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(54) **METAL COMPLEX COMPOUND AND ORGANIC LIGHT EMITTING DIODE DEVICE INCLUDING THE SAME**

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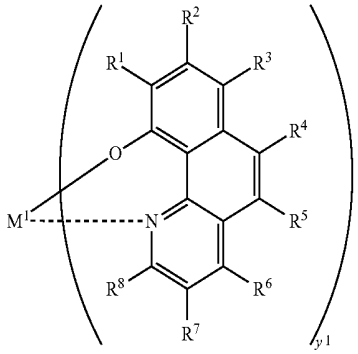
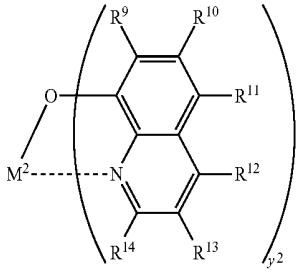
(57) **ABSTRACT**

Disclosed are a metal complex compound represented by the following Chemical Formula 1 or 3, and an organic light emitting diode device including the same.

[Chemical Formula 1]



[Chemical Formula 3]



In Chemical Formulae 1 and 3, M^1, M^2, R_1 to R_{14}, y_1 and y_2 are as defined in the detailed description.

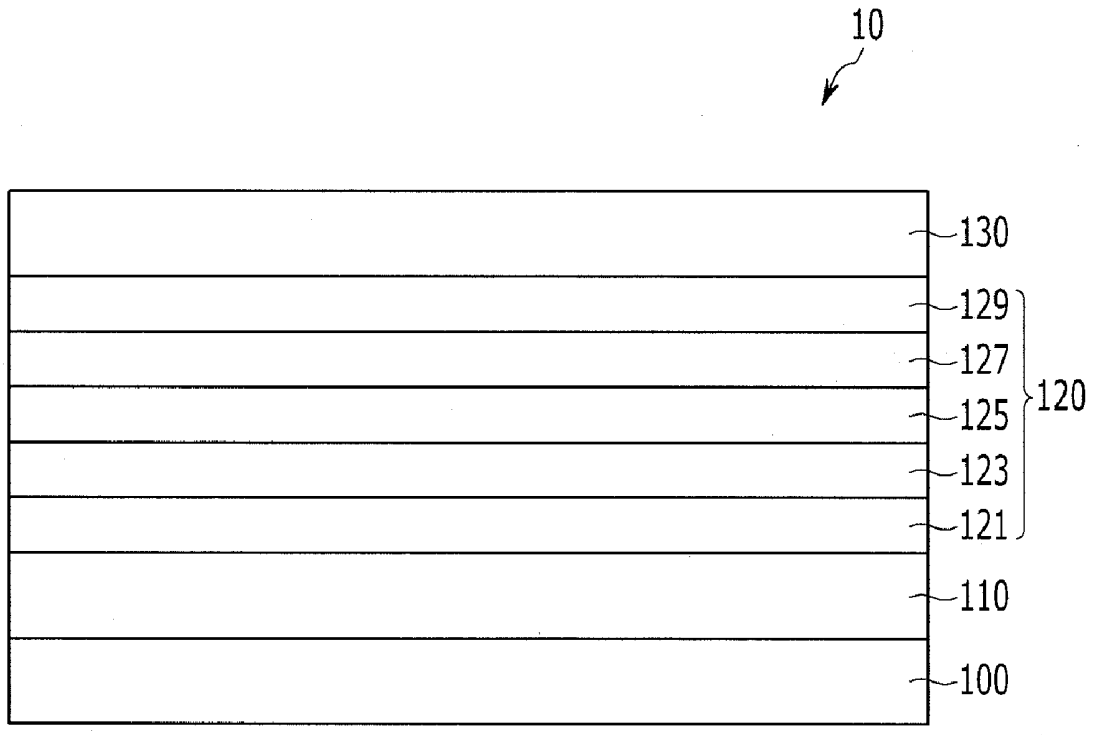
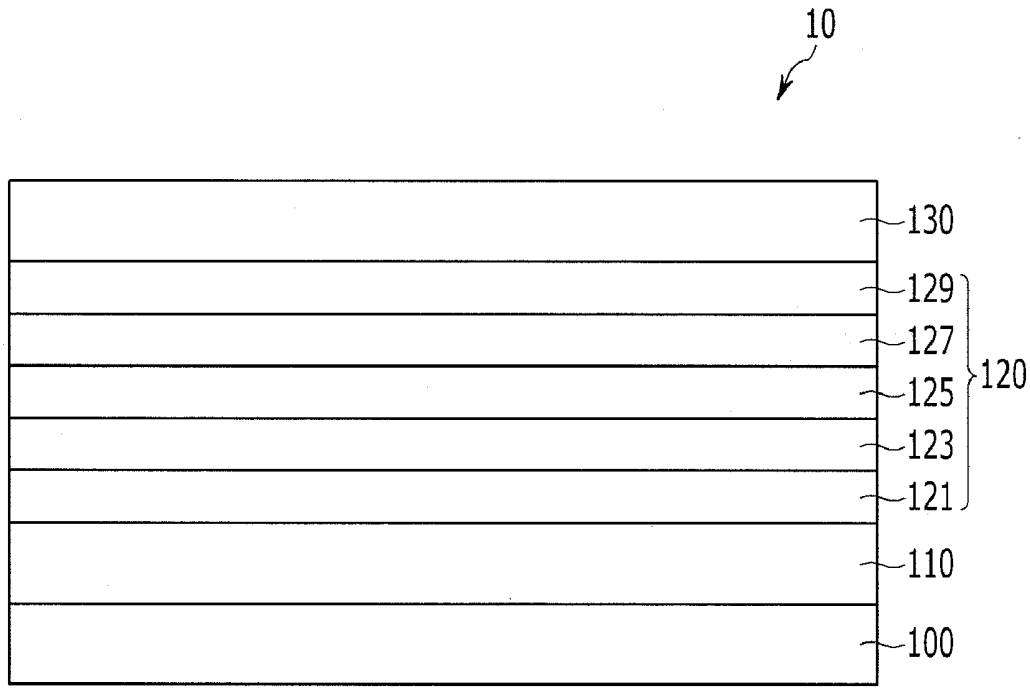


FIG. 1



METAL COMPLEX COMPOUND AND ORGANIC LIGHT EMITTING DIODE DEVICE INCLUDING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to and the benefit of Korean Patent Application No. 10-2010-0093351 filed in the Korean Intellectual Property Office on Sep. 27, 2010, the entire contents of which are incorporated herein by reference.

BACKGROUND

[0002] 1. Field

[0003] This disclosure relates to a metal complex compound and an organic light emitting diode device including the same.

[0004] 2. Description of the Related Technology

[0005] Organic light emitting diode (OLED) devices have been drawing attention as a display device and a luminous device. An organic light emitting diode device includes two electrodes and an emission layer interposed therebetween, and emits light when electrons injected from one electrode are combined with holes injected from another electrode in an emission layer to generate excitons that release energy. Since the organic light emitting diode device emits light in itself without a particular light source, it has excellent response speed, viewing angle, and contrast ratio as well as low power consumption. An organic light emitting diode device has been required to have increased luminous efficiency but decreased driving voltage.

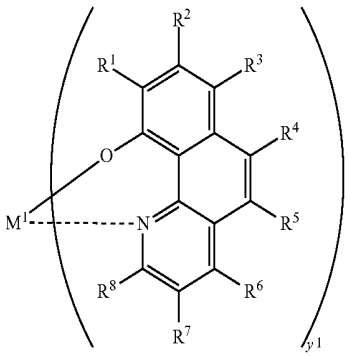
SUMMARY

[0006] One aspect of this disclosure provides a metal complex compound being capable of increasing luminous efficiency and reducing a driving voltage.

