiency of 17.4%. The quantum efficiency is graphed in FIG. 6. The color coordinates were (0.14, 0.15).

Example 6

[0120] A blue phosphorescent device including Compound 30 (PPO3) synthesized in the present invention was formed using FCNIr which is a known blue dopant. The present compound exhibited a triplet energy of 3.03 eV, a HOMO energy level of 6.23 eV, and a LUMO energy level of 2.65 eV. The structure of the device was ITO/DNTPD(60nm)/NPD(20nm)/mCP(10nm)/Compound 30:FCNIr(30nm, 15%)/Bphen(20nm)/LiF/Al. The device was manufactured in the same manner as in Example 3, with the exception that Compound 30 was used in lieu of Compound 3.

[0121] The blue organic EL device manufactured in the present invention manifested a maximum quantum efficiency of 18.6%. The quantum efficiency is graphed in FIG. 7. The color coordinates were (0.15, 0.15).

Example 7

[0122] A blue phosphorescent device including Compound 31 (PPO4) synthesized in the present invention was formed using FCNIr which is a known blue dopant. The present compound exhibited a triplet energy of 3.01 eV, a HOMO energy level of 6.22 eV, and a LUMO energy level of 2.59 eV. The structure of the device was ITO/DNTPD(60nm)/NPD(20nm)/mCP(10nm)/Compound 31:FCNIr(30nm, 15%)/Bphen(20nm)/LiF/Al. The device was manufactured in the same manner as in Example 3, with the exception that Compound 31 was used in lieu of Compound 3.

[0123] The blue organic EL device manufactured in the present invention manifested a maximum quantum efficiency of 16.8%. The quantum efficiency is graphed in FIG. 8. The color coordinates were (0.14, 0.15).

Example 8

[0124] A blue phosphorescent device including Compound 103 synthesized in the present invention was formed using FCNIr which is a known blue dopant. The present compound exhibited a triplet energy of 2.96 eV, a HOMO energy level of 6.03 eV, and a LUMO energy level of 2.59 eV. The structure of the device was ITO/DNTPD(60nm)/NPD(20nm)/mCP(10nm)/Compound 103:FCNIr(30nm,15%)/Bphen(20nm)/LiF/Al. The device was manufactured in the same manner as in Example 3, with the exception that Compound 103 was used in lieu of Compound

3.

[0125] The blue organic EL device manufactured in the present invention manifested a maximum quantum efficiency of 14.5%. The quantum efficiency is graphed in FIG. 9. The color coordinates were (0.15, 0.17).

Example 9

[0126] A blue phosphorescent device including Compound 132 synthesized in the present invention was formed using FCNIr which is a known blue dopant. The present compound exhibited a triplet energy of 2.97 eV, a HOMO energy level of 6.01 eV, and a LUMO energy level of 2.63 eV. The structure of the device was ITO/DNTPD(60nm)/NPD(20nm)/mCP(10nm)/Compound 132:FCNIr (30nm, 15%)/Bphen(20nm)/LiF/Al. The device was manufactured in the same manner as in Example 3, with the exception that Compound 132 was used in lieu of Compound 3.

[0127] The blue organic EL device manufactured in the present invention manifested a maximum quantum efficiency of 15.2%. The quantum efficiency is graphed in FIG. 10. The color coordinates were (0.15, 0.16).

Comparative Example 1

[0128] A typically known device having the structure of ITO/DNTPD(60nm)/NPD(20nm)/mCP(10nm)/mCP:FC-NIr(30nm, 15%)/BCP(5nm)/Alq3(20nm)/LiF/Al was manufactured. The device was manufactured in the same manner as in Example 3, with the exception that a blue phosphorescent material mCP was used instead of Compound 3 as the host material for a light-emitting layer, and BCP/Alq3 was usedinstead of Bphen as the material for the electron transport layer.

[0129] This blue phosphorescent device manifested a low quantum efficiency of 6.87%. The quantum efficiency is graphed in FIG. 11. The color coordinates were (0.15, 0.22).

Comparative Example 2

[0130] A typically known device having the structure of ITO/DNTPD(60nm)/NPD(20nm)/mCP(10nm)/mCP:FC-NIr(30nm, 15%)/Bphen(20nm)/LiF/Al was manufactured. The device was manufactured in the same manner as in Example 3, with the exception that mCP was used instead of Compound 3.

[0131] This blue phosphorescent device manifested a low quantum efficiency of 9.06%. The quantum efficiency is graphed in FIG. 12. The color coordinates were (0.14, 0.16).

TABLE 23

Comparison of Device Characteristics of Comparative Examples and Examples		
	Quantum Efficiency (%)	Color Coordinates
Ex.3	7.95	(0.14, 0.17)
Ex.5	17.4	(0.14, 0.15)
Ex.6	18.6	(0.15, 0.15)
Ex7	16.8	(0.14, 0.15)
Ex.8	14.5	(0.15, 0.17)
Ex.9	15.2	(0.15, 0.16)
C.Ex.1	6.87	(0.15, 0.22)
C.Ex.2	9.06	(0.14, 0.16)

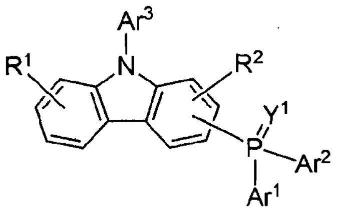
Industrial Applicability

[0132] As described above, the present invention adopts a carbazole-based phosphine oxide compound, and thereby an organic EL device can be provided, which solved the problems of thermal instability and the low efficiency of conventional organic EL devices and furthermore achieved superior efficiency characteristics in a pure blue phosphorescent device.

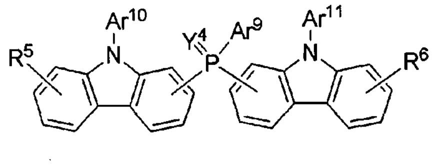
Claims

1. A compound for an organic electroluminescent device, represented by any of the chemical formulae below:

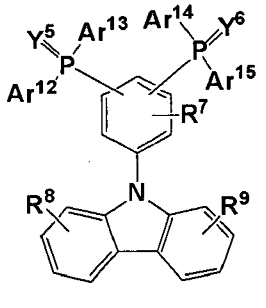
[Chemical Formula 1]



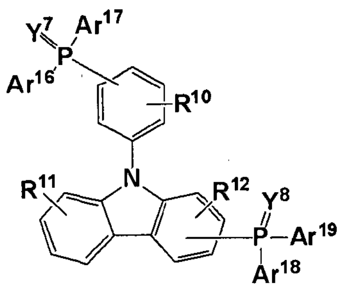
[Chemical Formula 3]



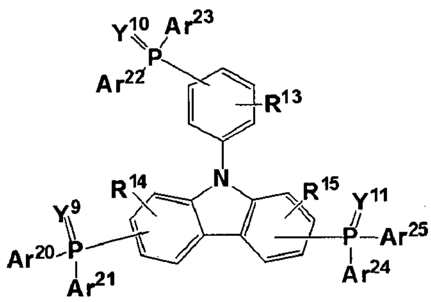
[Chemical Formula 4]



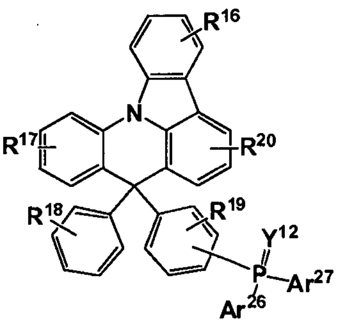
[Chemical Formula 5]



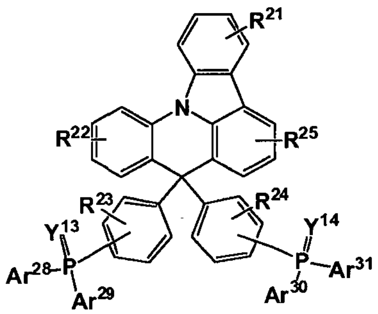
[Chemical Formula 6]



[Chemical Formula 7]



[Chemical Formula 8]



wherein

Y^1 and Y^4 represent an oxygen atom and Y^{12} represent an oxygen atom, a sulfur atom or a selenium atom, Y^5 and Y^6, Y^7 and Y^8, Y^9 to Y^{11}, Y^{13} and Y^{14} are identical or different substituents and each represent an oxygen atom, a sulfur atom or a selenium atom,
Ar^1 and Ar^2 each represent a phenyl group, Ar^{10} and Ar^{11} are identical or different substituents and each represent a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, and Ar^{12} to Ar^{15}, Ar^{16} to Ar^{19}, Ar^{20} to Ar^{25}, Ar^{26} and Ar^{27}, Ar^{28} to Ar^{31} are identical or different substituents and each represent a substituted or unsubstituted aryl group having 6 to 50 ring carbons, or a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms,
Ar^3 represents a phenyl group, and Ar^9 represents a substituted or unsubstituted phenyl group having 6 to 34

carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, and

R^1 and R^2 each represent a phenyl group, and

part or all of R^5 and R^6 are independently a hydrogen atom, or R^5 and R^6 are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, wherein the substituted or unsubstituted phenyl group having 6 to 34 carbons, the substituted or unsubstituted biphenyl group, the substituted or unsubstituted terphenyl group, the substituted or unsubstituted naphthyl group, the substituted or unsubstituted anthryl group, or the substituted or unsubstituted pyrenyl group forms a saturated or unsaturated ring independently or with an adjacent group, and

