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(54) **METAL COORDINATION COMPOUND AND ELECTROLUMINESCENCE DEVICE**

(57) A metal coordination compound having a basis structure represented by a general formula MLmL'n (1) (wherein M is a metal atom of Ir, Pt, Rh or Pd; L and L' represent mutually different bidentate ligands; m is 1, 2 or 3; and n is 0, 1 or 2, with the proviso that m+n is 2 or 3) in which basic structure at least one bidentate ligand L has a partial structure formed by condensation via an alkylene group having 2 - 10 carbon atoms, is provided. In an electroluminescence device constituted by one or a plurality of organic films disposed between a cathode and an anode, at least one layer is a luminescence layer which is formed by mixing luminescent molecules consisting of the metal coordination compound having the structure represented by the formula (1) as a guest material in a host material. By this luminescence layer, it becomes possible to provide an electroluminescence device which produce high-efficiency luminescence and retains a high luminance stably for a long period of time.

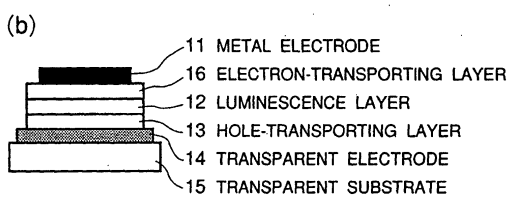

FIG. 1

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Description

[TECHNICAL FIELD]

[0001] The present invention relates to an electroluminescence device using an organic compound, more particularly to an organic electroluminescence device (hereinafter, referred to as an "organic EL device") using a metal coordination compound as a luminescent material.

[BACKGROUND ART]

[0002] An applied research of an organic EL device as a luminescence device of a high-speed responsiveness and a high efficiency, has been energetically conducted. Basic structures thereof are shown in Figures 1(a) and (b) (e.g., Macromol Symp. 125, 1 - 48 (1977)).

[0003] As shown in Figure 1, an organic EL device generally has a structure comprising a transparent, electrode 14, a metal electrode 11, and a plurality of organic film layers therebetween on a transparent substrate 15.

[0004] In the device of Figure 1(a), the organic layers comprise a luminescence layer 12 and a hole-transporting layer 13. For the transparent electrode 14, ITO, etc., having a large work function are used, for providing a good hole-injection characteristic from the transparent electrode 14 to the hole-transporting layer 13. For the metal electrode 11, a metal, such as aluminum, magnesium or an alloy of these, having a small work function is used for providing a good electron-injection characteristic. These electrodes have a thickness of 50 - 200 nm.

[0005] For the luminescence layer 12, aluminum quinolynol complexes (a representative example thereof is Alq3 shown hereinafter), etc., having an electron-transporting characteristic and luminescence characteristic are used. For the hole-transporting layer, biphenyldiamine derivatives (a representative example thereof is α-NPD shown hereinafter), etc., having an electron-donative characteristic are used.

[0006] The above-structured device has a rectifying characteristic, and when an electric field is applied between the metal electrode 11 as a cathode and the transparent electrode 14 as an anode, electrons are injected from the metal electrode 11 into the luminescence layer 12 and holes are injected from the transparent electrode 15. The injected holes and electrons are recombined within the luminescence layer 12 to form excitons and produce luminescence. At this time, the hole-transporting layer 13 functions as an electron-blocking layer to increase the recombination efficiency at a boundary between the luminescence layer 12 and hole-transporting layer 13, thereby increasing the luminescence efficiency.

[0007] Further, in the structure of Figure 1(b), an electron-transporting layer 16 is disposed between the metal electrode 11 and the luminescence layer 12. By separating the luminescence and the electron and hole-transportation to provide a more effective carrier blocking structure, effective luminescence can be performed. For the electron-transporting layer 16, an electron-transporting material, such as an oxidiazole derivative, is used.

[0008] Known luminescence processes used heretofore in organic EL devices include fluorescence and phosphorescence. In a fluorescence luminescence device, fluorescence at the time of the transition from a singlet exciton state to the ground state is produced. On the other hand, in the phosphorescence luminescence device, the transition from a triplet exciton state to the ground state is utilized.

[0009] In recent years, devices utilizing phosphorescence providing a luminescence yield higher than those utilizing fluorescence have been studied.

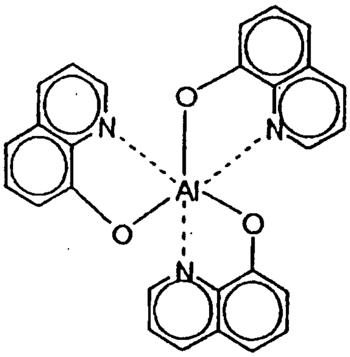
[0010] Representative published literature may include:

Article 1: Improved energy transfer in electrophosphorescent device (D.F. O'Brien, et al., Applied Physics Letters, Vol. 74, No. 3, p. 422 (1999)); and
Article 2: Very high-efficiency green organic light-emitting devices based on electrophosphorescence (M.A. Baldo, et al., Applied Physics Letters, Vol. 75, No. 1, p. 4 (1999)).

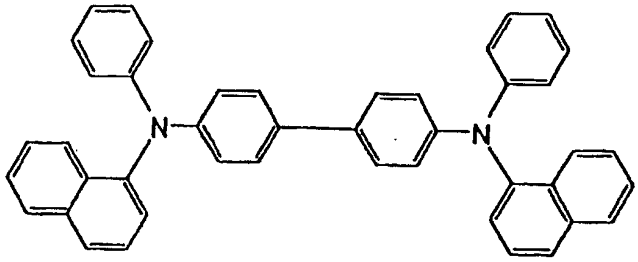
[0011] In these articles, a structure including 4 organic layers devices as shown in Figure 1(c) has been principally used, including, from the anode side, a hole-transporting layer 13, a luminescence layer 12, an exciton diffusion-prevention layer 17 and an electron-transporting layer 16. Materials used therein include carrier-transporting materials and phosphorescent materials, of which the abbreviations are shown below.

Alq3: aluminum-quinolinol complex
α-NPD: N4,N4'-di-naphthalene-1-yl-N4,N4'-diphenyl-biphenyl-4,4'-diamine
CBP: 4,4'-N,N'-dicarbazole-biphenyl
BCP: 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline
PtOEP: platinum-octaethylporphyrin complex

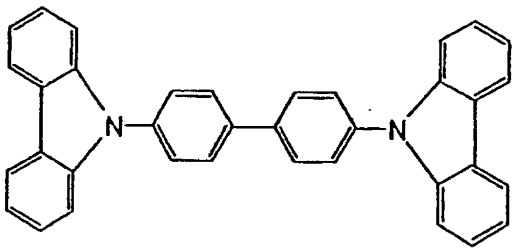
$Ir(ppy)_3$: iridium-phenylpyrimidine complex



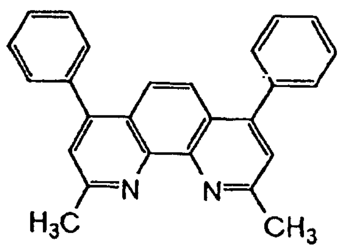
Alq3



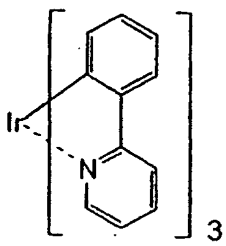
α -NPD



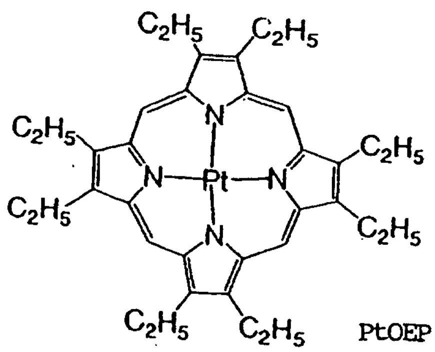
CBP



BCP



$Ir(ppy)_3$



PtOEP

[0012] The above-mentioned organic EL devices utilizing phosphorescence have accompanied with a problem of luminescent deterioration particularly in an energized state. The reason for luminescent deterioration has not been clarified as yet but may be attributable to such a phenomenon that the life of triplet exciton is generally longer than that of singlet exciton by at least three digits, so that molecule is placed in a higher-energy state for a long period to cause reaction with ambient substance, formation of exciplex or excimer, change in minute molecular structure, structural change of ambient substance, etc.

[0013] Anyway, the phosphorescence luminescence device is expected to provide a higher luminescence efficiency as described above, while the EL device is accompanied with the problem of the luminescent deterioration in energized state. As a luminescent material used in the phosphorescence device, a compound which produces high-efficiency luminescence and has a high stability is desired.

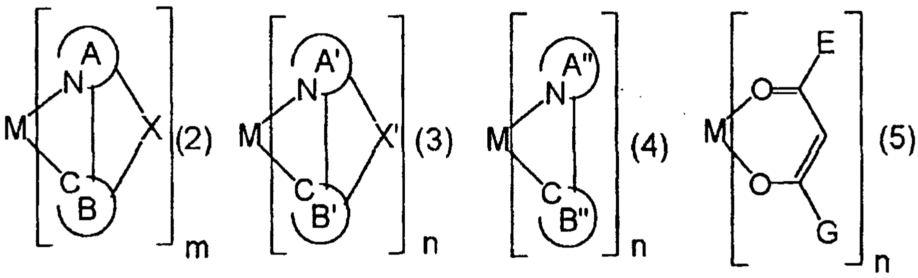
[DISCLOSURE OF INVENTION]

[0014] Accordingly, an object of the present invention is to provide a stable luminescence device capable of producing high-efficiency luminescence and maintaining a high luminance (brightness) for a long period of time. As a novel luminescent material therefor, the present invention provides a specific metal coordination compound.

[0015] The metal coordination compound according to the present invention is represented by the following formula (1):

$$ML_mL'_n \qquad (1),$$

wherein M is a metal atom of Ir, Pt, Rh or Pd; L and L' are mutually different bidentate ligands; m is 1, 2 or 3; n is 0, 1 or 2 with the proviso that m+n is 2 or 3; a partial structure ML_m is represented by formula (2) shown below and a partial structure ML'_n is represented by formula (3), (4) or (5) shown below:



wherein N and C are nitrogen and carbon atoms, respectively; A and A' are respectively a cyclic group capable of having a substituent and bonded to the metal atom M via the nitrogen atom; B, B' and B" are respectively a cyclic group capable of having a substituent and connected to the metal atom M via the carbon atom;

{wherein the substituent is selected from a halogen atom, a cyano group, a nitro group, a trialkylsilyl group (of which the alkyl groups are independently a linear or branched alkyl group having 1 to 8 carbon atoms), a linear or branched alkyl group having 1 to 20 carbon atoms (of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C- and the alkyl group can include a hydrogen atom that can be replaced with a fluorine atom), or an aromatic cyclic group capable of having a substituent (of which the substituent is a halogen atom, a cyano group, a nitro group, or a linear or branched alkyl group having 1 to 20 carbon atoms (of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C- and the alkyl group can include a hydrogen atom that can be replaced with a fluorine atom)};

[0016] A and B, A' and B', and A" and B" are respectively bonded to each other via a covalent bond; and A and B, and A' and B' are respectively bonded to each other via X and X', respectively;

[0017] X and X' are independently a linear or branched alkylene group having 2 to 10 carbon atoms (of which the alkylene group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C- and the alkylene group can include a hydrogen atom that can be replaced with a fluorine atom);

[0018] E and G are independently a linear or branched alkyl group having 1 to 20 carbon atoms (of which the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom), or an aromatic cyclic group capable of having a substituent (of which the substituent is a halogen atom, a cyano group, a nitro group, a trialkylsilyl group (of which the alkyl groups are independently a linear or branched alkyl group having 1 to 8 carbon atoms), or a linear or branched alkyl group having 1 to 20 carbon atoms (of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C- and the alkyl group can include a hydrogen atom that can be replaced with a fluorine atom)}.

[0019] The metal coordination compound of the present invention may preferably be one wherein: n is 0 in the formula (1); the partial structure ML'n in the formula (1) is represented by the formula (3); the partial structure ML'n in the formula (1) is represented by the formula (4); or the partial structure ML'n in the formula (1) is represented by the formula (5).

[0020] Further, in the formula (1), X may preferably be a linear or branched alkylene group having 2 to 6 carbon atoms (of which the alkylene group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, - O-CO-, -CH=CH- or -C≡C- and the alkylene group can include a hydrogen atom that can be replaced with a fluorine atom).

[0021] Further, the metal coordination compound may preferably contain Ir as M in the formula (1) described above.

[0022] Further, the present invention provides an electroluminescence device wherein a layer containing the aforementioned metal coordination compound is sandwiched between two oppositely disposed electrodes and a voltage is applied between the electrodes to produce luminescence.

[0023] Particularly, the electroluminescence device may preferably be an electroluminescence device which produces phosphorescence.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[0024]

Figure 1 illustrates embodiments of the luminescence device according to the present invention, wherein (a) is device structure having two organic layers, (b) is a device structure having three organic layers, and (c) is a device structure having four organic layers.
Figure 2 schematically illustrates an example of a panel structure including an organic EL device and drive means.
Figure 3 illustrates an example of pixel circuit using TFTs (thin film transistors).

