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

(11) EP 1 784 057 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
07.05.2014 Bulletin 2014/19

(51) Int Cl.:
H05B 33/14 *(2006.01)* ***C09K 11/06*** *(2006.01)*
C07F 15/00 *(2006.01)*

(21) Application number: **06023132.1**

(22) Date of filing: **07.11.2006**

(54) **Red phosphorescent compounds and organic electroluminescent devices using the same**

Rote phosphorezente Verbindungen und organische Elektrolumineszenz-Vorrichtungen, die diese verwenden

Composés phosphorescents rouges et dispositifs électroluminescents organiques utilisant ceux-ci

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR

(30) Priority: **07.11.2005 KR 20050105981**
25.04.2006 KR 20060037101
25.04.2006 KR 20060037102

(43) Date of publication of application:
09.05.2007 Bulletin 2007/19

(73) Proprietor: **LG Display Co., Ltd.**
Youngdungpo-gu,
Seoul (KR)

(72) Inventors:
- **Kim, Jung Keun**
  Yeongdeungpo-gu
  150-797 Seoul (KR)
- **Seo, Jeong Dae**
  Gyeonggi-do
  427-070 (KR)
- **Jeong, Hyun Cheol**
  Jinju-si
  Gyeongsangnam-do
  660-787 (KR)
- **Park, Chun Gun**
  Seoul 151-878 (KR)
- **Bin, Jong Kwan**
  Seoul 156-861 (KR)
- **Lee, Kyung Hoon**
  Seoul 135-961 (KR)
- **Pieh, Sung Hoon**
  Yangcheon-gu
  Seoul 158-838 (KR)

(74) Representative: **Ter Meer Steinmeister & Partner Patentanwälte**
Postfach 86 07 69
81634 München (DE)

(56) References cited:
WO-A-2006/014599 **WO-A2-03/040256**

- **HUANG Y-T ET AL: "Bi-substituted Effect on Phenylisoquinoline Iridium(III) Complexes" ORGANOMETALLICS, vol. 24, no. 25, 2005, pages 6230-6238, XP009079764 ISSN: 0276-7333**
- **YANG C-H ET AL: "Color tuning of iridium complexes for organic light-emitting diodes: The electronegative effect and pi-conjugation effect" JOURNAL OF ORGANOMETALLIC CHEMISTRY, vol. 691, no. 12, 1 June 2006 (2006-06-01), pages 2767-2773, XP005429595 ISSN: 0022-328X**
- **LEE Y H ET AL: "Theoretical study of Ir(III) complexes of fluorinated phenylbenzoquinoline as red phosphorescent material" JAPANESE JOURNAL OF APPLIED PHYSICS, PART 1: REGULAR PAPERS, BRIEF COMMUNICATIONS & REVIEW PAPERS, vol. 45, no. 1B, 2006, pages 563-567, XP009079763**
- **FANG K-H ET AL: "Color tuning of iridium complexes - Part I: Substituted phenylisoquinoline-based iridium complexes as the triplet emitter" INORGANICA CHIMICA ACTA, vol. 359, no. 2, 20 January 2006 (2006-01-20), pages 441-450, XP005232525 ISSN: 0020-1693**

Printed by Jouve, 75001 PARIS (FR)

(Cont. next page)

- LI C-L ET AL: "Yellow and red electrophosphors based on linkage isomers of phenylisoquinolinyliridium complexes: distinct differences in photophysical and electroluminescence properties" ADVANCED FUNCTIONAL MATERIALS, vol. 15, no. 3, March 2005 (2005-03), pages 387-395, XP001224595 ISSN: 1616-301X
- YANG C-H ET AL: "Synthesis of a high-efficiency red phosphorescent emitter for organic light-emitting diodes" JOURNAL OF MATERIALS CHEMISTRY, vol. 14, no. 6, 2004, pages 947-950, XP009079766 ISSN: 0959-9428
- DATABASE CA [Online] CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; QIU, YONG ET AL: "Method for manufacturing organic electrophosphorescent device" XP002422602 retrieved from STN Database accession no. 145: 220753 -& CN 1 582 073 A (UNIV TSINGHUA [CN]) 16 February 2005 (2005-02-16)

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to red light-emitting phosphorescent compounds (hereinafter, referred to simply to as 'red phosphorescent compounds') and organic electroluminescent (EL) devices using the same. More particularly, the present invention relates to red phosphorescent compounds, and organic electroluminescent devices comprising a laminate of an anode, a light-emitting layer and a cathode wherein one of the red phosphorescent compounds is used as a dopant of the light-emitting layer.

Discussion of the Related Art

[0002] With recent trends toward large-area displays, there has been increased demand for flat display devices that take up little space. In particular, technology of organic electroluminescent (EL) devices (also termed 'organic light emitting diodes (OLEDs)') as flat display devices has been rapidly developed. A variety of prototypes of organic electroluminescent (EL) devices have been reported to date.

[0003] When charge carriers are injected into an organic film formed between an electron injecting electrode (cathode) and a hole injecting electrode (anode) of an organic electroluminescent device, electrons combine with holes to create electron-hole pairs, which then decay to emit light. Organic electroluminescent devices have advantages in that they can be fabricated on flexible transparent substrates (*e.g.*, plastic substrates) and can be operated at a voltage (*e.g.*, 10V or below) lower than voltages required to operate plasma display panels (PDPs) and inorganic electroluminescent devices. Other advantages of organic electroluminescent devices are relatively low power consumption and excellent color representation. Further, since organic electroluminescent (EL) devices can emit light of three colors (i.e., green, blue and red), they have been the focus of intense interest lately as next-generation display devices capable of producing images of various colors. A general method for fabricating organic EL devices will be briefly explained below.

[0004] (1) First, a transparent substrate is covered with an anode material. Indium tin oxide (ITO) is generally used as the anode material.

[0005] (2) A hole injecting layer (HIL) is formed to a thickness of 10 to 30 nm on the anode. Copper (II) phthalocyanine (CuPc) is mainly used as a material of the hole injecting layer.

[0006] (3) A hole transport layer (HTL) is introduced into the resulting structure. The hole transport layer is formed by depositing 4,4'-bis[N-(1-naphthyl)-N-phenylamino]-biphenyl (NPB) to a thickness of about 30 to about 60 nm on the hole injecting layer.

[0007] (4) An organic light-emitting layer is formed on the hole transport layer. If necessary, a dopant may be added to a material for the organic light-emitting layer. For green light emission, tris(8-hydroxyquinoline)aluminum (Alq_3) as a material for the organic light-emitting layer is deposited to a thickness of about 30 to about 60 nm on the hole transport layer, and N-methylquinacridone (MQD) is mainly used as the dopant.

[0008] (5) An electron transport layer (ETL) and an electron injecting layer (EIL) are sequentially formed on the organic light-emitting layer. Alternatively, an electron injecting/transport layer is formed on the organic light-emitting layer. In the case of green light emission, since Alq_3 has excellent electron-transport ability, the formation of the electron injecting/transport layer may be unnecessary.

[0009] (6) A cathode material is coated on the electron injecting layer, and finally a passivation film is covered thereon.

[0010] The type of the organic electroluminescent devices (i.e. blue, green and red light-emitting devices) will be determined depending on the kind of materials for the light-emitting layer.

[0011] In the light-emitting layer, holes injected from the anode are recombined with electrons injected from the cathode to form excitons. Singlet excitons and triplet excitons are involved in the fluorescence and phosphorescence processes, respectively. Fluorescent materials using triplet excitons, which are involved in the phosphorescence process, whose probability of formation is 75%, exhibit high luminescence efficiency, as compared to fluorescent materials using singlet excitons whose probability of formation is 25%. In particular, the luminescence efficiency of red phosphorescent materials is considerably high, compared to that of fluorescent materials. Accordingly, a number of studies associated with the use of red phosphorescent materials in organic electroluminescent devices are being made to enhance the luminescence efficiency of the organic electroluminescent devices.

[0012] For example, the international patent application WO 03/040256 A2 discloses electroluminescent iridium (III) complexes having red-orange or red emission and the respective organic light emitting devices. These compounds comprise acac-ligands and also phenyl-isoquinoline ligands. Similar iridium complexes have also been described by Fang et al. in Inorganica Chimica Acta, Vol. 359, 2006, no. 2, pages 441-450.

[0013] Phosphorescent materials for use in organic EL devices must satisfy the requirements of high luminescence

efficiency, high color purity and long luminescence lifetime. As shown in FIG. 1, as the color purity of an organic EL device using a red phosphorescent material becomes higher (*i.e.* as the x-values on CIE chromaticity coordinates increase), the spectral luminous efficacy of the organic EL device decreases, making it difficult to achieve high luminescence efficiency of the organic EL device.

[0014] Thus, there is a demand to develop a red phosphorescent compound that exhibit desirable chromaticity coordinate characteristics (CIE color purity $x \geq 0.65$), high luminescence efficiency, and long luminescence lifetime.

SUMMARY OF THE INVENTION

[0015] Accordingly, the present invention is directed to red phosphorescent compounds and organic electroluminescent (EL) devices using the same that substantially obviate one or more problems due to limitations and disadvantages of the related art.

[0016] An object of the present invention is to provide compounds of Formulas 1 to 3 that follow.

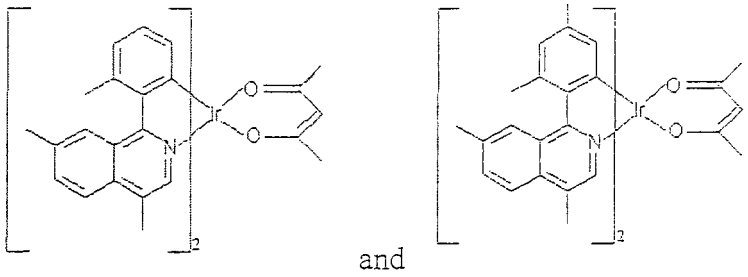
[0017] Another object of the present invention is to provide organic electroluminescent (EL) devices with high color purity, high luminance and long lifetime which use one of the compounds as a dopant of a light-emitting layer.

[0018] Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0019] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, there is provided an organic electroluminescent (EL) device comprising:

an anode, a hole injecting layer, a hole transport layer, a light-emitting layer, an electron transport layer, an electron injecting layer, and a cathode laminated in this order,

wherein the red phosphorescent compound selected from



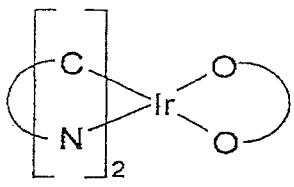
and

is used as a dopant of the light-emitting layer and is present in an amount of 0.5 to 20% by weight, based on the weight of a host,

wherein the host is selected from an Al complex, a Zn complex, and a carbazole derivative,

wherein the Al or Zn complex has at least one ligand selected from quinolyl, biphenyl, isoquinolyl, phenyl, naphthyl, methylquinolyl, dimethylquinolyl and dimethylisoquinolyl groups, and the carbazole derivative is 4, 4'-N,N' dicarbazole biphenyl (CBP).