part or all of R^7 to R^9, R^{10} to R^{12}, R^{13} to R^{15}, R^{16} to R^{20}, R^{21} to R^{25} are independently a hydrogen atom, or R^7 to R^9, R^{10} and R^{12}, R^{13} to R^{15}, R^{16} to R^{20}, R^{21} to R^{25} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted aryl group having 6 to 50 ring carbons, a substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, a substituted or unsubstituted alkyl group having 1 to 50 carbons, a substituted or unsubstituted cycloalkyl group having 3 to 50 carbons, a substituted or unsubstituted thio group having 1 to 50 carbons, or a substituted or unsubstituted silyl group having 1 to 50 carbons, wherein the substituted or unsubstituted aryl group having 6 to 50 ring carbons, the substituted or unsubstituted heteroaryl group having 5 to 50 ring atoms, or the substituted or unsubstituted cycloalkyl group having 3 to 50 carbons forms a saturated or unsaturated ring independently or with an adjacent group,

wherein the group suitable for substitution on the Ar^9 to Ar^{11}, or R^5 and R^6 is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 34 ring carbons, a heteroaryl group having 5 to 34 ring atoms, an alkyl group having 1 to 34 carbons, a cycloalkyl group having 3 to 34 carbons, a thio group having 1 to 34 carbons, or a silyl group having 1 to 34 carbons, and

wherein a group suitable for substitution on the Ar^{12} to Ar^{31} or R^7 to R^{25} is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 50 ring carbons, a heteroaryl group having 5 to 50 ring atoms, an alkyl group having 1 to 50 carbons, a cycloalkyl group having 3 to 50 carbons, a thio group having 1 to 50 carbons, or a silyl group having 1 to 50 carbons.

2. The compound of claim 1, wherein the compound for an organic electroluminescent device is represented by chemical formula 4 and wherein

Y^5 and Y^6 represent an oxygen atom,

Ar^{12} to Ar^{15} are identical or different substituents and each represent a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, and

part or all of R^7 to R^9 are independently a hydrogen atom, or R^7 to R^9 are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, wherein the substituted or unsubstituted phenyl group having 6 to 34 carbons, the substituted or unsubstituted biphenyl group, the substituted or unsubstituted terphenyl group, the substituted or unsubstituted naphthyl group, the substituted or unsubstituted anthryl group, or the substituted or unsubstituted pyrenyl group forms a saturated or unsaturated ring independently or with an adjacent group,

wherein the group suitable for substitution on the Ar^{12} to Ar^{15} and R^7 to R^9 is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 34 ring carbons, a heteroaryl group having 5 to 34 ring atoms, an alkyl group having 1 to 34 carbons, a cycloalkyl group having 3 to 34 carbons, a thio group having 1 to 34 carbons, or a silyl group having 1 to 34 carbons.

3. The compound of claim 1, wherein the compound for an organic electroluminescent device is represented by chemical formula 5 and wherein

Y^7 and Y^8 each represent an oxygen atom,

Ar^{16} to Ar^{19} are identical or different substituents and each represent a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a.substituted or unsubstituted pyrenyl group, and

part or all of R^{10} to R^{12} are independently a hydrogen atom, or R^{10} to R^{12} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, wherein the substituted or unsubstituted phenyl group having 6 to 34 carbons, the substituted or unsubstituted biphenyl group, the substituted or unsubstituted terphenyl group, the substituted or unsubstituted naphthyl group, the substituted or unsubstituted anthryl group, or the substituted or unsubstituted pyrenyl group forms a saturated or unsaturated ring independently or with an adjacent group,

wherein the group suitable for substitution on the Ar^{16} to Ar^{19} and R^{10} to R^{12} is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 34 ring carbons, a heteroaryl group having 5 to 34 ring atoms, an alkyl group having 1 to 34 carbons, a cycloalkyl group having 3 to 34 carbons, a thio group having 1 to 34 carbons, or a silyl group having 1 to 34 carbons.

4. The compound of claim 1, wherein the compound for an organic electroluminescent device is represented by chemical formula 6 and wherein

Y^9 to Y^{11} each represent an oxygen atom,

Ar^{20} to Ar^{25} are identical or different substituents and each represent a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, and

part or all of R^{13} to R^{15} are independently a hydrogen atom, or R^{13} to R^{15} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, wherein the substituted or unsubstituted phenyl group having 6 to 34 carbons, the substituted or unsubstituted biphenyl group, the substituted or unsubstituted terphenyl group, the substituted or unsubstituted naphthyl group, the substituted or unsubstituted anthryl group, or the substituted or unsubstituted pyrenyl group forms a saturated or unsaturated ring independently or with an adjacent group,

wherein the group suitable for substitution on the Ar^{20} to Ar^{25} and R^{13} to R^{15} is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 34 ring carbons, a heteroaryl group having 5 to 34 ring atoms, an alkyl group having 1 to,34 carbons, a cycloalkyl group having 3 to 34 carbons, a thio group having 1 to 34 carbons, or a silyl group having 1 to 34 carbons.

5. The compound of claim 1, wherein the compound for an organic electroluminescent device is represented by chemical formula 7 and wherein

Y^{12} represents an oxygen atom,

Ar^{26} and Ar^{27} are identical or different substituents and each represent a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, and

part or all of R^{16} to R^{20} are independently a hydrogen atom, or R^{16} to R^{20} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, wherein the substituted or unsubstituted phenyl group having 6 to 34 carbons, the substituted or unsubstituted biphenyl group, the substituted or unsubstituted terphenyl group, the substituted or unsubstituted naphthyl group, the substituted or unsubstituted anthryl group, or the substituted or unsubstituted pyrenyl group forms a saturated or unsaturated ring independently or with an adjacent group,

wherein the group suitable for substitution on the Ar^{26}, Ar^{27} and R^{16} to R^{20} is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 34 ring carbons, a heteroaryl group having 5 to 34 ring atoms, an alkyl group having 1 to 34 carbons, a cycloalkyl group having 3 to 34 carbons, a thio group having 1 to 34 carbons, or a silyl group having 1 to 34 carbons.

6. The compound of claim 1, wherein the compound for an organic electroluminescent device is represented by chemical formula 8 and wherein

Y^{13} and Y^{14} each represent an oxygen atom,
Ar^{28} to Ar^{31} are identical or different substituents and each represent a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, and
part or all of R^{21} to R^{25} are independently a hydrogen atom, or R^{21} to R^{25} are identical or different substituents and each represent a halogen atom, a cyano group, a nitro group, a substituted or unsubstituted phenyl group having 6 to 34 carbons, a substituted or unsubstituted biphenyl group, a substituted or unsubstituted terphenyl group, a substituted or unsubstituted naphthyl group, a substituted or unsubstituted anthryl group, or a substituted or unsubstituted pyrenyl group, wherein the substituted or unsubstituted phenyl group having 6 to 34 carbons, the substituted or unsubstituted biphenyl group, the substituted or unsubstituted terphenyl group, the substituted or unsubstituted naphthyl group, the substituted or unsubstituted anthryl group, or the substituted or unsubstituted pyrenyl group forms a saturated or unsaturated ring independently or with an adjacent group,
wherein the group suitable for substitution on the Ar^{28} to Ar^{31} and R^{21} to R^{25} is a halogen atom, a cyano group, a nitro group, an aryl group having 6 to 34 ring carbons, a heteroaryl group having 5 to 34 ring atoms, an alkyl group having 1 to 34 carbons, a cycloalkyl group having 3 to 34 carbons, a thio group having 1 to 34 carbons, or a silyl group having 1 to 34 carbons.

7. An organic electroluminescent device, comprising:

a first electrode;
a second electrode; and
a single organic layer or a plurality of organic layers having at least one light-emitting layer, formed between the first electrode and the second electrode,
wherein the organic layer includes the compound for an organic electroluminescent device of any one of claims 1 to 6.

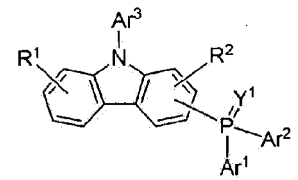
8. The organic electroluminescent device of claim 7, wherein the light-emitting layer includes the compound for an organic electroluminescent device of any one of claims 1 to 6.

9. The organic electroluminescent device of claim 7, wherein the organic layer includes a hole transport layer including the compound for an organic electroluminescent device of any one of claims 1 to 6.