[BEST MODE FOR PRACTICING THE INVENTION]

[0025] In the case where a luminescence layer is formed of a carrier transporting host material and a phosphorescent guest material, in order to improve a luminescence efficiency of the resultant organic EL device, a luminescence center material per se is required to provide a higher yield of luminescence quantum. In addition thereto, an efficient energy transfer between host material molecules or between host material molecule and guest material molecule is also an important factor.

[0026] Further, the reason of the luminescent deterioration has not been clarified as yet but may presumably relate to at least the luminescent material per se or an environmental change thereof by its ambient molecular structure.

[0027] For this reason, the present inventors have conducted various studies and have found out the metal coordination compound represented by the above-mentioned formula (1) and have found that an organic EL device using the luminescent material allows a high-efficiency luminescence,keeps a high brightness (luminance) for a long period, and provides less (luminescent) deterioration in energized state.

[0028] In the metal coordination compound of formula (1), n may preferably be 0 or 1, more preferably be 0. Further, the partial structure ML'n may preferably be represented by the above-mentioned formula (3).

[0029] Further, in the formula (1), X may preferably be a linear or branched alkylene group having 2 to 10 carbon atoms (of which the alkylene group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C- and the alkylene group can include a hydrogen atom that can be replaced with a fluorine atom). Further, in the formula, M may preferably be Ir or Rh, more preferably be Ir.

[0030] The metal coordination compound used in the present invention emits phosphorescence, and its lowest excited state is believed to be an MLCT* (metal-to-ligand charge transfer) excited state or π-π* excited state in a triplet state, and phosphorescence is produced at the time of transition from such a state to the ground state.

<Measurement methods of physical properties>

[0031] Hereinbelow, methods for measurement of physical properties in the present invention will be described.

(1) Method of judgment between phosphorescence and fluorescence
The identification of phosphorescence was effected depending on whether deactivation with oxygen was caused or not. A (sample) compound is dissolved in chloroform and, after aeration with oxygen or with nitrogen, is subjected to photoillumination to compare photo-luminescence. Almost no luminescence attributable to the compound is observed with respect to the solution aerated with oxygen but in contrast thereto, photo-luminescence is confirmed with respect to the solution aerated with nitrogen, thus allowing differentiation therebetween. The phosphorescence of all the compounds of the present invention has been confirmed by this method unless otherwise noted specifically.

(2) Phosphorescence yield used in the present invention may be determined according to the following formula:

$$\Phi(\text{sample})/\Phi(\text{st}) =$$

[Sem(sample)/Iabs(sample)]/[Sem(st)/Iabs(st)],

wherein Iabs(st) denotes an absorption coefficient at an excitation wavelength of the standard sample; Sem(st), a luminescence spectral areal intensity when excited at the same wavelength: Iabs(sample), an absorption coefficient at an excitation wavelength of an objective compound; and Sem(sample), a luminescence spectral areal intensity when excited at the same wavelength.

Phosphorescence yield values described herein are relative values with respect a phosphorescence yield $\Phi = 1$ of $Ir(ppy)_3$ as a standard sample.

(3) Method of measurement of phosphorescence life.

A (sample) compound is dissolved in chloroform and spin-coated onto a quartz substrate in a thickness of ca. 0.1 μm and is exposed to pulsative nitrogen laser light at an excitation wavelength of 337 nm at room temperature by using a luminescence life meter (made by Hamamatsu Photonics K.K.). After completion of the excitation pulses, the decay time of luminescence intensity is measured.

[0032] When an initial luminescence intensity is denoted by I_0, a luminescence intensity after t(sec) is expressed according to the following formula with reference to a luminescence life τ(sec):

$$I = I_0 \cdot \exp(-t/\tau).$$

[0033] The metal coordination compound of the present invention exhibited a high phosphorescence quantum yield of 0.11 to 0.8 and short phosphorescence life of 1 to 40 μsec. If the phosphorescence life is long, the number of molecules placed in triplet excited state waiting for luminescence is increased, thus resulting in a problem of lowering in luminescence efficiency particularly at the time of a high-current density. Accordingly, in order to enhance the luminescence efficiency, it is effective to shorter the above-mentioned phosphorescence life. The metal coordination compound invention has a high phosphorescence quantum yield and a relatively short phosphorescence life, and is therefore suitable as a luminescence material for an organic EL device.

[0034] Further, as shown in Example 1 described later, by the alkylene group, represented by X of the formula (2), which is a feature of the present invention, rotational vibration in a direction of a dihedral angle between the intermolecular cyclic groups A and B (further between the intramolecular cyclic groups A' and B', by the alkylene group represented by X' in the case here the partial structure ML'n is represented by the formula (3)) is suppressed. For this reason, the metal coordination compound of the present invention provides a decreased path of energy deactivation within molecule at the time of luminescence, thus being considered that high efficiency-luminescence is achieved.

[0035] Further, by appropriately selecting a length of the above-mentioned alkylene group, a dihedral angle between the intramolecular cyclic groups A an B and A' and B' is changed to control an emission wavelength, particularly to allow shifting toward a shorter wavelength.

[0036] Also from the viewpoints described above, the metal coordination compound of the present invention is suitable as the luminescent material of the present invention.

[0037] Further, as described in Examples appearing hereinafter, in a continuous energization test, it has been clarified that the metal coordination compound of the present invention exhibits an excellent performance in terms of also a stability. By introducing the above-mentioned alkylene group, which is a feature of the present invention, to cause a change in state as to intermolecular interaction, it is possible to control an intermolecular interaction with the host material etc., thus suppressing formation of excited associates leading to thermal deactivation. As a result, a device characteristic is considered to be improved.

<Synthesis of iridium coordination compound>

[0038] A synthesis scheme of the metal coordination compound represented by the formula (1) of the present invention will be shown by taking an iridium coordination compound as an example.

Synthesis of iridium coordination compound

[0039]

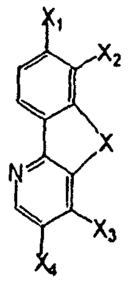
$$Ir\ (CH_3COCHCOCH_3)_3 \xrightarrow{3 \times L} Ir\ (L)_3$$

or

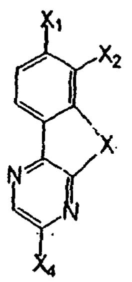
$$IrCl_3 \cdot 3H_2O \xrightarrow{2 \times L} [Ir\ (L)_2Cl]_2 \xrightarrow{L'} Ir\ (L)_2L'$$

[0040] Hereinbelow, specific structure formulas of the metal coordination compounds used in the present invention will be shown in Tables 1-1 to Tables 1-14. However, these are merely representative examples and the present invention is not limited to these examples.

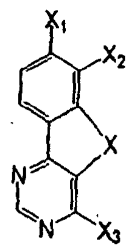
[0041] L_1 to L_{11}' used for L and L' shown in Tales 1-1 to 1-14 have the structures shown below.



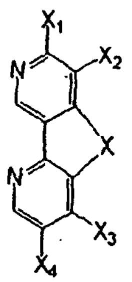
L_1



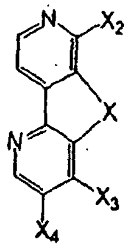
L_2



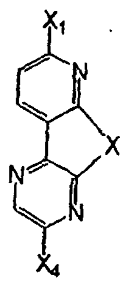
L_3



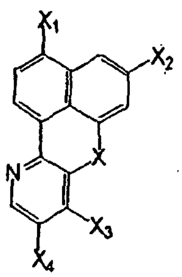
L_4



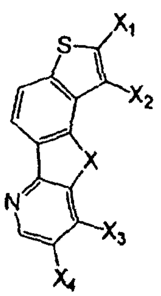
L_5



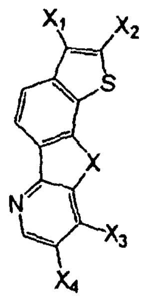
L_6



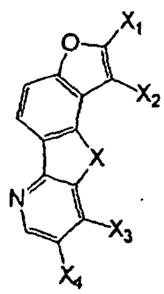
L_7



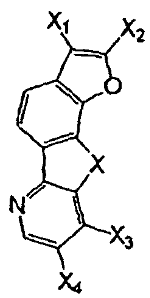
L_8



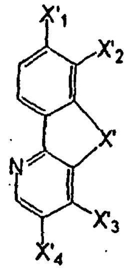
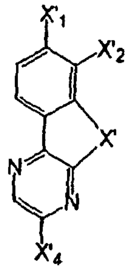
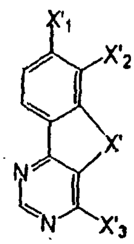
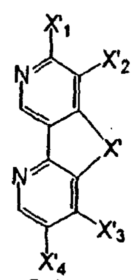
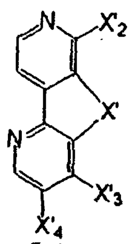
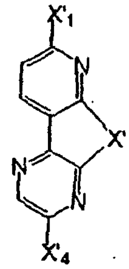
L_9

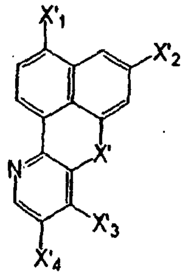
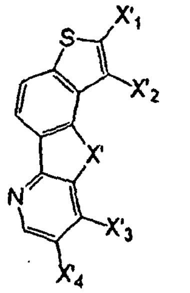
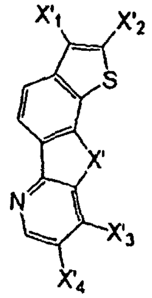
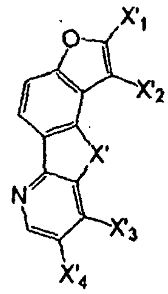
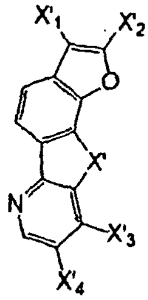


L_{10}

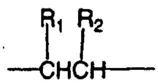
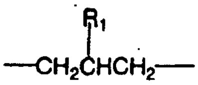
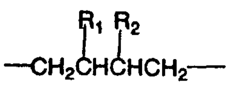


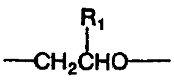
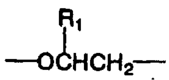
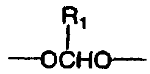
L_{11}

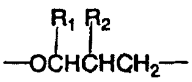
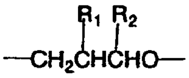
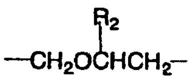
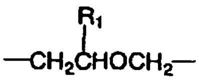

L_1'

L_2'

L_3'

L_4'

L_5'

L_6'

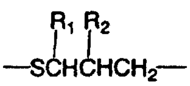
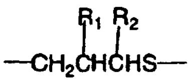
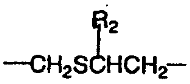
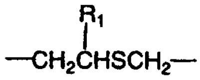

L_7'

L_8'

L_9'

L_{10}'

L_{11}'

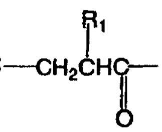
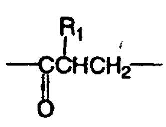
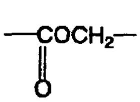
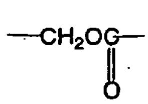
[0042] Further, B to M' used for x and X' in Tables 1-1 to 1-14 have the structures shown below.