[0007] Another aspect of this disclosure provides an organic light emitting diode device including the metal complex compound.

[0008] According to one aspect of this disclosure, provided is a metal complex compound represented by the following Chemical Formula 1.

[Chemical Formula 1]



[0009] In Chemical Formula 1,

[0010] M^1 is a Group 2 metal ion or Group 3 metal ion,

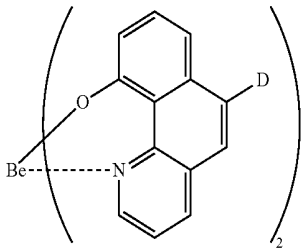
[0011] R^1 to R^8 are the same or different, and are hydrogen, deuterium, a halogen, a hydroxyl group, a substituted or unsubstituted C_1 to C_{20} alkyl group, a substituted or unsubstituted C_2 to C_{20} alkenyl group, a substituted or unsubstituted C_2 to C_{20} alkynyl group, a substituted or unsubstituted C_1 to C_{20} alkoxy group, a substituted or unsubstituted C_3 to C_{30} cycloalkyl group, a substituted or unsubstituted C_3 to C_{30} cycloalkenyl group, a substituted or unsubstituted C_3 to C_{30} cycloalkynyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkyl group, a substituted or unsubstituted C2 to C30 heterocycloalkenyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkynyl group, a substituted or unsubstituted C_6 to C_{30} an aryl group, a substituted or unsubstituted C_6 to C_{30} aryloxy group, a substituted or unsubstituted C_2 to C_{30} heteroaryl group, an amine group, an ester group, a carboxyl group, a nitro group, or a cyano group, provided that at least one of R^1 to R^8 is deuterium, and

[0012] y^1 is 2 or 3.

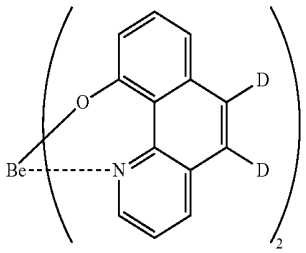
[0013] In Chemical Formula 1, M^1 may be Be, Zn, Mg, Al, Ga, In, or a combination thereof.

[0014] The metal complex compound may be represented by one of the following Chemical Formulae 2-1 to 2-10.

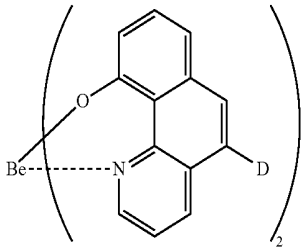
[Chemical Formula 2-1]



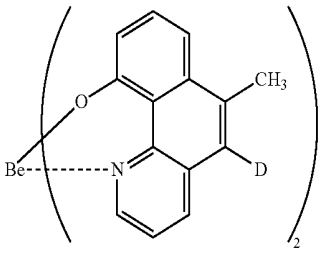
[Chemical Formula 2-2]



[Chemical Formula 2-3]



[Chemical Formula 2-4]



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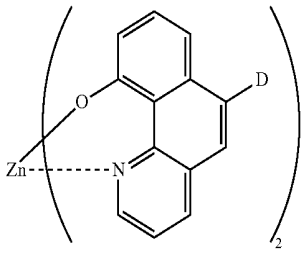
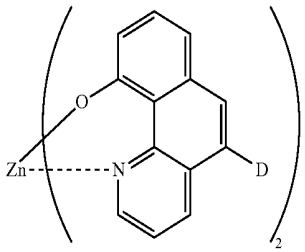
[Chemical Formula 2-5]

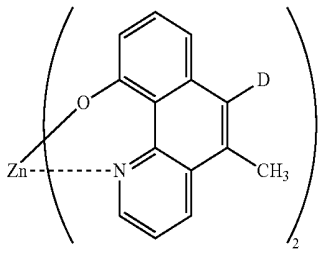


[Chemical Formula 2-6]

[Chemical Formula 2-7]

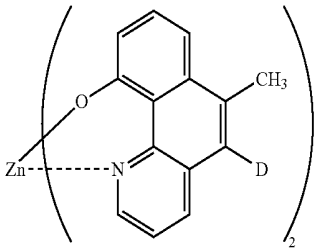


[Chemical Formula 2-8]



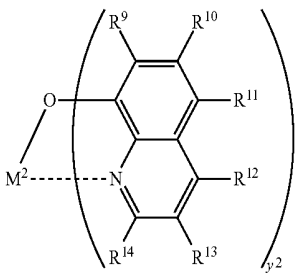
[Chemical Formula 2-9]

[Chemical Formula 2-10]



[0015] According to another aspect of this disclosure, a metal complex compound represented by the following Chemical Formula 3 is provided.

[Chemical Formula 3]



[0016] In Chemical Formula 3,

[0017] M^2 is a Group 2 metal ion or Group 3 metal ion,

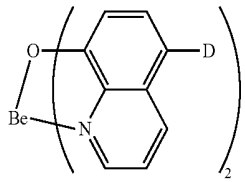
[0018] R^9 to R^{14} are the same or different, and are hydrogen, deuterium, a halogen, a hydroxyl group, a substituted or unsubstituted C_1 to C_{20} alkyl group, a substituted or unsubstituted C_2 to C_{20} alkenyl group, a substituted or unsubstituted C_2 to C_{20} alkynyl group, a substituted or unsubstituted C_1 to C_{20} alkoxy group, a substituted or unsubstituted C_3 to C_{30} cycloalkyl group, a substituted or unsubstituted C_3 to C_{30} cycloalkenyl group, a substituted or unsubstituted C_3 to C_{30} cycloalkynyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkenyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkynyl group, a substituted or unsubstituted C_6 to C_{30} an aryl group, a substituted or unsubstituted C_6 to C_{30} aryloxy group, a substituted or unsubstituted C_2 to C_{30} heteroaryl group, an amine group, an ester group, a carboxyl group, a nitro group, or a cyano group, provided that at least one of R^9 to R^{14} is deuterium, and

[0019] y^2 is 2 or 3.

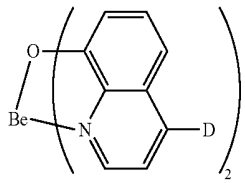
[0020] In Chemical Formula 3, M^2 may be Be, Zn, Mg, Al, Ga, In, or a combination thereof.

[0021] The metal complex compound may be represented by one of the following Chemical Formulae 4-1 to 4-10.

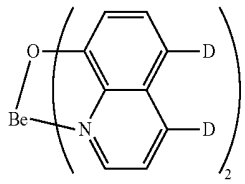
[Chemical Formula 4-1]



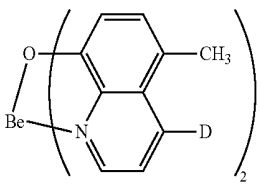
[Chemical Formula 4-2]



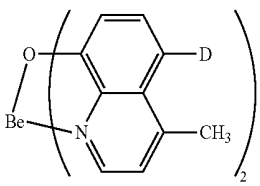
[Chemical Formula 4-3]



[Chemical Formula 4-4]



[Chemical Formula 4-5]



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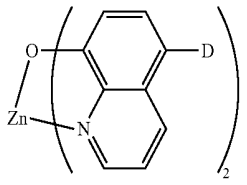
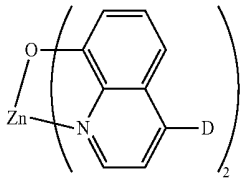
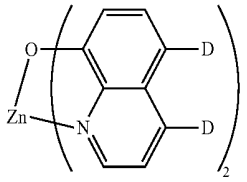
[Chemical Formula 4-6]



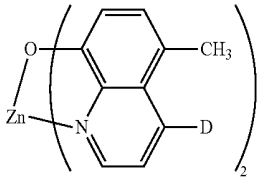
[Chemical Formula 4-7]



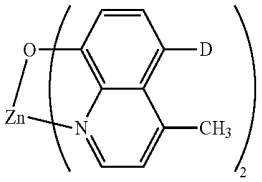
[Chemical Formula 4-8]



[Chemical Formula 4-9]



[Chemical Formula 4-10]



[0022] According to yet another aspect of this disclosure, an organic light emitting device is provided, which includes a first electrode, a second electrode facing the first electrode, and an organic layer interposed between the first electrode and the second electrode, wherein the organic layer includes a metal complex compound represented by the above Chemical Formula 1.