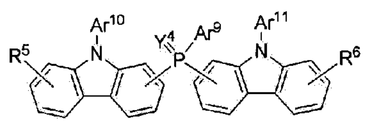
Patentansprüche

1. Eine Verbindung für eine organische elektrolumineszierende Vorrichtung, dargestellt durch eine der folgenden chemischen Formeln:

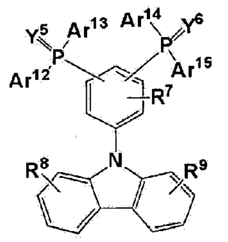
[Chemische Formel 1]



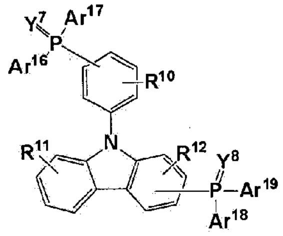
[Chemische Formel 3]



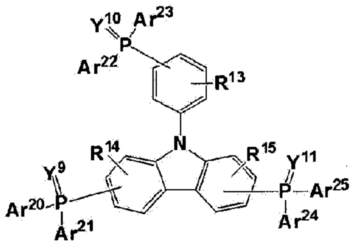
[Chemische Formel 4]



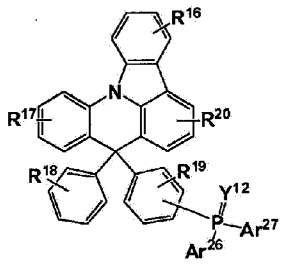
[Chemische Formel 5]



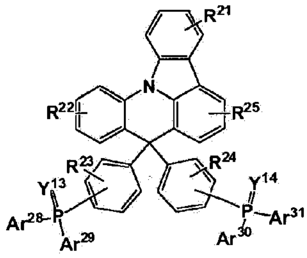
[Chemische Formel 6]



[Chemische Formel 7]



[Chemische Formel 8]



wobei

Y^1 und Y^4 für ein Sauerstoffatom stehen und Y^{12} für ein Sauerstoffatom, ein Schwefelatom oder ein Selenatom steht,
Y^5 und Y^6, Y^7 und Y^8, Y^9 bis Y^{11}, Y^{13} und Y^{14} identische oder unterschiedliche Substituenten sind und jeweils für ein Sauerstoffatom, ein Schwefelatom oder ein Selenatom stehen,
Ar^1 und Ar^2 jeweils für eine Phenylgruppe stehen, Ar^{10} und Ar^{11} identische oder unterschiedliche Substituenten sind und jeweils für eine substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, eine substituierte oder nicht substituierte Biphenylgruppe, eine substituierte oder nicht substituierte Terphenylgruppe, eine substituierte oder nicht substituierte Naphthylgruppe, eine substituierte oder nicht substituierte Anthrylgruppe oder eine substituierte oder nicht substituierte Pyrenylgruppe stehen, und Ar^{12} bis Ar^{15}, Ar^{16} bis Ar^{19}, Ar^{20} bis Ar^{25}, Ar^{26} und Ar^{27}, Ar^{28} bis Ar^{31} identische oder unterschiedliche Substituenten sind und jeweils für eine substituierte oder nicht substituierte Arylgruppe mit 6 bis 50 Ringkohlenstoffen oder eine substituierte oder nicht substituierte Heteroarylgruppe mit 5 bis 50 Ringatomen stehen,
Ar^3 für eine Phenylgruppe steht und Ar^9 für eine substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, eine substituierte oder nicht substituierte Biphenylgruppe, eine substituierte oder nicht substituierte Terphenylgruppe, eine substituierte oder nicht substituierte Naphthylgruppe, eine substituierte oder nicht substituierte Anthrylgruppe oder eine substituierte oder nicht substituierte Pyrenylgruppe steht, und R^1 und R^2 jeweils für eine Phenylgruppe stehen, und
es sich bei einigen oder allen der R^5 und R^6 unabhängig voneinander um ein Wasserstoffatom handelt, oder R^5 und R^6 identische oder unterschiedliche Substituenten sind, die jeweils für ein Halogenatom, eine Cyanogruppe, eine Nitrogruppe, eine substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, eine substituierte oder nicht substituierte Biphenylgruppe, eine substituierte oder nicht substituierte Terphenylgruppe, eine substituierte oder nicht substituierte Naphthylgruppe, eine substituierte oder nicht substituierte Anthrylgruppe oder eine substituierte oder nicht substituierte Pyrenylgruppe stehen, wobei die substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, die substituierte oder nicht substituierte Biphenylgruppe, die substituierte oder nicht substituierte Terphenylgruppe, die substituierte oder nicht substituierte Naphthylgruppe, die substituierte oder nicht substituierte Anthrylgruppe oder die substituierte oder nicht substituierte Pyrenylgruppe allein oder mit einer benachbarten Gruppe einen gesättigten oder ungesättigten Ring bildet, und
es sich bei einigen oder allen der R^7 bis R^9, R^{10} bis R^{12}, R^{13} bis R^{15}, R^{16} bis R^{20}, R^{21} bis R^{25} unabhängig voneinander um ein Wasserstoffatom handelt, oder R^7 bis R^9, R^{10} und R^{12}, R^{13} bis R^{15}, R^{16} bis R^{20}, R^{21} bis R^{25} identische oder unterschiedliche Substituenten sind, die jeweils für ein Halogenatom, eine Cyanogruppe, eine Nitrogruppe, eine substituierte oder nicht substituierte Arylgruppe mit 6 bis 50 Ringkohlenstoffen, eine

substituierte oder nicht substituierte Heteroarylgruppe mit 5 bis 50 Ringatomen, eine substituierte oder nicht substituierte Alkylgruppe mit 1 bis 50 Kohlenstoffen, eine substituierte oder nicht substituierte Cycloalkylgruppe mit 3 bis 50 Kohlenstoffen, eine substituierte oder nicht substituierte Thiogruppe mit 1 bis 50 Kohlenstoffen oder eine substituierte oder nicht substituierte Silylgruppe mit 1 bis 50 Kohlenstoffen stehen, wobei die substituierte oder nicht substituierte Arylgruppe mit 6 bis 50 Ringkohlenstoffen, die substituierte oder nicht substituierte Heteroarylgruppe mit 5 bis 50 Ringatomen oder die substituierte oder nicht substituierte Cycroalkylgruppe mit 3 bis 50 Kohlenstoffen allein oder mit einer benachbarten Gruppe einen gesättigten oder ungesättigten Ring bildet,
wobei es sich bei der für eine Substitution geeigneten Gruppe am Ar^9 bis Ar^{11} oder R^5 und R^6 um ein Halogenatom, eine Cyanogruppe, eine Nitrogruppe, eine Arylgruppe mit 6 bis 34 Ringkohlenstoffen, eine Heteroarylgruppe mit 5 bis 34 Ringatomen, eine Alkylgruppe mit 1 bis 34 Kohlenstoffen, eine Cycloalkylgruppe mit 3 bis 34 Kohlenstoffen, eine Thiogruppe mit 1 bis 34 Kohlenstoffen oder um eine Silylgruppe mit 1 bis 34 Kohlenstoffen handelt, und
wobei es sich bei einer für eine Substitution am Ar^{12} bis Ar^{31} oder R^7 bis R^{25} geeigneten Gruppe um eine Halogenatom, eine Cyanogruppe, eine Nitrogruppe, eine Arylgruppe mit 6 bis 50 Ringkohlenstoffen, eine Heteroarylgruppe mit 5 bis 50 Ringatomen, eine Alkylgruppe mit 1 bis 50 Kohlenstoffen, eine Cycloalkylgruppe mit 3 bis 50 Kohlenstoffen, eine Thiogruppe mit 1 bis 50 Kohlenstoffen oder um eine Silylgruppe mit 1 bis 50 Kohlenstoffen handelt.

2. Die Verbindung gemäß Anspruch 1, wobei die Verbindung für eine organische elektrolumineszierende Vorrichtung durch die chemische Formel 4 dargestellt ist und wobei

Y^5 und Y^6 für ein Sauerstoffatom stehen,
es sich bei Ar^{12} bis Ar^{15} um identische oder unterschiedliche Substituenten handelt, die jeweils für eine substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, eine substituierte oder nicht substituierte Biphenylgruppe, einer substituierte oder nicht substituierte Terphenylgruppe, eine substituierte oder nicht substituierte Naphthylgruppe, eine substituierte oder nicht substituierte Anthrylgruppe oder eine substituierte oder nicht substituierte Pyrenylgruppe stehen, und
es sich bei einigen oder allen der R^7 bis R^9 unabhängig voneinander um ein Wasserstoffatom handelt, oder R^7 bis R^9 identische oder unterschiedliche Substituenten sind, die jeweils für ein Halogenatom, eine Cyanogruppe, eine Nitrogruppe, eine substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, eine substituierte oder nicht substituierte Biphenylgruppe, eine substituierte oder nicht substituierte Terphenylgruppe, eine substituierte oder nicht substituierte Naphthylgruppe, eine substituierte oder nicht substituierte Anthrylgruppe oder eine substituierte oder nicht substituierte Pyrenylgruppe stehen, wobei die substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, die substituierte oder nicht substituierte Biphenylgruppe, die substituierte oder nicht substituierte Terphenylgruppe, die substituierte oder nicht substituierte Naphthylgruppe, die substituierte oder nicht substituierte Anthrylgruppe oder die substituierte oder nicht substituierte Pyrenylgruppe allein oder mit einer benachbarten Gruppe einen gesättigten oder ungesättigten Ring bildet,
wobei es sich bei der für eine Substitution am Ar^{12} bis Ar^{15} und R^7 bis R^9 geeigneten Gruppe um ein Halogenatom, eine Cyanogruppe, eine Nitrogruppe, eine Arylgruppe mit 6 bis 34 Ringkohlenstoffen, eine Heteroarylgruppe mit 5 bis 34 Ringatomen, eine Alkylgruppe mit 1 bis 34 Kohlenstoffen, eine Cycloalkylgruppe mit 3 bis 34 Kohlenstoffen, eine Thiogruppe mit 1 bis 34 Kohlenstoffen oder um eine Silylgruppe mit 1 bis 34 Kohlenstoffen handelt.