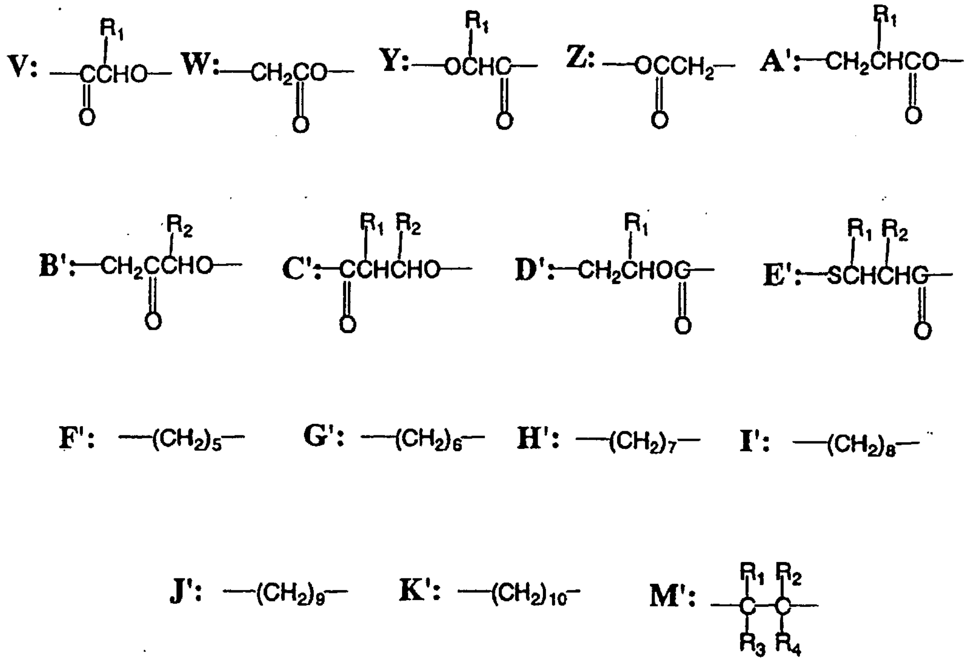
B:  **C:**  **D:** 

E: $—CH_2OCH_2—$ **F:**  **G:**  **H:** 

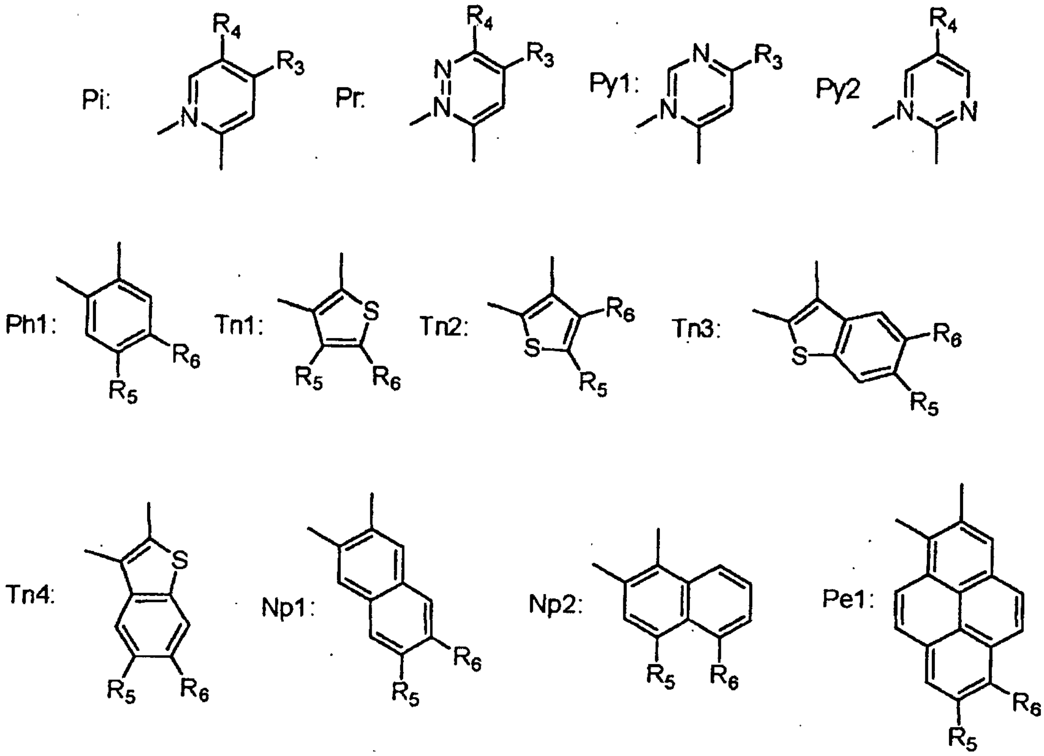
I:  **J:**  **K:**  **M:** 

N:  **O:**  **P:**  **Q:** 

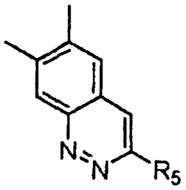
R:  **S:**  **T:**  **U:** 



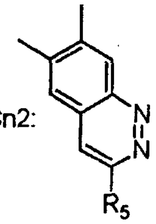
[0043] Pi to Qn2 used for cyclic structures A" and B" in Tables 1-1 to 1-11 have the structures shown below.



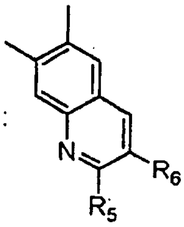
Cn1:



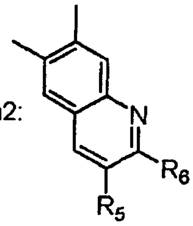
Cn2:



Qn1:

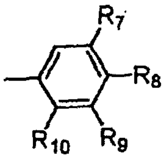


Qn2:

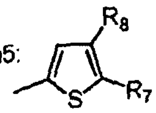


[0044] Further, Ph2 to Ph3 used for L and L'; the aromatic groups present as substituents for the cyclic structures A" and B"; and E and G in Tables 1-1 to 1-14 have the structures shown below.

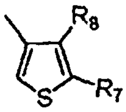
Ph2:



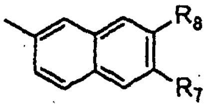
Tn5:



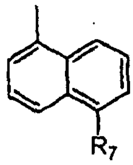
Tn6:



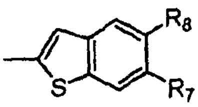
Np3:



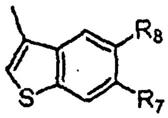
Np4:



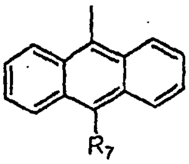
Tn7:



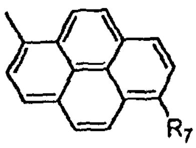
Tn8:



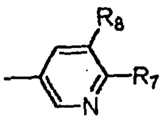
An:



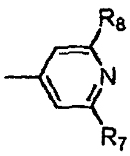
Pe2:



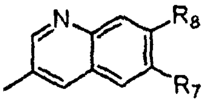
Pi2:



Pi3:



Qn2:



Ph3:

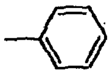


Table 1-1

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
1	Ir	3	0	L1	B	H	H	H	H	H	H	-	-	-	-
2	Ir	3	0	L1	B	H	H	F	H	H	H	-	-	-	-
3	Ir	3	0	L1	B	H	H	H	F	H	H	-	-	-	-
4	Ir	3	0	L1	B	H	H	F	F	H	H	-	-	-	-
5	Ir	3	0	L1	B	H	H	CF3	H	H	H	-	-	-	-
6	Ir	3	0	L1	B	H	H	H	CF3	H	H	-	-	-	-
7	Ir	3	0	L1	B	H	H	F	CF3	H	H	-	-	-	-

Table 1-1 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
8	Ir	3	0	L1	B	H	H	CF3	F	H	H	-	-	-	-
9	Ir	3	0	L1	B	H	H	Cl	CF3	H	H	-	-	-	-
10	Ir	3	0	L1	B	H	H	CH3	H	H	H	-	-	-	-
11	Ir	3	0	L1	B	H	H	H	CH3	H	H	-	-	-	-
12	Ir	3	0	L1	B	H	H	OCH3	H	H	H	-	-	-	-
13	Ir	3	0	L1	B	H	H	H	OCH3	H	H	-	-	-	-
14	Ir	3	0	L1	B	H	H	OCF3	H	H	H	-	-	-	-
15	Ir	3	0	L1	B	H	H	H	OCF3	H	H	-	-	-	-
16	Ir	3	0	L1	B	H	H	Cl	H	H	H	-	-	-	-
17	Ir	3	0	L1	B	H	H	H	Cl	H	H	-	-	-	-
18	Ir	3	0	L1	B	H	H	Br	H	H	H	-	-	-	-
19	Ir	3	0	L1	B	H	H	H	Br	H	H	-	-	-	-
20	Ir	3	0	L1	B	H	H	H	OC4H9	H	H	-	-	-	-
21	Ir	3	0	L1	B	H	H	OC4H9	H	H	H	-	-	-	-
22	Ir	3	0	L1	B	H	H	H	OCH (CH3)2	H	H	-	-	-	-
23	Ir	3	0	L1	B	H	H	Br	H	H	H	-	-	-	-
24	Ir	3	0	L1	B	H	H	H	H	Cl	H	-	-	-	-
25	Ir	3	0	L1	B	H	H	H	H	H	Cl	-	-	-	-
26	Ir	3	0	L1	B	H	H	H	H	CF3	H	-	-	-	-
27	Ir	3	0	L1	B	H	H	H	H	H	CF3	-	-	-	-
28	Ir	3	0	L1	B	H	H	Ph3	H	H	H	-	-	-	-
29	Ir	3	0	L1	B	H	H	Ph3	H	H	CF3	-	-	-	-
30	Ir	3	0	L1	B	H	H	Ph2	H	H	H	H	F	H	H
31	Ir	3	0	L1	B	H	H	Ph2	H	H	H	H	H	CF3	H
32	Ir	3	0	L1	B	H	H	Tn5	H	H	H	H	H	-	-
33	Ir	3	0	L1	B	H	H	Np3	H	H	H	H	H	-	-
34	Ir	3	0	L1	B	H	H	H	Tn5	H	H	H	H	-	-
35	Ir	3	0	L1	B	H	H	Tn7	H	H	H	H	H	-	-
36	Ir	3	0	L1	B	H	H	Pe2	H	H	H	H	-	-	-
37	Ir	3	0	L1	B	H	H	Tn8	H	H	H	H	H	-	-
38	Ir	3	0	L1	B	H	H	Np4	H	H	H	H	-	-	-
39	Ir	3	0	L1	B	H	H	Tn6	H	H	H	H	H	-	-
40	Ir	3	0	L1	B	CH3	H	H	H	H	H	-	-	-	-
41	Ir	3	0	L1	B	CH3	H	F	H	H	H	-	-	-	-
42	Ir	3	0	L1	B	CH3	H	CF3	H	H	H	-	-	-	-
43	Ir	3	0	L1	B	CH3	H	H	CF3	H	H	-	-	-	-
44	Ir	3	0	L1	B	CH3	H	F	CF3	H	H	-	-	-	-

Table 1-1 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
45	Ir	3	0	L1	B	H	CH3	CF3	F	H	H	-	-	-	-
46	Ir	3	0	L1	B	H	CH3	Cl	CF3	H	H	-	-	-	-
47	Ir	3	0	L1	B	H	CH3	OC4H9	H	H	H	-	-	-	-
48	Ir	3	0	L1	B	H	CH3	H	OCH (CH3)2	H	H	-	-	-	-
49	Ir	3	0	L1	B	H	CH3	Ph2	H	H	H	H	F	H	H
50	Ir	3	0	L1	B	H	CH3	Np3	H	H	H	H	H	-	-

Table 1-2

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
51	Ir	3	0	L1	B	H	CH3	Tn6	H	H	H	H	H	-	-
52	Ir	3	0	L1	B	CH3	CH3	H	H	H	H	-	-	-	-
53	Ir	3	0	L1	C	H	-	H	H	H	H	-	-	-	-
54	Ir	3	0	L1	C	H	-	F	H	H	H	-	-	-	-
55	Ir	3	0	L1	C	H	-	H	F	H	H	-	-	-	-
56	Ir	3	0	L1	C	H	-	F	F	H	H	-	-	-	-
57	Ir	3	0	L1	C	H	-	CF3	H	H	H	-	-	-	-
58	Ir	3	0	L1	C	H	-	H	CF3	H	H	-	-	-	-
59	Ir	3	0	L1	C	H	-	F	CF3	H	H	-	-	-	-
60	Ir	3	0	L1	C	H	-	CF3	F	H	H	-	-	-	-
61	Ir	3	0	L1	C	H	-	Cl	CF3	H	H	-	-	-	-
62	Ir	3	0	L1	C	H	-	CH3	H	H	H	-	-	-	-
63	Ir	3	0	L1	C	H	-	H	CH3	H	H	-	-	-	-
64	Ir	3	0	L1	C	H	-	OCH3	H	H	H	-	-	-	-
65	Ir	3	0	L1	C	H	-	H	OCH3	H	H	-	-	-	-
66	Ir	3	0	L1	C	H	-	OCF3	H	H	H	-	-	-	-
67	Ir	3	0	L1	C	H	-	H	OCF3	H	H	-	-	-	-
68	Ir	3	0	L1	C	H	-	Cl	H	H	H	-	-	-	-
69	Ir	3	0	L1	C	H	-	H	Cl	H	H	-	-	-	-
70	Ir	3	0	L1	C	H	-	Br	H	H	H	-	-	-	-
71	Ir	3	0	L1	C	H	-	H	Br	H	H	-	-	-	-
72	Ir	3	0	L1	C	H	-	H	OC4H9	H	H	-	-	-	-
73	Ir	3	0	L1	C	H	-	OC4H9	H	H	H	-	-	-	-
74	Ir	3	0	L1	C	H	-	H	OCH (CH3)2	H	H	-	-	-	-
75	Ir	3	0	L1	C	H	-	Br	H	H	H	-	-	-	-
76	Ir	3	0	L1	C	H	-	H	H	Cl	H	-	-	-	-
77	Ir	3	0	L1	C	H	-	H	H	H	Cl	-	-	-	-