[0023] According to still another aspect of this disclosure, an organic light emitting device is provided, which includes a first electrode, a second electrode facing the first electrode, and an organic layer interposed between the first electrode and the second electrode, wherein the organic layer includes a metal complex compound represented by the above Chemical Formula 3.

[0024] The organic layer may include at least one among a hole injection layer, a hole transport layer, an emission layer, an electron transport layer, and an electron injection layer that are sequentially positioned on the first electrode. The metal complex compound may be included in the emission layer or the electron transport layer.

[0025] Further aspects of this disclosure are described in more detail.

[0026] Luminous efficiency of an organic light emitting device is improved, while reducing its driving voltage.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] FIG. **1** is the schematic cross-sectional view of an organic light emitting diode device according to one embodiment.

DETAILED DESCRIPTION

[0028] The present disclosure will be described more fully hereinafter with reference to the accompanying drawings, in which example embodiments of this disclosure are shown. This disclosure may, however, be embodied in many different forms and is not construed as limited to the example embodiments set forth herein.

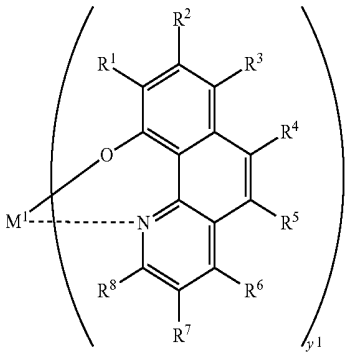
[0029] In the drawings, the thickness of layers, films, panels, regions, etc., may be exaggerated for clarity. Like reference numerals designate like elements throughout the specification. It will be understood that when an element such as a layer, film, region, or substrate is referred to as being "on" another element, it can be directly on the other element or intervening elements may also be present. In contrast, when an element is referred to as being "directly on" another element, there are no intervening elements present.

[0030] As used herein, when a definition is not otherwise provided, the term "substituted" refers to one substituted with a halogen, a hydroxy group, a C_1 to C_{20} alkyl group, a C_2 to C_{20} alkenyl group, a C_2 to C_{20} alkynyl group, a C_1 to C_{20} alkoxy group, a C_3 to C_{30} cycloalkyl group, a C_3 to C_{30} cycloalkenyl group, a C_3 to C_{30} cycloalkynyl group, a C_2 to C_{30} heterocycloalkyl group, a C_2 to C_{30} heterocycloalkenyl group, a C_2 to C_{30} heterocycloalkynyl group, a C_6 to C_{30} aryl group, a C_6 to C_{30} aryloxy group, a C_2 to C_{30} heteroaryl group, an amine group (—NR'R", wherein R' and R" are the same or different, and are hydrogen, a C_1 to C_{20} alkyl group or a C_6 to C_{30} aryl group), an ester group (—COOR'", wherein R'" is hydrogen, a C_1 to C_{20} alkyl group or a C_6 to C_{30} aryl group), a carboxyl group (—COOH), a nitro group (—NO_2) or a cyano group (—CN).

[0031] As used herein, when a definition is not otherwise provided, the terms "heterocycloalkyl group", "heterocycloalkenyl group", "heterocycloalkynyl group" and "heteroaryl group" respectively refer to a cycloalkyl group, a cycloalkenyl group, a cycloalkynyl group, and an aryl group including at least one of N, O, S, and P in their rings.

[0032] The metal complex compound according to one embodiment may be represented by the following Chemical Formula 1.

[Chemical Formula 1]



[0033] In Chemical Formula 1,

[0034] M^1 is a Group 2 metal ion or Group 3 metal ion,

[0035] R^1 to R^8 are the same or different, and are hydrogen, deuterium (D), a halogen, a hydroxyl group, a substituted or unsubstituted C_1 to C_{20} alkyl group, a substituted or unsubstituted C_2 to C_{20} alkenyl group, a substituted or unsubstituted C_2 to C_{20} alkynyl group, a substituted or unsubstituted C_1 to C_{20} alkoxy group, a substituted or unsubstituted C_3 to C_{30} cycloalkyl group, a substituted or unsubstituted C_3 to C_{30} cycloalkenyl group, a substituted or unsubstituted C_3 to C_{30} cycloalkynyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkenyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkynyl group, a substituted or unsubstituted C_6 to C_{30} an aryl group, a substituted or unsubstituted C_6 to C_{30} aryloxy group, a substituted or unsubstituted C_2 to C_{30} heteroaryl group, an amine group, an ester group, a carboxyl group, a nitro group, or a cyano group, provided that at least one of R^1 to R^8 is deuterium, and

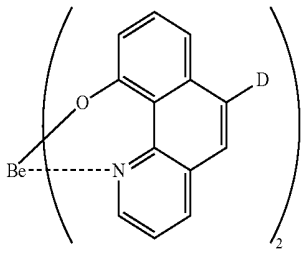
[0036] y^1 is 2 or 3.

[0037] R^1 to R^8 are ligands of the metal a complex compound. When the ligands comprise at least one deuterium, it can bind with carbon more strongly than light isotope hydrogen, and therefore the metal complex compound having deuterium show a decreased substituted reaction activity. From this result, chemical stability of the metal complex compound is improved and thus the metal complex compound may be usefully applicable as an organic material of an organic light emitting diode device.

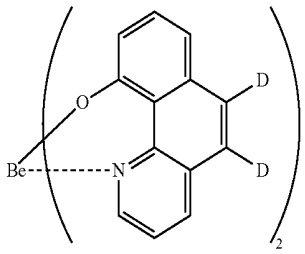
[0038] In Chemical Formula 1, M^1 may be Be, Zn, Mg, Al, Ga, In, or a combination thereof.

[0039] Examples of the metal complex compound may include one of the following Chemical Formulae 2-1 to 2-10, but are not limited thereto.

[Chemical Formula 2-1]



[Chemical Formula 2-2]



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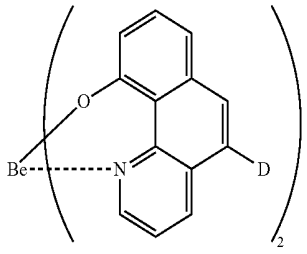
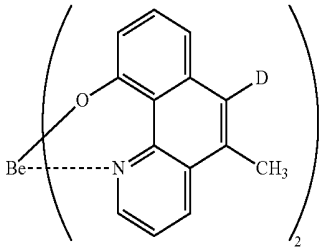
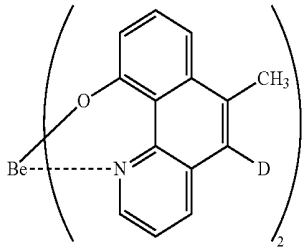
[Chemical Formula 2-3]



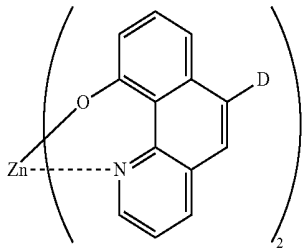
[Chemical Formula 2-4]