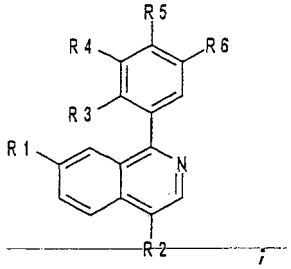
[0020] In a reference embodiment, there is provided a red phosphorescent compound of Formula 1:



(1)

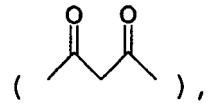
wherein

is

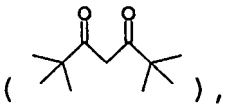


R1 and R2 are independently a C_1-C_4 alkyl group; R3, R4, R5 and R6 are independently selected from hydrogen, C_1-C_4 alkyl groups and C_1-C_4 alkoxy groups; and

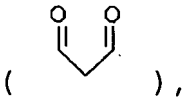
is selected from 2,4-pentanedione



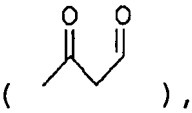
2,2,6,6,-tetramethylheptane-3,5-dione



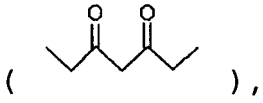
1,3-propanedione



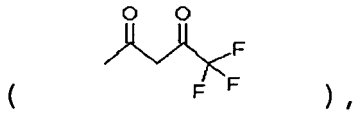
1,3-butanedione



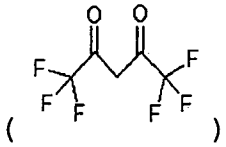
3,5-heptanedione



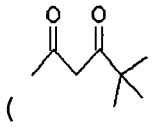
1,1,1-trifluoro-2,4-pentanedione



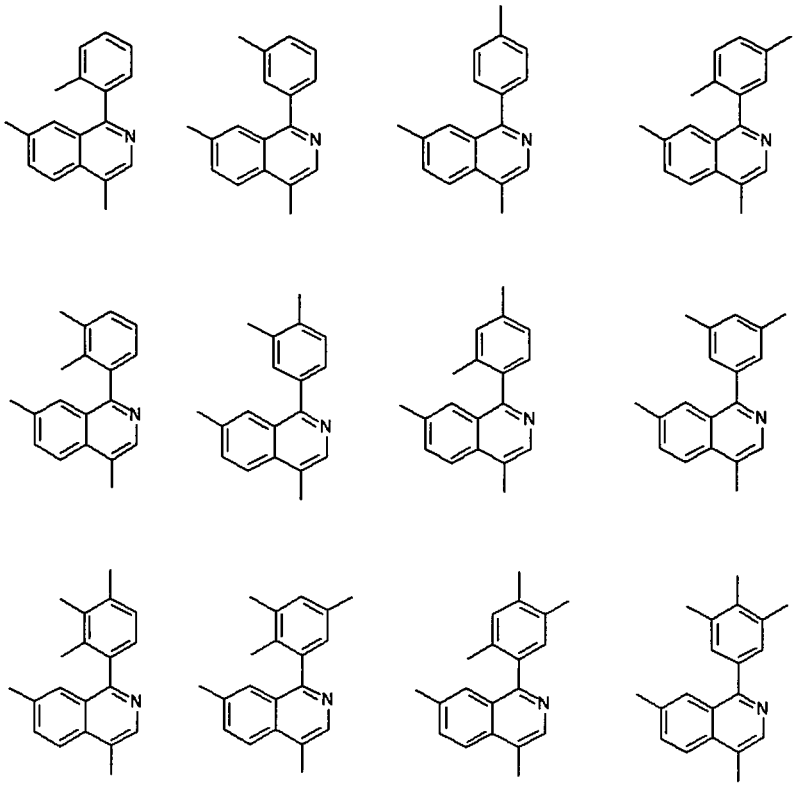
1,1,1,5,5,5-hexafluoro-2,4-pentanedione



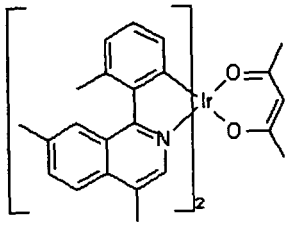
and 2,2-dimethyl-3,5-hexanedione



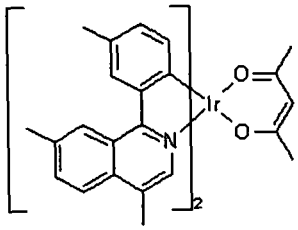
in Formula 1 is selected from the following compounds:



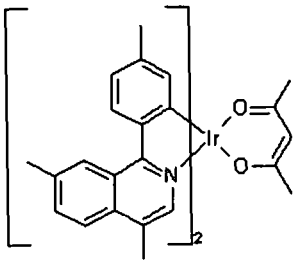
[0021] Examples of preferred compounds that can be represented by Formula 1 include the following compounds:



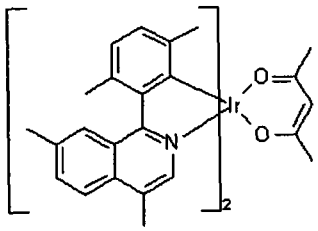
A-1



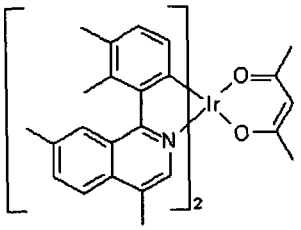
A-2



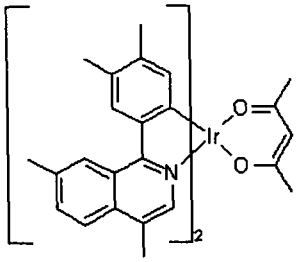
A-3



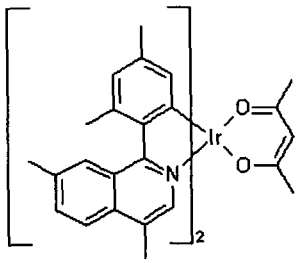
A-4



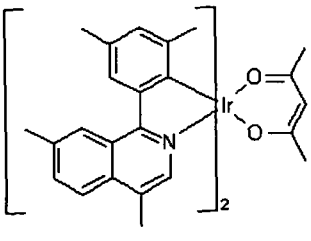
A-5



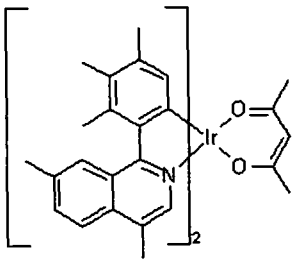
A-6



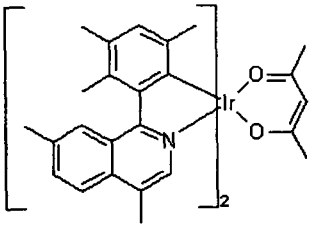
A-7



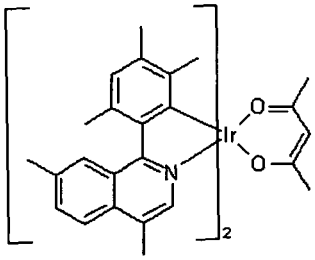
A-8



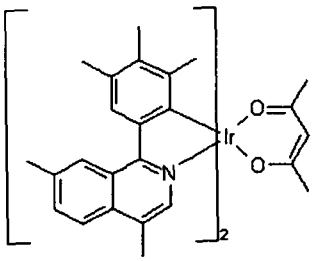
A-9



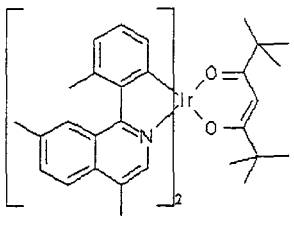
A-10



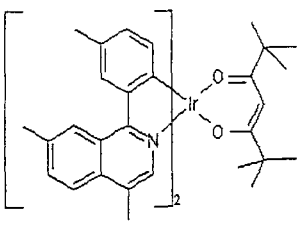
A-11



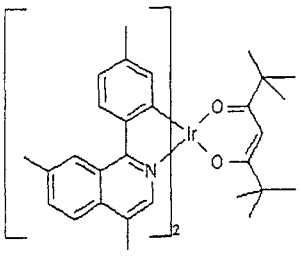
A-12



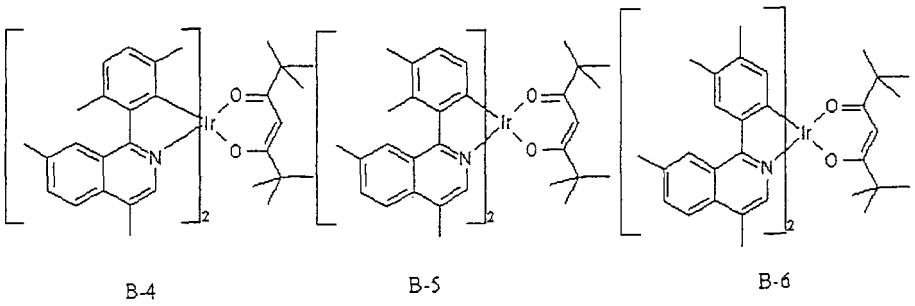
B-1



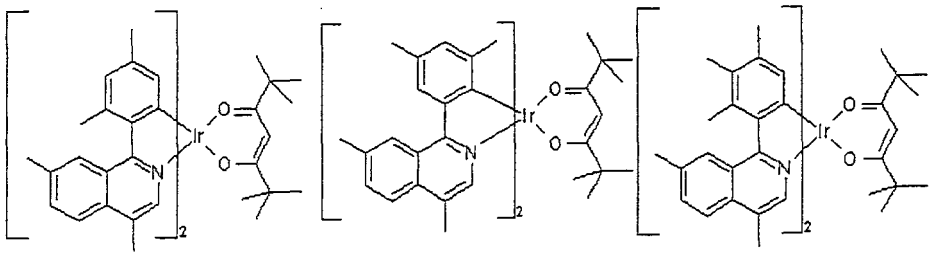
B-2



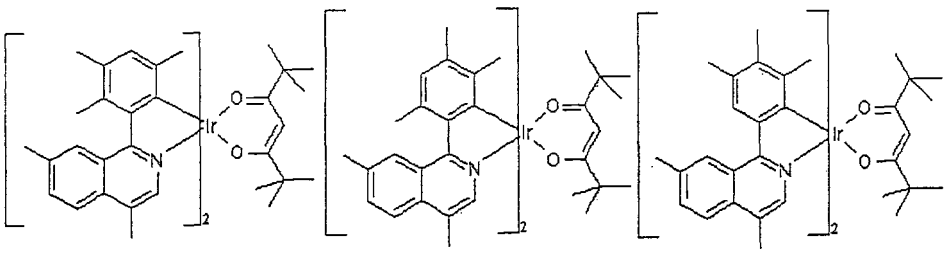
B-3



B-4 B-5 B-6

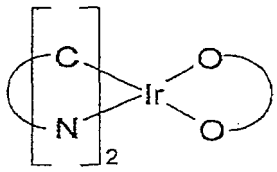


B-7 B-8 B-9



B-10 B-11 B-12

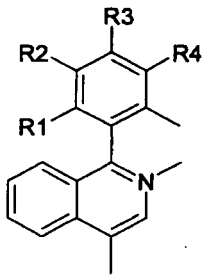
[0022] In another reference aspect, there is provided a red phosphorescent compound of Formula 2:



(2)

wherein

is



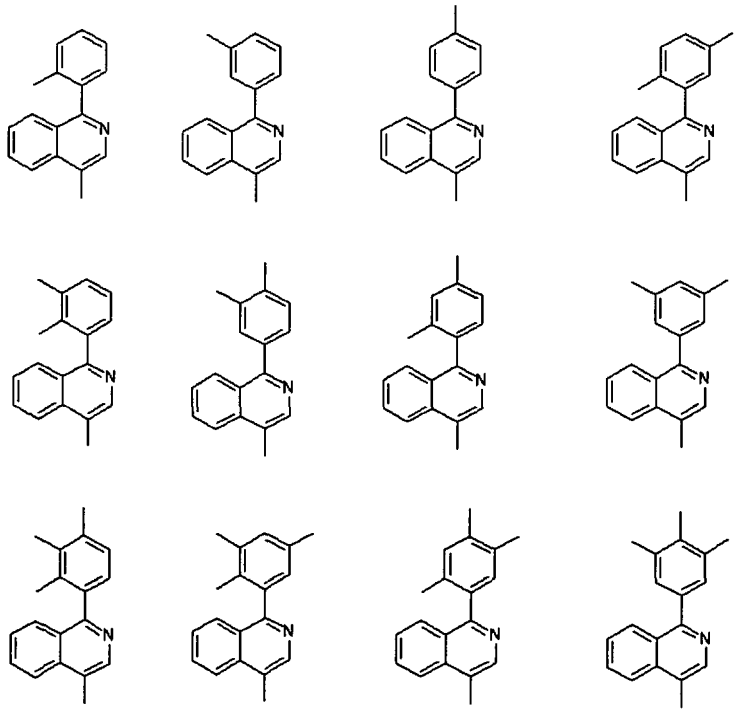
;

R1, R2, R3 and R4 are independently selected from C_1-C_4 alkyl groups and C_1-C_4 alkoxy groups; and

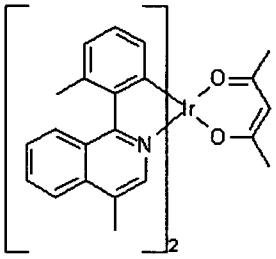
is selected from 2,4-pentanedione, 2,2,6,6,-tetramethylheptane-3,5-dione, 1,3-propanedione, 1,3-butanedione, 3,5-heptanedione, 1,1,1-trifluoro-2,4-pentanedione, 1,1,1,5,5,5-hexafluoro-2,4-pentanedione and 2,2-dimethyl-3,5-hexanedione.

[0023]

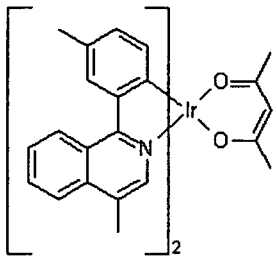
in Formula 2 is selected from the following compounds:



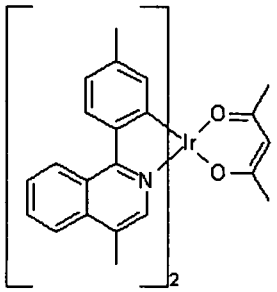
[0024] Examples of preferred compounds that can be represented by Formula 2 include the following compounds:



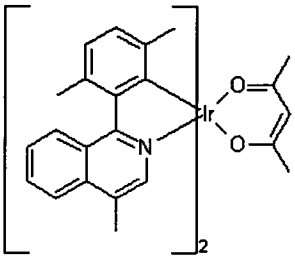
A-1



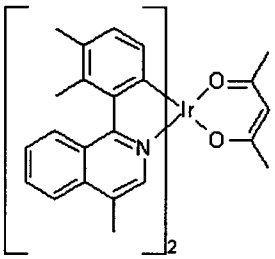
A-2



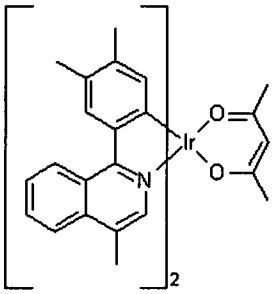
A-3



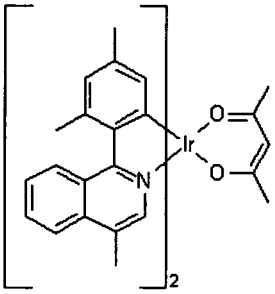
A-4



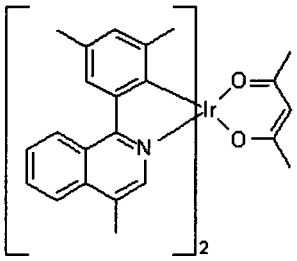
A-5



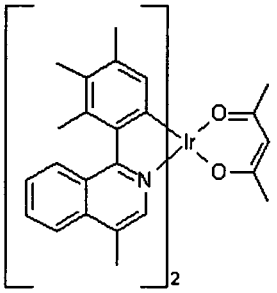
A-6



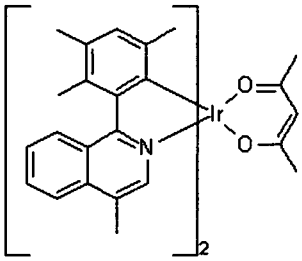
A-7



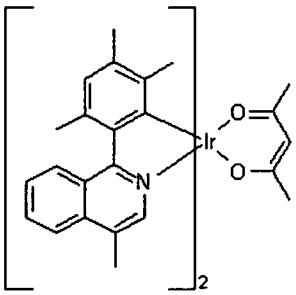
A-8



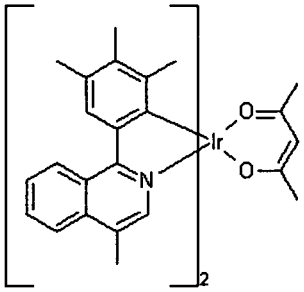
A-9



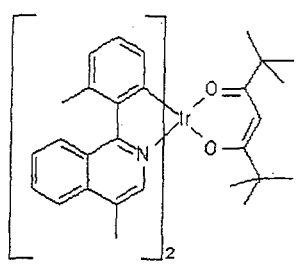
A-10



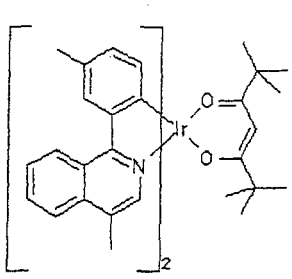
A-11



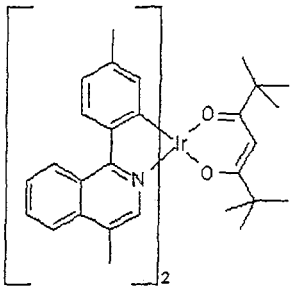
A-12



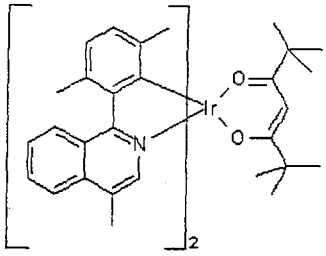
B-1



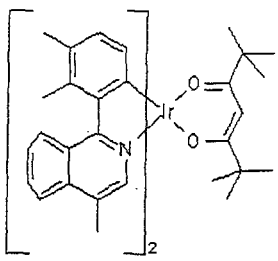
B-2



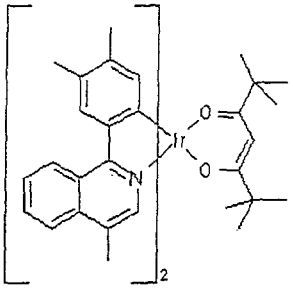
B-3



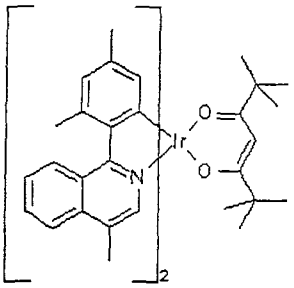
B-4



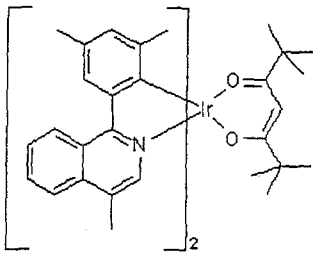
B-5



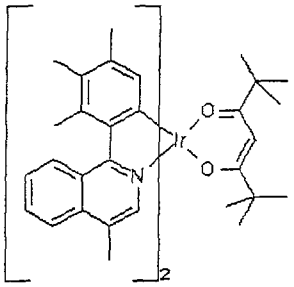
B-6



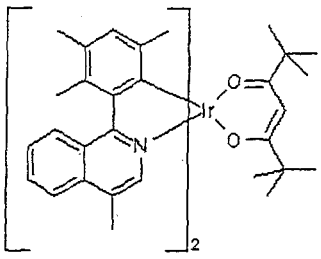
B-7



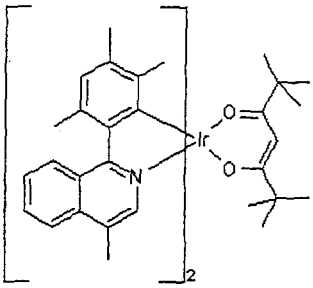
B-8



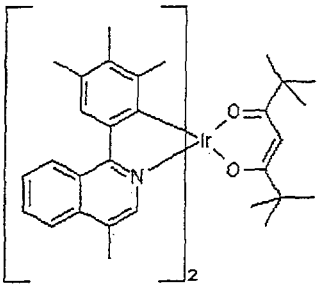
B-9



B-10

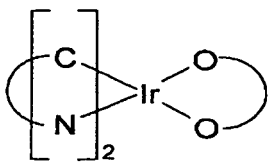


B-11



B-12

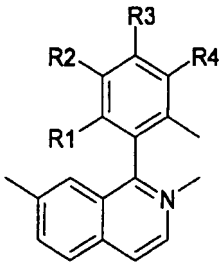
[0025] In another reference aspect, there is provided a red phosphorescent compound of Formula 3:



(3)

wherein

is



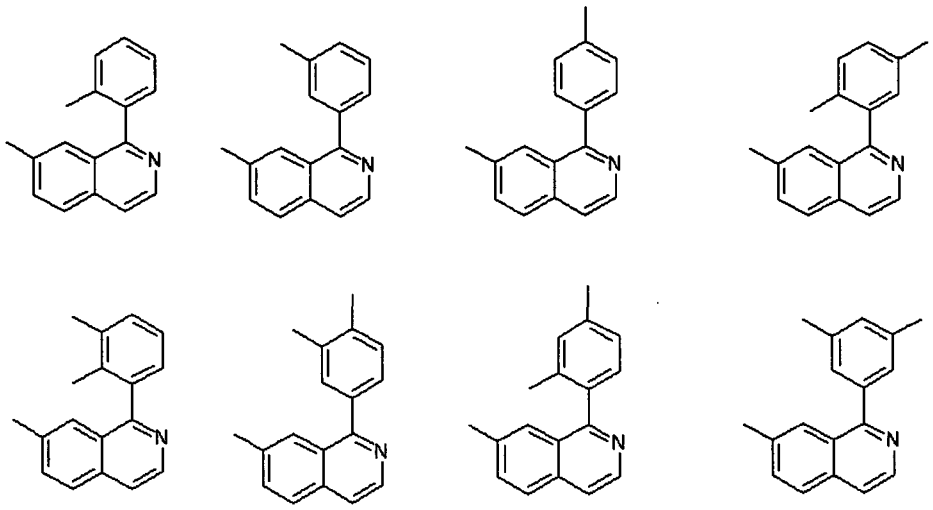
;

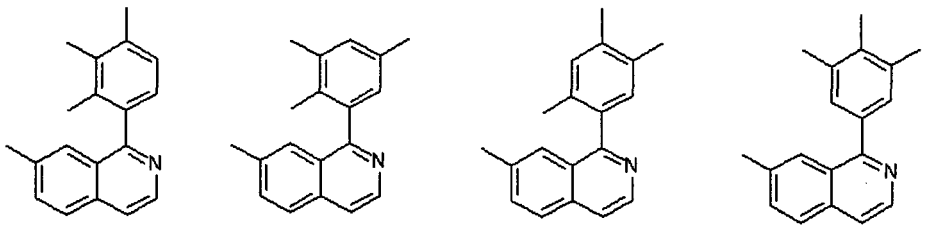
R1, R2, R3 and R4 are independently selected from hydrogen, C_1-C_4 alkyl groups and C_1-C_4 alkoxy groups; and

is selected from 2,4-pentanedione, 2,2,6,6,-tetramethylheptane-3,5-dione, 1,3-propanedione, 1,3-butanedione, 3,5-heptanedione, 1,1,1-trifluoro-2,4-pentanedione, 1,1,1,5,5,5-hexafluoro-2,4-pentanedione and 2,2-dimethyl-3,5-hexanedione.

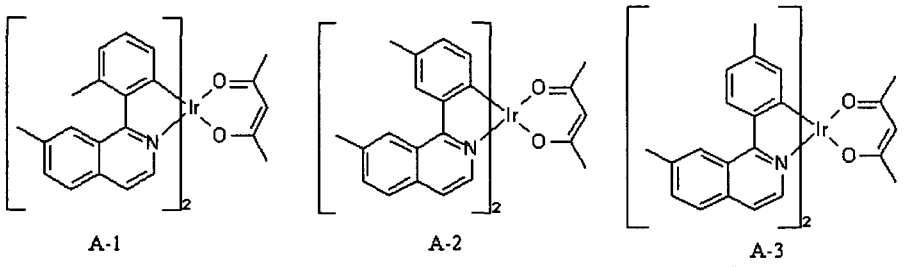
[0026]

in Formula 3 is selected from the following compounds:

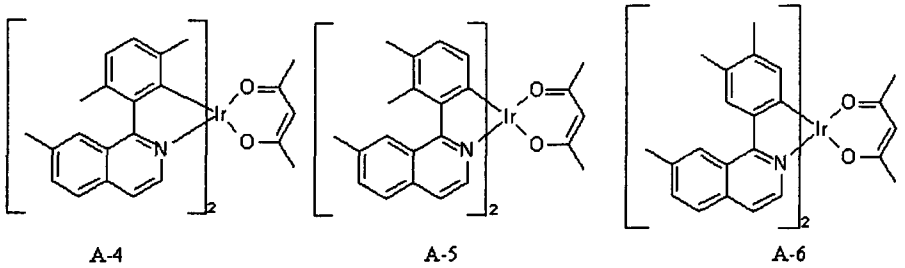




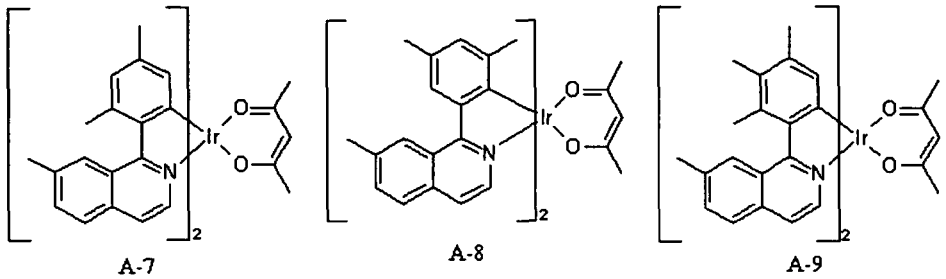
[0027] Examples of preferred compounds that can be represented by Formula 3 include the following compounds:



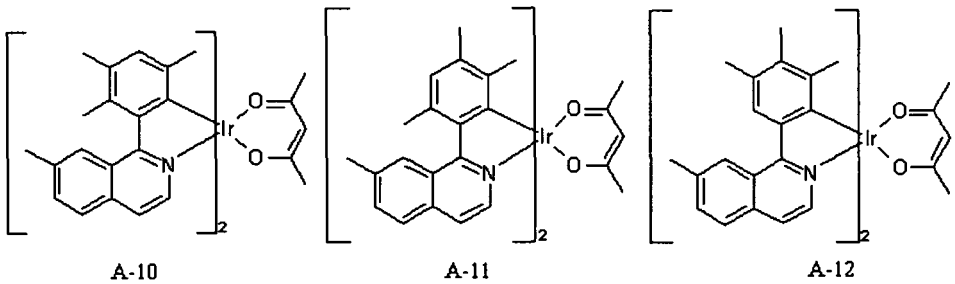
A-1 A-2 A-3



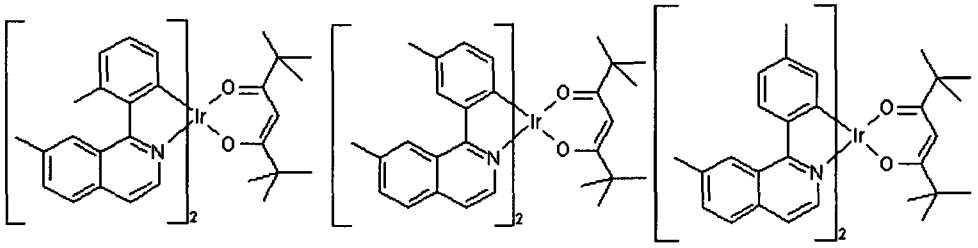
A-4 A-5 A-6



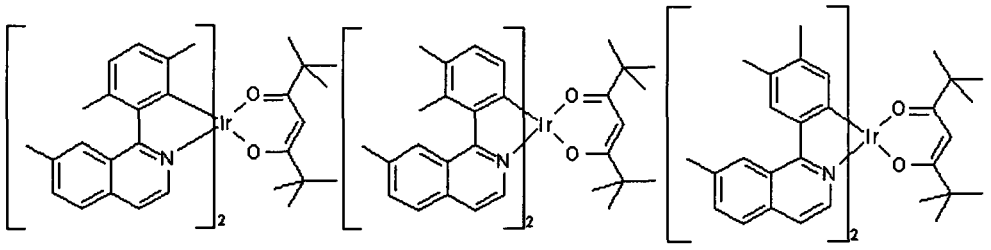
A-7 A-8 A-9



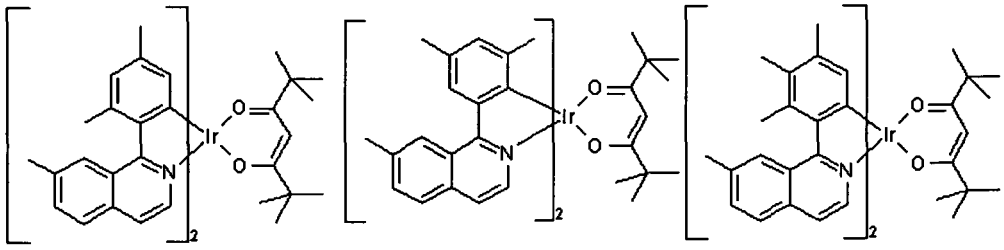
A-10 A-11 A-12



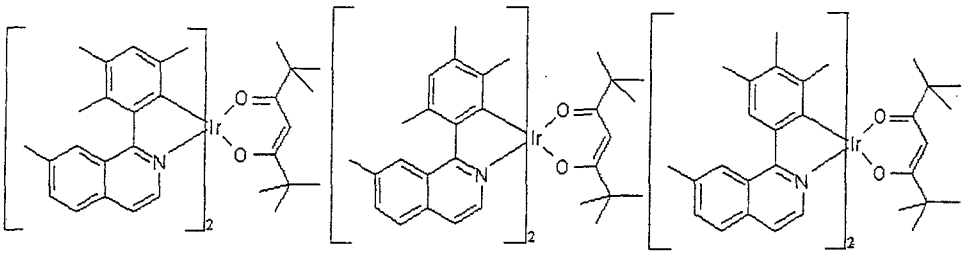
B-1 B-2 B-3



B-4 B-5 B-6



B-7 B-8 B-9



B-10 B-11 B-12

[0028] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

[0030] FIG. 1 shows a graph showing a phenomenon wherein the color purity of an organic EL device becomes higher (i.e. as the x-values on CIE chromaticity coordinates increase), the relative sensitivity of the organic EL device decreases; and

[0031] FIG. 2 shows the structural formulas of NPB, copper (II) phthalocyanine (CuPc), $(btp)_2Ir(acac)$, Alq_3, BAlq and CBP used in Example Section according to the present invention.

