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(54) **Title:** ORGANIC ELECTROLUMINESCENT MATERIAL AND ORGANIC ELECTROLUMINESCENT DEVICE COMPRISING THE SAME

(57) **Abstract:** The present disclosure relates to an organic electroluminescent material comprising at least two types of compounds and an organic electroluminescent device comprising the same. The organic electroluminescent device having better color purity than a conventional organic electroluminescent device can be provided by comprising the specific combination of the compounds of the present disclosure.

Description

Title of Invention: ORGANIC ELECTROLUMINESCENT MATERIAL AND ORGANIC ELECTROLUMINESCENT DEVICE COMPRISING THE SAME

Technical Field

[1] The present disclosure relates to an organic electroluminescent material comprising at least two types of compounds and an organic electroluminescent device comprising the same.

Background Art

[2] An electroluminescent device (EL device) is a self-light-emitting display device which has advantages in that it provides a wider viewing angle, a greater contrast ratio, and a faster response time. The first organic EL device was developed by Eastman Kodak in 1987, by using small aromatic diamine molecules and aluminum complexes as materials for forming a light-emitting layer (*see* Appl. Phys. Lett. 51, 913, 1987).

[3] An organic EL device (OLED) changes electric energy into light by applying electricity to an organic electroluminescent material, and commonly comprises an anode, a cathode, and an organic layer formed between the two electrodes. The organic layer of the organic EL device may comprise a hole injection layer, a hole transport layer, a hole auxiliary layer, a light-emitting auxiliary layer, an electron blocking layer, a light-emitting layer (containing host and dopant materials), an electron buffer layer, a hole blocking layer, an electron transport layer, an electron injection layer, etc., if necessary. The materials used in the organic layer can be classified into a hole injection material, a hole transport material, a hole auxiliary material, a light-emitting auxiliary material, an electron blocking material, a light-emitting material, an electron buffer material, a hole blocking material, an electron transport material, an electron injection material, etc., depending on their functions. In the organic EL device, holes from the anode and electrons from the cathode are injected into a light-emitting layer by the application of electric voltage, and excitons having high energy are produced by the recombination of the holes and electrons. The organic light-emitting compound moves into an excited state by the energy and emits light from an energy when the organic light-emitting compound returns to the ground state from the excited state.

[4] The most important factor determining luminous efficiency in an organic EL device is light-emitting materials. The light-emitting materials are required to have the following features: high quantum efficiency, high mobility of an electron and a hole, and uniformity and stability of the formed light-emitting material layer. The light-emitting material is classified into blue, green, and red light-emitting materials

according to the light-emitting color, and further includes yellow or orange light-emitting materials. Furthermore, the light-emitting material is classified into a host material and a dopant material in a functional aspect.

[5] Generally, a device having excellent EL characteristics has a structure comprising a light-emitting layer made by doping a dopant to a host. When only one material is used as a light-emitting material, a problem arises in that the maximum emission wavelength moves toward a long wavelength and the color purity deteriorates due to intermolecular forces.

[6] Iridium(III) complexes have been widely known as phosphorescent light-emitting materials, including bis(2-(2'-benzothienyl)-pyridinato-N,C-3')iridium(acetylacetonate) [(acac)Ir(btp)$_2$], tris(2-phenylpyridine)iridium [Ir(ppy)$_3$] and bis(4,6-difluorophenylpyridinato-N,C2)picolinato iridium (Firpic) as red, green, and blue light-emitting materials, respectively.

[7] Also, 4,4'-N,N'-dicarbazol-biphenyl (CBP) has been the most widely known host material for phosphorescent materials. Recently, Pioneer (Japan) et al., developed a high performance organic electroluminescent device using bathocuproine (BCP) and aluminum(III) bis(2-methyl-8-quinolinate)(4-phenylphenolate) (BAlq), etc., as host materials, which were known as hole blocking materials.

[8] However, although these conventional phosphorescent host materials provide good luminous characteristics, they have disadvantages in that the materials change when a high temperature deposition process is performed under vacuum due to low glass transition temperature and low thermal stability. Thus, the color purity of the device was still unsatisfactory.

[9] Recently, many electronic panel companies are making organic electroluminescent devices using three colors of blue, green, and red, and these three colors are combined to realize various colors of displays that are currently in use. The colors that can be implemented on the display can represent only the colors that can be combined with one another at the three vertexes of blue, green, and red. Thus, for a more colorful implementation, these three color vertexes must reach their respective color wavelengths as much as possible.

[10] Korean Patent No. 1082144 discloses an organic electroluminescent device comprising an indolocarbazole derivative, or a compound wherein a dibenzoindolocarbazole and a naphthyridinyl are combined, as a host. Also, Korean Patent Application Laid-Open No. 2016-0039561 discloses an organic electroluminescent device comprising an indolocarbazole derivative as a host. However, the aforementioned documents do not specifically disclose a device comprising a benzoindolocarbazole as a host.

Disclosure of Invention

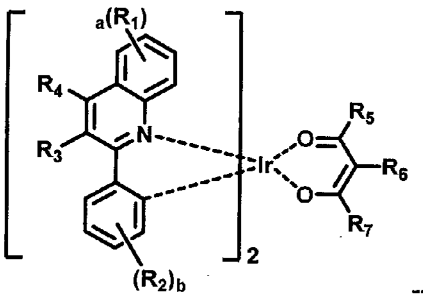
Technical Problem

[11] The objective of the present disclosure is to provide an organic electroluminescent material for producing an organic electroluminescent device having better color purity than a conventional organic electroluminescent device.

Solution to Problem

[12] As a result of intensive studies to solve the technical problem above, the present inventors found that the color reproduction range can be increased by drawing the wavelength band toward the longest wavelength in red light-emission. Although the characteristics of the dopant material of host and dopant materials more influence the wavelength band, it is possible to further optimize the luminous characteristics by using a host material suitable for the dopant material. In the case of red light-emission, it can be expected that the energy band gap of the dopant material is narrow since it has a long wavelength. The host material used in the present disclosure has a narrow energy band gap, which is suitable for the dopant material having a long wavelength. Thus, it is considered that the combination is suitable for the objective of transferring energy from a host to a dopant. Specifically, the above objective can be achieved by an organic electroluminescent material comprising a compound represented by the following formula 1 and a compound represented by the following formula 2. The compound represented by formula 1 may be comprised as a dopant, and the compound represented by formula 2 may be comprised as a host.

[13]



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[14] Wherein

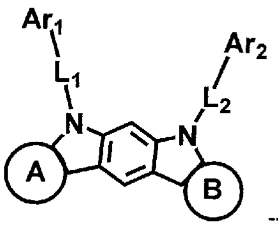
[15] R_1 to R_3, each independently, represent hydrogen, deuterium, a substituted or unsubstituted (C1-C10)alkyl, a substituted or unsubstituted (C2-C10)alkenyl, or a substituted or unsubstituted (C6-C30)aryl, or may be linked to an adjacent substituent to form a substituted or unsubstituted, mono- or polycyclic, (C3-C30) alicyclic or aromatic ring, or the combination thereof, whose carbon atom(s) may be replaced with at least one heteroatom selected from nitrogen, oxygen, and sulfur,

[16] R_4 represents a substituted or unsubstituted (C1-C10)alkyl, or a substituted or unsubstituted (C6-C30)aryl,

[17] R_5 to R_7, each independently, represent hydrogen, deuterium, a substituted or unsubstituted (C1-C10)alkyl, or a substituted or unsubstituted (C6-C30)aryl,

[18] a and b, each independently, represent an integer of 1 to 4, where if a and b, each independently, are an integer of 2 or more, each of R_1 and R_2 may be the same or different.

[19]



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[20] Wherein

[21] A ring and B ring, each independently, represent a substituted or unsubstituted benzene ring, or a substituted or unsubstituted naphthalene ring, with a proviso that at least one of A ring and B ring is a substituted or unsubstituted naphthalene ring,

[22] Ar_1 and Ar_2, each independently, represent a substituted or unsubstituted (C6-C30)aryl, or a substituted or unsubstituted nitrogen-containing (8- to 30-membered)heteroaryl,

[23] L_1 and L_2, each independently, represent a single bond, a substituted or unsubstituted (C6-C30)arylene, or a substituted or unsubstituted (3- to 30-membered)heteroarylene, and

[24] the heteroaryl(ene) contains at least one heteroatom selected from B, N, O, S, Si, and P.

Advantageous Effects of Invention

[25] According to the present desclosure, an organic electroluminescent device having excellent color purity can be provided.

Mode for the Invention

[26] Hereinafter, the present disclosure will be described in detail. However, the following description is intended to explain the disclosure, and is not meant in any way to restrict the scope of the disclosure.

[27] The term “an organic electroluminescent material” in the present disclosure means a material that may be used in an organic electroluminescent device, and may comprise at least one compound. If necessary, the organic electroluminescent material may be comprised in any layers constituting an organic electroluminescent device. For example, the organic electroluminescent material may be a hole injection material, a hole transport material, a hole auxiliary material, a light-emitting auxiliary material, an electron blocking material, a light-emitting material, an electron buffer material, a hole blocking material, an electron transport material, an electron injection material, etc.

[28] The organic electroluminescent material of the present disclosure may comprise at least one compound represented by formula 1, and at least one compound represented by formula 2. Although not limited thereto, the compound of formula 1 and the compound of formula 2 may be included in the light-emitting layer. In this case, the compound of formula 1 may be included as a dopant, and the compound of formula 2 may be included as a host.