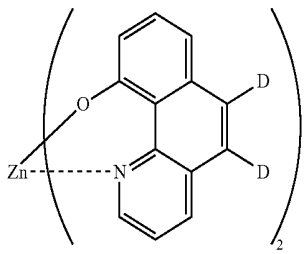
[Chemical Formula 2-5]



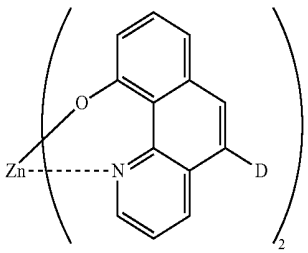
[Chemical Formula 2-6]



[Chemical Formula 2-7]



[Chemical Formula 2-8]



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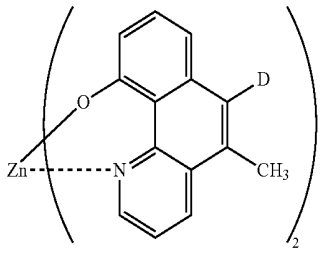
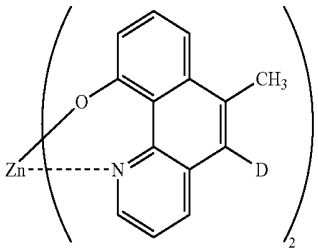
[Chemical Formula 2-9]

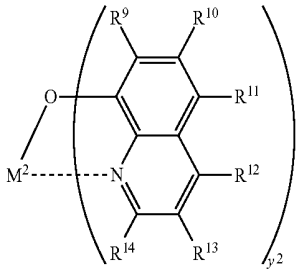


[Chemical Formula 2-10]



[0040] The metal complex compound according to another embodiment is represented by the following Chemical Formula 3.

[Chemical Formula 3]



[0041] In Chemical Formula 3,

[0042] M^2 is a Group 2 metal ion or Group 3 metal ion,

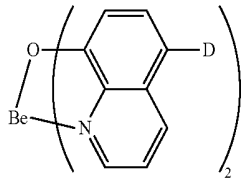
[0043] R^9 to R^{14} are the same or different, and are hydrogen, deuterium(D), a halogen, a hydroxyl group, a substituted or unsubstituted C_1 to C_{20} alkyl group, a substituted or unsubstituted C_2 to C_{20} alkenyl group, a substituted or unsubstituted C_2 to C_{20} alkynyl group, a substituted or unsubstituted C_1 to C_{20} alkoxy group, a substituted or unsubstituted C_3 to C_{30} cycloalkyl group, a substituted or unsubstituted C_3 to C_{30} cycloalkenyl group, a substituted or unsubstituted C_3 to C_{30} cycloalkynyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkenyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkynyl group, a substituted or unsubstituted C_6 to C_{30} an aryl group, a substituted or unsubstituted C_6 to C_{30} aryloxy group, a substituted or unsubstituted C_2 to C_{30} heteroaryl group, an amine group, an ester group, a carboxyl group, a nitro group, or a cyano group, provided that at least one of R^1 to R^8 is deuterium, and

[0044] y^1 is 2 or 3.

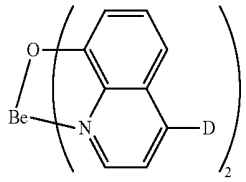
[0045] In Chemical Formula 3, M^2 may be Be, Zn, Mg, Al, Ga, In or a combination thereof.

[0046] The metal complex compound may be represented by one of the following Chemical Formulae 4-1 to 4-10, but are not limited thereto.

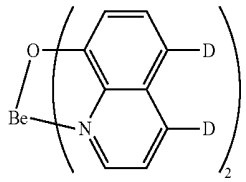
[Chemical Formula 4-1]



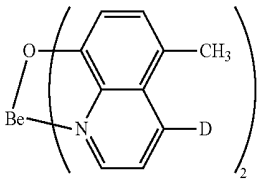
[Chemical Formula 4-2]



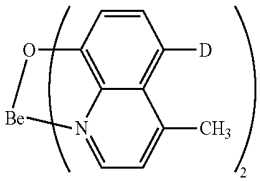
[Chemical Formula 4-3]



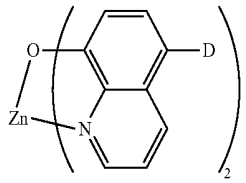
[Chemical Formula 4-4]



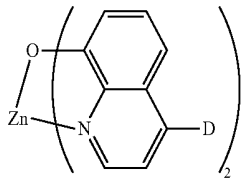
[Chemical Formula 4-5]



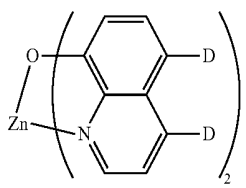
[Chemical Formula 4-6]



[Chemical Formula 4-7]

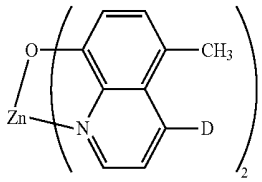


[Chemical Formula 4-8]

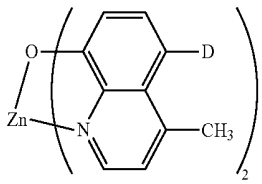


-continued

[Chemical Formula 4-9]



[Chemical Formula 4-10]



[0047] Referring to FIG. **1**, an organic light emitting diode device according to one embodiment is described.

[0048] FIG. **1** is a schematic cross-sectional view showing an organic light emitting diode device according to one embodiment.

[0049] Referring to FIG. **1**, the organic light emitting diode device includes a substrate **100**, a first electrode **110** disposed on the substrate, an organic layer **120** disposed on the first electrode **110**, and a second electrode **130** disposed on the organic layer **120**.

[0050] The substrate **100** may include a substrate commonly used for an organic light emitting diode device, and in particular, a glass substrate, a plastic substrate, and the like may be used.

[0051] The first electrode **110** may be an anode, and may comprise a transparent conductor or an opaque conductor. The transparent conductor may include, for example, ITO (indium tin oxide), IZO (indium zinc oxide), TO (tin oxide), ZnO (zinc oxide), or a combination thereof. The opaque conductor may include silver (Ag), magnesium (Mg), aluminum (Al), platinum (Pt), palladium (Pd), gold (Au), nickel (Ni), neodymium (Nd), iridium (Ir), chromium (Cr), or a combination thereof. When the first electrode **110** is made of a transparent conductor, it may be a bottom emission type emitting light from the bottom.

[0052] The organic layer **120** may include at least one layer among a hole injection layer **121**, a hole transport layer **123**, an emission layer **125**, an electron transport layer **127**, and an electron injection layer **129** that are sequentially positioned on the first electrode.

[0053] The organic layer **120** may include a metal complex compound used for forming at least one layer among the hole injection layer **121**, the hole transport layer **123**, the emission layer **125**, the electron transport layer **127**, and the electron injection layer **129**. In particular, the metal complex compound may be used to form the emission layer **125** or the electron transport layer **127**.

[0054] The second electrode **130** may be a cathode and may comprise a transparent conductor or an opaque conductor. The transparent conductor may include ITO (indium tin oxide), IZO (indium zinc oxide), TO (tin oxide), ZnO (zinc oxide), or a combination thereof The opaque conductor may include silver (Ag), magnesium (Mg), aluminum (Al), platinum (Pt), palladium (Pd), gold (Au), nickel (Ni), neodymium (Nd), iridium (Ir), chromium (Cr), or a combination thereof When the second electrode **130** is made of a transparent conductor, it may be a top emission type emitting light from the organic layer **120** to the top.

[0055] The organic layer may comprise the metal complex compound, and may increase luminous efficiency of an organic light emitting diode device and decrease its driving voltage.