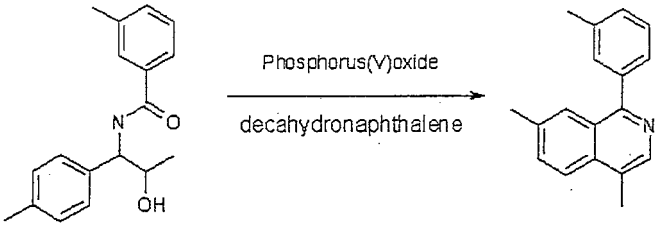
DETAILED DESCRIPTION OF THE INVENTION

[0032] Reference will now be made in detail to the preferred embodiments of the present invention associated with an organic electroluminescent (EL) device using one of the red phosphorescent compounds according to the present invention, examples of which are illustrated in the annexed drawings.

[0033] Hereinafter, methods for synthesizing the red phosphorescent compounds represented by Formulas 1 to 3 for use in the organic EL devices according to the present invention will be described. First, a method for synthesizing iridium (III) (2-(3-methylphenyl)-4,7-dimethylquinolinato-N,$C^{2'}$) (2,4-pentanedionate-O,O) ("A-2"), which is a red phosphorescent compound represented by Formula 1, for use in an organic electroluminescent device.

1. Synthesis of 1-(3-methylphenyl)-4,7-dimethylisoquinoline

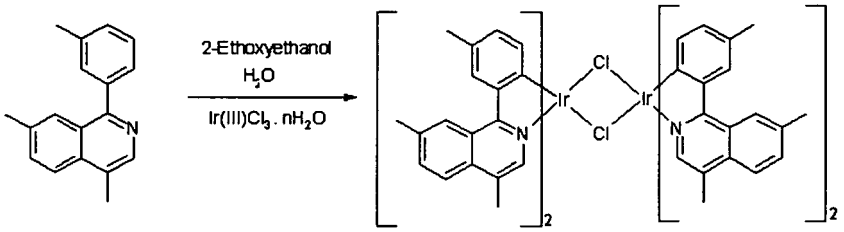
[0034]



[0035] N-(2-hydroxy-1-p-tolyl-propyl)-3-methylbezamide (2.1 mmol), phosphorus (V) oxide (10 mmol) and decahydronaphtalene (50 mmol) were put in a dried two-neck round-bottom flask. Then, the mixture was stirred at 120□ for 5 hours. After completion of the reaction, the reaction mixture was extracted with dichloromethane and water and distilled under reduced pressure. The resulting residue was purified by silica gel column chromatography. The eluate was distilled under reduced pressure. The residue was recrystallized from dichloromethane and petroleum ether, and filtered to yield 1-(3-methylphenyl)-4,7-dimethylisoquinoline.

2. Synthesis of dichloro-crosslinked dimer complex

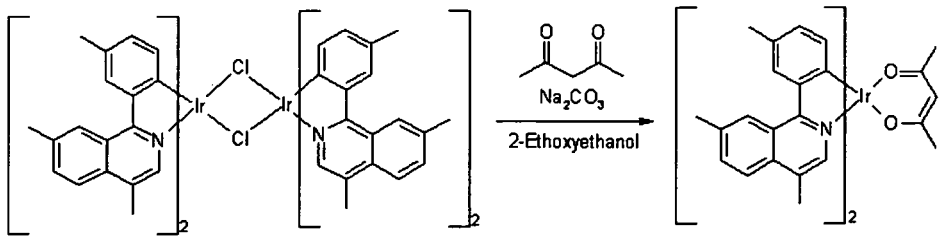
[0036]



[0037] Iridium (III) chloride hydrate (1 mmol), the 1-(3-methylphenyl)-4,7-dimethylisoquinoline (2.5 mmol) and a mixed solvent (30 mL) of 2-ethoxyethanol and water (3 : 1) were put in a dried two-neck round-bottom flask. After the mixture was refluxed for 24 hours and water was added thereto to obtain a solid. The solid was filtered and washed with methanol and petroleum ether to yield the dichloro-crosslinked dimer complex.

3. Synthesis of iridium (III) (1-(3-methylphenyl)-4,7-dimethylisoquinolinato-N,$C^{2'}$)(2,4-pentanedionate-O,O)

[0038]

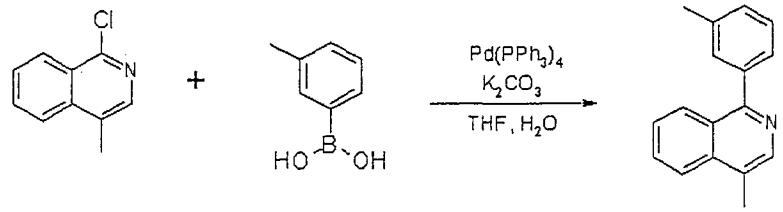


[0039] The dichloro-crosslinked dimer complex (1 mmol), 2,4-pentanedione (3 mmol), sodium carbonate (Na_2CO_3) (6 mmol) and 2-ethoxyethanol (30 mL) were put in a dried two-neck round-bottom flask. Then, the mixture was refluxed for 2 hours. The reaction mixture was allowed to cool to room temperature, and then distilled water was added thereto to obtain a solid. The solid was filtered and dissolved in dichloromethane. The solution was filtered through silica gel. The solvent was distilled off under reduced pressure and the resulting residue was washed with methanol and petroleum ether to yield to obtain the iridium (III) (1-(3-methylphenyl)-4,7-dimethylisoquinolinato-N,$C^{2'}$)(2,4-pentanedionate-O,O).

[0040] Next, a method for synthesizing iridium (III) (2-(3'-methylphenyl)-4-methylisoquinolinato-N,$C^{2'}$)(2,4-pentanedionate-O,O) ("A-2"), which is a red phosphorescent compound used as a dopant of the light-emitting layer as defined in claim 1 and represented by Formula 2, for use in an organic electroluminescent device.

1. Synthesis of 1-(3-methylphenyl)-4-methylisoquinoline

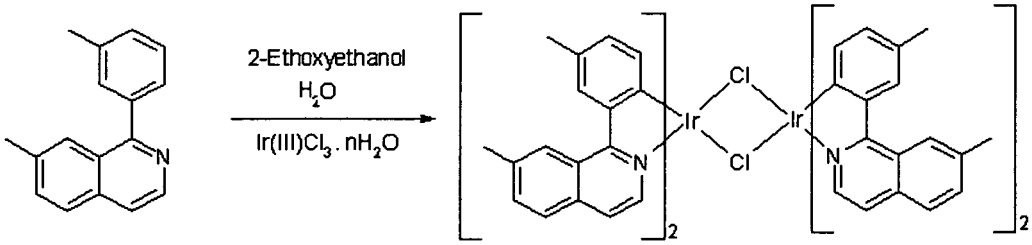
[0041]



[0042] 3-Methylphenyl borate (1.3 mmol), 2-chloro-4-methylquinoline (1 mmol), tetrakis(triphenylphosphine) palladium(O) (0.05 mmol) and potassium carbonate (3 mmol) were dissolved in THF (30 mL) and H_2O (10 mL). The resulting solution was stirred in a bath at 100°C for 24 hours. After completion of the reaction, the solvents were removed. The reaction mixture was extracted with dichloromethane and water and distilled under reduced pressure. The resulting residue was purified by silica gel column chromatography. The eluate was distilled under reduced pressure. The residue was recrystallized from dichloromethane and petroleum ether, and filtered to yield 1-(3-methylphenyl)-4-methylisoquinoline as a solid.

2. Synthesis of dichloro-crosslinked dimer complex

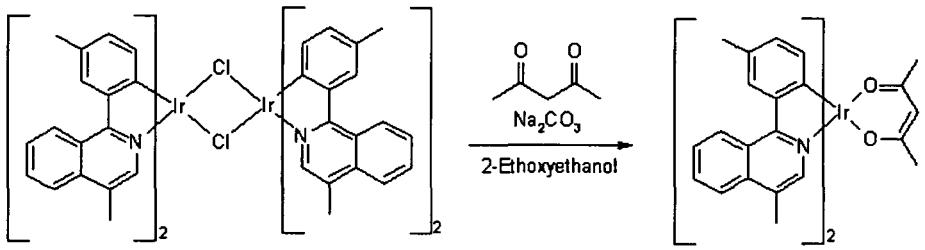
[0043]



[0044] Iridium (III) chloride hydrate (1 mmol), the 1-(3-methylphenyl)-4-methylisoquinoline (2.5 mmol) and a mixed solvent (30 mL) of 2-ethoxyethanol and distilled water (3 : 1 (v/v) were put in a dried two-neck round-bottom flask. After the mixture was refluxed for 24 hours, water was added thereto to obtain a solid. The solid was filtered and washed with methanol and petroleum ether to yield the dichloro-crosslinked dimer complex.

3. Synthesis of iridium (III) (2-(3'-methylphenyl)-4-methylisoquinolinato-N,$C^{2'}$) (2,4-pentanedionate-O,O)

[0045]

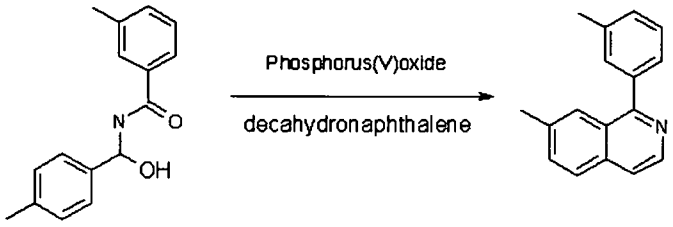


[0046] The dichloro-crosslinked dimer complex (1 mmol), 2,4-pentanedione (3 mmol), sodium carbonate (Na_2CO_3) (6 mmol) and 2-ethoxyethanol (30 mL) were put in a dried two-neck round-bottom flask. Then, the mixture was refluxed for 24 hours. The reaction mixture was allowed to cool to room temperature, and then distilled water was added thereto to obtain a solid. The solid was filtered and dissolved in dichloromethane. The solution was filtered through silica gel. The solvent was distilled off under reduced pressure and the resulting residue was washed with methanol and petroleum ether to yield iridium (III) (2-(3'-methylphenyl)-4-methylisoquinolinato-N,$C^{2'}$) (2,4-pentanedionate-O,O).

[0047] Lastly, a method for synthesizing iridium (III) (2-(3-methylphenyl)-7-methylisoquinolinato-N,$C^{2'}$)(2,4-pentanedionate-O,O) ("A-2"), which is a red phosphorescent compound represented by Formula 3, for use in an organic electroluminescent device.