Table 1-2 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
78	Ir	3	0	L1	C	H	-	H	H	CF3	H	-	-	-	-
79	Ir	3	0	L1	C	H	-	H	H	H	CF3	-	-	-	-
80	Ir	3	0	L1	C	H	-	Ph3	H	H	H	-	-	-	-
81	Ir	3	0	L1	C	H	-	Ph3	H	H	CF3	-	-	-	-
82	Ir	3	0	L1	C	H	-	Ph2	H	H	H	H	F	H	H
83	Ir	3	0	L1	C	H	-	Ph2	H	H	H	H	H	CF3	H
84	Ir	3	0	L1	C	H	-	Tn5	H	H	H	H	H	-	-
85	Ir	3	0	L1	C	H	-	Np3	H	H	H	H	H	-	-
86	Ir	3	0	L1	C	H	-	H	Tn5	H	H	H	H	-	-
87	Ir	3	0	L1	C	H	-	Tn7	H	H	H	H	H	-	-
88	Ir	3	0	L1	C	H	-	Pe2	H	H	H	H	-	-	-
89	Ir	3	0	L1	C	H	-	Tn8	H	H	H	H	H	-	-
90	Ir	3	0	L1	C	H	-	Np4	H	H	H	H	-	-	-
91	Ir	3	0	L1	C	H	-	Tn6	H	H	H	H	H	-	-
92	Ir	3	0	L1	C	CH3	-	H	H	H	H	-	-	-	-
93	Ir	3	0	L1	C	CH3	-	F	H	H	H	-	-	-	-
94	Ir	3	0	L1	C	CH3	-	CF3	H	H	H	-	-	-	-
95	Ir	3	0	L1	C	CH3	-	H	CF3	H	H	-	-	-	-
96	Ir	3	0	L1	C	CH3	-	F	CF3	H	H	-	-	-	-
97	Ir	3	0	L1	C	CH3	-	CF3	F	H	H	-	-	-	-
98	Ir	3	0	L1	C	CH3	-	Cl	CF3	H	H	-	-	-	-
99	Ir	3	0	L1	C	CH3	-	OC4H9	H	H	H	-	-	-	-
100	Ir	3	0	L1	C	CH3	-	H	OCH (CH3)2	H	H	-	-	-	-

Table 1-3

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
101	Rh	3	0	L1	B	H	H	H	H	H	H	-	-	-	-
102	Rh	3	0	L1	B	H	H	F	H	H	H	-	-	-	-
103	Rh	3	0	L1	B	H	H	H	F	H	H	-	-	-	-
104	Rh	3	0	L1	B	H	H	F	F	H	H	-	-	-	-
105	Rh	3	0	L1	B	H	H	CF3	H	H	H	-	-	-	-
106	Rh	3	0	L1	B	H	H	H	CF3	H	H	-	-	-	-
107	Rh	3	0	L1	B	H	H	F	CF3	H	H	-	-	-	-
108	Rh	3	0	L1	B	H	H	CF3	F	H	H	-	-	-	-
109	Rh	3	0	L1	B	H	H	Cl	CF3	H	H	-	-	-	-
110	Rh	3	0	L1	B	H	H	CH3	H	H	H	-	-	-	-
111	Rh	3	0	L1	B	H	H	H	CH3	H	H	-	-	-	-

Table 1-3 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
112	Rh	3	0	L1	B	H	H	OCH3	H	H	H	-	-	-	-
113	Rh	3	0	L1	B	H	H	H	OCH3	H	H	-	-	-	-
114	Rh	3	0	L1	B	H	H	OCF3	H	H	H	-	-	-	-
115	Rh	3	0	L1	B	H	H	H	OCF3	H	H	-	-	-	-
116	Rh	3	0	L1	B	H	H	Cl	H	H	H	-	-	-	-
117	Rh	3	0	L1	B	H	H	H	Cl	H	H	-	-	-	-
118	Rh	3	0	L1	B	H	H	Br	H	H	H	-	-	-	-
119	Rh	3	0	L1	B	H	H	H	Br	H	H	-	-	-	-
120	Rh	3	0	L1	B	H	H	H	OC4H9	H	H	-	-	-	-
121	Rh	3	0	L1	B	H	H	OC4H9	H	H	H	-	-	-	-
122	Rh	3	0	L1	B	H	H	H	OCH (CH3)2	H	H	-	-	-	-
123	Rh	3	0	L1	B	H	H	Br	H	H	H	-	-	-	-
124	Rh	3	0	L1	B	H	H	H	H	Cl	H	-	-	-	-
125	Rh	3	0	L1	B	H	H	H	H	H	Cl	-	-	-	-
126	Pt	2	0	L1	B	H	H	H	H	CF3	H	-	-	-	-
127	Pt	2	0	L1	B	H	H	H	H	H	CF3	-	-	-	-
128	Pt	2	0	L1	B	H	H	Ph3	H	H	H	-	-	-	-
129	Pt	2	0	L1	B	H	H	Ph3	H	H	CF3	-	-	-	-
130	Pt	2	0	L1	B	H	H	Ph2	H	H	H	H	F	H	H
131	Pt	2	0	L1	B	H	H	Ph2	H	H	H	H	H	CF3	H
132	Pt	2	0	L1	B	H	H	Tn5	H	H	H	H	H	-	-
133	Pt	2	0	L1	B	H	H	Np3	H	H	H	H	H	-	-
134	Pt	2	0	L1	B	H	H	H	Tn5	H	H	H	H	-	-
135	Pt	2	0	L1	B	H	H	Tn7	H	H	H	H	H	-	-
136	Pt	2	0	L1	B	CH3	H	F	H	H	H	-	-	-	-
137	Pt	2	0	L1	B	CH3	H	CF3	H	H	H	-	-	-	-
138	Pt	2	0	L1	B	CH3	H	H	CF3	H	H	-	-	-	-
139	Pt	2	0	L1	B	CH3	H	F	CF3	H	H	-	-	-	-
140	Pt	2	0	L1	B	CH3	H	H	H	H	H	-	-	-	-
141	Pd	2	0	L1	B	CH3	H	F	H	H	H	-	-	-	-
142	Pd	2	0	L1	B	CH3	H	CF3	H	H	H	-	-	-	-
143	Pd	2	0	L1	B	CH3	H	H	CF3	H	H	-	-	-	-
144	Pd	2	0	L1	B	CH3	H	F	CF3	H	H	-	-	-	-
145	Pd	2	0	L1	B	H	CH3	CF3	F	H	H	-	-	-	-
146	Pd	2	0	L1	B	H	CH3	Cl	CF3	H	H	-	-	-	-
147	Pd	2	0	L1	B	H	CH3	OC4H9	H	H	H	-	-	-	-

Table 1-3 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
148	Pd	2	0	L1	B	H	CH3	H	OCH (CH3)2	H	H	-	-	-	-
149	Pd	2	0	L1	B	H	CH3	Ph2	H	H	H	H	F	H	H
150	Pd	2	0	L1	B	H	CH3	Np3	H	H	H	H	H	-	-

Table 1-4

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
151	Ir	3	0	L1	D	H	H	H	H	H	H	-	-	-	-
152	Ir	3	0	L1	D	H	H	F	H	H	H	-	-	-	-
153	Ir	3	0	L1	D	H	H	H	F	H	H	-	-	-	-
154	Ir	3	0	L1	D	H	H	F	F	H	H	-	-	-	-
155	Ir	3	0	L1	D	H	H	CF3	H	H	H	-	-	-	-
156	Ir	3	0	L1	D	H	H	H	CF3	H	H	-	-	-	-
157	Ir	3	0	L1	D	H	H	F	CF3	H	H	-	-	-	-
158	Ir	3	0	L1	D	H	H	CF3	F	H	H	-	-	-	-
159	Ir	3	0	L1	D	H	H	Cl	CF3	H	H	-	-	-	-
160	Ir	3	0	L1	D	H	H	CH3	H	H	H	-	-	-	-
161	Ir	3	0	L1	D	H	H	H	CH3	H	H	-	-	-	-
162	Ir	3	0	L1	D	CH3	H	OCH3	H	H	H	-	-	-	-
163	Ir	3	0	L1	D	H	CH3	H	OCH3	H	H	-	-	-	-
164	Ir	3	0	L1	D	CH3	CH3	OCF3	H	H	H	-	-	-	-
165	Ir	3	0	L1	D	H	H	H	OCF3	H	H	-	-	-	-
166	Ir	3	0	L1	E	-	-	H	H	H	H	-	-	-	-
167	Ir	3	0	L1	E	-	-	H	Cl	H	H	-	-	-	-
168	Ir	3	0	L1	E	-	-	Br	H	H	H	-	-	-	-
169	Ir	3	0	L1	E	-	-	H	Br	H	H	-	-	-	-
170	Ir	3	0	L1	E	-	-	H	OC4H9	H	H	-	-	-	-
171	Ir	3	0	L1	F	H	-	H	H	H	H	-	-	-	-
172	Ir	3	0	L1	F	H	-	H	OCH(CH3)2	H	H	-	-	-	-
173	Ir	3	0	L1	F	H	-	Br	H	H	H	-	-	-	-
174	Ir	3	0	L1	F	H	-	H	H	Cl	H	-	-	-	-
175	Ir	3	0	L1	F	C2H5	-	H	H	H	Cl	- -	-	-	-

Table 1-4 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
176	Ir	3	0	L1	G	H	-	H	H	CF3	H	-	-	-	-
177	Ir	3	0	L1	G	H	-	H	H	H	H	-	-	-	-
178	Ir	3	0	L1	G	H	-	Ph3	H	H	H	-	-	-	-
179	Ir	3	0	L1	G	H	-	Ph3	H	H	CF3	-	-	-	-
180	Ir	3	0	L1	G	H	-	H	H	H	H	-	-	-	-
181	Ir	3	0	L1	H	H	-	Ph2	H	H	H	H	H	GF3	H
182	Ir	3	0	L1	H	H	-	Tn5	H	H	H	H	H	-	-
183	Ir	3	0	L1	H	H	-	Np3	H	H	H	H	H	-	-
184	Ir	3	0	L1	H	CH3 -		H	Tn5	H	H	H	H	-	-
185	Ir	3	0	L1	H	H	-	Tn7	H	H	H	H	H	-	-
186	Ir	3	0	L1	I	H	H	H	H	H	H	-	-	-	-
187	Ir	3	0	L1	I	H	H	Tn8	H	H	H	H	H	-	-
188	Ir	3	0	L1	I	H	H	Np4	H	H	H	H	-	-	-
189	Ir	3	0	L1	I	H	H	Tn6	H	H	H	H	H	-	-
190	Ir	3	0	L1	I	CH3	H	H	H	H	H	-	-	-	-
191	Ir	3	0	L1	J	H	H	F	H	H	H	-	-	-	-
192	Ir	3	0	L1	J	H	H	CF3	H	H	H	-	-	-	-
193	Ir	3	0	L1	J	H	H	H	CF3	H	H	-	-	-	-
194	Ir	3	0	L1	J	CH3	H	F	CF3	H	H	-	-	-	-
195	Ir	3	0	L1	J	H	CH3	CF3	F	H	H	-	-	-	-
196	Ir	3	0	L1	K	-	H	Cl	CF3	H	H	-	-	-	-
197	Ir	3	0	L1	K	-	H	OC4H9	H	H	H	-	-	-	-
198	Ir	3	0	L1	K	-	H	H	OCH(CH3)2	H	H	-	-	-	-
199	Ir	3	0	L1	K	-	H	Ph2	H	H	H	H	F	H	H
200	Ir	3	0	L1	K	-	CH3	Np3	H	H	H	H	H	-	-

Table 1-5

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
201	Ir	3	0	L1	M	H	-	H	H	H	H	-	-	-	-
202	Ir	3	0	L1	M	H	-	F	H	H	H	-	-	-	-
203	Ir	3	0	L1	M	H	-	H	F	H	H	-	-	-	-
204	Ir	3	0	L1	N	H	H	H	H	H	H	-	-	-	-
205	Ir	3	0	L1	N	H	H	CF3	H	H	H	-	-	-	-
206	Ir	3	0	L1	N	CH3	H	H	CF3	H	H	-	-	-	-
207	Ir	3	0	L1	O	H	H	F	CF3	H	H	-	-	-	-
208	Ir	3	0	L1	O	H	H	CF3	F	H	H	-	-	-	-
209	Ir	3	0	L1	O	H	H	Cl	CF3	H	H	-	-	-	-
210	Ir	3	0	L1	P	-	H	H	H	H	H	-	-	-	-
211	Ir	3	0	L1	P	-	H	H	CH3	H	H	-	-	-	-
212	Ir	3	0	L1	P	-	H	OCH3	H	H	H	-	-	-	-
213	Ir	3	0	L1	Q	H	-	H	H	H	H	-	-	-	-
214	Ir	3	0	L1	Q	H	-	OCF3	H	H	H	-	-	-	-
215	Ir	3	0	L1	Q	H	-	H	OCF3	H	H	-	-	-	-
216	Ir	3	0	L1	R	H	-	H	H	H	H	-	-	-	-
217	Ir	3	0	L1	R	H	-	H	Cl	H	H	-	-	-	-
218	Ir	3	0	L1	R	H	-	H	H	H	H	-	-	-	-
219	Ir	3	0	L1	S	H	-	H	Br	H	H	-	-	-	-
220	Ir	3	0	L1	S	H	-	H	OC4H9	H	H	-	-	-	-
221	Ir	3	0	L1	S	H	-	OC4H9	H	H	H	-	-	-	-
222	Ir	3	0	L1	T	-	-	H	H	H	H	-	-	-	-
223	Ir	3	0	L1	T	-	-	Br	H	H	H	-	-	-	-
224	Ir	3	0	L1	T	-	-	H	H	H	H	-	-	-	-
225	Ir	3	0	L1	U	-	-	H	H	H	Cl	-	-	-	-
226	Ir	3	0	L1	U	-	-	H	H	CF3	H	-	-	-	-
227	Ir	3	0	L1	U	-	-	H	H	H	CF3	-	-	-	-
228	Ir	3	0	L1	V	H	-	H	H	H	H	-	-	-	-
229	Ir	3	0	L1	V	H	-	Ph3	H	H	H	-	-	-	-
230	Ir	3	0	L1	V	H	-	Ph2	H	H	H	H	F	H	H
231	Ir	3	0	L1	W	-	-	H	H	H	H	-	-	-	-
232	Ir	3	0	L1	W	-	-	Tn5	H	H	H	H	H	-	-
233	Ir	3	0	L1	W	-	-	Np3	H	H	H	H	H	-	-
234	Ir	3	0	L1	Y	H	-	H	H	H	H	-	-	-	-
235	Ir	3	0	L1	Y	H	-	Tn7	H	H	H	H	H	-	-
236	Ir	3	0	L1	Y	H	-	Pe2	H	H	H	H	-	-	-
237	Ir	3	0	L1	Z	-	-	H	H	H	H	-	-	-	-