[0056] The following examples illustrate this disclosure in more detail. These examples, however, are not in any sense to be interpreted as limiting the scope of this disclosure.

Preparation of Metal Complex Compound

EXAMPLE 1-1

[0057] 2.0 g (10.3 mmol) of 6-deuterio-10-hydroxybenzo[h]quinoline was put into a reaction vessel, and then 60 ml of a methanol and ethanol mixed solvent (1:1 volume ratio) was put thereto. Dissolution was performed while heating to provide a first solution. 0.91 g (5.15 mmol) of $BeSO_4.4H_2O$ was dissolved in 100 ml of pure water to provide a second solution. The first solution was added to the second solution while agitating, pH of the resultant solution was adjusted to be from neutral to weak alkaline, resulting in depositing bluish green precipitate having strong fluorescence. The precipitate was filtered, and dried by heating at 80° C. for 2 hours. The dried precipitate was purified using a sublimation purifying apparatus (H. J. Wagner, R. O. Loutfy and C. K. Hsiao, J. Mater. Sci., 17, 2781 1982), to prepare bis(6-deuterio-10-hydroxybenzo[h]quinolinato)beryllium.

EXAMPLE 1-2

[0058] 1.46 g (10.0mmol) of 5-deuterio-8-hydroxyquinoline was put into a reaction vessel, and then 60 ml of a methanol and ethanol mixed solvent (1:1 volume ratio) was put thereto. Dissolution was performed while heating to provide a first solution. 0.89 g (5.0 mmol) of $BeSO_4.4H_2O$ was dissolved in 100 ml of pure water to provide a second solution. The first solution was added to the second solution while agitating, pH of the resultant solution was adjusted to be from neutral to weak alkaline, resulting in depositing a green precipitate having strong fluorescence. The precipitate was filtered, and dried by heating at 80° C. for 2 hours. The dried precipitate was purified using a sublimation purifying apparatus to prepare bis(5-deuterio-8-hydroxyquinolinato)beryllium.

EXAMPLE 1-3

[0059] 2.10 g (10.0 mmol) of 5 -methyl-6-deuterio-10-hydroxybenzo[h]quinoline was put into a reaction vessel, and then 60 ml of a methanol and ethanol mixed solvent (1:1 volume ratio) was put thereto. Dissolution was performed while heating to provide a first solution. 0.89 g (5.0 mmol) of $BeSO_4.4H_2O$ was dissolved in 100 ml of pure water to provide a second solution. The first solution was added to the second solution while agitating, pH of the resultant solution was adjusted to be from neutral to weak alkaline, resulting in depositing a green precipitate having strong fluorescence. The precipitate was filtered, and dried by heating at 80° C. for 2 hours. The dried precipitate was purified using a sublima-

tion purifying apparatus to prepare bis(5-methyl-6-deuterio-10-hydroxybenzo[h]quinolinato)beryllium.

COMPARATIVE EXAMPLE 1-1

[0060] 1.95 g (10.0 mmol) of 10-hydroxybenzo[h]quinoline was put into a reaction vessel, and then 60 ml of a methanol and ethanol mixed solvent (1:1 volume ratio) was put thereto. Dissolution was performed while heating to provide a first solution. $BeSO_4.4H_2O$ 0.89 g (5.0 mmol) was dissolved in 100 ml of pure water to provide a second solution. The first solution was added to the second solution while agitating, pH of the resultant solution was adjusted to be from neutral to weak alkaline, resulting in depositing a green precipitate having strong fluorescence. The precipitate was filtered, and dried by heating at 80° C. for 2 hours. The dried precipitate was purified using a sublimation purifying apparatus to prepare bis(10-hydroxybenzo[h]quinolinato)beryllium.

COMPARATIVE EXAMPLE 1-2

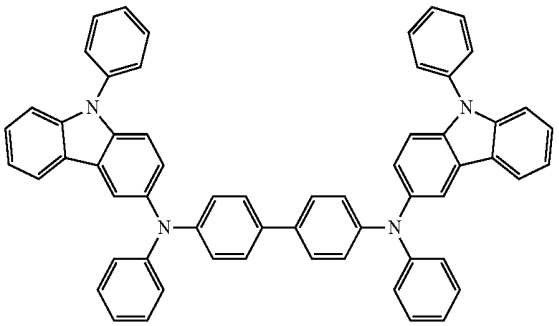
[0061] 1.45 g (10.0 mmol) of 8-hydroxyquinoline was put into a reaction vessel, and then 60 ml of a methanol and ethanol mixed solvent (1:1 volume ratio) was put thereto. Dissolution was performed while heating to provide a first solution. 0.89 g (5.0 mmol) of $BeSO_4.4H_2O$ was dissolved in 100 ml of pure water to provide a second solution. The first solution was added to the second solution while agitating, pH of the resultant solution was adjusted to be from neutral to weak alkaline, resulting in depositing a green precipitate having strong fluorescence. The precipitate was filtered, and dried by heating at 80° C. for 2 hours. The dried precipitate was purified using a sublimation purifying apparatus to prepare bis(8-hydroxyquinolinato)beryllium.

Fabrication of an Organic Light Emitting Diode Device

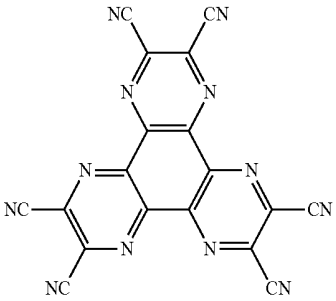
EXAMPLE 2-1

[0062] A lower electrode was prepared by laminating Ag/ITO on a glass substrate and patterning it, and then disposing a hole injection layer to be 70 nm thick on the lower electrode by depositing a compound represented by the following Chemical Formula 5-1, an interlayer to be 5 nm thick thereon by depositing another compound represented by following Chemical Formula 5-2, and a hole transport layer to be 155 nm thick thereon by depositing a compound represented by the following Chemical Formula 5-3. Next, a green phosphorescent red emission layer was disposed to be 40 nm thick by depositing a compound represented by the following Chemical Formula 5-4 as a dopant and bis(6-deuterio-10-hydroxybenzo[h]quinolinato)beryllium prepared in Example 1-1 as a host. Then, an electron transport layer was disposed to be 30 nm thick thereon by depositing a compound represented by the following Chemical Formula 5-5, and an electron injection layer was disposed to be 0.5 nm thick thereon by depositing a compound represented by the following Chemical Formula 5-6. Next, an upper electrode was disposed to be 200 nm thick thereon by depositing MgAg, fabricating an organic light emitting diode device. Herein, the phosphorescent red emission layer included the dopant in an amount of 10 wt % based on the total amount of the emission layer. The electron injection layer was included in an amount of 50 wt % based on the total amount of the electron transport layer and the electron injection layer.

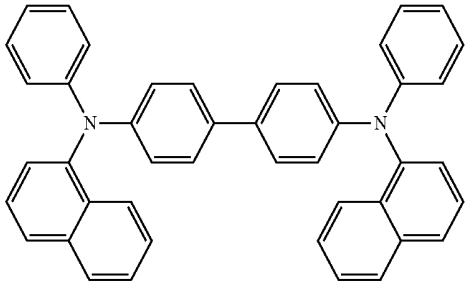
[Chemical Formula 5-1]



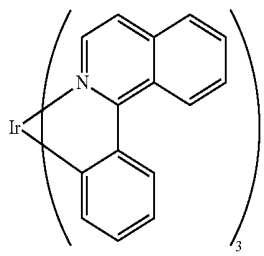
[Chemical Formula 5-2]



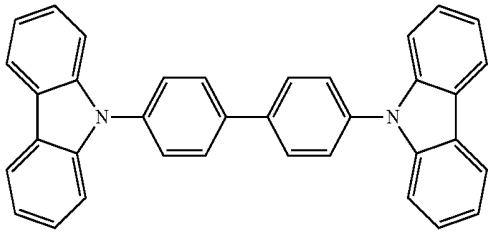
[Chemical Formula 5-3]



[Chemical Formula 5-4]



[Chemical Formula 5-5]



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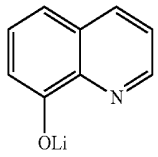
[Chemical Formula 5-6]



EXAMPLE 2-2

[0063] An organic light emitting diode device was fabricated according to the same method as Example 2-1, except for using the bis(5-deuterio-8-hydroxyquinolinato)beryllium prepared according to Example 1-2 as a host.