3. Die Verbindung gemäß Anspruch 1, wobei die Verbindung für eine organische elektrolumineszierende Vorrichtung durch die chemische Formel 5 dargestellt ist und wobei

Y^7 und Y^8 jeweils für ein Sauerstoffatom stehen,
es sich bei Ar^{16} bis Ar^{19} um identische oder unterschiedliche Substituenten handelt, die jeweils für eine substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, eine substituierte oder nicht substituierte Biphenylgruppe, eine substituierte oder nicht substituierte Terphenylgruppe, eine substituierte oder nicht substituierte Naphthylgruppe, eine substituierte oder nicht substituierte Anthrylgruppe oder eine substituierte oder nicht substituierte Pyrenylgruppe stehen, und
es sich bei einigen oder allen der R^{10} bis R^{12} unabhängig voneinander um ein Wasserstoffatom handelt, oder R^{10} bis R^{12} identische oder unterschiedliche Substituenten sind, die jeweils für ein Halogenatom, eine Cyanogruppe, eine Nitrogruppe, eine substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, eine substituierte oder nicht substituierte Biphenylgruppe, eine substituierte oder nicht substituierte Terphenylgruppe, eine substituierte oder nicht substituierte Naphthylgruppe, eine substituierte oder nicht substituierte

Anthrylgruppe oder eine substituierte oder nicht substituierte Pyrenylgruppe stehen, wobei die substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, die substituierte oder nicht substituierte Biphenylgruppe, die substituierte oder nicht substituierte Terphenylgruppe, die substituierte oder nicht substituierte Naphthylgruppe, die substituierte oder nicht substituierte Anthrylgruppe oder die substituierte oder nicht substituierte Pyrenylgruppe allein oder mit einer benachbarten Gruppe einen gesättigten oder ungesättigten Ring bildet,

wobei es sich bei der für eine Substitution am Ar^{16} bis Ar^{19} und am R^{10} bis R^{12} geeigneten Gruppe um ein Halogenatom, eine Cyanogruppe, eine Nitrogruppe, eine Arylgruppe mit 6 bis 34 Ringkohlenstoffen, eine Heteroarylgruppe mit 5 bis 34 Ringatomen, eine Alkylgruppe mit 1 bis 34 Kohlenstoffen, einen Cycloalkylgruppe mit 3 bis 34 Kohlenstoffen, eine Thiogruppe mit 1 bis 34 Kohlenstoffen oder um eine Silylgruppe mit 1 bis 34 Kohlenstoffen handelt.

4. Die Verbindung gemäß Anspruch 1, wobei die Verbindung für eine organische elektrolumineszierende Vorrichtung durch die chemische Formel 6 dargestellt ist und wobei

Y^9 bis Y^{11} jeweils für ein Sauerstoffatom stehen,

es sich bei Ar^{20} bis Ar^{25} um identische oder unterschiedliche Substituenten handelt, die jeweils für eine substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, eine substituierte oder nicht substituierte Biphenylgruppe, eine substituierte oder nicht substituierte Terphenylgruppe, eine substituierte oder nicht substituierte Naphthylgruppe, eine substituierte oder nicht substituierte Anthrylgruppe oder eine substituierte oder nicht substituierte Pyrenylgruppe stehen, und

es sich bei einigen oder allen der R^{13} bis R^{15} unabhängig voneinander um ein Wasserstoffatom handelt oder R^{13} bis R^{15} identische oder unterschiedliche Substituenten sind, die jeweils für ein Halogenatom, eine Cyanogruppe, eine Nitrogruppe, eine substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, eine substituierte oder nicht substituierte Biphenylgruppe, eine substituierte oder nicht substituierte Terphenylgruppe, eine substituierte oder nicht substituierte Naphthylgruppe, eine substituierte oder nicht substituierte Anthrylgruppe oder eine substituierte oder nicht substituierte Pyrenylgruppe stehen, wobei die substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, die substituierte oder nicht substituierte Biphenylgruppe, die substituierte oder nicht substituierte Terphenylgruppe, die substituierte oder nicht substituierte Naphthylgruppe, die substituierte oder nicht substituierte Anthrylgruppe oder die substituierte oder nicht substituierte Pyrenylgruppe allein oder mit einer benachbarten Gruppe einen gesättigten oder ungesättigten Ring bildet,

wobei es sich bei der für eine Substitution am Ar^{20} bis Ar^{25} und R^{13} bis R^{15} geeigneten Gruppe um ein Halogenatom, eine Cyanogruppe, eine Nitrogruppe, eine Arylgruppe mit 6 bis 34 Ringkohlenstoffen, eine Heteroarylgruppe mit 5 bis 34 Ringatomen, eine Alkylgruppe mit 1 bis 34 Kohlenstoffen, eine Cycloalkylgruppe mit 3 bis 34 Kohlenstoffen, eine Thiogruppe mit 1 bis 34 Kohlenstoffen oder um eine Silylgruppe mit 1 bis 34 Kohlenstoffen handelt.

5. Die Verbindung gemäß Anspruch 1, wobei die Verbindung für eine organische elektrolumineszierende Vorrichtung durch die chemische Formel 7 dargestellt ist und wobei

Y^{12} für ein Sauerstoffatom steht,

es sich bei Ar^{26} und Ar^{27} um identische oder unterschiedliche Substituenten handelt, die jeweils für eine substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, eine substituierte oder nicht substituierte Biphenylgruppe, eine substituierte oder nicht substituierte Terphenylgruppe, eine substituierte oder nicht substituierte Naphthylgruppe, eine substituierte oder nicht substituierte Anthrylgruppe oder eine substituierte oder nicht substituierte Pyrenylgruppe stehen, und

es sich bei einigen oder allen der R^{16} bis R^{20} unabhängig voneinander um ein Wasserstoffatom handelt oder R^{16} bis R^{20} identische oder unterschiedliche Substituenten sind, die jeweils für ein Halogenatom, eine Cyanogruppe, eine Nitrogruppe, eine substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, eine substituierte oder nicht substituierte Biphenylgruppe, eine substituierte oder nicht substituierte Terphenylgruppe, eine substituierte oder nicht substituierte Naphthylgruppe, eine substituierte oder nicht substituierte Anthrylgruppe oder eine substituierte oder nicht substituierte Pyrenylgruppe stehen, wobei die substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, die substituierte oder nicht substituierte Biphenylgruppe, die substituierte oder nicht substituierte Terphenylgruppe, die substituierte oder nicht substituierte Naphtlrylgruppe, die substituierte oder nicht substituierte Anthrylgruppe oder die substituierte oder nicht substituierte Pyrenylgruppe allein oder mit einer benachbarten Gruppe einen gesättigten oder ungesättigten Ring bildet, wobei es sich bei der für eine Substitution am $Ar^{26,}$ Ar^{27} und R^{16} bis R^{20} geeigneten Gruppe um ein Halogenatom, eine Cyanogruppe, eine Nitrogruppe, eine Arylgruppe mit 6 bis 34 Ringkohlenstoffen, eine Heteroarylgruppe mit 5 bis 34 Ringatomen, eine Alkylgruppe mit 1 bis 34 Kohlenstoffen, eine Cycloalkylgruppe mit 3 bis 34 Kohlenstoffen, eine Thiogruppe mit 1 bis 34 Kohlenstoffen oder um eine Silylgruppe mit 1 bis 34 Kohlenstoffen handelt.

6. Die Verbindung gemäß Anspruch 1, wobei die Verbindung für eine organische elektrolumineszierende Vorrichtung durch die chemische Formel 8 dargestellt ist und wobei

Y^{13} und Y^{14} jeweils für ein Sauerstoffatom stehen,
es sich bei Ar^{28} bis Ar^{31} um identische oder unterschiedliche Substituenten handelt, die jeweils für eine substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, eine substituierte oder nicht substituierte Biphenylgruppe, eine substituierte oder nicht substituierte Terphenylgruppe, eine substituierte oder nicht substituierte Naphtlrylgruppe, eine substituierte oder nicht substituierte Anthrylgruppe oder eine substituierte oder nicht substituierte Pyrenylgruppe stehen, und
es sich bei einigen oder allen der R^{21} bis R^{25} unabhängig voneinander um ein Wasserstoffatom handelt oder R^{21} bis R^{25} identische oder unterschiedliche Substituenten sind, die jeweils für ein Halogenatom, eine Cyanogruppe, eine Nitrogruppe, eine substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, eine substituierte oder nicht substituierte Biphenylgruppe, eine substituierte oder nicht substituierte Terphenylgruppe, eine substituierte oder nicht substituierte Naphthylgruppe, eine substituierte oder nicht substituierte Anthrylgruppe oder eine substituierte oder nicht substituierte Pyrenylgruppe stehen, wobei die substituierte oder nicht substituierte Phenylgruppe mit 6 bis 34 Kohlenstoffen, die substituierte oder nicht substituierte Biphenylgruppe, die substituierte oder nicht substituierte Terphenylgruppe, die substituierte oder nicht substituierte Naphthylgruppe, die substituierte oder nicht substituierte Anthrylgruppe oder die substituierte oder nicht substituierte Pyrenylgruppe allein oder mit einer benachbarten Gruppe einen gesättigten oder ungesättigten Ring bildet,
wobei es sich bei der für eine Substitution am Ar^{28} bis Ar^{31} und R^{21} bis R^{25} geeigneten Gruppe um ein Halogenatom, eine Cyanogruppe, eine Nitrogruppe, eine Arylgruppe mit 6 bis 34 Ringkohlenstoffen, eine Heteroarylgruppe mit 5 bis 34 Ringatomen, eine Alkylgruppe mit 1 bis 34 Kohlenstoffen, eine Cycloalkylgruppe mit 3 bis 34 Kohlenstoffen, eine Thiogruppe mit 1 bis 34 Kohlenstoffen oder um eine Silylgruppe mit 1 bis 34 Kohlenstoffen handelt.