1. Synthesis of 1-(3-methylphenyl)-7-methylisoquinoline

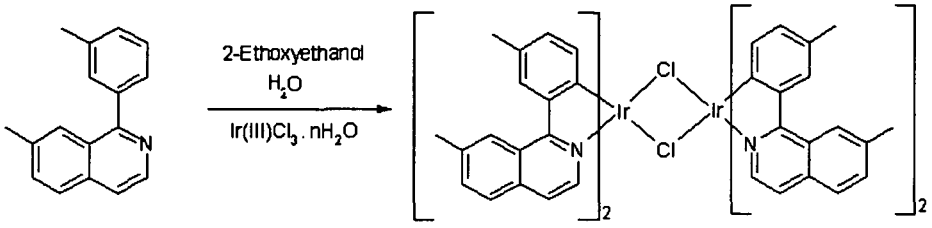
[0048]



[0049] Benzoic acid-(β -hydroxy-4-methyl-phenylamide) (2.1 mmol), phosphorus (V) oxide (10 mmol) and decahydronaphthalene (50 mmol) were put in a dried two-neck round-bottom flask. Then, the mixture was stirred at 120°C for 5 hours. After completion of the reaction, the reaction mixture was extracted with dichloromethane and water. The extract was distilled under reduced pressure. The resulting residue was purified by silica gel column chromatography. The eluate was distilled under reduced pressure. The residue was recrystallized from dichloromethane and petroleum ether and filtered to yield 1-(3-methylphenyl)-7-methylisoquinoline as a solid.

2. Synthesis of dichloro-crosslinked dimer complex

[0050]

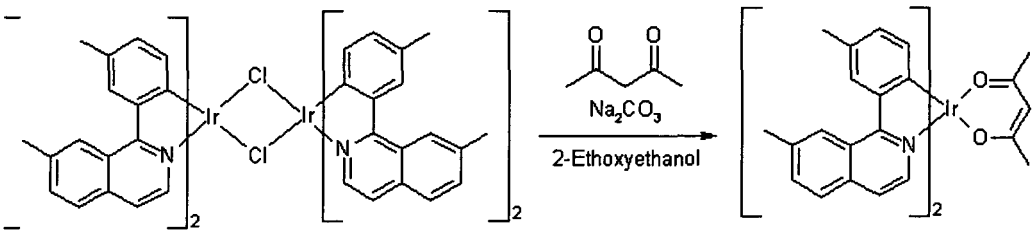


[0051] Iridium (III) chloride hydrate (1 mmol), 1-(3-methylphenyl)-7-methylisoquinoline (2.5 mmol) and a mixed solvent (30 mL) of 2-ethoxyethanol and distilled water (3 : 1) were put in a dried two-neck round-bottom flask. After the mixture

was refluxed for 24 hours, water was added thereto to obtain a solid. The solid was filtered and washed with methanol and petroleum ether to yield the dichloro-crosslinked dimer complex.

3. Synthesis of iridium (III) (1-(3-methylphenyl)-7-methylisoquinolinato-N,$C^{2'}$) (2,4-pentanedionate-O,O)

[0052]



[0053] The dichloro-crosslinked dimer complex (1 mmol), 2,4-pentanedione (3 mmol), sodium carbonate (Na_2CO_3) (6 mmol) and 2-ethoxyethanol (30 mL) were put in a dried two-neck round-bottom flask. Then, the mixture was stirred for 24 hours. After the mixture was allowed to cool to room temperature, distilled water was added thereto to obtain a solid. The solid was filtered and dissolved in dichloromethane. The solution was filtered through silica gel. The solvent was distilled off under reduced pressure and the residue was washed with methanol and petroleum ether to yield (1-(3-methylphenyl)-7-methylisoquinolinato-N,$C^{2'}$) (2,4-pentanedionate-O,O).

[0054] Hereinafter, a detailed description will be made of preferred examples of the present invention. The invention is not to be construed as being limited to the examples.

EXAMPLES A-1 to A-3 (Compounds of Formula 1) and Comparative Example A-1

Example A-1

[0055] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. After the patterned substrate was disposed in a vacuum chamber, the standard pressure of the chamber was adjusted to $1x10^{-6}$ torr. CuPc (200 Å), NPD (400 Å), BAlq + A-1 (7%) (200 Å), Alq_3 (300 Å), LiF (5 Å) and Al (1000 Å) were sequentially deposited on the ITO glass substrate to fabricate an organic EL device.

[0056] The luminance of the organic EL device was 801 cd/m^2 at an electric current of 0.9 mA and a voltage of 6.6 V. At this time, the CIE chromaticity coordinates were x = 0.649 and y = 0.360. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 5,100 hours at 2,000 cd/m^2.

Example A-2

[0057] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. After the patterned substrate was disposed in a vacuum chamber, the standard pressure of the chamber was adjusted to $1x10^{-6}$ torr. CuPc (200 Å), NPD (400 Å), BAlq + A-2 (7%) (200 Å), Alq_3 (300 Å), LiF (5 Å) and Al (1000 Å) were sequentially deposited on the ITO glass substrate to fabricate an organic EL device.

[0058] The luminance of the organic EL device was 795 cd/m^2 at an electric current of 0.9 mA and a voltage of 6.3 V. At this time, the CIE chromaticity coordinates were x = 0.650 and y = 0.361. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 4,800 hours at 2,000 cd/m^2.

Example A-3

[0059] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. After the patterned substrate was disposed in a vacuum chamber, the standard pressure of the chamber was adjusted to $1x10^{-6}$ torr. CuPc (200 Å), NPD (400 Å), BAlq + A-7 (7%) (200 Å), Alq_3 (300 Å), LiF (5 Å) and Al (1000 Å) were sequentially deposited on the ITO glass substrate to fabricate an organic EL device.

[0060] The luminance of the organic EL device was 783 cd/m^2 at an electric current of 0.9 mA and a voltage of 6.1 V. At this time, the CIE chromaticity coordinates were x = 0.651 and y = 0.362. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 5,500

hours at 2,000 cd/m^2.

Example A-4

[0061] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. The patterned substrate was disposed in a vacuum chamber. Then, the standard pressure of the chamber was adjusted to 1x10^{-6} torr. CuPc (200 Å), NPD (400 Å), BAlq + B-2 (7%) (200 Å), a hole blocking layer (100 Å), Alq_3 (300 Å), LiF (5 A) and Al (1000 Å) were sequentially deposited on the ITO glass substrate to manufacture an organic EL device.

[0062] When BAlq was used as a material for the hole blocking layer, the luminance of the organic EL device was 768 cd/m^2 at an electric current of 0.9 mA and a voltage of 6.0 V. At this time, the CIE chromaticity coordinates were x = 0.652, y = 0.361. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 4,000 hours at 2,000 cd/m^2.

Example A-5

[0063] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. The patterned substrate was disposed in a vacuum chamber. Then, the standard pressure of the chamber was adjusted to 1x10^{-6} torr. CuPc (200 Å), NPD (400 Å), BAlq + B-7 (7%) (200 Å), a hole blocking layer (100 Å), Alq_3 (300 Å), LiF (5 Å) and Al (1000 Å) were sequentially deposited on the ITO glass substrate to manufacture an organic EL device.

[0064] When BAlq was used as a material for the hole blocking layer, the luminance of the organic EL device was 753 cd/m^2 at an electric current of 0.9 mA and a voltage of 6.0 V. At this time, the CIE chromaticity coordinates were x = 0.652 and y = 0.362. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 4,000 hours at 2,000 cd/m^2.

Comparative Example A-1

[0065] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. The patterned substrate was disposed in a vacuum chamber. Then, the standard pressure of the chamber was adjusted to 1x10^{-6} torr. CuPc (200 Å), NPD (400 Å), BAlq + $(btp)_2Ir(acac)$ (7%) (200 Å), Alq_3 (300 Å), LiF (5 Å) and Al (1000 Å) were sequentially deposited on the ITO glass substrate to manufacture an EL device.

[0066] The luminance of the organic EL device was 780 cd/m^2 at an electric current of 0.9 mA and a voltage of 7.5 V. At this time, the CIE chromaticity coordinates were x = 0.659 and y = 0.329. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 2,500 hours at 2,000 cd/m^2.

[0067] The organic EL devices fabricated in Examples A-1 to A-5 and Comparative Example A-1 were evaluated for efficiency, CIE chromaticity coordinates, luminance and lifetime characteristics. The results are shown in Table 1.

TABLE 1

Device	Voltage (V)	Electric current (mA)	Luminance (cd/m^2)	Current efficiency (cd/A)	Power efficiency (1m/W)	CIE (X)	CIE (Y)	Life time (h) (half the initial luminance)
Ex.A-1	6.6	0.9	801	8.01	3.81	0.649	0.360	5,100
Ex. A-2	6.3	0.9	795	7.95	3.96	0.650	0.361	4,800
Ex. A-3	6.1	0.9	783	7.83	4.03	0.651	0.362	5,500
Ex. A-4	6.0	0.9	768	7.68	4.02	0.652	0.361	4,000
Ex. A-5	6.0	0.9	753	7.53	3.94	0.652	0.362	4,000
Comp. Ex. A-1	7.5	0.9	780	7.80	3.27	0.659	0.329	2,500

Examples B-1 to B-5 (Compounds of Formula 2) and Comparative Example B-1

Example B-1

[0068] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning.

After the patterned substrate was disposed in a vacuum chamber, the standard pressure of the chamber was adjusted to $1x10^{-6}$ torr. CuPc (200 Å), NPD (400 Å), BAlq + A-2 (7%) (200 Å), Alq_3 (300 Å), LiF (5 Å) and Al (1000 Å) were sequentially deposited on the ITO glass substrate to fabricate an organic EL device.

[0069] The luminance of the organic EL device was 1,115 cd/m^2 at an electric current of 0.9 mA and a voltage of 6.4 V. At this time, the CIE chromaticity coordinates were x = 0.646 and y = 0.356. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 5,000 hours at 2,000 cd/m^2.

Example B-2

[0070] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. After the patterned substrate was disposed in a vacuum chamber, the standard pressure of the chamber was adjusted to $1x10^{-6}$ torr. CuPc (200 Å), NPD (400 Å), BAlq + A-5 (7%) (200 Å), Alq_3 (300 Å), LiF (5 Å) and Al (1000 Å) were sequentially deposited on the ITO glass substrate to fabricate an organic EL device.

[0071] The luminance of the organic EL device was 1,032 cd/m^2 at an electric current of 0.9 mA and a voltage of 6.2 V. At this time, the CIE chromaticity coordinates were x = 0.647 and y = 0.358. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 4,600 hours at 2,000 cd/m^2.

Example B-3

[0072] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. After the patterned substrate was disposed in a vacuum chamber, the standard pressure of the chamber was adjusted to $1x10^{-6}$ torr. CuPc (200 Å), NPD (400 Å), BAlq + A-7 (7%) (200 Å), Alq_3 (300 Å), LiF (5 Å) and Al (1000 Å) were sequentially deposited on the ITO glass substrate to fabricate an organic EL device.