[29] In formula 1, R_1 to R_3, each independently, represent hydrogen, deuterium, a substituted or unsubstituted (C1-C10)alkyl, a substituted or unsubstituted (C2-C10)alkenyl, or a substituted or unsubstituted (C6-C30)aryl, or may be linked to an adjacent substituent to form a substituted or unsubstituted, mono- or polycyclic, (C3-C30) alicyclic or aromatic ring, or the combination thereof, whose carbon atom(s) may be replaced with at least one heteroatom selected from nitrogen, oxygen, and sulfur; as one embodiment, hydrogen, a substituted or unsubstituted (C1-C8)alkyl, or a substituted or unsubstituted (C6-C25)aryl, or may be linked to an adjacent substituent to form a substituted or unsubstituted, mono- or polycyclic, (C5-C25) alicyclic or aromatic ring, or the combination thereof, whose carbon atom(s) may be replaced with at least one heteroatom selected from nitrogen, oxygen, and sulfur; and as another embodiment, hydrogen, a substituted or unsubstituted (C1-C4)alkyl, or a substituted or unsubstituted (C6-C18)aryl, or may be linked to an adjacent substituent to form a substituted or unsubstituted, mono- or polycyclic, (C5-C18) alicyclic or aromatic ring, or the combination thereof. For example, R_1 may represent hydrogen, an unsubstituted methyl, a phenyl unsubstituted or substituted with a methyl(s), or an unsubstituted biphenyl, or may be linked to an adjacent substituent to form an indene ring substituted with a methyl(s); R_2 may represent hydrogen, or an unsubstituted methyl; and R_3 may represent hydrogen.

[30] In formula 1, R_4 represents a substituted or unsubstituted (C1-C10)alkyl, or a substituted or unsubstituted (C6-C30)aryl; as one embodiment, a substituted or unsubstituted (C1-C8)alkyl, or a substituted or unsubstituted (C6-C25)aryl; as another embodiment, a substituted or unsubstituted (C1-C4)alkyl, or a substituted or unsubstituted (C6-C18)aryl; and for example, an unsubstituted methyl, an unsubstituted *iso*-butyl; a phenyl unsubstituted or substituted with a methyl(s), an *iso*-butyl(s) and/or a *tert*-butyl(s).

[31] In formula 1, R_5 to R_7, each independently, represent hydrogen, deuterium, a substituted or unsubstituted (C1-C10)alkyl, or a substituted or unsubstituted (C6-C30)aryl; and as one embodiment, hydrogen, a substituted or unsubstituted (C1-C8)alkyl, or a substituted or unsubstituted (C6-C25)aryl. As another embodiment, R_5 and R_7, each independently, represent an unsubstituted (C1-C5)alkyl, or a substituted or unsubstituted (C6-C18)aryl, and R_6 represents hydrogen, an unsubstituted (C1-C5)alkyl, or a sub-

stituted or unsubstituted (C6-C18)aryl. For example, R_5 and R_7, each independently, may represent an unsubstituted methyl, an unsubstituted butyl, an unsubstituted *tert*-butyl, an unsubstituted *iso*-butyl, an unsubstituted pentyl, or an unsubstituted phenyl; and R_6 may represent hydrogen, an unsubstituted methyl, or an unsubstituted phenyl.

[32] In formula 1, a and b, each independently, represent an integer of 1 to 4; as one embodiment, may represent 1 or 2, where if a and b, each independently, are an integer of 2 or more, each of R_1 and R_2 may be the same or different,

[33] In formula 2, A ring and B ring, each independently, represent a substituted or unsubstituted benzene ring, or a substituted or unsubstituted naphthalene ring, with a proviso that at least one of A ring and B ring is a substituted or unsubstituted naphthalene ring. As one embodiment, any one of A ring and B ring may represent a substituted or unsubstituted benzene ring, and the other may represent a substituted or unsubstituted naphthalene ring. A ring and B ring, each independently, may represent an unsubstituted benzene ring, or a naphthalene ring unsubstituted or substituted with a phenyl(s).

[34] In formula 2, Ar_1 and Ar_2, each independently, represent a substituted or unsubstituted (C6-C30)aryl, or a substituted or unsubstituted nitrogen-containing (8- to 30-membered)heteroaryl. Any one of Ar_1 and Ar_2 may represent a substituted or unsubstituted (C6-C30)aryl, and the other may represent a substituted or unsubstituted nitrogen-containing (8- to 30-membered)heteroaryl. As one embodiment, Ar_1 and Ar_2, each independently, represent a substituted or unsubstituted (C6-C25)aryl, or a substituted or unsubstituted nitrogen-containing (8- to 25-membered)heteroaryl; and as another embodiment, represent a substituted or unsubstituted (C6-C18)aryl, or a substituted or unsubstituted nitrogen-containing (8- to 18-membered)heteroaryl. For example, Ar_1 and Ar_2, each independently, represent an unsubstituted phenyl; an unsubstituted naphthyl; a quinazolinyl substituted with a phenyl(s); or a quinoxalinyl unsubstituted or substituted with a phenyl(s), a biphenyl(s), a naphthyl(s) and/or a naphthylphenyl(s).

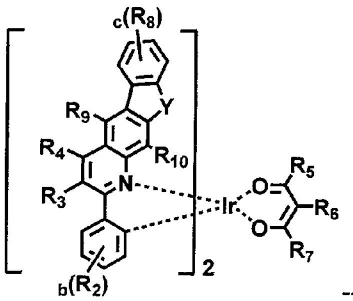
[35] In formula 2, L_1 and L_2, each independently, represent a single bond, a substituted or unsubstituted (C6-C30)arylene, or a substituted or unsubstituted (3- to 30-membered)heteroarylene; as one embodiment, a single bond, a substituted or unsubstituted (C6-C25)arylene, or a substituted or unsubstituted (5- to 25-membered)heteroarylene; as another embodiment, a single bond, a substituted or unsubstituted (C6-C18)arylene, or a substituted or unsubstituted (5- to 18-membered)heteroarylene; and for example, a single bond, an unsubstituted phenylene, or an unsubstituted pyridinylene.

[36] In formulas 1 and 2, the heteroaryl(ene) contains at least one heteroatom selected from B, N, O, S, Si, and P; as one embodiment, may contain at least one heteroatom

selected from N, O and S; as another embodiment, may contain a nitrogen(s).

[37] According to one embodiment of the present disclosure, formula 1 may be represented by any one of the following formulas 3 to 6.

[38]



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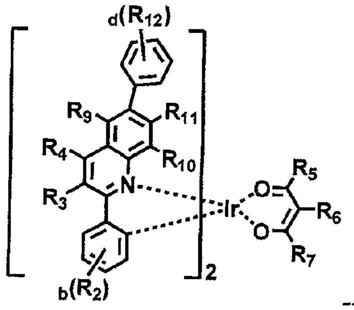

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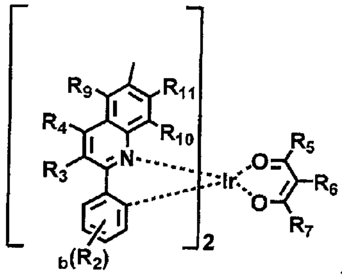
[39]



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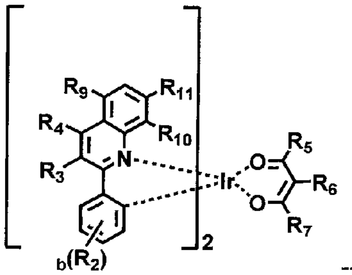

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[40] In formula 3, Y represents $CR_{13}R_{14}$, O or S; and as one embodiment, may represent $CR_{13}R_{14}$.

[41] In formula 3, R_8, R_{13} and R_{14}, each independently, represent hydrogen, deuterium, a substituted or unsubstituted (C1-C10)alkyl, or a substituted or unsubstituted (C6-C30)aryl; as one embodiment, hydrogen, a substituted or unsubstituted (C1-C8)alkyl, or a substituted or unsubstituted (C6-C18)aryl; and as another embodiment, hydrogen, or a substituted or unsubstituted (C1-C4)alkyl. As another embodiment, R_8 may represent hydrogen, and R_{13} and R_{14}, each independently, may represent an unsubstituted (C1-C4)alkyl. For example, R_8 may represent hydrogen, and R_{13} and R_{14}, each independently, may represent an unsubstituted methyl.

[42] In formula 4, R_{12} represents hydrogen, deuterium, a substituted or unsubstituted (C1-C10)alkyl, or a substituted or unsubstituted (C6-C30)aryl; as one embodiment, hydrogen, a substituted or unsubstituted (C1-C8)alkyl, or a substituted or unsubstituted (C6-C25)aryl; as another embodiment, hydrogen, an unsubstituted (C1-C4)alkyl, or an unsubstituted (C6-C18)aryl; and for example, hydrogen, an unsubstituted methyl, or an unsubstituted phenyl.

[43] In formulas 3 to 6, R_9 to R_{11}, each independently, represent hydrogen, or a substituted or unsubstituted (C1-C10)alkyl; as one embodiment, may represent hydrogen, or a substituted or unsubstituted (C1-C8)alkyl; as another embodiment, may represent hydrogen, or a substituted or unsubstituted (C1-C4)alkyl; and for example, may

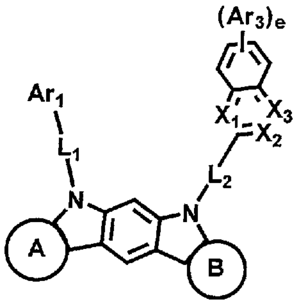
represent hydrogen.

[44] In formulas 3 and 4, c represents an integer of 1 to 4, d represents an integer of 1 to 5, where if c and d, each independently, are an integer of 2 or more, each of R_8 and R_{12} may be the same or different. As one embodiment, c and d, each independently, may represent 1 or 2. As another embodiment, c and d, each independently, may represent 1.

[45] In formulas 3 to 6, R_2 to R_7, and b are as defined in formula 1.