7. Eine organische elektrolumineszierende Vorrichtung, umfassend:

eine erste Elektrode,
eine zweite Elektrode, und
eine einzige organische Schicht oder eine Vielzahl von organischen Schichten mit zumindest einer lichtemittierenden Schicht, die zwischen der ersten Elektrode und der zweiten Elektrode ausgebildet ist,
wobei die organische Schicht die Verbindung für eine organische elektrolumineszierende Vorrichtung gemäß einem der Ansprüche 1 bis 6 umfasst.

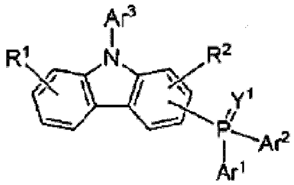
8. Die organische elektrolumineszierende Vorrichtung gemäß Anspruch 7, wobei die lichtemittierende Schicht die Verbindung für eine organische elektrolumineszierende Vorrichtung gemäß einem der Ansprüche 1 bis 6 umfasst.

9. Die organische elektrolumineszierende Vorrichtung gemäß Anspruch 7, wobei die organische Schicht eine Lochleitungsschicht umfasst, die die Verbindung für eine organische elektrolumineszierende Vorrichtung gemäß einem der Ansprüche 1 bis 6 umfasst.

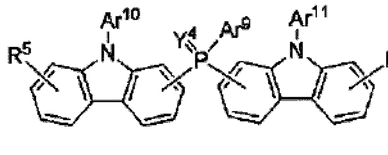
Revendications

1. Composé pour un dispositif électroluminescent organique, représenté par l'une des formules chimiques suivantes :

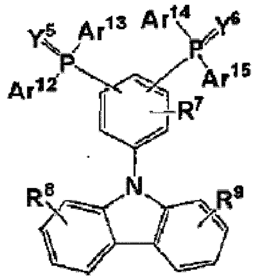
[Formule chimique 1]



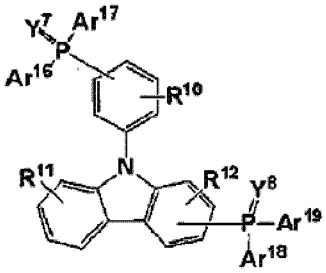
[Formule chimique 3]



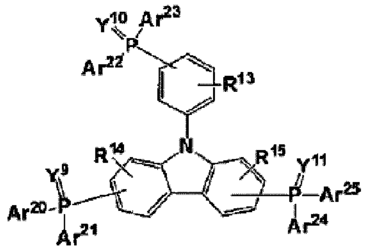
[Formule chimique 4]



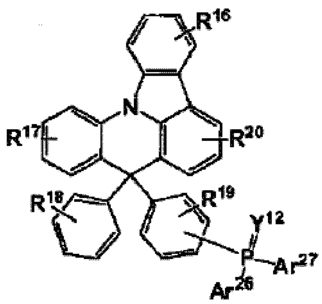
[Formule chimique 5]



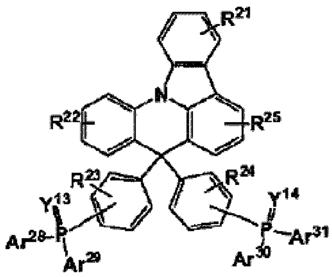
[Formule chimique 6]



[Formule chimique 7]



[Formule chimique 8]



dans lequel

Y^1 et Y^4 représentent un atome d'oxygène et Y^{12} représente un atome d'oxygène, un atome de soufre ou un atome de sélénium,

Y^5 et Y^6, Y^7 et Y^8, Y^9 à Y^{11}, Y^{13} et Y^{14} sont des substituants identiques ou différents et représentent chacun un atome d'oxygène, un atome de soufre ou un atome de sélénium,

Ar^1 et Ar^2 représentent chacun un groupe phényle, Ar^{10} et Ar^{11} sont des substituants identiques ou différents et représentent chacun un groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, un groupe biphényle substitué ou non substitué, un groupe terphényle substitué ou non substitué, un groupe naphtyle substitué ou non substitué, un groupe anthryle substitué ou non substitué, ou un groupe pyrényle substitué ou non substitué, et Ar^{12} à Ar^{15}, Ar^{16} à Ar^{19}, Ar^{20} à Ar^{25}, Ar^{26} et Ar^{27}, Ar^{28} à Ar^{31} sont des substituants identiques ou différents, et représentent chacun un groupe aryle substitué ou non substitué ayant 6 à 50 atomes de carbone cycliques, ou un groupe hétéroaryle substitué ou non substitué ayant 5 à 50 atomes cycliques,

Ar^3 représente un groupe phényle, et Ar^9 représente un groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, un groupe biphényle substitué ou non substitué, un groupe terphenyl substitué ou non substitué, un groupe naphtyle substitué ou non substitué, un groupe anthryle substitué ou non substitué, ou un groupe pyrényle substitué ou non substitué, et

R^1 et R^2 représentent chacun un groupe phényle, et

tout ou partie de R^5 et R^6 sont indépendamment un atome d'hydrogène, ou R^5 et R^6 sont des substituants identiques ou différents et représentent chacun un atome d'halogène, un groupe cyano, un groupe nitro, un groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, un groupe biphényle substitué ou non substitué, un groupe terphényle substitué ou non substitué, un groupe naphtyle substitué ou non substitué, un groupe anthryle substitué ou non substitué, ou un groupe pyrényle substitué ou non substitué, dans lequel le groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, le groupe biphényle substitué ou non substitué, le groupe terphényle substitué ou non substitué, le groupe naphtyle substitué ou non substitué, le groupe anthryle substitué ou non substitué, ou le groupe pyrényle substitué ou non substitué forme un cycle saturé ou insaturé indépendamment ou avec un groupe adjacent, et

tout ou partie de R^7 à R^9, R^{10} à R^{12}, R^{13} à R^{15}, R^{16} à R^{20}, R^{21} à R^{25} sont indépendamment un atome d'hydrogène, ou R^7 à R^9, R^{10} et R^{12}, R^{13} à R^{15}, R^{16} à R^{20}, R^{21} à R^{23} sont des substituants identiques ou différents et représentent chacun un atome d'halogène, un groupe cyano, un groupe nitro, un groupe aryle substitué ou non substitué ayant 6 à 50 atomes de carbone cycliques, un groupe hétéroaryle substitué ou non substitué ayant 5 à 50 atomes cycliques, un groupe alkyle substitué ou non substitué ayant 1 à 50 atomes de carbone, un groupe cycloalkyle substitué ou non substitué ayant 3 à 50 atomes de carbone, un groupe thio substitué ou non substitué ayant 1 à 50 atomes de carbone, ou un groupe silyle substitué ou non substitué ayant 1 à 50 atomes de carbone, dans lequel le groupe aryle substitué ou non substitué ayant 6 à 50 atomes de carbone cycliques, le groupe hétéroaryle substitué ou non substitué ayant 5 à 50 atomes cycliques, ou le groupe cycloalkyle substitué ou non substitué ayant de 3 à 50 atomes de carbone forme un cycle saturé ou insaturé indépendamment ou avec un groupe adjacent,

dans lequel le groupe approprié à la substitution sur Ar^9 à Ar^{11}, ou R^5 et R^6 est un atome d'halogène, un groupe cyano, un groupe nitro, un groupe aryle ayant 6 à 34 atomes de carbone cycliques, un groupe hétéroaryle ayant 5 à 34 atomes cycliques, un groupe alkyle ayant 1 à 34 atomes de carbone, un groupe cycloalkyle ayant 3 à 34 atomes de carbone, un groupe thio ayant 1 à 34 atomes de carbone, ou un groupe silyle comportant 1 à 34 atomes de carbone, et

dans lequel un groupe approprié à la substitution sur Ar^{12} à Ar^{31} ou R^7 à R^{25} est un atome d'halogène, un groupe cyano, un groupe nitro, un groupe aryle ayant 6 à 50 atomes de carbone cycliques, un groupe hétéroaryle ayant 5 à 50 atomes cycliques, un groupe alkyle ayant 1 à 50 atomes de carbone, un groupe cycloalkyle ayant 3 à 50 atomes de carbone, un groupe thio ayant 1 à 50 atomes de carbone, ou un groupe silyle ayant 1 à 50 atomes de carbone.

2. Composé selon la revendication 1, dans lequel le composé pour un dispositif électroluminescent organique est représenté par la formule chimique 4 et dans lequel

Y^5 et Y^6 représentent un atome d'oxygène,

Ar^{12} à Ar^{15} sont des substituants identiques ou différents et représentent chacun un groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, un groupe biphényle substitué ou non substitué, un groupe terphényle substitué ou non substitué, un groupe naphtyle substitué ou non substitué, un groupe anthryle substitué ou non substitué, ou un groupe pyrényle substitué ou non substitué, et

tout ou partie de R^7 à R^9 sont indépendamment un atome d'hydrogène, ou R^7 à R^9 sont des substituants identiques ou différents et représentent chacun un atome d'halogène, un groupe cyano, un groupe nitro, un groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, un groupe biphényle substitué ou non substitué, un groupe terphenyle substitué ou non substitué, un groupe naphtyle substitué ou non substitué, un groupe anthryle substitué ou non substitué, ou un groupe pyrényle substitué ou non substitué, dans lequel le groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, le groupe biphényle substitué ou non substitué, le groupe terphényle substitué ou non substitué, le groupe naphtyle substitué ou non substitué, le groupe anthryle substitué ou non substitué, ou le groupe pyrényle substitué ou non substitué forme un cycle saturé ou insaturé indépendamment ou avec un groupe adjacent,

dans lequel le groupe approprié à la substitution sur Ar^{12} à Ar^{10} et R^7 à R^9 est un atome d'halogène, un groupe cyano, un groupe nitro, un groupe aryle ayant 6 à 34 atomes de carbone cycliques, un groupe hétéroaryle ayant 5 à 34 atomes cycliques, un groupe alkyle ayant 1 à 34 atomes de carbone, un groupe cycloalkyle ayant 3 à 34 atomes de carbone, un groupe thio ayant 1 à 34 atomes de carbone, ou un groupe silyle ayant 1 à 34 atomes de carbone.