[0073] The luminance of the organic EL device was 963 cd/m^2 at an electric current of 0.9 mA and a voltage of 5.3 V. At this time, the CIE chromaticity coordinates were x = 0.649 and y = 0.359. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 4,100 hours at 2,000 cd/m^2.

Example B-4

[0074] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. After the patterned substrate was disposed in a vacuum chamber, the standard pressure of the chamber was adjusted to $1x10^{-6}$ torr. CuPc (200 Å), NPD (400 Å), BAlq + B-2 (7%) (200 Å), Alq_3 (300 Å), LiF (5 Å) and Al (1000 A) were sequentially deposited on the ITO glass substrate to fabricate an organic EL device.

[0075] The luminance of the organic EL device was 932 cd/m^2 at an electric current of 0.9 mA and a voltage of 6.3 V. At this time, the CIE chromaticity coordinates were x = 0.647 and y = 0.360. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 3,100 hours at 2,000 cd/m^2.

Example B-5

[0076] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. After the patterned substrate was disposed in a vacuum chamber, the standard pressure of the chamber was adjusted to $1x10^{-6}$ torr. CuPc (200 Å), NPD (400 Å), BAlq + B-5 (7%) (200 Å), Alq_3 (300 Å), LiF (5 Å) and Al (1000 Å) were sequentially deposited on the ITO glass substrate to fabricate an organic EL device.

[0077] The luminance of the organic EL device was 911 cd/m^2 at an electric current of 0.9 mA and a voltage of 6.6 V. At this time, the CIE chromaticity coordinates were x = 0.647 and y = 0.358. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 3,150 hours at 2,000 cd/m^2.

Comparative Example B-1

[0078] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. After the patterned substrate was disposed in a vacuum chamber, the standard pressure of the chamber was adjusted to $1x10^{-6}$ torr. CuPc (200 Å), NPD (400 Å), BAlq + $(btp)_2Ir(acac)$ (7%) (200 Å), Alq_3 (300 A), LiF (5 Å) and Al (1000 Å) were sequentially deposited on the ITO glass substrate to manufacture an organic EL device.

[0079] The luminance of the organic EL device was 780 cd/m^2 at an electric current of 0.9 mA and a voltage of 7.5 V. At this time, the CIE chromaticity coordinates were x = 0.659 and y = 0.329. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 2,500 hours at 2,000 cd/m^2.

[0080] The organic EL devices fabricated in Examples B-1 to B-5 and Comparative Example B-1 were evaluated for efficiency, CIE chromaticity coordinates, luminance and lifetime characteristics. The results are shown in Table 2.

TABLE 2

Device	Voltage (V)	Electric current (mA)	Luminance (cd/m^2)	Current efficiency (cd/A)	Power efficiency (1m/W)	CIE (X)	CIE (Y)	Life time (h) (half the initial luminance)
Ex. B-1	6.4	0.9	1,115	11.15	5.47	0.646	0.356	5,000
Ex. B-2	6.2	0.9	1,032	10.32	5.23	0.647	0.351	4,600
Ex. B-3	6.1	0.9	963	9.63	4.96	0.649	0.359	4,100
Ex. B-4	6.3	0.9	932	9.32	4.65	0.647	0.360	3,100
Ex. B-5	6.6	0.9	911	9.11	4.33	0.647	0.358	3,150
Comp. Ex. B-1	7.5	0.9	780	7.80	3.27	0.659	0.329	2,500

Examples C-1 to C-6 (Compounds of Formula 3) and Comparative Example C-1

Example C-1

[0081] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. After the patterned substrate was disposed in a vacuum chamber, the standard pressure of the chamber was adjusted to 1x10^{-6} torr. CuPc (200 Å), NPD (400 Å), BAlq + A-1 (7%) (200 Å), Alq_3 (300 Å), LiF (5 Å) and Al (1000 Å) were sequentially deposited on the ITO glass substrate to fabricate an organic EL device.

[0082] The luminance of the organic EL device was 801 cd/m^2 at an electric current of 0.9 mA and a voltage of 6.6 V. At this time, the CIE chromaticity coordinates were x = 0.649 and y = 0.360. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 5,100 hours at 2,000 cd/m^2.

Example C-2

[0083] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. After the patterned substrate was disposed in a vacuum chamber, the standard pressure of the chamber was adjusted to 1x10^{-6} torr. CuPc (200 Å), NPD (400 Å), BAlq + A-2 (7%) (200 Å), Alq_3 (300 Å), LiF (5 Å) and Al (1000 Å) were sequentially deposited on the ITO glass substrate to fabricate an organic EL device.

[0084] The luminance of the organic EL device was 795 cd/m^2 at an electric current of 0.9 mA and a voltage of 6.3 V. At this time, the CIE chromaticity coordinates were x = 0.650 and y = 0.361. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 4,800 hours at 2,000 cd/m^2.

Example C-3

[0085] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. After the patterned substrate was disposed in a vacuum chamber, the standard pressure of the chamber was adjusted to 1x10^{-6} torr. CuPc (200 Å), NPD (400 Å), BAlq + A-7 (7%) (200 Å), Alq_3 (300 Å), LiF (5 Å) and Al (1000 A) were sequentially deposited on the ITO glass substrate to fabricate an organic EL device.

[0086] The luminance of the organic EL device was 783 cd/m^2 at an electric current of 0.9 mA and a voltage of 6.1 V. At this time, the CIE chromaticity coordinates were x = 0.651 and y = 0.362. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 5,500 hours at 2,000 cd/m^2.

Example C-4

[0087] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. After the patterned substrate was disposed in a vacuum chamber, the standard pressure of the chamber was adjusted to $1x10^{-6}$ torr. CuPc (200 A), NPD (400 Å), BAlq + B-2 (7%) (200 Å), Alq_3 (300 Å), LiF (5 Å) and Al (1000 Å) were sequentially deposited on the ITO glass substrate to fabricate an organic EL device.

[0088] The luminance of the organic EL device was 768 cd/m^2 at an electric current of 0.9 mA and a voltage of 6.0 V. At this time, the CIE chromaticity coordinates were x = 0.652 and y = 0.361. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 4,000 hours at 2,000 cd/m^2.

Example C-5

[0089] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. After the patterned substrate was disposed in a vacuum chamber, the standard pressure of the chamber was adjusted to $1x10^{-6}$ torr. CuPc (200 Å), NPD (400 Å), BAlq + B-7 (7%) (200 Å), Alq_3 (300 Å), LiF (5 A) and Al (1000 Å) were sequentially deposited on the ITO glass substrate to fabricate an organic EL device.

[0090] The luminance of the organic EL device was 753 cd/m^2 at an electric current of 0.9 mA and a voltage of 6.0 V. At this time, the CIE chromaticity coordinates were x = 0.652 and y = 0.362. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 4,000 hours at 2,000 cd/m^2.

Comparative Example C-1

[0091] An ITO-coated glass substrate was patterned to have a light-emitting area of 3 mm x 3 mm, followed by cleaning. After the patterned substrate was disposed in a vacuum chamber, the standard pressure of the chamber was adjusted to $1x10^{-6}$ torr. CuPc (200 Å), NPD (400 Å), BAlq + $(btp)_2Ir(acac)$ (7%) (200 Å), Alq_3 (300 Å), LiF (5 Å) and Al (1000 Å) were sequentially deposited on the ITO glass substrate to manufacture an organic EL device.

[0092] The luminance of the organic EL device was 780 cd/m^2 at an electric current of 0.9 mA and a voltage of 7.5 V. At this time, the CIE chromaticity coordinates were x = 0.659 and y = 0.329. The lifetime (defined as the time taken before the luminance of the organic EL device decreases to half its initial value) of the organic EL device was 2,500 hours at 2,000 cd/m^2.

[0093] The organic EL devices fabricated in Examples C-1 to C-5 and Comparative Example C-1 were evaluated for efficiency, CIE chromaticity coordinates, luminance and lifetime characteristics. The results are shown in Table 3.

TABLE 3

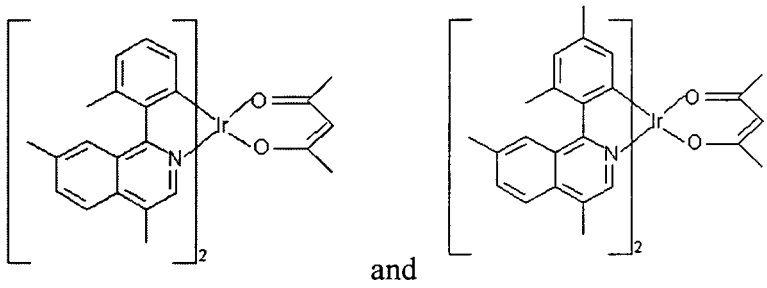
Device	Voltage (V)	Electric current (mA)	Luminance (cd/m^2)	Current efficiency (cd/A)	Power efficiency (1m/W)	CIE (X)	CIE (Y)	Life time (h) (half the initial luminance)
Ex. C-1	6.6	0.9	801	8.01	3.81	0.649	0.360	5,100
Ex. C-2	6.3	0.9	795	7.95	3.96	0.650	0.351	4,800
Ex. C-3	6.1	0.9	783	7.83	4.03	0.651	0.362	5,500
Ex. C-4	6.0	0.9	768	7.68	4.02	0.652	0.361	4,000
Ex. C-5	6.0	0.9	753	7.53	3.94	0.652	0.362	4,000
Comp. Ex. C-1	7.5	0.9	780	7.80	3.27	0.659	0.329	2,500

Claims

1. An organic electroluminescent (EL) device comprising:

an anode, a hole injecting layer, a hole transport layer, a light-emitting layer, an electron transport layer, an electron injecting layer, and a cathode laminated in this order,

wherein the red phosphorescent compound selected from

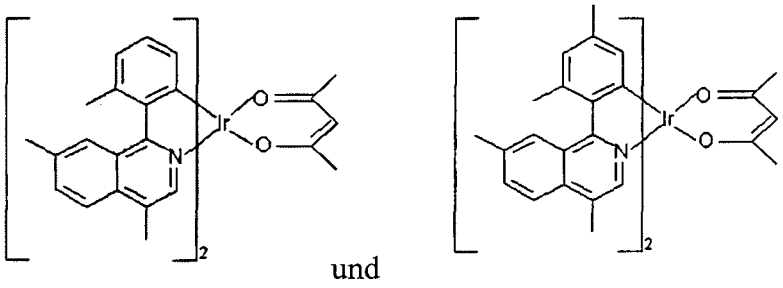


is used as a dopant of the light-emitting layer and is present in an amount of 0.5 to 20% by weight, based on the weight of a host,
wherein the host is selected from an Al complex, a Zn complex, and a carbazole derivative,
wherein the A1 or Zn complex has at least one ligand selected from quinolyl, biphenyl, isoquinolyl, phenyl, naphthyl, methylquinolyl, dimethylquinolyl and dimethylisoquinolyl groups, and the carbazole derivative is 4, 4'-N,N' dicarbazole biphenyl (CBP).