Table 1-5 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
238	Ir	3	0	L1	Z	-	-	Np4	H	H	H	H	-	-	-
239	Ir	3	0	L1	Z	-	-	Tn6	H	H	H	H	H	-	-
240	Ir	3	0	L1	A'	H	-	H	H	H	H	-	-	-	-
241	Ir	3	0	L1	A'	H	-	F	H	H	H	-	-	-	-
242	Ir	3	0	L1	A'	CH3	-	CF3	H	H	H	-	-	-	-
243	Ir	3	0	L1	B'	-	H	H	H	H	H	-	-	-	-
244	Ir	3	0	L1	B'	-	H	F	CF3	H	H	-	-	-	-
245	Ir	3	0	L1	B'	-	CH3	CF3	F	H	H	-	-	-	-
246	Ir	3	0	L1	C'	H	H	Cl	CF3	H	H	-	-	-	-
247	Ir	3	0	L1	C'	H	H	OC4H9	H	H	H	-	-	-	-
248	Ir	3	0	L1	C'	H	CH3	H	H	H	H	-	-	-	-
249	Ir	3	0	L1	D'	H	-	Ph2	H	H	H	H	F	H	H
250	Ir	3	0	L1	D'	CH3	-	Np3	H	H	H	H	H	-	-

Table 1-6

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
251	Ir	3	0	L1	D'	H	H	H	H	H	H	-	-	-	-
252	Ir	3	0	L1	E'	H	H	H	H	H	H	-	-	-	-
253	Ir	3	0	L1	E'	H	H	H	F	H	H	-	-	-	-
254	Ir	3	0	L1	E'	H	CH3	F	F	H	H	-	-	-	-
255	Ir	3	0	L1	F'	-	-	CF3	H	H	H	-	-	-	-
256	Ir	3	0	L1	F'	-	-	H	H	H	H	-	-	-	-
257	Ir	3	0	L1	F'	-	-	F	CF3	H	H	-	-	-	-
258	Ir	3	0	L1	F'	-	-	CF3	F	H	H	-	-	-	-
259	Ir	3	0	L1	F'	-	-	Cl	CF3	H	H	-	-	-	-
260	Ir	3	0	L1	G'	-	-	H	H	H	H	-	-	-	-
261	Ir	3	0	L1	G'	-	-	H	CH3	H	H	-	-	-	-
262	Ir	3	0	L1	G'	-	-	OCH3	H	H	H	-	-	-	-
263	Ir	3	0	L1	G'	-	-	H	OCH3	H	H	-	-	-	-
264	Ir	3	0	L1	G'	-	-	OCF3	H	H	H	-	-	-	-
265	Ir	3	0	L1	G'	-	-	H	OCF3	H	H	-	-	-	-
266	Ir	3	0	L1	H'	-	-	H	H	H	H	-	-	-	-
267	Ir	3	0	L1	H'	-	-	H	Cl	H	H	-	-	-	-
268	Ir	3	0	L1	H'	-	-	Br	H	H	H	-	-	-	-
269	Ir	3	0	L1	H'	-	-	H	Br	H	H	-	-	-	-
270	Ir	3	0	L1	H'	-	-	H	OC4H9	H	H	-	-	-	-
271	Ir	3	0	L1	I'	-	-	H	H	H	H	-	-	-	-

Table 1-6 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
272	Ir	3	0	L1	I'	-	-	H	OCH (CH3)2	H	H	-	-	-	-
273	Ir	3	0	L1	I'	-	-	Br	H	H	H	-	-	-	-
274	Ir	3	0	L1	I'	-	-	H	H	Cl	H	-	-	-	-
275	Ir	3	0	L1	I'	-	-	H	H	H	Cl	-	-	-	-
276	Ir	3	0	L1	J'	-	-	H	H	H	H	-	-	-	-
277	Ir	3	0	L1	J'	-	-	H	H	H	CF3	-	-	-	-
278	Ir	3	0	L1	J'	-	-	Ph3	H	H	H	-	-	-	-
279	Ir	3	0	L1	J'	-	-	Ph3	H	H	CF3	-	-	-	-
280	Ir	3	0	L1	J'	-	-	Ph2	H	H	H	H	F	H	H
281	Ir	3	0	L1	K'	-	-	Ph2	H	H	H	H	H	CF3	H
282	Ir	3	0	L1	K'	-	-	H	H	H	H	-	-	-	-
283	Ir	3	0	L1	K'	-	-	Np3	H	H	H	H	H	-	-
284	Ir	3	0	L1	K'	-	-	H	Tn5	H	H	H	H	-	-
285	Ir	3	0	L1	K'	-	-	Tn7	H	H	H	H	H	-	-
286	Rh	3	0	L1	C	H	-	Pe2	H	H	H	H	-	-	-
287	Rh	3	0	L1	C	H	-	Tn8	H	H	H	H	H	-	-
288	Rh	3	0	L1	C	H	-	Np4	H	H	H	H	-	-	-
289	Rh	3	0	L1	I	H	H	Tn6	H	H	H	H	H	-	-
290	Rh	3	0	L1	D'	CH3	-	H	H	H	H	-	-	-	-
291	Rh	3	0	L1	F'	-	-	F	H	H	H	-	-	-	-
292	Pt	2	0	L1	C	H	-	CF3	H	H	H	-	-	-	-
293	Pt	2	0	L1	O	H	H	H	CF3	H	H	-	-	-	-
294	Pt	2	0	L1	Z	-	-	F	CF3	H	H	-	-	-	-
295	Pt	2	0	L1	D'	H	-	CF3	F	H	H	-	-	-	-
296	Pt	2	0	L1	F'	-	-	Cl	CF3	H	H	-	-	-	-
297	Pt	2	0	L1	H'	-	-	OC4H9	H	H	H	-	-	-	-
298	Pd	2	0	L1	I'	-	-	H	OCH (CH3)2	H	H	-	-	-	-
299	Pd	2	0	L1	G	H	-	Ph2	H	H	H	H	F	H	H
300	Pd	2	0	L1	C	H	-	Np3	H	H	H	H	H	-	-

Table 1-7

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
				L'	X'	R1	R2	X1'	X2'	X3'	X4'	R7	R8	R9	R10
301	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	F	H	H	H	-	-	-	-

Table 1-7 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
				L'	X'	R1	R2	X1'	X2'	X3'	X4'	R7	R8	R9	R10
302	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	H	F	H	H	-	-	-	-
303	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	F	F	H	H	-	-	-	-
304	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	CF3	H	H	H	-	-	-	-
305	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	H	CF3	H	H	-	-	-	-
306	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	F	CF3	H	H	-	-	-	-
307	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	Cl	CF3	H	H	-	-	-	-
308	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	CH3	H	H	H	-	-	-	-
309	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	OCF3	H	H	H	-	-	-	-
310	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	H	OC4H9	H	H	-	-	-	-
311	Ir	2	1	L1	B	H	H	OC4H9	H	H	H	-	-	-	-
				L1'	B	H	H	H	OCH (CH3)2	H	H	-	-	-	-
312	Ir	2	1	L1	B	H	H	Br	H	H	H	-	-	-	-
				L1'	B	H	H	H	H	Cl	H	-	-	-	-
313	Ir	2	1	L1	B	H	H	H	H	H	Cl	-	-	-	-
				L1'	B	H	H	H	H	CF3	H	-	-	-	-
314	Ir	2	1	L1	B	H	H	H	H	H	CF3	-	-	-	-
				L1'	B	H	H	Ph3	H	H	H	-	-	-	-
315	Ir	2	1	L1	B	H	H	Ph3	H	H	CF3	-	-	-	-
				L1'	B	H	H	Ph2	H	H	H	H	F	H	H
316	Ir	2	1	L1	B	H	H	Ph2	H	H	H	H	H	CF3	H
				L1'	B	H	H	Tn5	H	H	H	H	H	-	-
317	Ir	2	1	L1	B	H	H	Np3	H	H	H	H	H	-	-
				L1'	B	H	H	H	Tn5	H	H	H	H	-	-
318	Ir	2	1	L1	B	H	H	Tn7	H	H	H	H	H	-	-
				L1'	B	H	H	Pe2	H	H	H	H	-	-	-
319	Ir	2	1	L1	B	H	H	Tn8	H	H	H	H	H	-	-
				L1'	B	H	H	Np4	H	H	H	H	-	-	-

Table 1-7 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
				L'	X'	R1	R2	X1'	X2'	X3'	X4'	R7	R8	R9	R10
320	Ir	2	1	L1	B	H	H	Tn6	H	H	H	H	H	-	-
				L1'	B	CH3	H	H	H	H	H	-	-	-	-
321	Ir	2	1	L1	B	CH3	H	F	H	H	H	-	-	-	-
				L1'	B	CH3	H	CF3	H	H	H	-	-	-	-
322	Ir	2	1	L1	B	CH3	H	H	CF3	H	H	-	-	-	-
				L1'	B	CH3	H	F	CF3	H	H	-	-	-	-
323	Ir	2	1	L1	B	H	CH3	CF3	F	H	H	-	-	-	-
				L1'	B	H	CH3	Cl	CF3	H	H	-	-	-	-
324	Ir	2	1	L1	B	H	CH3	OC4H9	H	H	H	-	-	-	-
				L1'	B	H	CH3	H	OCH (CH3)2	H	H	-	-	-	-
325	Ir	2	1	L1	B	H	CH3	Ph2	H	H	H	H	F	H	H
				L1'	B	H	CH3	Np3	H	H	H	H	H	-	-

Table 1-8

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
				L'	X'	R1	R2	X1'	X2'	X3'	X4'	R7	R8	R9	R10
326	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	C	H	-	H	H	H	H	-	-	-	-
327	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	C	H	-	F	H	H	H	-	-	-	-
328	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	C	H	-	F	F	H	H	-	-	-	-
329	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	C	H	-	F	CF3	H	H	-	-	-	-
330	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	C	H	-	Cl	CF3	H	H	-	-	-	-
331	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	D	CH3	H	OCH3	H	H	H	-	-	-	-
332	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	E	-	-	H	OC4H9	H	H	-	-	-	-
333	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	F	C2H5	-	H	H	H	Cl	-	-	-	-
334	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	G	H	-	Ph3	H	H	CF3	-	-	-	-
335	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	H	H	-	Ph2	H	H	H	H	H	CF3	H
336	Ir	2	1	L1	B	H	H	OC4H9	H	H	H	-	-	-	-
				L1'	I	H	H	H	H	H	H	-	-	-	-
337	Ir	2	1	L1	B	H	H	Br	H	H	H	-	-	-	-
				L1'	J	H	H	CF3	H	H	H	-	-	-	-

Table 1-8 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
				L'	X'	R1	R2	X1'	X2'	X3'	X4'	R7	R8	R9	R10
338	Ir	2	1	L1	B	H	H	H	H	H	Cl	-	-	-	-
				L1'	K	-	CH3	Np3	H	H	H	H	H	-	-
339	Ir	2	1	L1	B	H	H	H	H	H	CF3	-	-	-	-
				L1'	M	H	-	H	F	H	H	-	-	-	-
340	Ir	2	1	L1	B	H	H	Ph3	H	H	CF3	-	-	-	-
				L1'	N	CH3	H	H	CF3	H	H	-	-	-	-
341	Ir	2	1	L1	B	H	H	Ph2	H	H	H	H	H	CF3	H
				L1'	O	H	H	Cl	CF3	H	H	-	-	-	-
342	Ir	2	1	L1	B	H	H	Np3	H	H	H	H	H	-	-
				L1'	P	-	H	OCH3	H	H	H	-	-	-	-
343	Ir	2	1	L1	B	H	H	Tn7	H	H	H	H	H	-	-
				L1'	Q	H	-	H	H	H	H	-	-	-	-
344	Ir	2	1	L1	B	H	H	Tn8	H	H	H	H	H	-	-
				L1'	R	H	-	H	Cl	H	H	-	-	-	-
345	Ir	2	1	L1	B	H	H	Tn6	H	H	H	H	H	-	-
				L1'	S	H	-	H	OC4H9	H	H	-	-	-	-
346	Ir	2	1	L1	B	CH3	H	F	H	H	H	-	-	-	-
				L1'	V	H	-	Ph2	H	H	H	H	F	H	H
347	Ir	2	1	L1	B	CH3	H	H	CF3	H	H	-	-	-	-
				L1'	Y	H	-	Pe2	H	H	H	H	-	-	-
348	Ir	2	1	L1	B	H	CH3	CF3	F	H	H	-	-	-	-
				L1'	A'	CH3	-	CF3	H	H	H	-	-	-	-
349	Ir	2	1	L1	B	H	CH3	OC4H9	H	H	H	-	-	-	-
				L1'	C'	H	H	Cl	CF3	H	H	-	-	-	-