3. Composé selon la revendication 1, dans lequel le composé pour un dispositif électroluminescent organique est représenté par la formule chimique 5 et dans lequel

Y^7 et Y^8 représentent chacun un atome d'oxygène,

Ar^{16} à Ar^{19} sont des substituants identiques ou différents et représentent chacun un groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, un groupe biphényle substitué ou non substitué, un groupe terphényle substitué ou non substitué, un groupe naphtyle substitué ou non substitué, un groupe anthryle substitué ou non substitué, ou un groupe pyrényle substitué ou non substitué, et

tout ou partie de R^{10} à R^{12} sont indépendamment un atome d'hydrogène, ou R^{10} à R^{12} sont des substituants identiques ou différents et représentent chacun un atome d'halogène, un groupe cyano, un groupe nitro, un groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, un groupe biphényle substitué ou non substitué, un groupe terphényle substitué ou non substitué, un groupe naphtyle substitué ou non substitué, un groupe anthryle substitué ou non substitué, ou un groupe pyrényle substitué ou non substitué, dans lequel le groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, le groupe biphényle substitué ou non substitué, le groupe terphényle substitué ou non substitué, le groupe naphtyle substitué ou non substitué, le groupe anthryle substitué ou non substitué, ou le groupe pyrényle substitué ou non substitué forme un cycle saturé ou insaturé indépendamment ou avec un groupe adjacent,

dans lequel le groupe approprié à la substitution sur Ar^{16} à Ar^{19} et R^{10} à R^{12} est un atome d'halogène, un groupe cyano, un groupe nitro, un groupe aryle ayant 6 à 34 atomes de carbone cycliques, un groupe hétéroaryle ayant 5 à 34 atomes cycliques, un groupe alkyle ayant 1 à 34 atomes de carbone, un groupe cycloalkyle ayant 3 à 34 atomes de carbone, un groupe thio ayant 1 à 34 atomes de carbone, ou un groupe silyle ayant 1 à 34 atomes de carbone.

4. Composé selon la revendication 1, dans lequel le composé pour un dispositif électroluminescent organique est représenté par la formule chimique 6 et dans lequel

Y^9 à Y^{11} représentent chacun un atome d'oxygène,

Ar^{20} à Ar^{23} sont des substituants identiques ou différents et représentent chacun un groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, un groupe biphényle substitué ou non substitué, un groupe terphényle substitué ou non substitué, un groupe naphtyle substitué ou non substitué, un groupe anthryle substitué ou non substitué, ou un groupe pyrényle substitué ou non substitué, et

tout ou partie de R^{13} à R^{15} sont indépendamment un atome d'hydrogène, ou R^{13} à R^{15} sont des substituants identiques ou différents et représentent chacun un atome d'halogène, un groupe cyano, un groupe nitro, un groupe phényle substitué ou non substitué ayant 6à 34 atomes de carbone, un groupe biphényle substitué ou non substitué, un groupe terphényle substitué ou non substitué, un groupe naphtyle substitué ou non substitué, un groupe anthryle substitué ou non substitué, ou un groupe pyrényle substitué ou non substitué, dans lequel le groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, le groupe biphényle substitué ou non substitué, le groupe terphényle substitué ou non substitué, le groupe naphtyle substitué ou non substitué, le groupe anthryle substitué ou non substitué, ou le groupe pyrényle substitué ou non substitué forme un cycle saturé ou insaturé indépendamment ou avec un groupe adjacent,

dans lequel le groupe approprié à la substitution sur Ar^{20} à Ar^{25} et R^{13} à R^{15} est un atome d'halogène, un groupe cyano, un groupe nitro, un groupe aryle ayant 6 à 34 atomes de carbone cycliques, un groupe hétéroaryle ayant 5 à 34 atomes cycliques, un groupe alkyle ayant 1 à 34 atomes de carbone, un groupe cycloalkyle ayant 3 à 34 atomes de carbone, un groupe thio ayant 1 à 34 atomes de carbone, ou un groupe silyle ayant 1 à 34 atomes de carbone.

5. Composé selon la revendication 1, dans lequel le composé pour un dispositif électroluminescent organique est représenté par la formule chimique 7 et dans lequel

Y^{12} représente un atome d'oxygène,

Ar^{26} et Ar^{27} sont des substituants identiques ou différents et représentent chacun un groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, un groupe biphényle substitué ou non substitué, un groupe terphényle substitué ou non substitué, un groupe naphtyle substitué ou non substitué, un groupe anthryle substitué ou non substitué, ou un groupe pyrényle substitué ou non substitué, et

tout ou partie de R^{16} à R^{20} sont indépendamment un atome d'hydrogène, ou R^{16} à R^{20} sont des substituants identiques ou différents et représentent chacun un atome d'halogène, un groupe cyano, un groupe nitro, un groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, un groupe biphényle substitué ou non substitué, un groupe terphenyle substitué ou non substitué, un groupe naphtyle substitué ou non substitué, un groupe anthryle substitué ou non substitué, ou un groupe pyrényle substitué ou non substitué, dans lequel le groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, le groupe biphényle substitué ou non substitué, le groupe terphenyle substitué ou non substitué, le groupe naphtyle substitué ou non substitué, le groupe anthryle substitué ou non substitué, ou le groupe pyrényle substitué ou non substitué forme un cycle saturé ou insaturé indépendamment ou avec un groupe adjacent,

dans lequel le groupe approprié à la substitution sur Ar^{26}, Ar^{27} et R^{16} à R^{20} est un atome d'halogène, un groupe cyano, un groupe nitro, un groupe aryle ayant 6 à 34 atomes de carbone cycliques, un groupe hétéroaryle ayant 5 à 34 atomes cycliques, un groupe alkyle ayant 1 à 34 atomes de carbone, un groupe cycloalkyle ayant 3 à 34 atomes de carbone, un groupe thio ayant 1 à 34 atomes de carbone, ou un groupe silyle ayant 1 à 34 atomes de carbone.

6. Composé selon la revendication 1, dans lequel le composé pour un dispositif électroluminescent organique est représenté par la formule chimique 8 et dans lequel

Y^{13} et Y^{14} représentent chacun un atome d'oxygène,
Ar^{28} à Ar^{31} sont des substituants identiques ou différents et représentent chacun un groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, un groupe biphényle substitué ou non substitué, un groupe terphényle substitué ou non substitué, un groupe naphtyle substitué ou non substitué, un groupe anthryle substitué ou non substitué, ou un groupe pyrényle substitué ou non substitué, et
tout ou partie de R^{21} à R^{25} sont indépendamment un atome d'hydrogène, ou R^{21} à R^{25} sont des substituants identiques ou différents et représentent chacun un atome d'halogène, un groupe cyano, un groupe nitro, un groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, un groupe biphényle substitué ou non substitué, un groupe terphenyle substitué ou non substitué, un groupe naphtyle substitué ou non substitué, un groupe anthryle substitué ou non substitué, ou un groupe pyrényle substitué ou non substitué, dans lequel le groupe phényle substitué ou non substitué ayant 6 à 34 atomes de carbone, le groupe biphényle substitué ou non substitué, le groupe terphényle substitué ou non substitué, le groupe naphtyle substitué ou non substitué, le groupe anthryle substitué ou non substitué, ou le groupe pyrényle substitué ou non substitué forme un cycle saturé ou insaturé indépendamment ou avec un groupe adjacent,
dans lequel le groupe approprié à la substitution sur Ar^{28} à Ar^{31} et R^{21} à R^{25} est un atome d'halogène, un groupe cyano, un groupe nitro, un groupe aryle ayant 6 à 34 atomes de carbone cycliques, un groupe hétéroaryle ayant 5 à 34 atomes cycliques, un groupe alkyle ayant 1 à 34 atomes de carbone, un groupe cycloalkyle ayant 3 à 34 atomes de carbone, un groupe thio ayant 1 à 34 atomes de carbone, ou un groupe silyle ayant 1 à 34 atomes de carbone.

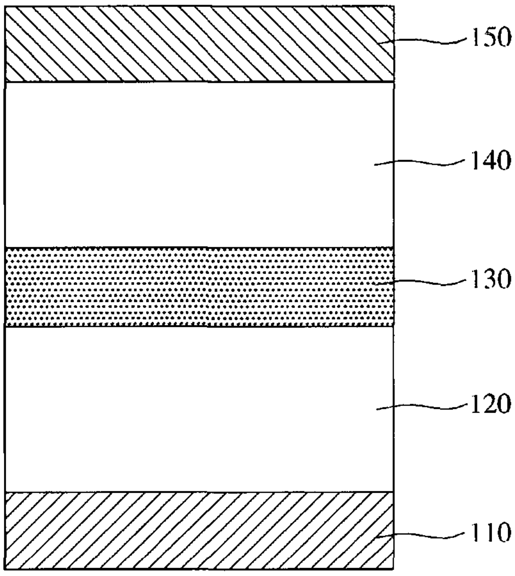
7. Dispositif électroluminescent organique, comprenant :

une première électrode ;
une seconde électrode ; et
une couche organique unique ou une pluralité de couches organiques ayant au moins une couche émettrice de lumière, formées entre la première électrode et la seconde électrode,
dans lequel la couche organique comprend le composé pour un dispositif électroluminescent organique selon l'une quelconque des revendications 1 à 6.