EXAMPLE 2-3

[0064] An organic light emitting diode device was fabricated according to the same method as Example 2-1, except for using the bis(5-methyl-6-deuterio-10-hydroxybenzo[h] quinolinato)beryllium prepared according to Example 1-3 as a host.

COMPARATIVE EXAMPLE 2-1

[0065] An organic light emitting diode device was fabricated according to the same method as Example 2-1, except for using the bis(10-hydroxybenzo[h]quinolinato)beryllium prepared according to Comparative Example 1-1 as a host.

COMPARATIVE EXAMPLE 2-2

[0066] An organic light emitting diode device was fabricated according to the same method as Example 2-1, except for using the bis(8-hydroxyquinolinato)beryllium prepared according to Comparative Example 1-2 as a host.

Evaluation 1

[0067] The organic light emitting diode devices according to Examples 2-1 to 2-3 and Comparative Examples 2-1 and 2-2 were evaluated regarding luminous efficiency and color characteristic. The results are provided in the following Table 1.

TABLE 1

		Efficiency	Color coordinates (CIE)	
	Voltage (V)	(cd/A)	x	y
Example 2-1	4.2	31	0.660	0.340
Example 2-2	5.1	27	0.661	0.340
Example 2-3	4.2	30	0.661	0.339
Comparative Example 2-1	4.3	26	0.661	0.338
Comparative Example 2-2	5.3	24	0.660	0.339

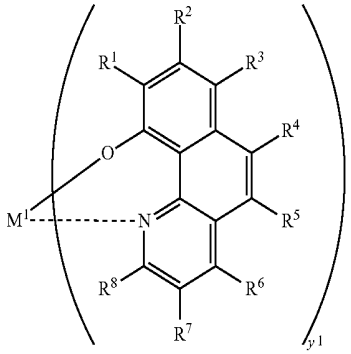
[0068] Referring to Table 1, the organic light emitting diode devices according to Examples 2-1 to 2-3 had higher efficiency and similar color coordinates to those according to Comparative Examples 2-1 and 2-2.

[0069] While this disclosure has been described in connection with what is presently considered to be practical example embodiments, it is to be understood that the embodiments are not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

What is claimed is:

1. A metal complex compound represented by the following Chemical Formula

[Chemical Formula 1]



wherein, in Chemical Formula 1,

M^1 is a Group 2 metal ion or Group 3 metal ion,

R^1 to R^8 are the same or different, and are independently selected from the group consisting of hydrogen, deuterium, a halogen, a hydroxyl group, a substituted or unsubstituted C_1 to C_{20} alkyl group, a substituted or unsubstituted C_2 to C_{20} alkenyl group, a substituted or unsubstituted C_2 to C_{20} alkynyl group, a substituted or unsubstituted C_1 to C_{20} alkoxy group, a substituted or unsubstituted C_3 to C_{30} cycloalkyl group, a substituted or unsubstituted C_3 to C_{30} cycloalkenyl group, a substituted or unsubstituted C_3 to C_{30} cycloalkynyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkenyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkynyl group, a substituted or unsubstituted C_6 to C_{30} an aryl group, a substituted or unsubstituted C_6 to C_{30} aryloxy group, a substituted or unsubstituted C_2 to C_{30} heteroaryl group, an amine group, an ester group, a carboxyl group, a nitro group, and a cyano group,

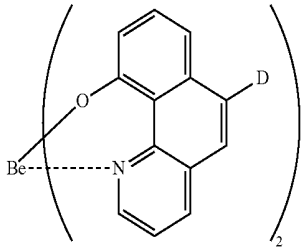
wherein at least one of R^1 to R^8 is deuterium, and

y^1 is 2 or 3.

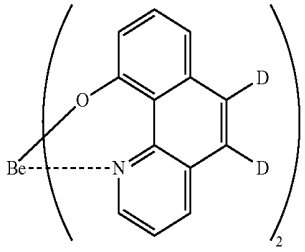
2. The metal complex compound of claim **1**, wherein in Chemical Formula 1, M^1 is Be, Zn, Mg, Al, Ga, In, or a combination thereof

3. The metal complex compound of claim **1**, wherein the metal complex compound is represented by one of the following Chemical Formulae 2-1 to 2-10:

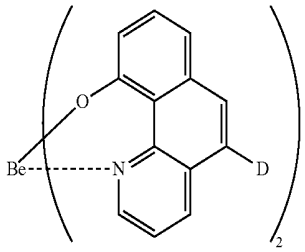
[Chemical Formula 2-1]



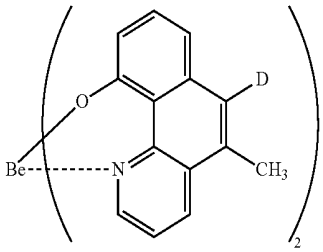
[Chemical Formula 2-2]



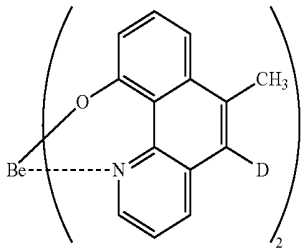
[Chemical Formula 2-3]



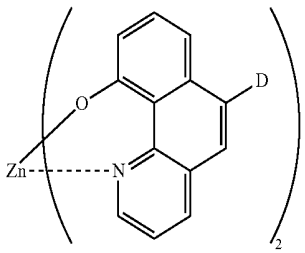
[Chemical Formula 2-4]



[Chemical Formula 2-5]



[Chemical Formula 2-6]



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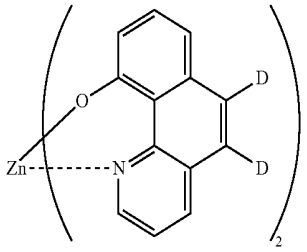
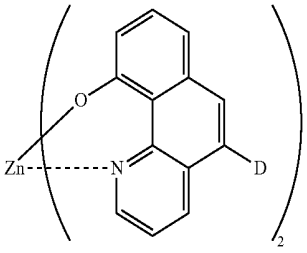
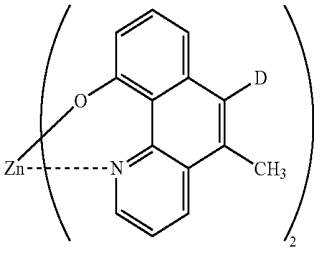
[Chemical Formula 2-7]



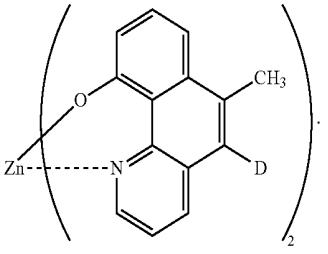
[Chemical Formula 2-8]



[Chemical Formula 2-9]

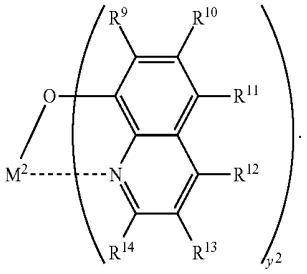


[Chemical Formula 2-10]