[46] According to one embodiment of the present disclosure, formula 2 may be represented by the following formula 7.

[47]



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[48] In formula 7, any one of A ring and B ring represents a substituted or unsubstituted naphthalene ring, and the other represents a substituted or unsubstituted benzene ring. As one embodiment, any one of A ring and B ring represents a naphthalene ring unsubstituted or substituted with a phenyl(s), and the other represents an unsubstituted benzene ring.

[49] In formula 7, X_1 to X_3, each independently, represent CR_{15} or N, with a proviso that at least one of X_1 to X_3 represents N; as one embodiment, at least two of X_1 to X_3 may represent N; and as another embodiment, two of X_1 to X_3 may represent N. For example, X_1 may represent N; any one of X_2 and X_3 may represnet N; and the other of X_2 and X_3 may represent CR_{15}.

[50] Herein, R_{15} represents hydrogen, or a substituted or unsubstituted (C6-C30)aryl; as one embodiment, may represent a substituted or unsubstituted (C6-C25)aryl; as another embodiment, may represent a substituted or unsubstituted (C6-C18)aryl; and for example, an unsubstituted phenyl, an unsubstituted naphthyl, an unsubstituted biphenyl, or an unsubstituted naphthylphenyl.

[51] In formula 7, Ar_3 represents represent hydrogen, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C6-C30)aryl, or a substituted or unsubstituted (3- to 30-membered)heteroaryl; as one embodiment, hydrogen, a substituted or unsubstituted (C1-C20)alkyl, a substituted or unsubstituted (C6-C25)aryl, or a substituted or unsubstituted (3- to 25-membered)heteroaryl; as another embodiment, hydrogen, a substituted or unsubstituted (C1-C10)alkyl, a substituted or unsubstituted

(C6-C18)aryl, or a substituted or unsubstituted (5- to 18-membered)heteroaryl; and for example, hydrogen.

[52] In formula 7, e represents an integer of 1 to 4; as one embodiment, may represent 1 or 2; and as another embodiment, may represent 1. If e is an integer of 2 or more, each of Ar_3 may be the same or different.

[53] In formula 7, Ar_1, L_1 and L_2 are as defined in formula 2.

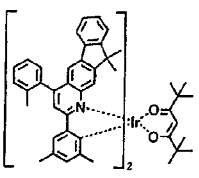
[54] Herein, the term "(C1-C30)alkyl" is meant to be a linear or branched alkyl having 1 to 30 carbon atoms constituting the chain, in which the number of carbon atoms is preferably 1 to 20, and more preferably 1 to 10. The above alkyl may include methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, etc. The term "(C3-C30)cycloalkyl" is a mono- or polycyclic hydrocarbon having 3 to 30 ring backbone carbon atoms, in which the number of carbon atoms is preferably 3 to 20, and more preferably 3 to 7. The above cycloalkyl may include cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, etc. The term "(3- to 7-membered) heterocycloalkyl" is a cycloalkyl having 3 to 7, preferably 5 to 7, ring backbone atoms, and including at least one heteroatom selected from the group consisting of B, N, O, S, Si, and P, and preferably the group consisting of O, S, and N. The above heterocycloalkyl may include tetrahydrofuran, pyrrolidine, thiolan, tetrahydropyran, etc. The term "(C6-C30)aryl(ene)" is a monocyclic or fused ring radical derived from an aromatic hydrocarbon having 6 to 30 ring backbone carbon atoms, in which the number of the ring backbone carbon atoms is preferably 6 to 25, more preferably 6 to 18. The above aryl(ene) may be partially saturated, and may comprise a spiro structure. The above aryl may include phenyl, biphenyl, terphenyl, naphthyl, binaphthyl, phenylnaphthyl, naphthylphenyl, fluorenyl, phenylfluorenyl, benzofluorenyl, dibenzofluorenyl, phenanthrenyl, phenylphenanthrenyl, anthracenyl, indenyl, triphenylenyl, pyrenyl, tetracenyl, perylenyl, chrysenyl, naphthacenyl, fluoranthenyl, spirobifluorenyl, etc. The term "(3- to 30-membered)heteroaryl(ene)" is an aryl having 3 to 30 ring backbone atoms, and including at least one, preferably 1 to 4 heteroatoms selected from the group consisting of B, N, O, S, Si, and P. The above heteroaryl(ene) may be a monocyclic ring, or a fused ring condensed with at least one benzene ring; may be partially saturated; may be one formed by linking at least one heteroaryl or aryl group to a heteroaryl group via a single bond(s); and may comprise a spiro structure. The above heteroaryl may include a monocyclic ring-type heteroaryl such as furyl, thiophenyl, pyrrolyl, imidazolyl, pyrazolyl, thiazolyl, thiadiazolyl, isothiazolyl, isoxazolyl, oxazolyl, oxadiazolyl, triazinyl, tetrazinyl, triazolyl, tetrazolyl, furazanyl, pyridyl, pyrazinyl, pyrimidinyl, and pyridazinyl, and a fused ring-type heteroaryl such as benzofuranyl, benzothiophenyl, isobenzofuranyl, dibenzofuranyl, dibenzothiophenyl, benzimidazolyl, benzothiazolyl, benzoisothiazolyl, benzoisoxazolyl, ben-

zoxazolyl, isoindolyl, indolyl, benzoindolyl, indazolyl, benzothiadiazolyl, quinolyl, isoquinolyl, cinnolinyl, quinazolinyl, quinoxalinyl, naphthyridinyl, carbazolyl, benzocarbazolyl, dibenzocarbazolyl, phenoxazinyl, phenothiazinyl, phenanthridinyl, benzodioxolyl, and dihydroacridinyl. Furthermore, “halogen” includes F, Cl, Br, and I.

[55] Herein, “substituted” in the expression “substituted or unsubstituted” means that a hydrogen atom in a certain functional group is replaced with another atom or another functional group, i.e. a substituent. The substituents of the substituted alkyl, the substituted alkenyl, the substituted aryl(ene), the substituted heteroaryl(ene), the substituted benzene ring, the substituted naphthalene ring, and the substituted mono- or polycyclic, alicyclic or aromatic ring, or the combination thereof, in R_1 to R_{15}, Ar_1, Ar_2, Ar_3, L_1, L_2, A ring and B ring of formulas 1 to 7, each independently, are at least one selected from the group consisting of deuterium, a halogen, a cyano, a carboxyl, a nitro, a hydroxyl, a (C1-C30)alkyl, a halo(C1-C30)alkyl, a (C2-C30)alkenyl, a (C2-C30)alkynyl, a (C1-C30)alkoxy, a (C1-C30)alkylthio, a (C3-C30)cycloalkyl, a (C3-C30)cycloalkenyl, a (3- to 7-membered)heterocycloalkyl, a (C6-C30)aryloxy, a (C6-C30)arylthio, a (C6-C30)aryl, a (5- to 30-membered)heteroaryl, a tri(C1-C30)alkylsilyl, a tri(C6-C30)arylsilyl, a di(C1-C30)alkyl(C6-C30)arylsilyl, a (C1-C30)alkyldi(C6-C30)arylsilyl, an amino, a mono- or di- (C1-C30)alkylamino, a mono- or di- (C6-C30)arylamino, a (C1-C30)alkyl(C6-C30)arylamino, a (C1-C30)alkylcarbonyl, a (C1-C30)alkoxycarbonyl, a (C6-C30)arylcarbonyl, a di(C6-C30)arylboronyl, a di(C1-C30)alkylboronyl, a (C1-C30)alkyl(C6-C30)arylboronyl, a (C6-C30)aryl(C1-C30)alkyl, and a (C1-C30)alkyl(C6-C30)aryl; as one embodiment, at least one of a (C1-C20)alkyl and a (C6-C25)aryl; as another embodiment, at least one of a (C1-C10)alkyl and a (C6-C18)aryl; and for example, at least one of a methyl, a *tert*-butyl, a *iso*-butyl, a phenyl, a biphenyl, a naphthyl and a naphthylphenyl.

[56] The compound represented by formula 1 includes the following compounds, but is not limited thereto.