Table 1-8 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
				L'	X'	R1	R2	X1'	X2'	X3'	X4'	R7	R8	R9	R10
350	Ir	2	1	L1	B	H	CH3	Ph2	H	H	H	H	F	H	H
				L1'	D'	CH3	-	Np3	H	H	H	H	H	-	-

Table 1-9

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
				L'	X'	R1	R2	X1'	X2'	X3'	X4'	R7	R8	R9	R10
351	Rh	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	F	H	H	H	-	-	-	-
352	Rh	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	H	F	H	H	-	-	-	-
353	Rh	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	F	F	H	H	-	-	-	-
354	Rh	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	CF3	H	H	H	-	-	-	-
355	Rh	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	H	CF3	H	H	-	-	-	-
356	Rh	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	F	CF3	H	H	-	-	-	-
357	Rh	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	Cl	CF3	H	H	-	-	-	-
358	Rh	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	CH3	H	H	H	-	-	-	-
359	Rh	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	OCF3	H	H	H	-	-	-	-
360	Rh	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	B	H	H	H	OC4H9	H	H	-	-	-	-
361	Pt	1	1	L1	B	H	H	OC4H9	H	H	H	-	-	-	-
				L1'	B	H	H	H	OCH(CH3)2	H	H	-	-	-	-
362	Pt	1	1	L1	B	H	H	Br	H	H	H	-	-	-	-
				L1'	B	H	H	H	H	Cl	H	-	-	-	-

Table 1-9 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
				L'	X'	R1	R2	X1'	X2'	X3'	X4'	R7	R8	R9	R10
363	Pt	1	1	L1	B	H	H	H	H	H	Cl	-	-	-	-
				L1'	B	H	H	H	H	CF3	H	-	-	-	-
364	Pt	1	1	L1	B	H	H	H	H	H	CF3	-	-	-	-
				L1'	B	H	H	Ph3	H	H	H	-	-	-	-
365	Pt	1	1	L1	B	H	H	Ph3	H	H	CF3	-	-	-	-
				L1'	B	H	H	Ph2	H	H	H	H	F	H	H
366	Pd	1	1	L1	B	H	H	Ph2	H	H	H	H	H	CF3	H
				L1'	B	H	H	Tn5	H	H	H	H	H	-	-
367	Pd	1	1	L1	B	H	H	Np3	H	H	H	H	H	-	-
				L1'	B	H	H	H	Tn5	H	H	H	H	-	-
368	Pd	1	1	L1	B	H	H	Tn7	H	H	H	H	H	-	-
				L1'	B	H	H	Pe2	H	H	H	H	-	-	-
369	Pd	1	1	L1	B	H	H	Tn8	H	H	H	H	H	-	-
				L1'	B	H	H	Np4	H	H	H	H	-	-	-
370	Pd	1	1	L1	B	H	H	Tn6	H	H	H	H	H	-	-
				L1'	B	CH3	H	H	H	H	H	-	-	-	-
371	Rh	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				L1'	C	H	-	Cl	CF3	H	H	-	-	-	-
372	Rh	2	1	L1	B	H	H	Ph3	H	H	CF3	-	-	-	-
				L1'	N	CH3	H	H	CF3	H	H	-	-	-	-
373	Pt	1	1	L1	B	H	H	Tn6	H	H	H	H	H	-	-
				L1'	S	H	-	H	OC4H9	H	H	-	-	-	-
374	Pt	1	1	L1	B	H	CH3	OC4H9	H	H	H	-	-	-	-
				L1'	C'	H	H	Cl	CF3	H	H	-	-	-	-

Table 1-9 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
				L'	X'	R1	R2	X1'	X2'	X3'	X4'	R7	R8	R9	R10
375	Pd	1	1	L1	B	H	CH3	Ph2	H	H	H	H	F	H	H
				L1'	D'	CH3	-	Np3	H	H	H	H	H	-	-

Table 1-10

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
				L'		A"	B"	R3	R4	R5	R6	A"			
												R7	R8	R9	R10
												B"			
												R7	R8	R9	R10
376	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				-		Ph1	Pi	H	H	H	H	-	-	-	-
												-	-	-	-
377	Ir	2	1	L1	B	H	H	F	CF3	H	H	-	-	-	-
				-		Ph1	Pi	H	H	H	H	-	-	-	-
												-	-	-	-
378	Ir	2	1	L1	B	H	H	Cl	CF3	H	H	-	-	-	-
				-		Ph1	Pi	H	H	H	H	-	-	-	-
												-	-	-	-
379	Ir	2	1	L1	B	H	H	H	OCF3	H	H	-	-	-	-
				-		Ph1	Pi	H	H	H	H	-	-	-	-
												-	-	-	-
380	Ir	2	1	L1	B	H	H	OC4H9	H	H	H	-	-	-	-
				-		Ph1	Pi	H	H	H	H	-	-	-	-
381	Ir	2	1	L1	B	H	H	Ph2	H	H	H	H	H	CF3	H
				-		Ph1	Pi	Ph2	H	H	H	H	F	H	H
												-	-	-	-
382	Ir	2	1	L1	B	H	H	Tn7	H	H	H	H	H	-	-
				-		Ph1	Pi	H	H	H	H	-	-	-	-
												-	-	-	-
383	Ir	2	1	L1	B	H	CH3	Ph2	H	H	H	H	F	H	H
				-		Tn2	Pi	H	CH3	H	H	-	-	-	-
												-	-	-	-
384	Ir	2	1	L1	B	H	CH3	Np3	H	H	H	H	H	-	-
				-		Tn3	Pi	H	H	H	H	-	-	-	-
												-	-	-	-
385	Ir	2	1	L1	C	H	-	H	H	H	H	-	-	-	-
				-		Tn4	Pi	H	H	H	H	-	-	-	-
												-	-	-	-
386	Ir	2	1	L1	D	H	H	CF3	H	H	H	-	-	-	-
				-		Np2	Pi	H	H	H	CF3	-	-	-	-
												-	-	-	-

Table 1-10 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
				L'		A"	B"	R3	R4	R5	R6	A"			
												R7	R8	R9	R10
												B"			
												R7	R8	R9	R10
387	Ir	2	1	L1	E	-	-	H	Cl	H	H	-	-	-	-
				-		Pe1	Py1	H	-	H	H	-	-	-	-
												-	-	-	-
388	Ir	2	1	L1	F	H	-	H	OCH (CH3) 2	H	H	-	-	-	-
				-		Tn1	Pr	H	H	Ph3	H	-	-	-	-
												-	-	-	-

Table 1-11

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
				L'		A"	B"	R3	R4	R5	R6	A"			
												R7	R8	R9	R10
												B"			
												R7	R8	R9	R10
389	Ir	2	1	L1	H	H	-	Ph2	H	H	H	H	H	CF3	H
				-		Ph1	Pi	H	H	H	Tn5	-	-	-	-
												H	H	-	-
390	Ir	2	1	L1	H	CH3	-	H	Tn5	H	H	H	H	-	-
				-		Ph1	Pi	H	H	H	Tn8	-	-	-	-
												H	H	-	-
391	Rh	2	1	L1	I	H	H	Tn8	H	H	H	H	H	-	-
				-		Ph1	Pi	H	H	H	H	-	-	-	-
												-	-	-	-
392	Rh	2	1	L1	P	-	H	OCH3	H	H	H	-	-	-	-
				-		Ph1	Pi	H	Ph2	H	H	F	F	F	F
												-	-	-	-
393	Rh	2	1	L1	V	H	-	Ph2	H	H	H	H	F	H	H
				-		Tn2	Py2	-	H	H	H	-	-	-	-
												-	-	-	-
394	Rh	2	1	L1	D'	H	-	Ph2	H	H	H	H	F	H	H
				-		Tn3	Pi	Np3	H	CF3	H	H	H	-	-
												-	-	-	-
395	Pt	1	1	L1	F'	-	-	F	CF3	H	H	-	-	-	-
				-		Ph1	Pi	H	H	H	H	-	- -	-	-
												-	-	-	-

Table 1-11 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
				L'		A"	B"	R3	R4	R5	R6	A"			
												R7	R8	R9	R10
												B"			
												R7	R8	R9	R10
396	Pt	1	1	L1	J'	-	-	Ph3	H	H	CF3	-	-	-	-
				-		Tn1	Pi	H	H	H	H	-	-	-	-
												-	-	-	-
397	Pt	1	1	L1	C	H	-	Pe2	H	H	H	H	-	-	-
				-		Np2	Pi	H	H	H	H	-	-	-	-
												-	-	-	-
398	Pd	1	1	L1	B	H	H	H	H	H	H	-	-	-	-
				-		Ph1	Pi	H	H	H	H	-	-	-	-
												-	-	-	-
399	Pd	1	1	L1	B	H	H	H	OCH(CH3)2	H	H	-	-	-	-
				-		Tn3	Pi	Ph2	H	H	CH3	H	C3F7	H	H
												-	-	-	-
400	Pd	1	1	L1	C	H	-	H	H	H	H	-	-	-	-
				-		Np1	Pr	H	H	An	H	-	-	-	-
												H	-	-	-

Table 1-12

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
				E								E			
												R7	R8	R9	R10
				G								G			
												R7	R8	R9	R10
401	Ir	2	1	L1	B	H	H	H	H	H	H	-	-	-	-
				CH3								-	-	-	-
				CH3								-	-	-	-
402	Ir	2	1	L1	B	H	H	F	CF3	H	H	-	-	-	-
				CH3								-	-	-	-
				CH3								-	-	-	-
403	Ir	2	1	L1	B	H	H	Cl	CF3	H	H	-	-	-	-
				CH3								-	-	-	-
				CH3								-	-	-	-
404	Ir	2	1	L1	B	H	H	H	OCF3	H	H	-	-	-	-
				CF3								-	-	-	-
				CF3								-	-	-	-
405	Ir	2	1	L1	B	H	H	OC4H9	H	H	H	-	-	-	-
				CF3								-	-	-	-
				CF3								-	-	-	-
406	Ir	2	1	L1	B	H	H	Ph2	H	H	H	H	H	CF3	H
				Ph3								-	-	-	-
				Ph3								-	-	-	-
407	Ir	2	1	L1	B	H	H	Tn7	H	H	H	H	H	-	-
				Ph2								H	C3H7	H	H
				Ph2								H	C3H7	H	H
408	Ir	2	1	L1	B	H	CH3	Ph2	H	H	H	H	F	H	H
				Tn5								H	H	-	-
				Tn5								H	H	-	-
409	Ir	2	1	L1	B	H	CH3	Np3	H	H	H	H	H	-	-
				CH3								-	-	-	-
				Ph3								-	-	-	-
410	Ir	2	1	L1	C	H	-	H	H	H	H	-	-	-	-
				Tn6								H	H	-	-
				Tn6								H	H	-	-
411	Ir	2	1	L1	D	H	H	CF3	H	H	H	-	-	-	-
				Np3								CH3O	H	-	-
				Np3								CH3O	H	-	-

Table 1-12 (continued)

No	M	m	n	L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
				E								E			
												R7	R8	R9	R10
				G								G			
												R7	R8	R9	R10
412	Ir	2	1	L1	E	-	-	H	I Cl	H	H	-	-	-	-
				Np4								F	-	-	-
				Np4								F	-	-	-
413	Ir	2	1	L1	F	H	-	H	OCH (CH3) 2	H	H	-	-	-	-
				Tn7								CH3	H	-	-
				Tn7								CH3	H	-	-

Table 1-13

				L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
No	M	m	n	E								E			
												R7	R8	R9	R10
				G								G			
												R7	R8	R9	R10
414	Ir	2	1	L1	H	H	-	Ph2	H	H	H	H	H	CF3	H
				Tn8								H	H	-	-
				Tn8								H	H	-	-
415	Ir	2	1	L1	H	CH3	-	H	Tn5	H	H	H	H	-	-
				Pe2								H	-	-	-
				Pe2								H	-	-	-
416	Rh	2	1	L1	I	H	H	Tn8	H	H	H	H	H	-	-
				CH3								-	-	-	-
				CH3								-	-	-	-
417	Rh	2	1	L1	P	-	H	OCH3	H	H	H	-	-	-	-
				CH3								-	-	-	-
				CH3								-	-	-	-
418	Rh	2	1	L1	V	H	-	Ph2	H	H	H	H	F	H	H
				CH3								-	-	-	-
				CH3								-	-	-	-
419	Rh	2	1	L1	D'	H	-	Ph2	H	H	H	H	F	H	H
				Ph3								-	-	-	-
				Ph3								-	-	-	-

Table 1-13 (continued)