4. A metal complex compound represented by the following Chemical Formula 3:

[Chemical Formula 3]



wherein, in Chemical Formula 3,

M^2 is a Group 2 metal ion or Group 3 metal ion,

R^9 to R^{14} are the same or different, and are independently selected from the group consisting of hydrogen, deuterium, a halogen, a hydroxyl group, a substituted or unsubstituted C_1 to C_{20} alkyl group, a substituted or

unsubstituted C_2 to C_{20} alkenyl group, a substituted or unsubstituted C_2 to C_{20} alkynyl group, a substituted or unsubstituted C_1 to C_{20} alkoxy group, a substituted or unsubstituted C_3 to C_{30} cycloalkyl group, a substituted or unsubstituted C_3 to C_{30} cycloalkenyl group, a substituted or unsubstituted C_3 to C_{30} cycloalkynyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkenyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkynyl group, a substituted or unsubstituted C_6 to C_{30} an aryl group, a substituted or unsubstituted C_6 to C_{30} aryloxy group, a substituted or unsubstituted C_2 to C_{30} heteroaryl group, an amine group, an ester group, a carboxyl group, a nitro group, and a cyano group,

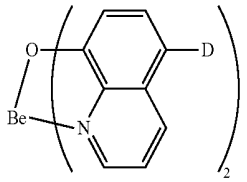
wherein at least one of R^9 to R^{14} is deuterium, and

y^2 is 2 or 3.

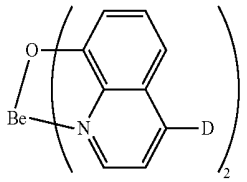
5. The metal complex compound of claim **4**, wherein in Chemical Formula 3, M^2 is Be, Zn, Mg, Al, Ga, In, or a combination thereof.

6. The metal complex compound of claim **4**, wherein the metal complex compound is represented by one of the following Chemical Formulae 4-1 to 4-10:

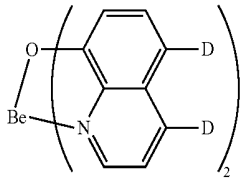
[Chemical Formula 4-1]



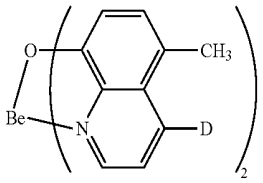
[Chemical Formula 4-2]



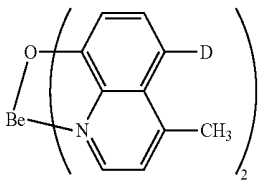
[Chemical Formula 4-3]



[Chemical Formula 4-4]



[Chemical Formula 4-5]



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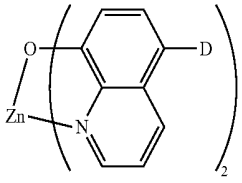
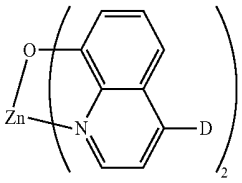
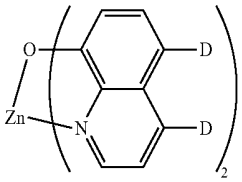
[Chemical Formula 4-6]



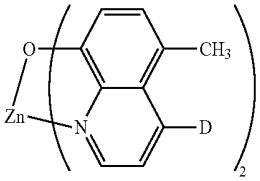
[Chemical Formula 4-7]



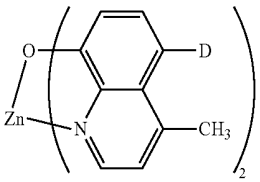
[Chemical Formula 4-8]



[Chemical Formula 4-9]



[Chemical Formula 4-10]



7. An organic light emitting device comprising

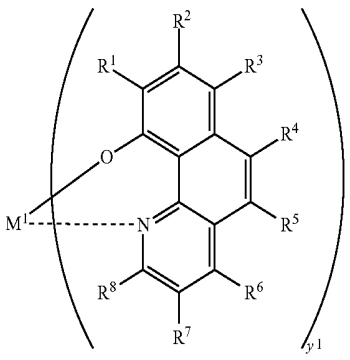
a first electrode,

a second electrode facing the first electrode, and

an organic layer interposed between the first electrode and the second electrode,

wherein the organic layer includes a metal complex compound represented by the following Chemical Fonnula 1:

[Chemical Formula 1]



wherein, in Chemical Formula 1,

M^1 is a Group 2 metal ion or Group 3 metal ion,

R^1 to R^8 are the same or different, and are independently selected from the group consisting of hydrogen, deuterium, a halogen, a hydroxyl group, a substituted or unsubstituted. C_1 to C_{20} alkyl group, a substituted or unsubstituted C_2 to C_{20} alkenyl group, a substituted or unsubstituted C_2 to C_{20} alkynyl group, a substituted or unsubstituted C_1 to C_{20} alkoxy group, a substituted or unsubstituted C_3 to C_{30} cycloalkyl group, a substituted or unsubstituted C_3 to C_{30} cycloalkenyl group, a substituted or unsubstituted C_3 to C_{30} cycloalkynyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkenyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkynyl group, a substituted or unsubstituted C_6 to C_{30} an aryl group, a substituted or unsubstituted C_6 to C_{30} aryloxy group, a substituted or unsubstituted C_2 to C_{30} heteroaryl group, an amine group, an ester group, a carboxyl group, a nitro group, and a cyano group,

wherein at least one of R^1 to R^8 is deuterium, and

y^1 is 2 or 3.

8. The organic light emitting diode device of claim **7**, wherein the organic layer comprises at least one among a hole injection layer (HIL), a hole transport layer (HTL), an emission layer, an electron transport layer (ETL), and an electron injection layer (EIL) that are sequentially positioned on the first electrode.

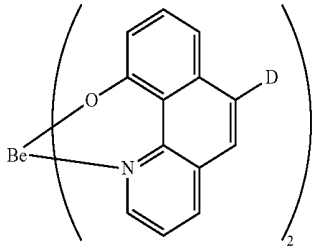
9. The organic light emitting diode device of claim **8**, wherein the metal complex compound is included in the emission layer.

10. The organic light emitting diode device of claim **8**, wherein the metal complex compound is included in the electron transport layer (ETL).

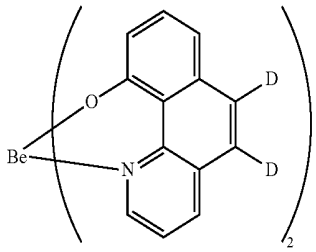
11. The organic light emitting diode device of claim **7**, wherein in Chemical Formula 1, M^1 is Be, Zn, Mg, Al, Ga, In, or a combination thereof.