[57]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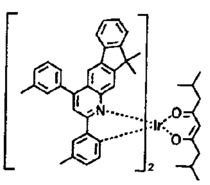
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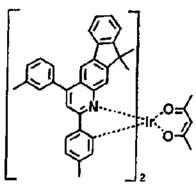
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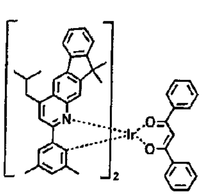
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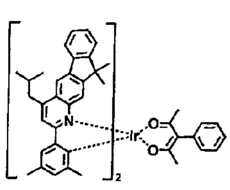
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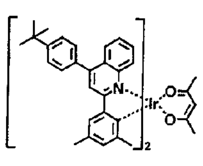
[58]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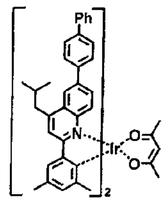
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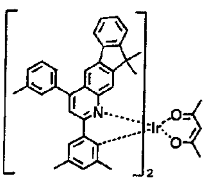
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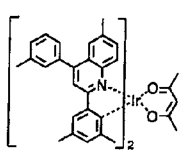
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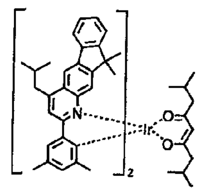
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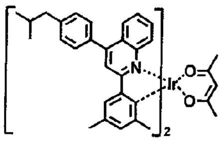
[59]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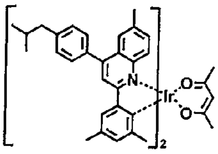
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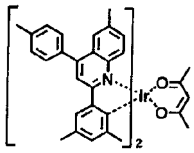
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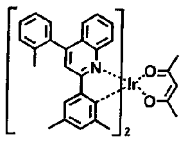
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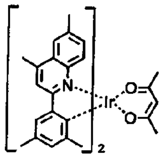
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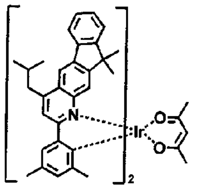
[60]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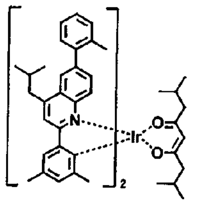
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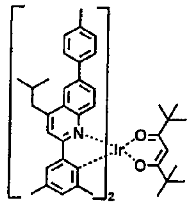
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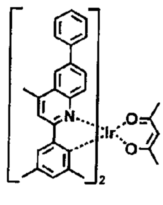
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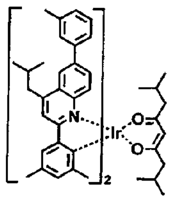
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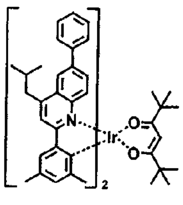
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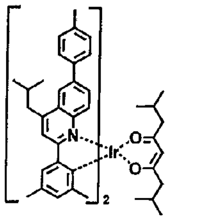
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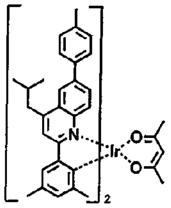
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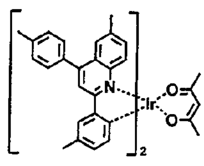
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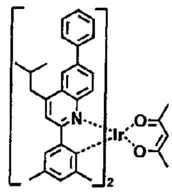
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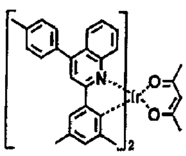
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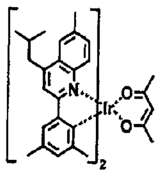
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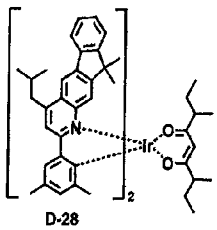
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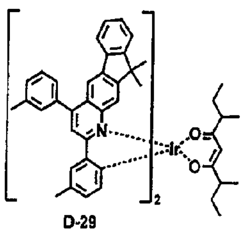
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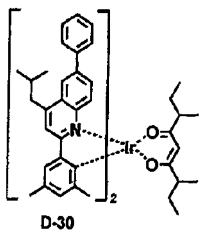
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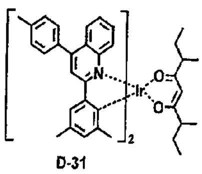
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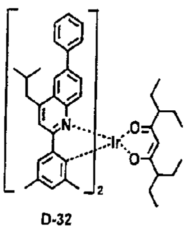
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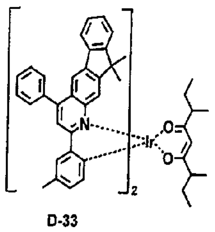
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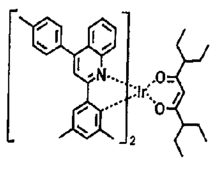
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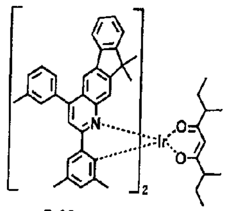
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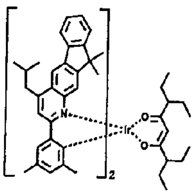
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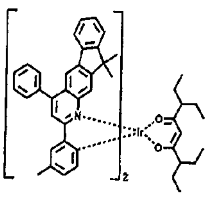
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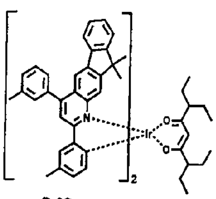
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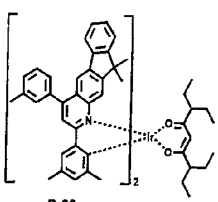
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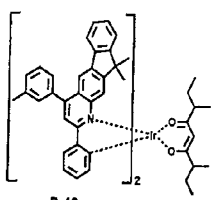
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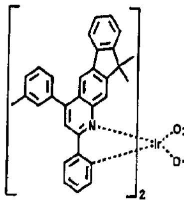
[65] 
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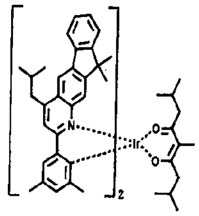
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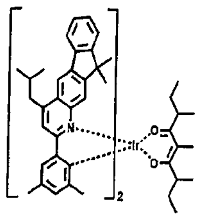
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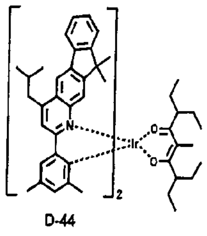
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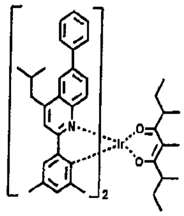
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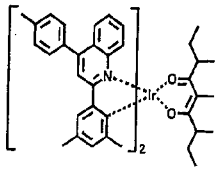
[66] 
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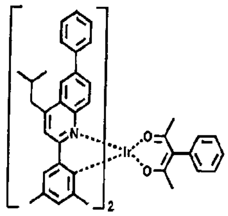
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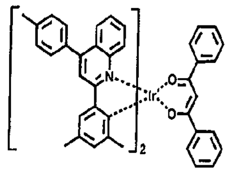
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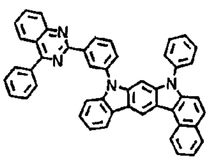
[67] The compound represented by formula 2 includes the following compounds, but is not limited thereto.

[68] 
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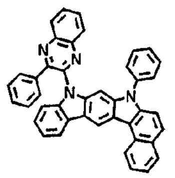
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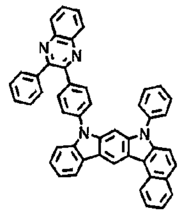
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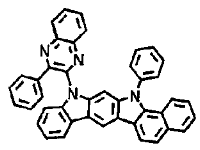
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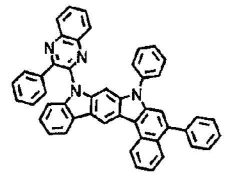
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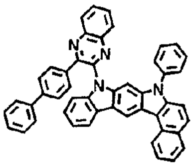
[69] 
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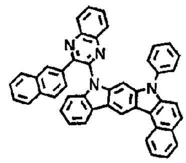
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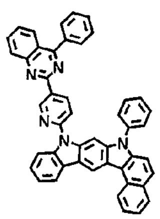
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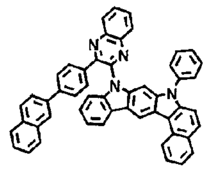
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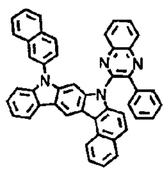
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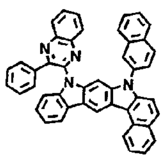
[70] 
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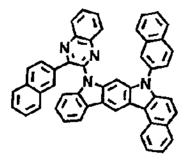
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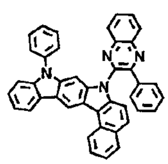
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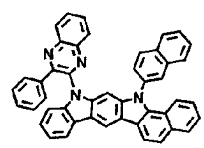
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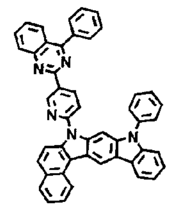
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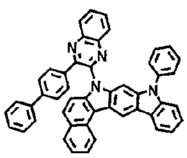
[71] 
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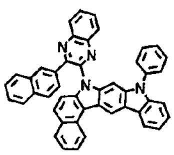
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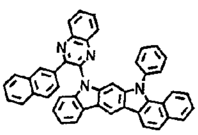
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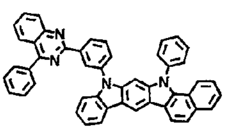
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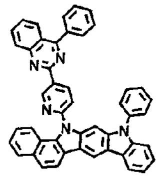
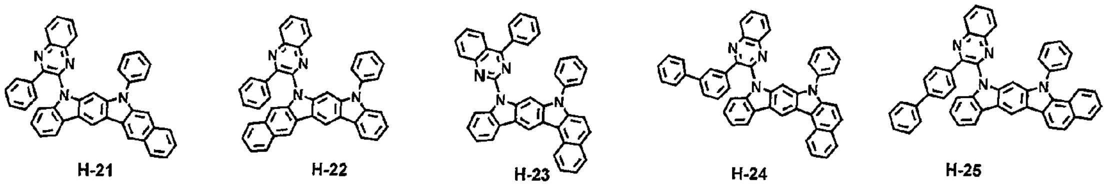
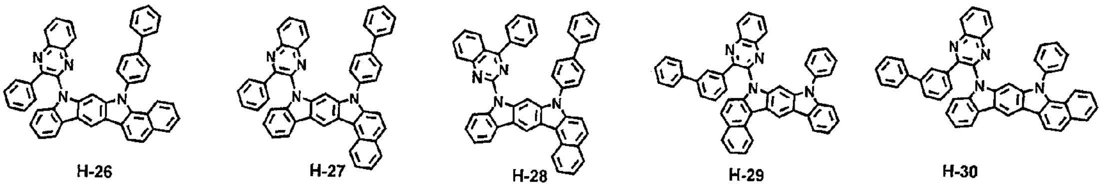

H-20

[72]



H-21 H-22 H-23 H-24 H-25

[73]



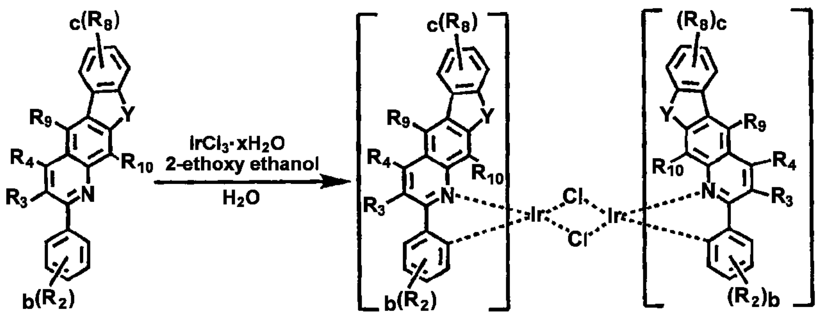
H-26 H-27 H-28 H-29 H-30

[74] The organic electroluminescent compounds represented by formulas 1 and 2 of the present disclosure may be produced by a synthetic method known to a person skilled in the art, and, for example, referring to the following method, but is not limited thereto.