Patentansprüche

1. Organische Elektrolumineszenz (EL)-Vorrichtung, umfassend:

eine Anode, eine Lochinjektionsschicht, eine Lochtransportschicht, eine Lichtemittierende Schicht, eine Elektronentransportschicht, eine Elektroneninjektionsschicht und eine Kathode, laminiert in dieser Reihenfolge, wobei die rote Phosphoreszenz-Verbindung, gewählt aus

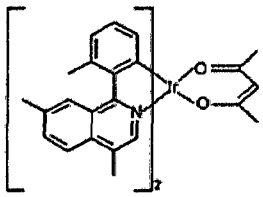


als ein Dotierungsmittel der Licht-emittierenden Schicht verwendet wird und in einer Menge von 0,5 bis 20 Gewichtsprozent, bezogen auf das Gewicht des Wirts, vorliegt,
wobei der Wirt gewählt ist aus einem Al-Komplex, einem Zn-Komplex und einem Carbazolderivat,
wobei der Al- oder Zn-Komplex mindestens einen Liganden besitzt, gewählt aus Chinolyl-, Biphenyl-, Isochinolyl-, Phenyl-, Naphthyl-, Methylchinolyl-, Dimethylchinolyl-, und Dimethylisochinolylgruppen und das Carbazolderivat 4,4'-N,N'-Dicarbazolbiphenyl (CBP) ist.

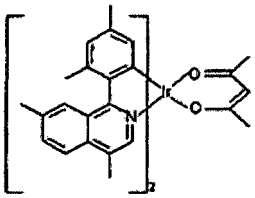
Revendications

1. Dispositif électroluminescent organique (EL) comprenant :

une anode, une couche à injection de trous, une couche de transport de trous, une couche électroluminescente, une couche à transport d'électrons, une couche à injection d'électrons et une cathode stratifiée dans cet ordre dans lequel le composé phosphorescent rouge sélectionné parmi



et



est utilisé comme dopant de la couche électroluminescente et est présent dans une quantité de 0,5 à 20 % en poids, sur la base du poids d'un hôte,
dans lequel l'hôte est sélectionné entre un complexe Al, un complexe Zn et un dérivé de carbazole,
dans lequel le complexe Al ou Zn possède au moins un ligand choisi entre les groupes suivants : quinolyl, biphényl, isoquinolyl, phényl, naphthyl, méthylquinolyl, diméthylquinolyl et diméthylisoquinolyl, et le dérivé de carbazole est le 4, 4-N, N, dicarbazole biphényl (CBP).

FIG. 1

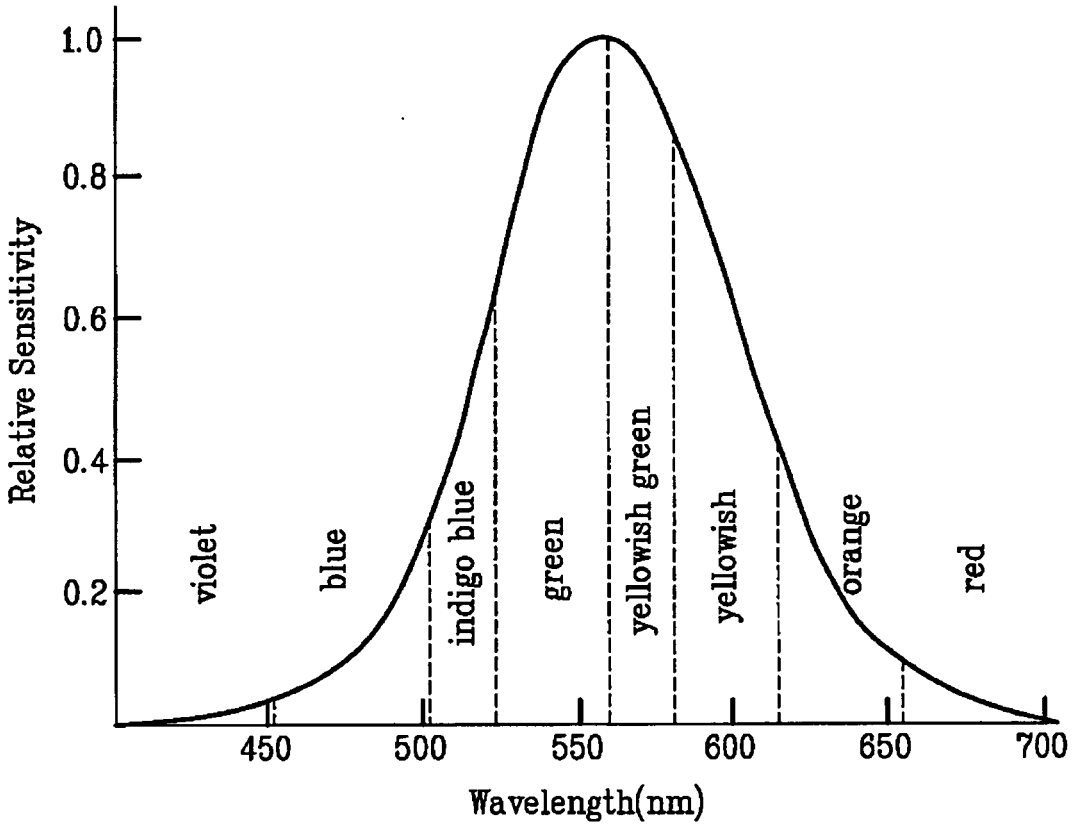
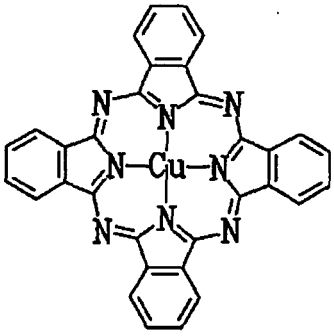
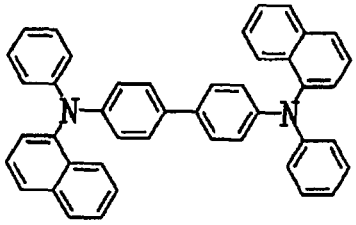

Relative Sensitivity
1.0
0.8
0.6
0.4
0.2
violet
blue
indigo blue
green
yellowish green
yellowish
orange
red
450
500
550
600
650
700
Wavelength(nm)

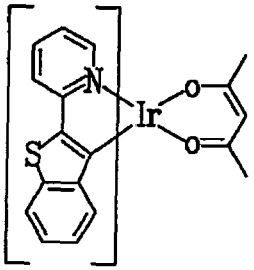
FIG. 2



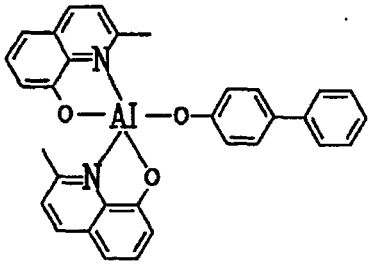
CuPC



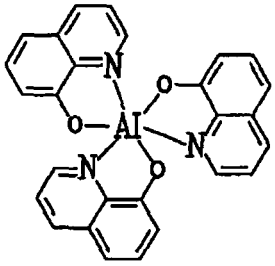
NPD



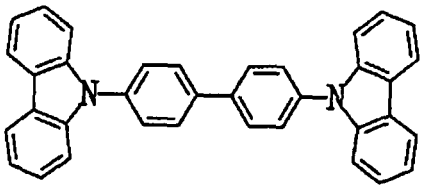
$(btp)_2Ir(acac)$



BAlq



Alq_3



CBP

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- WO 03040256 A2 **[0012]**

Non-patent literature cited in the description

- **FANG et al.** *Inorganica Chimica Acta,* 2006, vol. 359 (2), 441-450 **[0012]**

专利名称(译)	红色磷光化合物和使用其的有机电致发光器件		
公开(公告)号	EP1784057B1	公开(公告)日	2014-05-07
申请号	EP2006023132	申请日	2006-11-07
申请(专利权)人(译)	LG电子株式会社.		
当前申请(专利权)人(译)	LG DISPLAY CO.，LTD.		
[标]发明人	KIM JUNG KEUN SEO JEONG DAE JEONG HYUN CHEOL PARK CHUN GUN BIN JONG KWAN LEE KYUNG HOON PIEH SUNG HOON		
发明人	KIM, JUNG KEUN SEO, JEONG DAE JEONG, HYUN CHEOL PARK, CHUN GUN BIN, JONG KWAN LEE, KYUNG HOON PIEH, SUNG HOON		
IPC分类号	H05B33/14 C09K11/06 C07F15/00		
CPC分类号	C07F15/0033 C09K11/06 C09K2211/1007 C09K2211/1029 C09K2211/185 C09K2211/186 C09K2211/188 H05B33/14		
优先权	1020050105981 2005-11-07 KR 1020060037101 2006-04-25 KR 1020060037102 2006-04-25 KR		
其他公开文献	EP1784057A1		
外部链接	Espacenet		

摘要(译)

本文公开了下式1至3的红色磷光化合物：其中R 1和R 2独立地是C 1 -C 4烷基，R 3，R 4，R 5和R 6独立地选自氢，C 1 -C 4烷基和C 1 -C 4烷基。烷氧基，选自2,4-戊二酮，2,2,6,6-四甲基庚烷-3,5-二酮，1,3-丙二酮，1,3-丁二酮，3,5-庚二酮，1， 1,1-三氟-2,4-戊二酮，1,1,1,5,5,5-六氟-2,4-戊二酮和2,2-二甲基-3,5-己二酮;其中R1，R2，R3和R4独立地选自C1-C4烷基和C1-C4烷氧基，并且选自2,4-戊二酮，2,2,6,6-四甲基庚烷-3,5-二酮，1,3-丙二酮，1,3-丁二酮，3,5-庚二酮，1,1,1-三氟-2,4-戊二酮，1,1,1,5,5，5-六氟-2,4-戊二酮和2,2-二甲基-3,5-己二酮;其中R1，R2，R3和R4独立地选自氢，C1-C4烷基和C1-C4烷氧基，并且选自2,4-戊二酮，2,2,6,6-四甲基庚烷-3， 5-二酮，1,3-丙二酮，1,3-丁二酮，3,5-庚二酮，1,1,1-三氟-2,4-戊二酮，1,1,1,5,5,5-六氟 - 2,4-戊二酮和2,2-二甲基-3,5-己二酮。本发明进一步公开了一种有机电致发光（EL）器件，包括按顺序层压的阳极，空穴注入层，空穴传输层，发光层，电子传输层，电子注入层和阴极，其中一个红色磷光化合物的一部分用作发光的掺杂剂层。