12. The organic light emitting diode device of claim **7**, wherein the metal complex compound is represented by one of the following Chemical Formulae 2-1 to 2-10:

[Chemical Formula 2-1]



[Chemical Formula 2-2]



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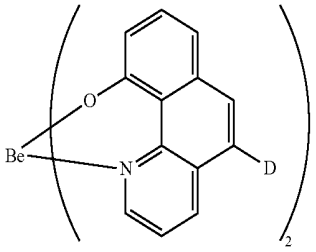
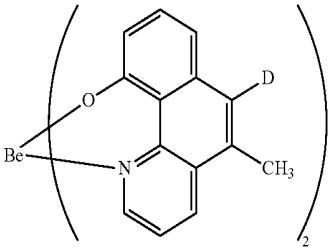
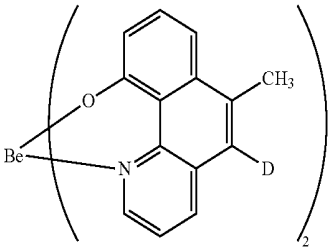
[Chemical Formula 2-3]



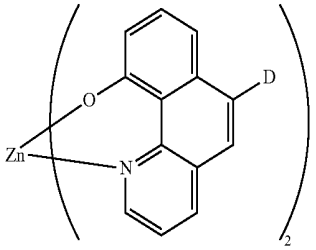
[Chemical Formula 2-4]



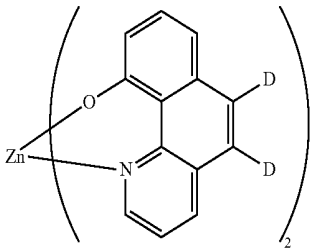
[Chemical Formula 2-5]



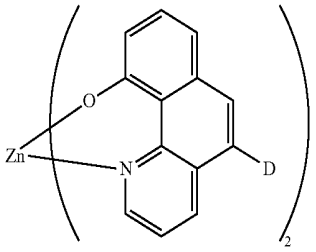
[Chemical Formula 2-6]



[Chemical Formula 2-7]



[Chemical Formula 2-8]



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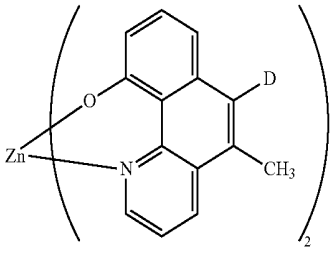
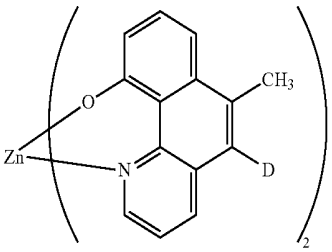
[Chemical Formula 2-9]



[Chemical Formula 2-10]



13. An organic light emitting device comprising

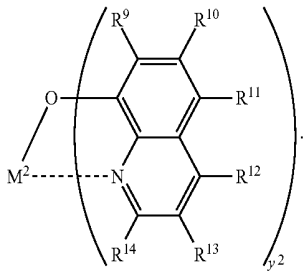
a first electrode,

a second electrode facing the first electrode, and

an organic layer interposed between the first electrode and the second electrode,

wherein the organic layer includes a metal complex compound represented by the following Chemical Formula 3:

[Chemical Formula 3]



wherein, in Chemical Formula 3,

M^2 is a Group 2 metal ion or Group 3 metal ion, R^9 to R^{14} are the same or different, and are independently selected from the group consisting of hydrogen, deuterium, a halogen, a hydroxyl group, a substituted or unsubstituted C_1 to C_{20} alkyl group, a substituted or unsubstituted C_2 to C_{20} alkenyl group, a substituted or unsubstituted C_2 to C_{20} alkynyl group, a substituted or unsubstituted C_1 to C_{20} alkoxy group, a substituted or unsubstituted C_3 to C_{30} cycloalkyl group, a substituted or unsubstituted C_3 to C_{30} cycloalkenyl group, a substituted or unsubstituted C_3 to C_{30} cycloalkynyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkenyl group, a substituted or unsubstituted C_2 to C_{30} heterocycloalkynyl group, a substituted or unsubstituted C_6 to C_{30} an aryl group, a substituted or unsubstituted C_6 to C_{30} aryloxy group, a substituted or unsubstituted C_2 to C_{30} heteroaryl group, an amine group, an ester group, a carboxyl group, a nitro group, and a cyano group,

wherein at least one of R^9 to R^{14} is deuterium, and

y^2 is 2 or 3.

14. The organic light emitting diode device of claim **13**, wherein the organic layer comprises at least one among a hole injection layer (HIL), a hole transport layer (HTL), an emission layer, an electron transport layer (ETL), and an electron injection layer (EIL) that are sequentially positioned on the first electrode.

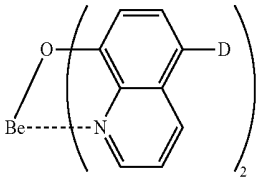
15. The organic light emitting diode device of claim **14**, wherein the metal complex compound is included in the emission layer.

16. The organic light emitting diode device of claim **14**, wherein the metal complex compound is included in the electron transport layer (ETL).

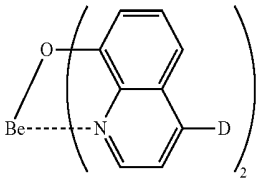
17. The organic light emitting diode device of claim **13**, wherein in Chemical Formula 3, M^2 is Be, Zn, Mg, Al, Ga, In, or a combination thereof.

18. The organic light emitting diode device of claim **13**, wherein the metal complex compound is represented by one of the following Chemical Formulae 4-1 to 4-10:

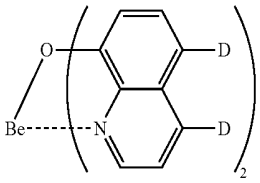
[Chemical Formula 4-1]



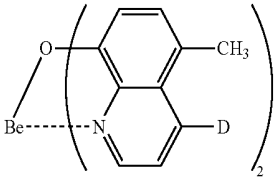
[Chemical Formula 4-2]



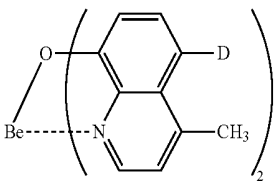
[Chemical Formula 4-3]



[Chemical Formula 4-4]



[Chemical Formula 4-5]



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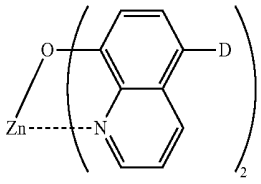
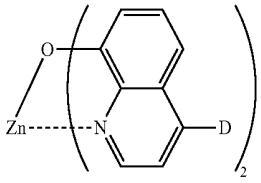
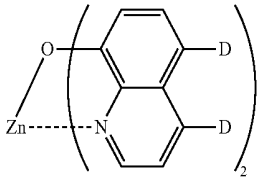
[Chemical Formula 4-6]



[Chemical Formula 4-7]



[Chemical Formula 4-8]



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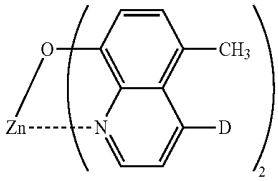
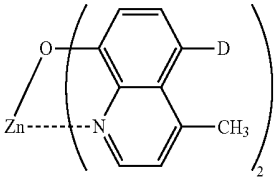
[Chemical Formula 4-9]



[Chemical Formula 4-10]



* * * * *

专利名称(译)	金属络合物和包括其的有机发光二极管器件		
公开(公告)号	US20120074389A1	公开(公告)日	2012-03-29
申请号	US13/181449	申请日	2011-07-12
[标]申请(专利权)人(译)	三星显示有限公司		
申请(专利权)人(译)	三星移动显示器有限公司.		
当前申请(专利权)人(译)	三星DISPLAY CO.，LTD.		
[标]发明人	HAMADA YUJI LEE KWAN HEE		
发明人	HAMADA, YUJI LEE, KWAN-HEE		
IPC分类号	H01L51/54 C07F3/00		
CPC分类号	C07D215/30 C07D221/10 H01L51/006 H01L51/0061 H01L51/0072 Y10S428/917 H01L51/0085 H01L51/0092 H01L51/5012 H01L51/5048 H01L51/0077		
优先权	1020100093351 2010-09-27 KR		
其他公开文献	US8835022		
外部链接	Espacenet USPTO		

摘要(译)

公开了由以下化学式1或3表示的金属配位化合物，以及包含其的有机发光二极管装置。 在化学式1和3中，M1，M2，R1至R14，y1和y2如详述中所定义。