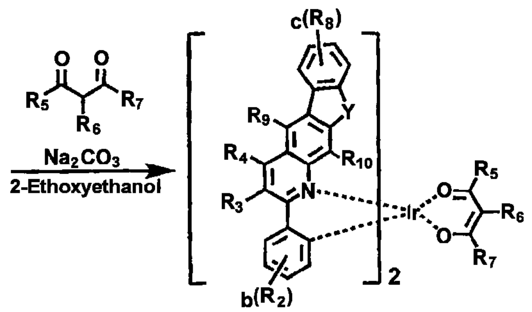
[75] As a specific example of formula 1, the compound represented by formula 3 may be synthesized as shown in the following reaction scheme 1.

[76] **[Reaction Scheme 1]**

[77]



[78]

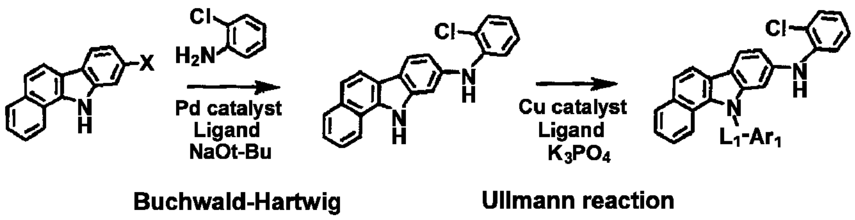


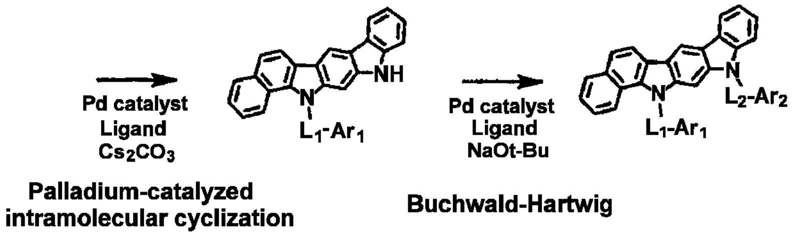
[79] In reaction scheme 1, Y, R_2 to R_{10}, b and c are as defined in formula 3.

[80] As a specific example of formula 1, the compound represented by formula 4 may be synthesized by the method disclosed in Korean Patent No. 1636310.

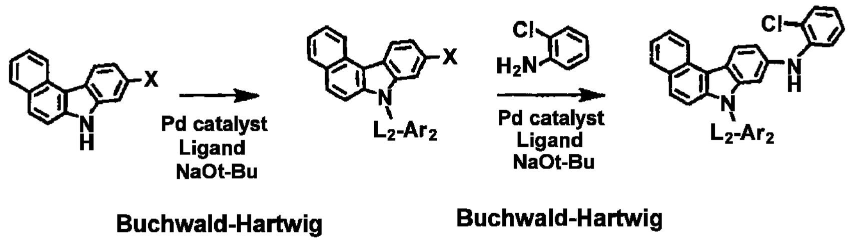
[81] The compound represented by formula 2 may be synthesized as shown in the following reaction scheme 2 or 3.

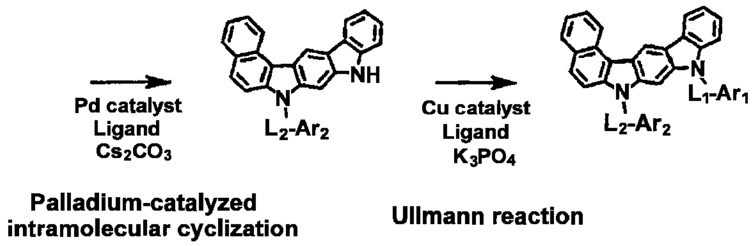
[82] **[Reaction Scheme 2]**

[83] 

[84] 

[85] **[Reaction Scheme 3]**

[86] 

[87] 

[88] In reaction schemes 2 and 3, Ar_1, Ar_2, L_1 and L_2 are as defined in formula 2.

[89] The organic electroluminescent device of the present disclosure may comprise a first electrode, a second electrode, and at least one organic layer between the first and second electrodes. The organic layer may comprise a light-emitting layer. The light-emitting layer may comprise at least one compound represented by formula 1 and at least one compound represented by formula 2, and the compound represented by formula 1 may be comprised as a dopant compound, and the compound represented by formula 2 may be comprised as a host compound.

[90] One of the first and second electrodes may be an anode, and the other may be a cathode. The organic layer may comprise a light-emitting layer, and may further comprise at least one layer selected from a hole injection layer, a hole transport layer, a hole auxiliary layer, a light-emitting auxiliary layer, an electron transport layer, an electron buffer layer, an electron injection layer, an interlayer, a hole blocking layer, and an electron blocking layer.

[91] The hole auxiliary layer or the light-emitting auxiliary layer may be placed between the hole transport layer and the light-emitting layer, and may control the hole transport rate. The hole auxiliary layer or the light-emitting auxiliary layer may have an effect of improving the efficiency and/or the lifespan of the organic electroluminescent device.

[92] The light-emitting layer is a layer from which light is emitted, and can be a single layer or a multi-layer of which two or more layers are stacked. In the light-emitting layer, it is preferable that the doping concentration of the dopant compound based on the host compound is less than 20 wt%.

[93] According to another aspect of the present disclosure, the combination of dopant and host may be provided as the combination of at least one dopant compound represented by formula 1 and at least one host compound represented by formula 2. Also, the organic electroluminescent device comprising the combination of dopant and host may be provided.

[94] According to another aspect of the present disclosure, an organic electroluminescent material comprising a combination of at least one dopant compound represented by formula 1 and at least one host compound represented by formula 2, and an organic electroluminescent device comprising the material may be provided. The material may consist of only the combination of the compound of formula 1 and the compound of formula 2, and may further comprise conventional materials comprised in an organic electroluminescent material.

[95] According to another aspect of the present disclosure, the organic layer comprising a combination of at least one dopant compound represented by formula 1 and at least one host compound represented by formula 2 may be provided. The organic layer may comprise a plurality of layers, and the dopant compound and the host compound may be comprised in the same layer or different layers, respectively. Also, an organic electroluminescent device comprising the organic layer may be provided in present disclosure.

[96] The organic electroluminescent device of the present disclosure may comprise the compounds of formulas 1 and 2, and further comprise at least one compound selected from the group consisting of arylamine-based compounds and styrylarylamine-based compounds.

[97] Also, in the organic electroluminescent device of the present disclosure, the organic layer may further comprise at least one metal selected from the group consisting of metals of Group 1, metals of Group 2, transition metals of the 4th period, transition metals of the 5th period, lanthanides and organic metals of d-transition elements of the Periodic Table, or at least one complex compound comprising said metal, besides the compounds of formulas 1 and 2. Further, the organic layer may further comprise a light-emitting layer and a charge generating layer.

[98] In addition, the organic electroluminescent device of the present disclosure may emit white light by further including at least one light-emitting layer containing a blue, red or green light-emitting compound, which are known in the art. Further, it may further comprise a yellow or orange light-emitting layer, if necessary.

[99] In the organic electroluminescent device of the present disclosure, at least one layer selected from a chalcogenide layer, a metal halide layer and a metal oxide layer (hereinafter, "a surface layer") may be preferably placed on an inner surface(s) of one or both electrodes. Specifically, a chalcogenide (including oxides) layer of silicon or aluminum is preferably placed on an anode surface of an electroluminescent medium layer, and a metal halide layer or a metal oxide layer is preferably placed on a cathode surface of an electroluminescent medium layer. Such a surface layer may provide operation stability for the organic electroluminescent device. Preferably, the chalcogenide includes $SiO_X(1\leq X\leq 2)$, $AlO_X(1\leq X\leq 1.5)$, SiON, SiAlON, etc.; the metal halide includes LiF, MgF_2, CaF_2, a rare earth metal fluoride, etc.; and the metal oxide includes Cs_2O, Li_2O, MgO, SrO, BaO, CaO, etc.

[100] In the organic electroluminescent device of the present disclosure, a mixed region of an electron transport compound and a reductive dopant, or a mixed region of a hole transport compound and an oxidative dopant is preferably placed on at least one surface of a pair of electrodes. In this case, the electron transport compound is reduced to an anion, and thus it becomes easier to inject and transport electrons from the mixed region to an electroluminescent medium. Further, the hole transport compound is oxidized to a cation, and thus it becomes easier to inject and transport holes from the mixed region to the electroluminescent medium. Preferably, the oxidative dopant includes various Lewis acids and acceptor compounds; and the reductive dopant includes alkali metals, alkali metal compounds, alkaline earth metals, rare-earth metals, and mixtures thereof. A reductive dopant layer may be employed as a charge-generating layer to prepare an organic electroluminescent device having two or more light-emitting layers and emitting white light.