				L	X	R1	R2	X1	X2	X3	X4	R7	R8	R9	R10
No	M	m	n	E								E			
												R7	R8	R9	R10
				G								G			
												R7	R8	R9	R10
420	Pt	1	1	L1	F'	-	-	F	CF3	H	H	-	-	-	-
				CH3								-	-	-	-
				CH3								-	-	-	-
421	Pt	1	1	L1	J'	-	-	Ph3	H	H	CF3	-	-	-	-
				CF3								-	-	-	-
				CF3								-	-	-	-
422	Pt	1	1	L1	C	H	-	Pe2	H	H	H	H	-	-	-
				Pi2								H	H	-	-
				Pi2								H	H	-	-
423	Pd	1	1	L1	B	H	H	H	H	H	H	-	-	-	-
				CH3								-	-	-	-
				CH3								-	-	-	-
424	Pd	1	1	L1	B	H	H	H	OCH (CH3) 2	H	H	-	-	-	-
				CF3								-	-	-	-
				CF3								-	-	-	-
425	Pd	1	1	L1	C	H	-	H	H	H	H	-	-	-	-
				Qn2								H	H	-	-
				Qn2								H	H	-	-

Table 1-14

No	M	m	n	L	X	R1	R2	R3	R4	X1	X2	X3	X4
426	Ir	3	0	L2	B	H	H	-	-	H	H	-	H
427	Ir	3	0	L3	B	H	H	-	-	F	H	H	-
428	Ir	3	0	L4	B	H	H	-	-	H	F	H	H
429	Ir	3	0	L5	B	H	H	-	-	-	F	H	H
430	Ir	3	0	L6	B	H	H	-	-	CF3	-	-	H
431	Ir	3	0	L7	B	H	H	-	-	H	H	H	H
432	Ir	3	0	L8	B	H	H	-	-	F	CF3	H	H
433	Ir	3	0	L9	B	H	H	-	-	H	H	CF3	F
434	Ir	3	0	L10	B	H	H	-	-	H	H	H	H
435	Ir	3	0	L11	B	H	H	-	-	H	H	H	H
436	Ir	3	0	L2'	B	H	H	-	-	H	CH3	-	H

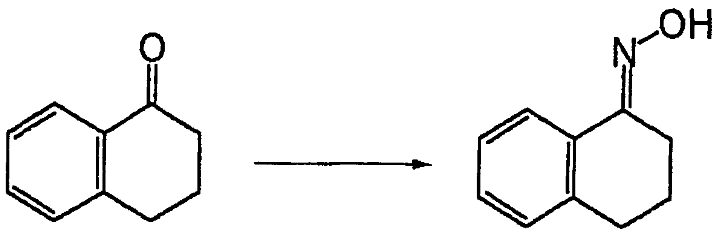
Table 1-14 (continued)

No	M	m	n	L	X	R1	R2	R3	R4	X1	X2	X3	X4
437	Ir	3	0	L3'	B	H	H	-	-	OCH3	H	H	-
438	Ir	3	0	L4'	B	H	H	-	-	H	H	H	H
439	Ir	3	0	L5'	B	H	H	-	-	-	H	H	H
440	Ir	3	0	L6'	B	H	H	-	-	H	-	-	H
441	Ir	3	0	L7'	B	H	H	-	-	H	H	H	H
442	Ir	3	0	L8'	B	H	H	-	-	H	H	H	H
443	Ir	3	0	L9'	B	H	H	-	-	H	H	H	H
444	Ir	3	0	L10'	B	H	H	-	-	H	H	H	H
445	Ir	3	0	L11'	B	H	H	-	-	H	H	H	H
446	Ir	3	0	L1	M'	CH3	CH3	CH3	CH3	H	H	H	H
447	Ir	3	0	L1	M'	C2H5	C2H5	C2H5	C2H5	H	H	H	H
448	Ir	3	0	L1	M'	CH3	CH3	CH3	CH3	F	H	H	H
449	Ir	3	0	L1	M'	CH3	CH3	CH3	CH3	H	F	H	H
450	Ir	3	0	L1	M'	CH3	CH3	CH3	CH3	F	CH3	H	H

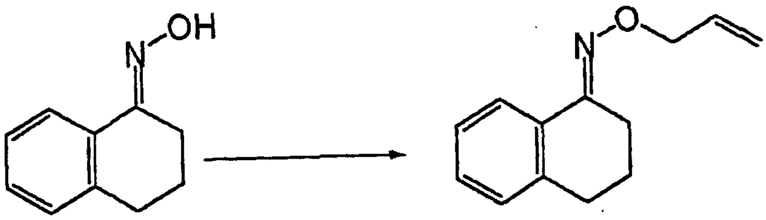
[0045] Hereinbelow, the present invention will be explained with reference to Examples

<Example 1> (Synthesis of Example Compound No. 1)

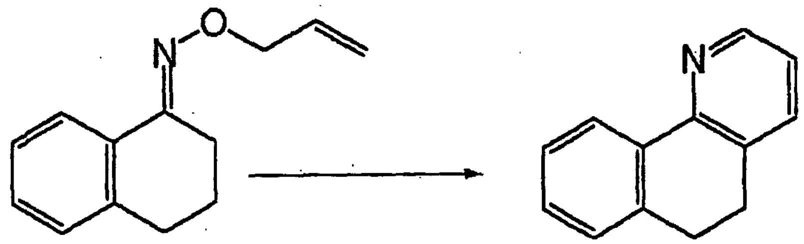
[0046]



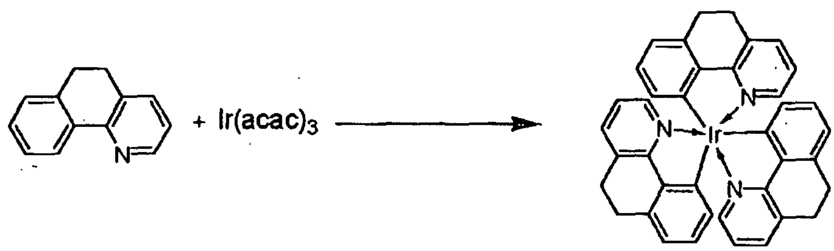
[0047] In a 2 liter-three-necked flask, 69.0 g (472 mM) of α-tetralon, 50.0 g (720 mM) of hydroxylamine hydrochloride, 500 ml of ethanol and 360 ml of 2N-sodium hydroxide aqueous solution were placed and stirred for 1 hour at room temperature. The solvent was removed under reduced pressure to obtain a residue (dry solid). To the residue, 500 ml of water was added, followed by extraction three times each with 150 ml of ethyl acetate. The organic layer was dried with anhydrous magnesium sulfate, followed by removal of the solvent under reduced pressure to obtain 74 g of a pale yellow crystal of α-tetralon = oxime (Yield: 97.2 %).



[0048] In a 1 liter-three-necked flask, 80 ml of tetrahydrofuran and 23.8 g (595 mM) of 60 %-oily sodium hydride were placed and stirred for 5 minutes at room temperature, followed by dropwise addition to a solution of 74 g (459 mM) of α-tetralon = oxime in 500 ml of anhydrous DMF (dimethylformamide) in 15 minutes. The mixture was then stirred for 1 hour at room temperature and thereto, 113.5 g (939 mM) of allyl bromide was added, followed by stirring for 12 hours at room temperature. After the reaction, the reaction product was dried under reduced pressure to obtain a residue. To the residue, 500 ml of water was added, followed by extraction three times each with 200 ml of ethyl acetate. The organic layer was dried with anhydrous magnesium sulfate, followed by removal of the solvent under reduced pressure to obtain a brown liquid. The liquid was subjected to distillation under reduced pressure to obtain 79.5 g (Yield: 86.0 %) of α-tetralon=oxime=O-allyl=ether (boiling point = 75 = 80 °C (6.7 Pa)).



[0049] In a 1 liter-autoclave, 58.0 g (288 mM) of α-tetralon=oxime=O-allyl=ether was placed and, after being aerated with oxygen gas, sealed hermetically, followed by vigorous stirring for 5 days at 190 °C. The liquid was cooled to room temperature to obtain a high-viscous brown liquid, which was dissolved in chloroform and subjected to extraction three times each with 300 ml of 5 %-hydrochloric acid. The aqueous layer was alkalified by 48 %-sodium hydroxide and subjected to extraction three times each with 350 ml of chloroform. The organic layer was dried with anhydrous magnesium sulfate, followed by evaporation under reduced pressure. The residue was purified by silica gel column chromatography (eluent: chloroform) and further purified by silica gel column chromatography (eluent: hexane/ethyl acetate = 5/1) to obtain 7.7 g of a pale brown liquid. The liquid was purified by a Kugelroh distiller to obtain 6.6 g of colorless benzo-[h]-5,6-dihydroquinoline (Yield: 12.6 %).

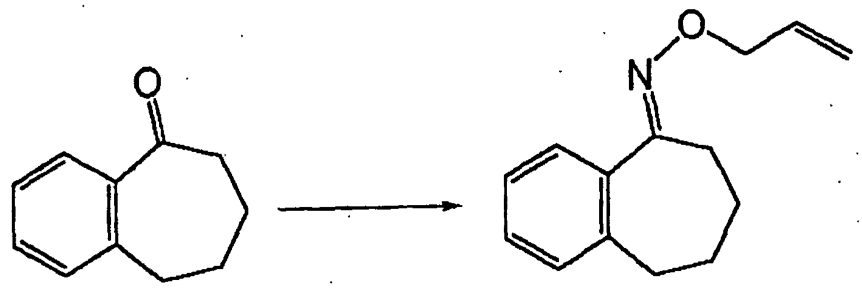


[0050] In a 100 ml-four-necked flask, 50 ml of glycerol was placed and heated for 2 hours at 130 - 140 °C under stirring and bubbling with nitrogen. The glycerol was cooled to 100 °C by standing and thereto, 0.91 g (5.02 mM) of benzo-[h]-5,6-dihydroquinoline and 0.50 g (1.02 mM) of iridium (III) acetylacetonate were placed, followed by heat-stirring for 5 hours at 190 - 215 °C in a nitrogen stream. The reaction product was cooled to room temperature and poured into 300 ml of 1N-hydrochloric acid. The precipitate was recovered by filtration, washed with water, and dissolved in acetone to remove an insoluble matter by filtration. The acetone was removed under reduced pressure to obtain a residue, which was purified by silica gel column chromatography (eluent: chloroform) to obtain 0.11 g of yellow powder of iridium (III) tris{benzo[h]-5,6-dihydroquinoline} (Yield: 14.7 %).

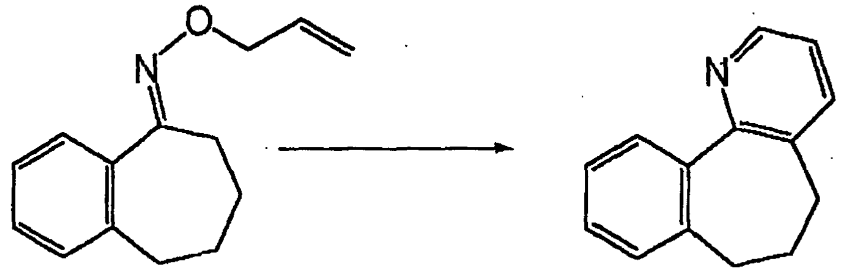
[0051] A solution of this compound exhibited PL (photoluminescence) spectrum having *max (maximum or peak emission wavelength) of 511 nm and quantum yield of 0.51. For comparison, when a PL spectrum of a solution of the aforementioned conventional luminescent material: $Ir(ppy)_3$ which is, not crosslinked with an alkylene group, different from the metal coordination compound, was measured, the material exhibited *max (maximum emission wavelength) of 510 nm and a quantum yield of 0.40. Further, an organic EL device obtained in Example 3 described later produced high-luminance luminescence by electric field application. Further, EL spectrum thereof provided *max (maximum emission wavelength) of 510 nm.

<Example 2> (Synthesis of Ex. Comp. No. 53)

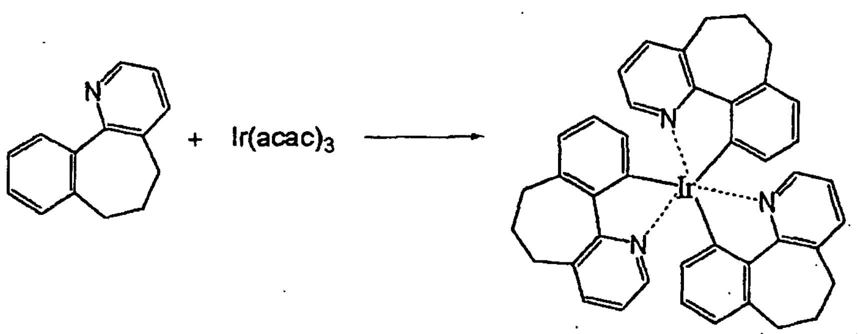
[0052]



[0053] In a 3 liter-three-necked flask, 166.0 g (1036 mM) of 1-benzosuberone, 125.0 g (1141 mM) of O-allylhydroxylamine hydrochloride, 93.5 g (1140 mM) of sodium acetate, 158.0 g (1143 mM) of potassium carbonate and 1500 ml of ethanol were placed and heat-stirred for 1.5 hour at 80 °C. The reaction product was cooled to room temperature and the solvent was removed under reduced pressure to obtain a residue. To the residue, 1500 ml of water was added, followed by extraction three times each with 500 ml of ethyl acetate. The organic layer was dried with anhydrous magnesium sulfate, followed by removal of the solvent under reduced pressure to obtain a pale brown liquid. The liquid was subjected to distillation under reduced pressure to obtain 221.8 g (Yield: 99.0 %) of 1-benzosuberone=oxime=O-allyl=ether (boiling point = 75 = 83 °C (4.0 Pa)).