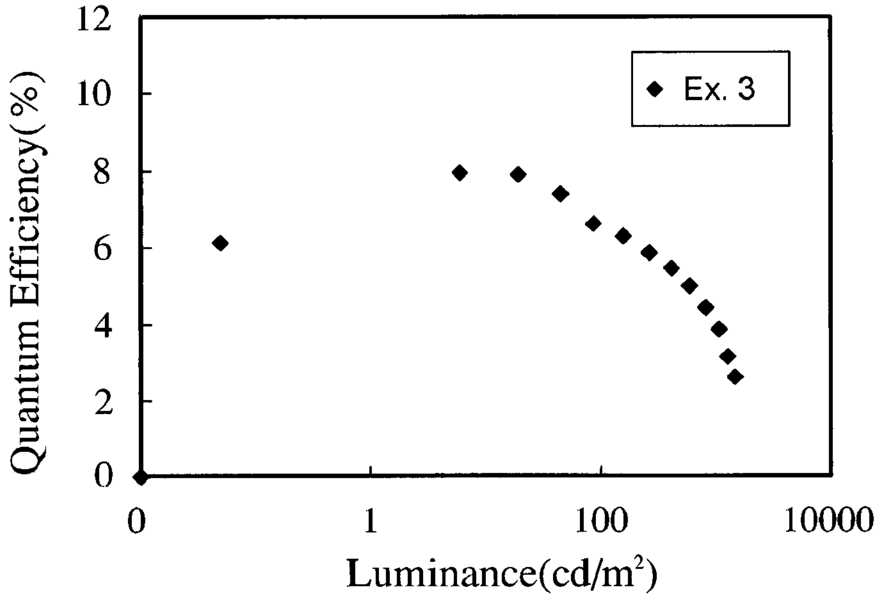
8. Dispositif électroluminescent organique selon la revendication 7, dans lequel la couche émettrice de lumière comprend le composé pour un dispositif électroluminescent organique selon l'une quelconque des revendications 1 à 6.

9. Dispositif électroluminescent organique selon la revendication 7, dans lequel la couche organique comprend une couche de transport de trous incluant le composé pour un dispositif électroluminescent organique selon l'une quelconque des revendications 1 à 6.

[FIG. 1]

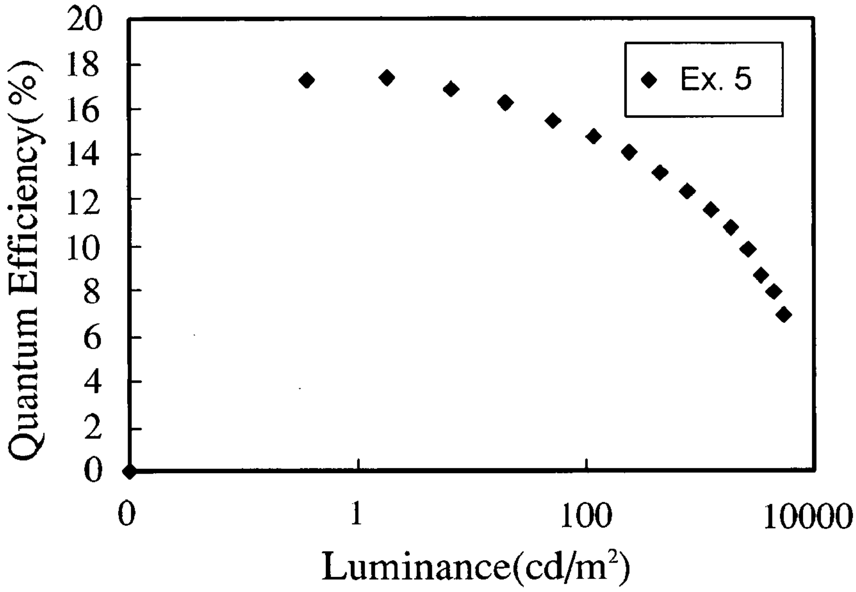


[FIG. 4]



12
10
8
6
4
2
0
Quantum Efficiency(%)
Ex. 3
0
1
100
10000
Luminance(cd/m2)

[FIG. 6]


20
18
16
14
12
10
8
6
4
2
0
Quantum Efficiency(%)
Ex. 5
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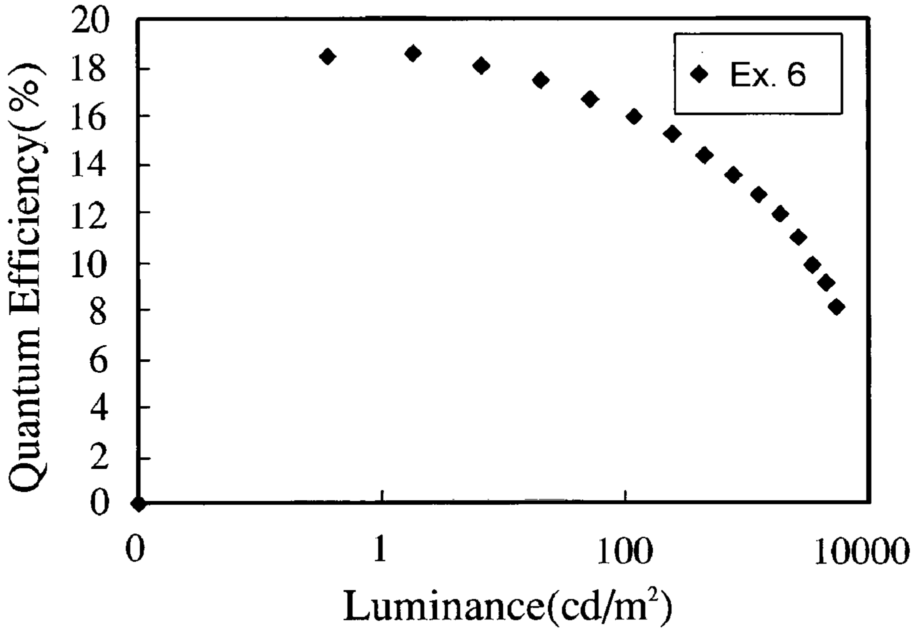
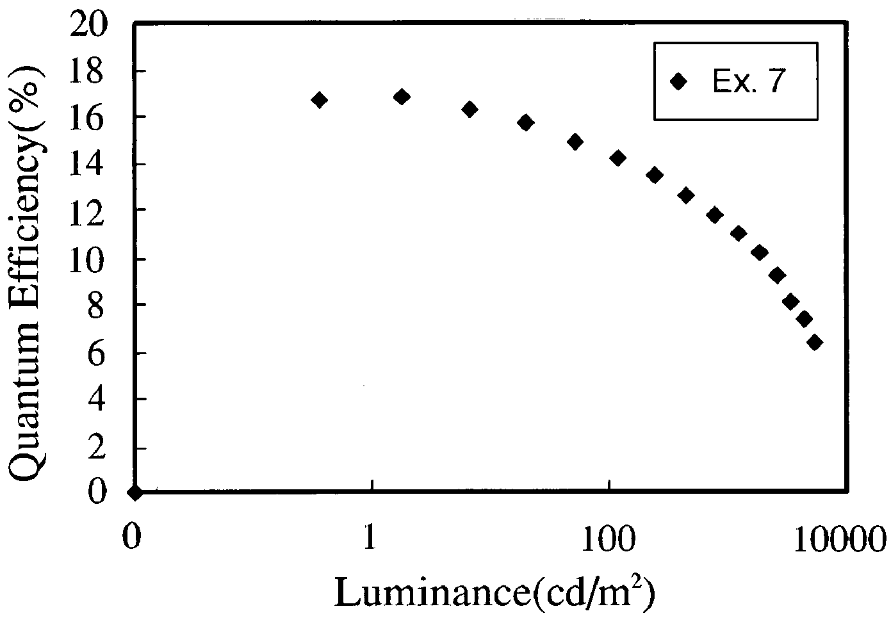
1
100
10000
Luminance(cd/m2)

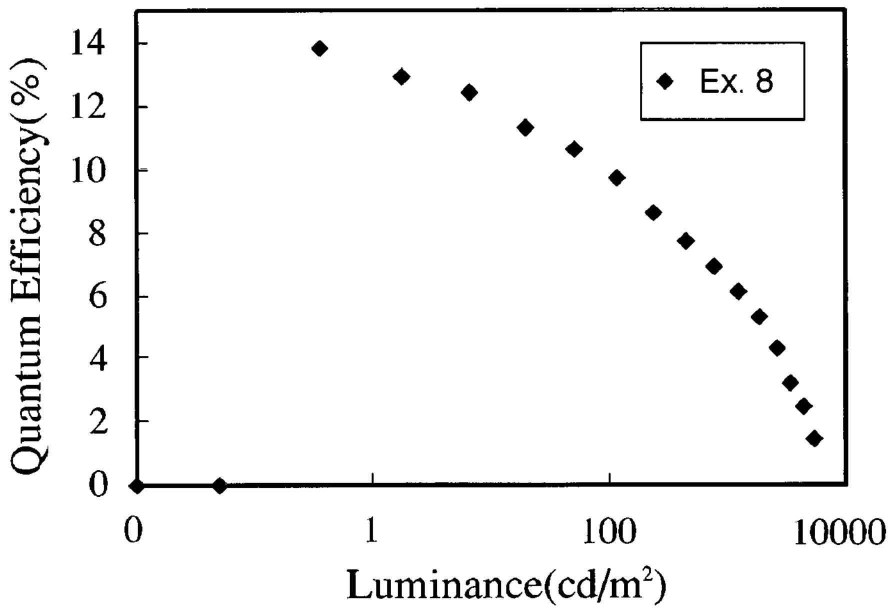
[FIG. 7]