[101] In order to form each layer of the organic electroluminescent device of the present disclosure, dry film-forming methods such as vacuum evaporation, sputtering, plasma and ion plating methods, or wet film-forming methods such as ink jet printing, nozzle printing, slot coating, spin coating, dip coating, and flow coating methods may be used. The dopant and host compounds of the present disclosure may be co-evaporated or mixture-evaporated.

[102] When using a wet film-forming method, a thin film may be formed by dissolving or diffusing materials forming each layer into any suitable solvent such as ethanol, chloroform, tetrahydrofuran, dioxane, etc. The solvent may be any solvent where the materials forming each layer can be dissolved or diffused, and where there are no

problems in film-formation capability.

[103] The co-evaporation is a mixed deposition method in which two or more isomer materials are placed in a respective individual crucible source and a current is applied to both cells at the same time to evaporate the materials. The mixture-evaporation is a mixed deposition method in which two or more isomer materials are mixed in one crucible source before evaporating them, and a current is applied to the cell to evaporate the materials.

[104] A display system or a lighting system can be produced by using the organic electroluminescent device of the present disclosure.

[105] Hereinafter, the luminous properties of the organic light-emitting diode (OLED) device comprising the dopant copmpoud and the host compound of the present disclosure will be explained in detail by comparing with the conventional OLED device. However, the present disclosure is not limited by the following examples.

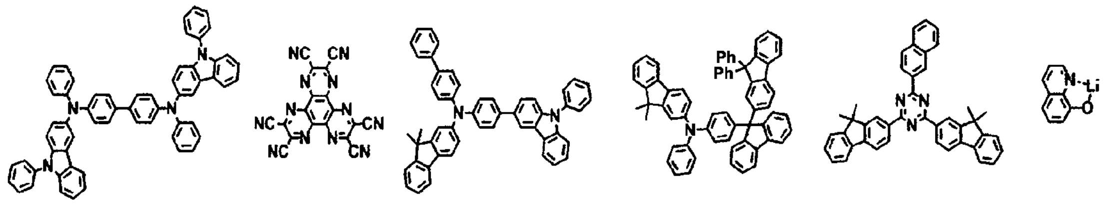
[106] **Device Example 1: Producing an OLED device comprising the organic**

[107] **electroluminescent compound of the present disclosure**

[108] An OLED device was produced by using the organic electroluminescent compound according to the present disclosure. A transparent electrode indium tin oxide (ITO) thin film (10 Ω/sq) on a glass substrate for an OLED device (GEOMATEC CO., LTD., Japan) was subjected to an ultrasonic washing with acetone, ethanol, and distilled water, sequentially, and then was stored in isopropanol. The ITO substrate was then mounted on a substrate holder of a vacuum vapor deposition apparatus. Compound **HI-1** was introduced into a cell of the vacuum vapor deposition apparatus, and then the pressure in the chamber of the apparatus was controlled to 10^{-6} torr. Thereafter, an electric current was applied to the cell to evaporate the above-introduced material, thereby forming a first hole injection layer having a thickness of 80 nm on the ITO substrate. Next, compound **HI-2** was introduced into another cell of the vacuum vapor deposition apparatus and was evaporated by applying an electric current to the cell, thereby forming a second hole injection layer having a thickness of 5 nm on the first hole injection layer. Compound **HT-1** was then introduced into another cell of the vacuum vapor deposition apparatus and was evaporated by applying an electric current to the cell, thereby forming a first hole transport layer having a thickness of 10 nm on the second hole injection layer. Compound **HT-2** was then introduced into another cell of the vacuum vapor deposition apparatus and was evaporated by applying an electric current to the cell, thereby forming a second hole transport layer having a thickness of 60 nm on the first hole transport layer. After forming the hole injection layer and the hole transport layer, a light-emitting layer was formed thereon as follows: Compound **H-2** was introduced into one cell of the vacuum vapor depositing apparatus as a host, and compound **D-11** was introduced into another cell as a dopant. The dopant was

deposited in a doping amount of 3 wt% based on the total amount of the host and dopant to form a light-emitting layer having a thickness of 40 nm on the second hole transport layer. Compound **ET-1** and compound **EI-1** were then introduced into the other two cells and evaporated at a rate of 1:1 to form an electron transport layer having a thickness of 30 nm on the light-emitting layer. After depositing compound **EI-1** as an electron injection layer having a thickness of 2 nm on the electron transport layer, an Al cathode having a thickness of 80 nm was deposited on the electron injection layer by another vacuum vapor deposition apparatus. Thus, an OLED device was produced.

[109]



HI-1 HI-2 HT-1 HT-2 ET-1 EI-1

[110] **Device Example 2: Producing an OLED device comprising the organic**

[111] **electroluminescent compound of the present disclosure**

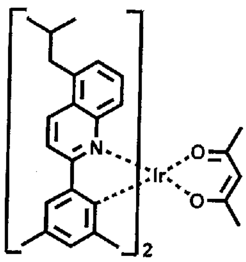
[112] An OLED device was produced in the same manner as in Device Example 1, except that compound **D-1** was used as a dopant.

[113] **Comparative Example 1: Producing an OLED device comprising a**

[114] **conventional organic electroluminescent compound**

[115] An OLED device was produced in the same manner as in Device Example 1, except that the following compound **X** was used as a dopant.

[116]



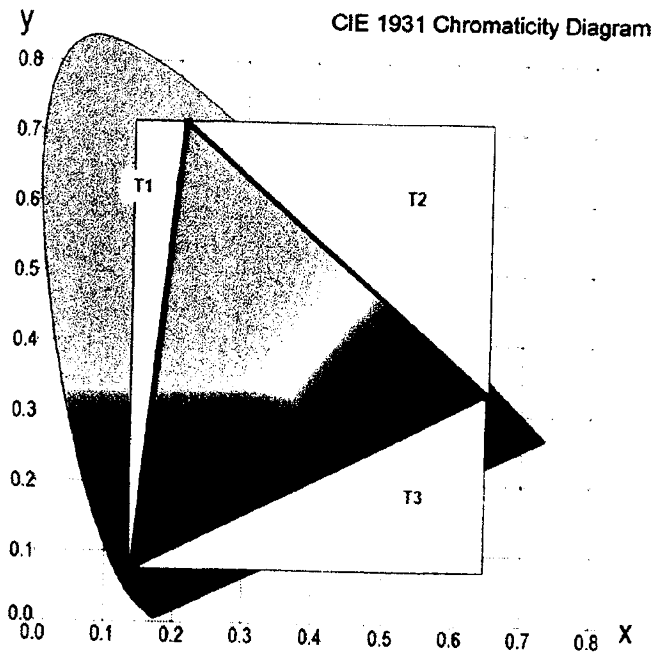
X

[117] **Comparison of Color Reproduction Range**

[118] The color reproduction range was calculated under the standard of the color space made by the National Television System Committee (NTSC), which is based on the color coordinate system defined by the International Commission on Illumination (CIE). The area of the triangle formed by the three points of red (0.67, 0.33), green (0.21, 0.71), and blue (0.14, 0.08) defined by NTSC is calculated (hereinafter, "NTSC area"). Also, the area of the triangle is calculated by using NTSC definition values for blue and green, and the measured values in the produced device for red, and the ratio

of the triangle area versus the NTSC area is then calculated.

[119]



[120] The percentages of the areas of the Comparative Example and the Device Examples versus the NTSC area, i.e. NTSC Color Space, are calculated as shown in Table 1 below.

[121] **[Table 1]**

Whole Rectangle	{R(x)-B(x)} * {G(y)-B(y)}
Triangle 1 (T1)	{G(x)-B(x)} * {G(y)-B(y)}/2
Triangle 2 (T2)	{R(x)-G(x)} * {G(y)-R(y)}/2
Triangle 3 (T3)	{R(x)-B(x)} * {R(y)-B(y)}/2
NTSC Color Space	Whole Rectangle - (Triangle 1 + Triangle 2 + Triangle 3)

[122] In Table 1, R(x) represents CIE X coordinate of red light-emission, R(y) represents CIE Y coordinate of red light-emission, G(x) represents CIE X coordinate of green light-emission, G(y) represents a CIE Y coordinate of green light-emission, B(x) represents a CIE X coordinate of blue light-emission, and B(y) represents a CIE Y coordinate of blue light-emission.

[123] The CIE color coordinates of the organic electroluminescent devices of Device Examples 1 and 2 and Comparative Example 1, and the percentages of the area versus the NTSC area are shown in Table 2 below.

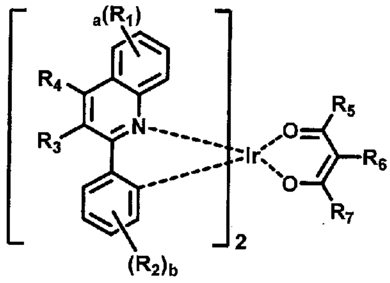
[124] **[Table 2]**

	Device Example 1	Device Example 2	Comparative Example 1
CIE_x	0.687	0.698	0.664
CIE_y	0.313	0.302	0.336
NTSC Color Space	103.7%	106.2%	98.7%

[125] From Table 2 above, it can be confirmed that the organic electroluminescent devices comprising the compound of the present disclosure (Device Examples 1 and 2) are superior to the organic electroluminescent device comprising the conventional compound (Comparative Example 1) in color reproduction range (color gamut).

Claims

[Claim 1] An organic electroluminescent material comprising at least one compound represented by the following formula 1:



-----(1)

wherein

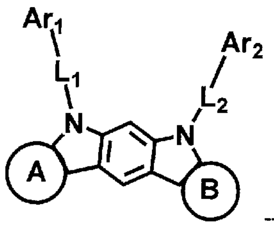
R_1 to R_3, each independently, represent hydrogen, deuterium, a substituted or unsubstituted (C1-C10)alkyl, a substituted or unsubstituted (C2-C10)alkenyl, or a substituted or unsubstituted (C6-C30)aryl, or may be linked to an adjacent substituent to form a substituted or unsubstituted, mono- or polycyclic, (C3-C30) alicyclic or aromatic ring, or the combination thereof, whose carbon atom(s) may be replaced with at least one heteroatom selected from nitrogen, oxygen, and sulfur,

R_4 represents a substituted or unsubstituted (C1-C10)alkyl, or a substituted or unsubstituted (C6-C30)aryl,

R_5 to R_7, each independently, represent hydrogen, deuterium, a substituted or unsubstituted (C1-C10)alkyl, or a substituted or unsubstituted (C6-C30)aryl, and

a and b, each independently, represent an integer of 1 to 4, where if a and b, each independently, are an integer of 2 or more, each of R_1 and R_2 may be the same or different;

and at least one compound represented by the following formula 2:



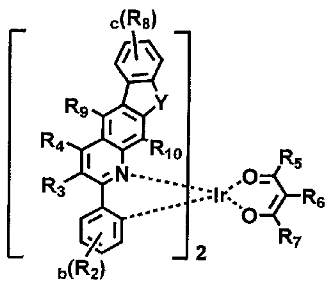
-----(2)

wherein

A ring and B ring, each independently, represent a substituted or unsubstituted benzene ring, or a substituted or unsubstituted naphthalene ring, with a proviso that at least one of A ring and B ring is a substituted or unsubstituted naphthalene ring,

Ar_1 and Ar_2, each independently, represent a substituted or unsubstituted (C6-C30)aryl, or a substituted or unsubstituted nitrogen-containing (8- to 30-membered)heteroaryl,
L_1 and L_2, each independently, represent a single bond, a substituted or unsubstituted (C6-C30)arylene, or a substituted or unsubstituted (3- to 30-membered)heteroarylene, and
the heteroaryl(ene) contains at least one heteroatom selected from B, N, O, S, Si, and P.

[Claim 2] The organic electroluminescent material according to claim 1, wherein formula 1 is represented by any one of the following formulas 3 to 6:



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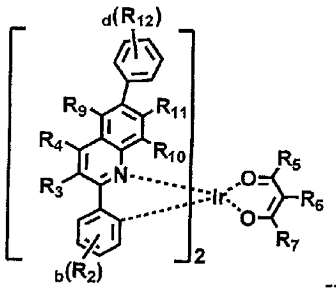
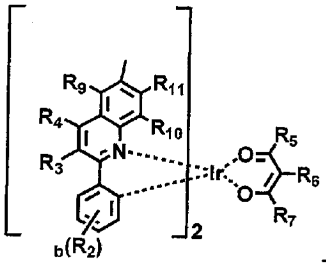


-----(4)



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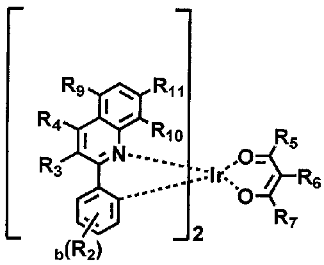
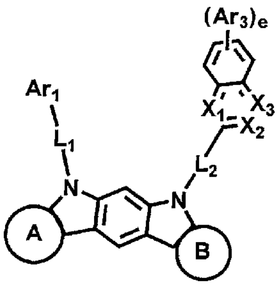


-----(6)

wherein
Y represents $CR_{13}R_{14}$, O or S,
R_8 and R_{12} to R_{14}, each independently, represent hydrogen, deuterium, a substituted or unsubstituted (C1-C10)alkyl, or a substituted or unsubstituted (C6-C30)aryl,
R_9 to R_{11}, each independently, represent hydrogen, or a substituted or unsubstituted (C1-C10)alkyl,
c represents an integer of 1 to 4, d represents an integer of 1 to 5, where if c and d, each independently, are an integer of 2 or more, each of R_8 and R_{12} may be the same or different, and
R_2 to R_7, and b are as defined in claim 1.

[Claim 3] The organic electroluminescent material according to claim 1, wherein formula 2 is represented by the following formula 7:



-----(7)

wherein

any one of A ring and B ring represents a substituted or unsubstituted naphthalene ring, and the other represents a substituted or unsubstituted benzene ring,

X_1 to X_3, each independently, represent CR_{15} or N, with a proviso that at least one of X_1 to X_3 represents N,

R_{15} represents hydrogen, or a substituted or unsubstituted (C6-C30)aryl,

Ar_3 represents represent hydrogen, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C6-C30)aryl, or a substituted or unsubstituted (3- to 30-membered)heteroaryl,

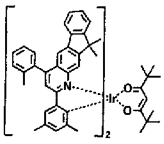
e represents an integer of 1 to 4, where if e is an integer of 2 or more, each of Ar_3 may be the same or different, and

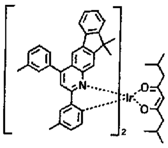
Ar_1, L_1 and L_2 are as defined in claim 1.

[Claim 4] The organic electroluminescent material according to claim 1, wherein the substituents of the substituted alkyl, the substituted alkenyl, the substituted aryl(ene), the substituted heteroaryl(ene), the substituted benzene ring, the substituted naphthalene ring, and the substituted mono- or polycyclic, alicyclic or aromatic ring, or the combination thereof, in R_1 to R_7, Ar_1, Ar_2, L_1, L_2, A ring and B ring, each independently, are at least one selected from the group consisting of deuterium, a halogen, a cyano, a carboxyl, a nitro, a hydroxyl, a (C1-C30)alkyl, a halo(C1-C30)alkyl, a (C2-C30)alkenyl, a (C2-C30)alkynyl, a (C1-C30)alkoxy, a (C1-C30)alkylthio, a (C3-C30)cycloalkyl, a (C3-C30)cycloalkenyl, a (3- to 7-membered)heterocycloalkyl, a (C6-C30)aryloxy, a (C6-C30)arylthio, a (C6-C30)aryl, a (5- to 30-membered)heteroaryl, a tri(C1-C30)alkylsilyl, a tri(C6-C30)arylsilyl, a di(C1-C30)alkyl(C6-C30)arylsilyl, a (C1-C30)alkyldi(C6-C30)arylsilyl, an amino, a mono- or di-(C1-C30)alkylamino, a mono- or di- (C6-C30)arylamino, a (C1-C30)alkyl(C6-C30)arylamino, a (C1-C30)alkylcarbonyl, a

(C1-C30)alkoxycarbonyl, a (C6-C30)arylcarbonyl, a di(C6-C30)arylboronyl, a di(C1-C30)alkylboronyl, a (C1-C30)alkyl(C6-C30)arylboronyl, a (C6-C30)aryl(C1-C30)alkyl, and a (C1-C30)alkyl(C6-C30)aryl.

[Claim 5] The organic electroluminescent material according to claim 1, wherein the compound represented by formula 1 is selected from the group consisting of:


D-1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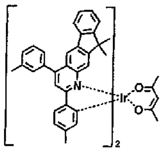
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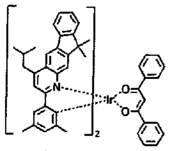
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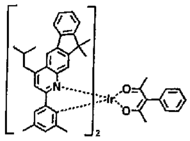
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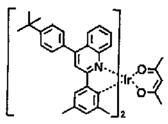
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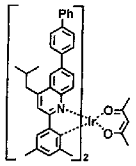
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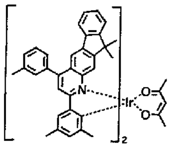
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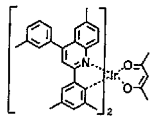
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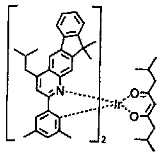
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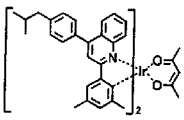
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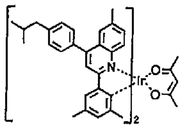
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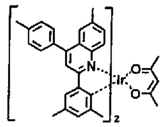
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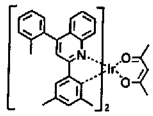
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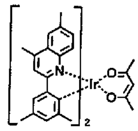
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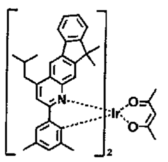
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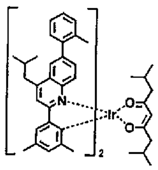
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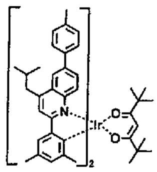
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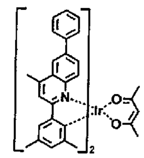
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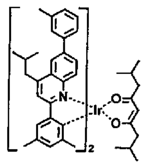
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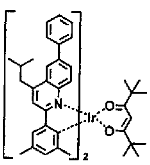
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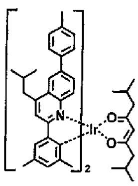
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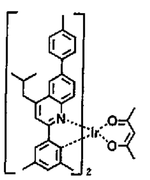
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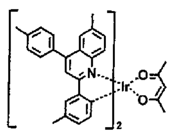
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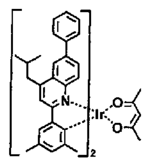
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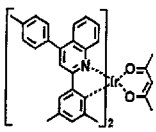
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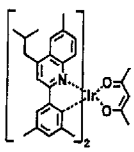
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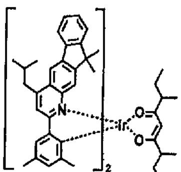
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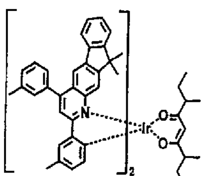
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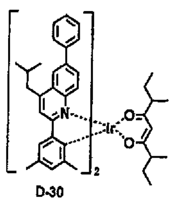
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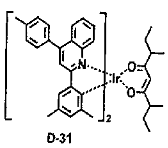
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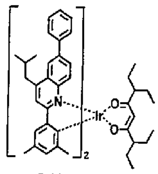
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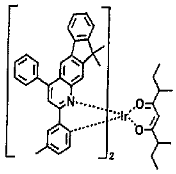
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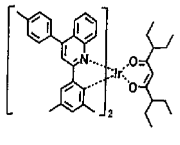
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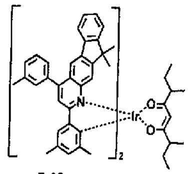
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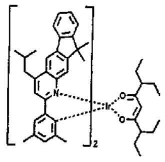
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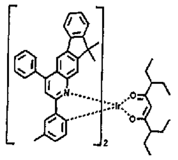
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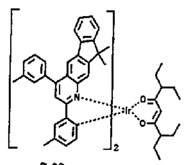
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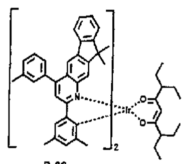
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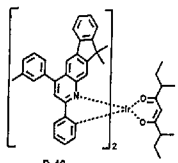
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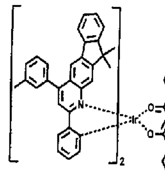
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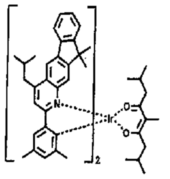
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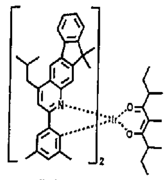
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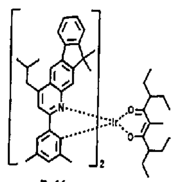
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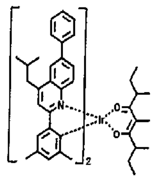
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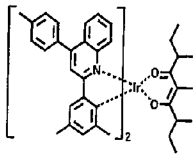
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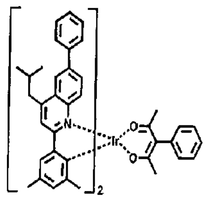
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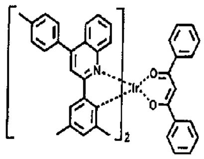
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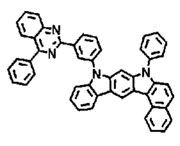
[Claim 6] The organic electroluminescent material according to claim 1, wherein the compound represented by formula 2 is selected from the group consisting of: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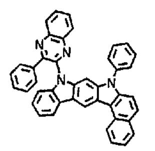
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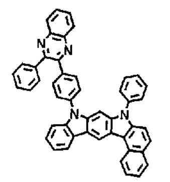
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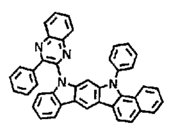
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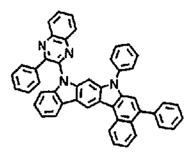
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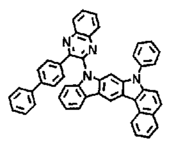
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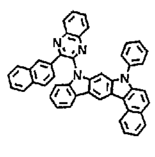
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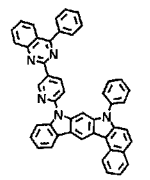
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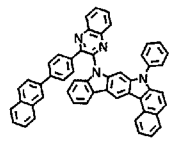
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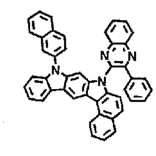
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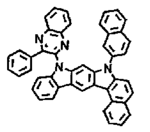
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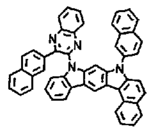
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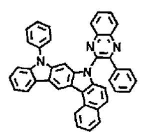
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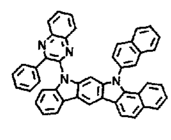
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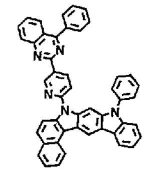
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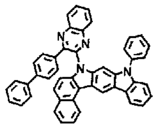
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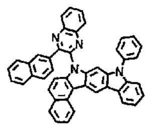
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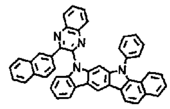
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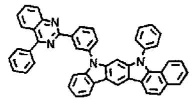
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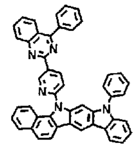
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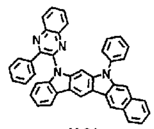
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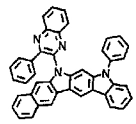
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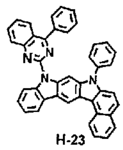
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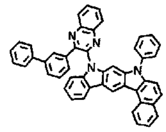
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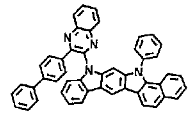
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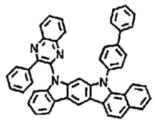
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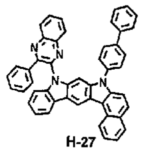
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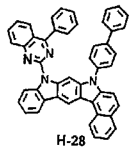
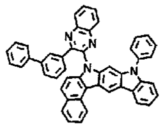
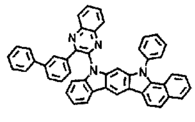

H-28


H-29


H-30 .

[Claim 7] An organic electroluminescent device comprising the organic electroluminescent material according to claim 1.

[Claim 8] The organic electroluminescent device according to claim 7, wherein the organic electroluminescent device comprises the compound represented by the formula 1 as a dopant, and the compound represented by the formula 2 as a host.

INTERNATIONAL SEARCH REPORT	International application No. PCT/KR2017/010326

A. CLASSIFICATION OF SUBJECT MATTER

C09K 11/06 (2006.01) C07F 15/00 (2006.01) C07D 487/04 (2006.01) H01L 51/50 (2006.01) H01L 51/54 (2006.01)

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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

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

CAPLUS, REGISTRY - substructure search based on compounds of formula (1) and formula (2), where necessary in combination with keywords such as *electrolumin*

Espacenet - applicant and inventor name search in combination with relevant CPC marks

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

*	Special categories of cited documents:
"A"	document defining the general state of the art which is not considered to be of particular relevance
"E"	earlier application or patent but published on or after the international filing date
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O"	document referring to an oral disclosure, use, exhibition or other means
"P"	document published prior to the international filing date but later than the priority date claimed
"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&"	document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 November 2017	20 November 2017
Name and mailing address of the ISA/AU	**Authorised officer**
AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustralia.gov.au	Cassandra Sweetman AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. +61262223633

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2017/010326

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2016/080749 A1 (ROHM AND HAAS ELECTRONIC MATERIALS LTD.) 26 May 2016 formulae (1), (2) and (5), paragraphs 42, 29-38, 39-130, 132, compounds D1-D43 and H2-182, H2-68, H2-69	1-8
X	WO 2016/080791 A1 (ROHM AND HAAS ELECTRONIC MATERIALS LTD.) 26 May 2016 formula (2), compounds H2-182, D160-D162, D189, D190, D192, D197-D198, D202, D204, D206	1-8
X	WO 2016/148390 A1 (ROHM AND HAAS ELECTRONIC MATERIALS LTD.) 22 September 2016 H6, H7, H9, H14, H15, H175, H176, D160-D162, D189, D190, D192, D197-D198, D202, D204, D206, D209, D210 and formula (3)	1-8
X	WO 2016/060516 A1 (ROHM AND HAAS ELECTRONIC MATERIALS LTD.) 21 April 2016 H2-182, D160-D162, D189, D190, D192, D197-D198 and formula (2)	1-8

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/KR2017/010326**

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document/s Cited in Search Report		**Patent Family Member/s**	
Publication Number	**Publication Date**	**Publication Number**	**Publication Date**
WO 2016/080749 A1	26 May 2016	WO 2016080749 A1	26 May 2016
		KR 20160059437 A	26 May 2016
WO 2016/080791 A1	26 May 2016	WO 2016080791 A1	26 May 2016
		KR 20160060569 A	30 May 2016
WO 2016/148390 A1	22 September 2016	WO 2016148390 A1	22 Sep 2016
		KR 20160110078 A	21 Sep 2016
		TW 201632527 A	16 Sep 2016
WO 2016/060516 A1	21 April 2016	WO 2016060516 A1	21 Apr 2016
		CN 106795166 A	31 May 2017
		EP 3207045 A1	23 Aug 2017
		KR 20160045604 A	27 Apr 2016
		US 2017309841 A1	26 Oct 2017

End of Annex

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

专利名称(译)	有机电致发光材料和包含其的有机电致发光器件		
公开(公告)号	EP3519532A1	公开(公告)日	2019-08-07
申请号	EP2017856644	申请日	2017-09-20
[标]申请(专利权)人(译)	罗门哈斯电子材料有限公司		
申请(专利权)人(译)	罗门哈斯电子材料KOREA LTD.		
当前申请(专利权)人(译)	罗门哈斯电子材料KOREA LTD.		
[标]发明人	KIM BITNARI KIM HYUN LEE DONG HYUNG		
发明人	KIM, BITNARI KIM, HYUN LEE, DONG HYUNG		
IPC分类号	C09K11/06 C07F15/00 C07D487/04 H01L51/50 H01L51/54		
CPC分类号	C07D487/04 C09K11/06 H01L51/0072 H01L51/0085 H01L51/5016 H05B33/14 H01L51/0052		
代理机构(译)	霍顿MARK PHILLIP		
优先权	1020160126226 2016-09-30 KR 1020160130817 2016-10-10 KR		
其他公开文献	EP3519532A4		
外部链接	Espacenet		

摘要(译)

本公开涉及包含至少两种类型的化合物的有机电致发光材料和包含其的有机电致发光器件。具有比常规有机电致发光器件更好的色纯度的有机电致发光器件可以通过包含本发明化合物的特定组合来提供。