20
18
16
14
12
10
8
6
4
2
0
Quantum Efficiency(%)
Ex. 6
0
1
100
10000
Luminance(cd/m²)

[FIG. 8]

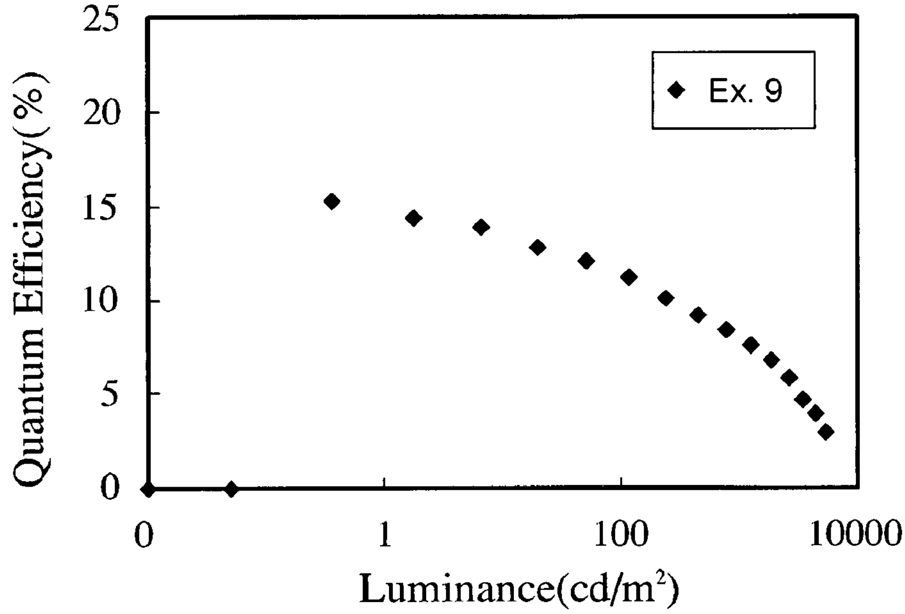

20
18
16
14
12
10
8
6
4
2
0
Quantum Efficiency(%)
Ex. 7
0
1
100
10000
Luminance(cd/m²)

[FIG. 9]



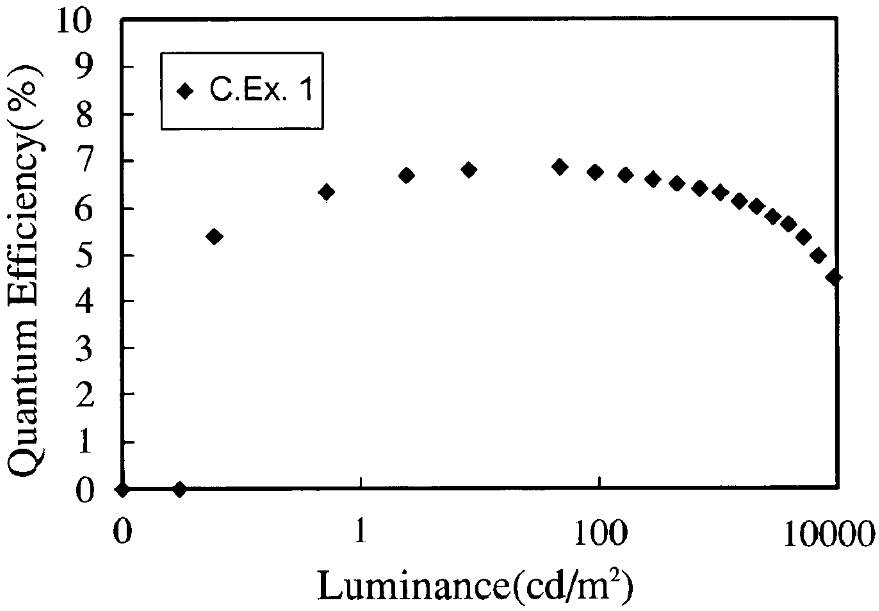
Quantum Efficiency(%)
14
12
10
8
6
4
2
0
Ex. 8
0
1
100
10000
Luminance(cd/m2)

[FIG. 10]

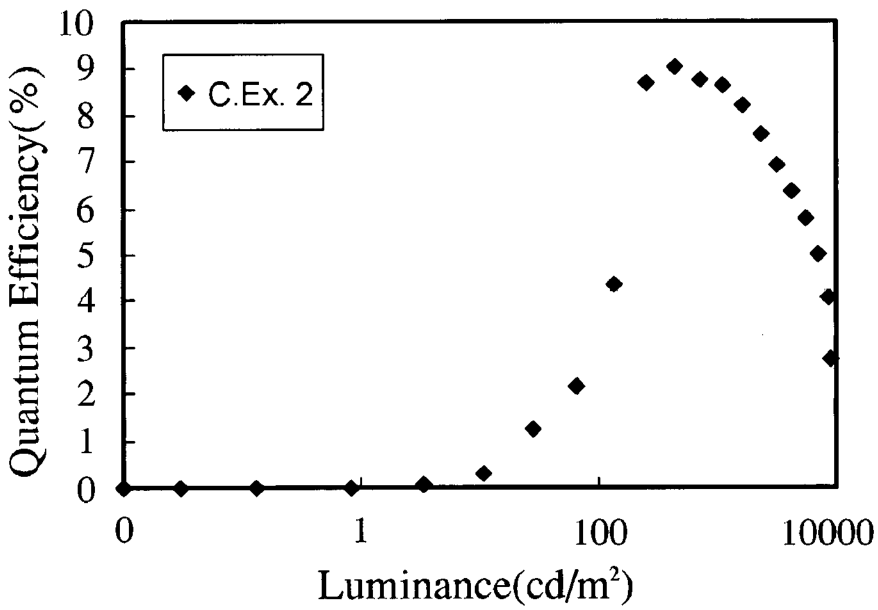


Quantum Efficiency(%)
25
20
15
10
5
0
Ex. 9
0
1
100
10000
Luminance(cd/m2)

[FIG. 11]


C.Ex. 1
Quantum Efficiency(%)
Luminance(cd/m2)
0
1
100
10000
0
1
2
3
4
5
6
7
8
9
10

[FIG. 12]


C.Ex. 2
Quantum Efficiency(%)
Luminance(cd/m2)
0
1
100
10000
0
1
2
3
4
5
6
7
8
9
10

REFERENCES CITED IN THE DESCRIPTION

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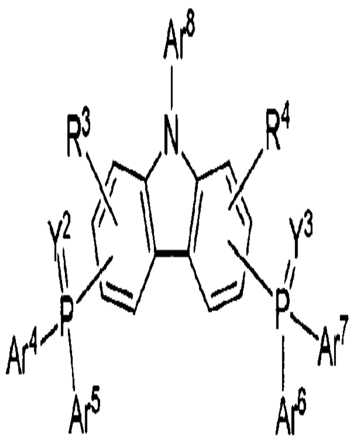
专利名称(译)	基于咔唑的氧化膦化合物和包括其的有机电致发光器件		
公开(公告)号	EP2436751B1	公开(公告)日	2015-01-07
申请号	EP2009845286	申请日	2009-11-16
[标]申请(专利权)人(译)	檀国大学校产学协力团		
申请(专利权)人(译)	产学合作基础，檀国大学		
当前申请(专利权)人(译)	SK CHEMICALS CO.，LTD.		
[标]发明人	LEE JUN YEOB JEON SOON OK YOOK KYOUNG SOO KIM OH YOUNG		
发明人	LEE, JUN-YEOB JEON, SOON-OK YOOK, KYOUNG-SOO KIM, OH-YOUNG		
IPC分类号	C09K11/06 C07F9/572 H01L51/54 H01L27/32 H05B33/14 H01L51/00 H01L51/50		
CPC分类号	C07F9/5728 C09K11/06 C09K2211/1007 C09K2211/1011 C09K2211/1014 C09K2211/1022 C09K2211/1029 C09K2211/1044 C09K2211/1088 H01L51/0072 H01L51/0081 H01L51/0085 H01L51/0094 H01L51/5012 H01L51/5016 H05B33/14		
优先权	1020090104025 2009-10-30 KR 1020090046425 2009-05-27 KR		
其他公开文献	EP2436751A4 EP2436751A1		
外部链接	Espacenet		

摘要(译)

本发明涉及咔唑系氧化膦化合物，以及包含该化合物的有机电致发光器件。根据本发明，提供了一种用于有机电致发光器件的化合物，其可以改善不稳定的热稳定性和低效率特性，这是已知的用于有机电致发光器件的化合物的问题，并且特别地，可以实现纯蓝色的优异效率特性。磷光装置，使用该化合物的咔唑系氧化膦化合物作为有机电致发光元件，和有机电致发光元件。根据本发明的一个方面，提供了用于有机电致发光器件的化合物的咔唑基氧化膦化合物，并且还提供了包含其的可以实现热稳定性和高效特性的有机电致发光器件。



Chemical Formula 2