[0054] In a 5 liter-autoclave, 220.0 g (1022 mM) of 1-benzosuberone=oxime=O-allyl=ether was placed and, after being aerated with oxygen gas, sealed hermetically, followed by vigorous stirring for 3 days at 190 °C. The liquid was cooled to room temperature to obtain a high-viscous brown liquid, which was dissolved in 2 liters of chloroform and subjected to extraction three times each with 500 ml of 5 %-hydrochloric acid. The aqueous layer was alkalified by 48 %-sodium hydroxide and subjected to extraction three times each with 500 ml of chloroform. The organic layer was dried with anhydrous magnesium sulfate, followed by purification by silica gel column chromatography (eluent: hexane/ethyl acetate = 5/1) to obtain 19 g of a pale brown liquid. The liquid was purified by a Kugelroh distiller to obtain 13.5 g of pale green liquid of 3,2'-trimethylene-2-phenylpyridine (Yield: 13.5 %).



[0055] In a 100 ml-four-necked flask, 50 ml of glycerol was placed and heated for 2 hours at 130 - 140 °C under stirring and bubbling with nitrogen. The glycerol was cooled to 100 °C by standing and thereto, 0.98 g (5.02 mM) of 3,2'-trimethylene-2-phenylpyridine and 0.50 g (1.02 mM) of iridium (III) acetylacetonate were placed, followed by heat-stirring for 8 hours at 190 - 215 °C in a nitrogen stream. The reaction product was cooled to room temperature and poured into 300 ml of 1N-hydrochloric acid. The precipitate was recovered by filtration, washed with water, and dissolved in acetone to remove an insoluble matter by filtration. The acetone was removed under reduced pressure to obtain a residue, which was purified by silica gel column chromatography (eluent: chloroform) to obtain 0.18 g of yellow powder of iridium (III) tris{3,2'-trimethylene-2-phenylpyridine} (Yield: 22.7 %).

[0056] An organic EL device obtained in Example 6 described later produced bluish green luminescence by electric field application.

<Examples 3 - 11 and Comparative Example 1>

[0057] As a device structure, a device having a three-layer structure of organic layers shown in Figure 1(b) was used. On a glass substrate (transparent substrate 15), a 100 nm-thick film (transparent electrode 14) of ITO (indium tin oxide) was formed, followed by patterning. On the ITO-formed substrate, organic layers and metal electrode layers shown below were successively formed by vacuum (vapor) deposition using resistance heating in a vacuum chamber (10^{-4} Pa).

Organic layer 1 (hole transport layer 13) (40 nm): α-NPD
Organic layer 2 (luminescence layer 12) (20 nm): mixture of CBP: luminescent material (95:5)

[0058] This layer was formed by co-deposition of CBP as a host material with a metal coordination compound shown in Table 2 below as the luminescent material so a to provide a weight proportion of 5 wt. %.

Organic layer 3 (electron transport layer 16) (30 nm): Alq3
Metal electrode layer 1 (metal electrode 11) (15 nm): Al-Li alloy (Li = 1.8 wt. %)
Metal electrode layer 2 (metal electrode 11) (100 nm): Al

[0059] After formation of the electrode material layers, patterning was performed so as to provide an electrode area of 3 mm^2.

[0060] An electric field (voltage) was applied, so as to provide each device with the same current value, to each luminescence device having the ITO electrode (as an anode) and the Al electrode (as a cathode), to measure a change in luminance (brightness) with time. The current amount was set to 70 mA/cm^2 and the respective devices showed luminances in the range of 80 - 250 cd/m^2 at an initial stage. A time required for decreasing these luminance values to 1/2 thereof.

[0061] For measurement, each luminescence device was taken out of the vacuum chamber and was subjected to the measurement in an atmosphere of dry nitrogen gas stream so as to remove device deterioration factors, such as oxygen and moisture (water content).

[0062] In Comparative Example 1, as the conventional luminescent material, $Ir(ppy)_3$ described in the above-mentioned Article 2 was used.

[0063] The results of continuous energization test o devices using the respective compounds are shown in Table 2. Compared with the device using the conventional luminescence material, the luminescence devices using the metal coordination compounds according to the present invention provide longer luminance half-lifes, thus resulting in a device having a high durability based on a good stability of the materials of the present invention.

Table 2

Ex. No.	Ex.Comp. No.	Luminance half-life (Hr)
3	(1)	950
4	(7)	850
5	(48)	700
6	(53)	900
7	(102)	600
8	(131)	500
9	(302)	800
10	(376)	750
11	(401)	650

Table 2 (continued)

Ex. No.	Ex.Comp. No.	Luminance half-life (Hr)
Comp.Ex. 1	$Ir(ppy)_3$	350

<Example 12>

[0064] With reference to Figure 2, an embodiment such that the electroluminescence device of the present invention is applied to an active matrix-type color organic EL display using a TFT circuit shown in Figure 3 will be described.

[0065] Figure 2 schematically illustrates an example of a panel structure provided with an organic EL device and drive means. In this embodiment, the number of pixels was 128x128 pixels. Incidentally, one pixel was constituted by three color pixels consisting of green pixel, blue pixel and red pixel.

[0066] On a glass substrate, a thin film transistor circuit (referred to as a "TFT circuit") using polysilicon was formed in a known manner.

[0067] In a region corresponding to each of the color pixels, by using a hard mask, organic layers and metal electrode layers were formed by vacuum deposition in the thicknesses indicated below, followed by patterning. Structures of the organic layers corresponding to the respective pixels are shown below.

Green pixel:α-NPD (40 nm)/CBP:phosphorescent material (= 93:7 in weight ratio) (30 nm)/BCP (20 nm)/Alq (40 nm)
Blue pixel:α-NPD (50 nm)/BCP (20 nm)/alq (50 nm)
Red pixel:α-NPD (40 nm)/CBP:PtOEP (= 93:7 in weight ratio) (30 nm)/BCP (20 nm)/Alq (40 nm)

[0068] The luminescence layer for the green pixel was formed by co-deposition of CBP as a host material with the phosphorescent material (Ex. Comp. No. 1) which provided a weight proportion of 7 %.

[0069] In the panel shown in Figure 2, a scanning signal driver, data signal driver and a current supply source and disposed and are respectively connected to gate selection lines, data signal lines and current supply lines. At intersections of the gate selection lines and the data signal lines, a pixel circuit (equivalent circuit) shown in Figure 3 is disposed. The scanning signal driver sequentially selects gate scanning lines G1, G2, G3, ..., Gn, and in synchronism therewith, picture signals are supplied from the data signal driver.

[0070] Next, a pixel circuit operation is described with reference to the equivalent circuit shown in Figure 3. When a selection signal is applied to a gate selection line, TFT1 is turned on so that a display signal is supplied from a data signal line to a capacitor Cadd, thereby determining the gate potential of TFT2. A current is supplied to an organic luminescence device portion (abbreviated as EL) disposed at each pixel through a current supply line depending on the gate potential of TFT2. The gate potential of TFT2 is held at Cadd during one frame period, so that the current continually flows from the current supply line to the EL device portion during the period. As a result, luminescence is retained during one frame period.

[0071] As a result, it has been confirmed that desired picture information can be displayed, and it has been found that good images are stably displayed.

[0072] In this embodiment, although the driving scheme using the TFT circuit being the active matrix scheme was used as the application to the display, the switching device used in the present invention need not be particularly restricted, and even a singler-crystal silicon substrate, an MIM (metal-insulator-metal) device, an a-Si (amorphous silicon) TFT circuit, etc., can be readily applied thereto.

[INDUSTRIAL APPLICABILITY]

[0073] As described above, a luminescence device using, as a luminescence material, the metal coordination compound represented by the aforementioned formula (1) of the present invention could provide a high luminescence efficiency and retain a high-brightness luminescence or a long period of time. Further, the material is an excellent material capable of adjusting an emission wavelength, particularly providing a shorter wavelength. The luminescence device of the present invention is also excellent as a display device.

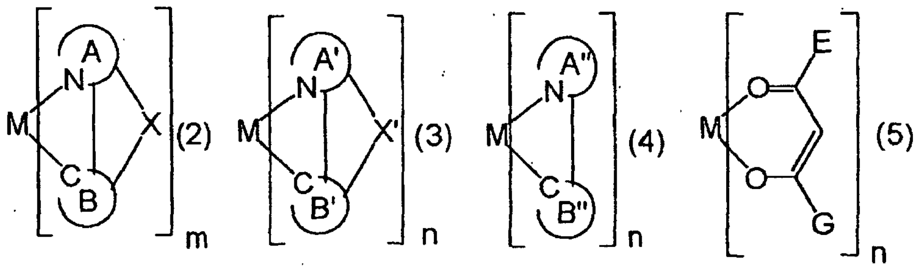
[0074] The high-efficiency luminescence device shown in the present invention is applicable to products requiring energy saving and high brightness. As applied examples, applications to a display apparatus, an illumination apparatus, a light source of a printer and a backlight for a liquid crystal display apparatus may be exemplified. As the display apparatus, it is possible to provide a flat panel display allowing energy saving, high recognizability or weight reduction. Further, as the light source or the printer, it is possible to replace a laser light source portion of a laser beam printer which has been currently used widely, with the luminescence device of the present invention. Image formation is performed by arranging independently addressable devices in the form of an array and effecting desired exposure to light against a photosensitive drum. By using the device of the present invention, it is possible to remarkably reduce an apparatus volume (size).

Claims

1. A metal coordination compound represented by formula (1) shown below:

$$ML_mL'_n \quad (1),$$

wherein M is a metal atom of Ir, Pt, Rh or Pd; L and L' are mutually different bidentate ligands; m is 1, 2 or 3; n is 0, 1 or 2 with the proviso that m+n is 2 or 3; a partial structure ML_m is represented by formula (2) shown below and a partial structure ML'_n is represented by formula (3), (4) or (5) shown below:



wherein N and C are nitrogen and carbon atoms, respectively; A and A' are respectively a cyclic group capable of having a substituent and bonded to the metal atom M via the nitrogen atom; B, B' and B" are respectively a cyclic group capable of having a substituent and connected to the metal atom M via the carbon atom;

{wherein the substituent is selected from a halogen atom, a cyano group, a nitro group, a trialkylsilyl group (of which the alkyl groups are independently a linear or branched alkyl group having 1 to 8 carbon atoms), a linear or branched alkyl group having 1 to 20 carbon atoms (of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, - CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C- and the alkyl group can include a hydrogen atom that can be replaced with a fluorine atom), or an aromatic cyclic group capable of having a substituent (of which the substituent is a halogen atom, a cyano group, a nitro group, or a linear or branched alkyl group having 1 to 20 carbon atoms (of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, - O-CO-, -CH=CH- or -C≡C- and the alkyl group can include a hydrogen atom that can be replaced with a fluorine atom));

A and B, A' and B', and A" and B" are respectively bonded to each other via a covalent bond; and A and B, and A' and B' are respectively bonded to each other via X and X', respectively;

X and X' are independently a linear or branched alkylene group having 2 to 10 carbon atoms (of which the alkylene group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C- and the alkylene group can include a hydrogen atom that can be replaced with a fluorine atom);

E and G are independently a linear or branched alkyl group having 1 to 20 carbon atoms (of which the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom), or an aromatic cyclic group capable of having a substituent (of which the substituent is a halogen atom, a cyano group, a nitro group, a trialkylsilyl group (of which the alkyl groups are independently a linear or branched alkyl group having 1 to 8 carbon atoms), or a linear or branched alkyl group having 1 to 20 carbon atoms (of which the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C- and the alkyl group can include a hydrogen atom that can be replaced with a fluorine atom)}.

2. A compound according to Claim 1, wherein n is 0 in the formula (1).

3. A compound according to Claim 1, wherein in the formula (1), the partial structure ML'n is represented by the

formula (3).

4. A compound according to Claim 1, wherein in the formula (1), the partial structure ML'n is represented by the formula (4).

5. A compound according to Claim 1, wherein in the formula (1), the partial structure ML'n is represented by the formula (5).

6. A compound according to Claim 1, wherein X is a linear or branched alkylene group having 2 to 10 carbon atoms (of which the alkylene group can include one or non-neighboring two or more methylene groups that can be replaced with -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- or -C≡C- and the alkylene group can include a hydrogen atom that can be replaced with a fluorine atom).

7. A compound according to Claim 1, wherein M is Ir in the formula (1).

8. An electroluminescence device, comprising: a substrate, a pair of electrodes disposed on the substrate, and at least one species of a metal coordination compound, represented by the formula (1) according to Claim 1, disposed between the pair of electrodes.

9. A device according to Claim 8, wherein a voltage is applied between the electrodes to produce phosphorescence.

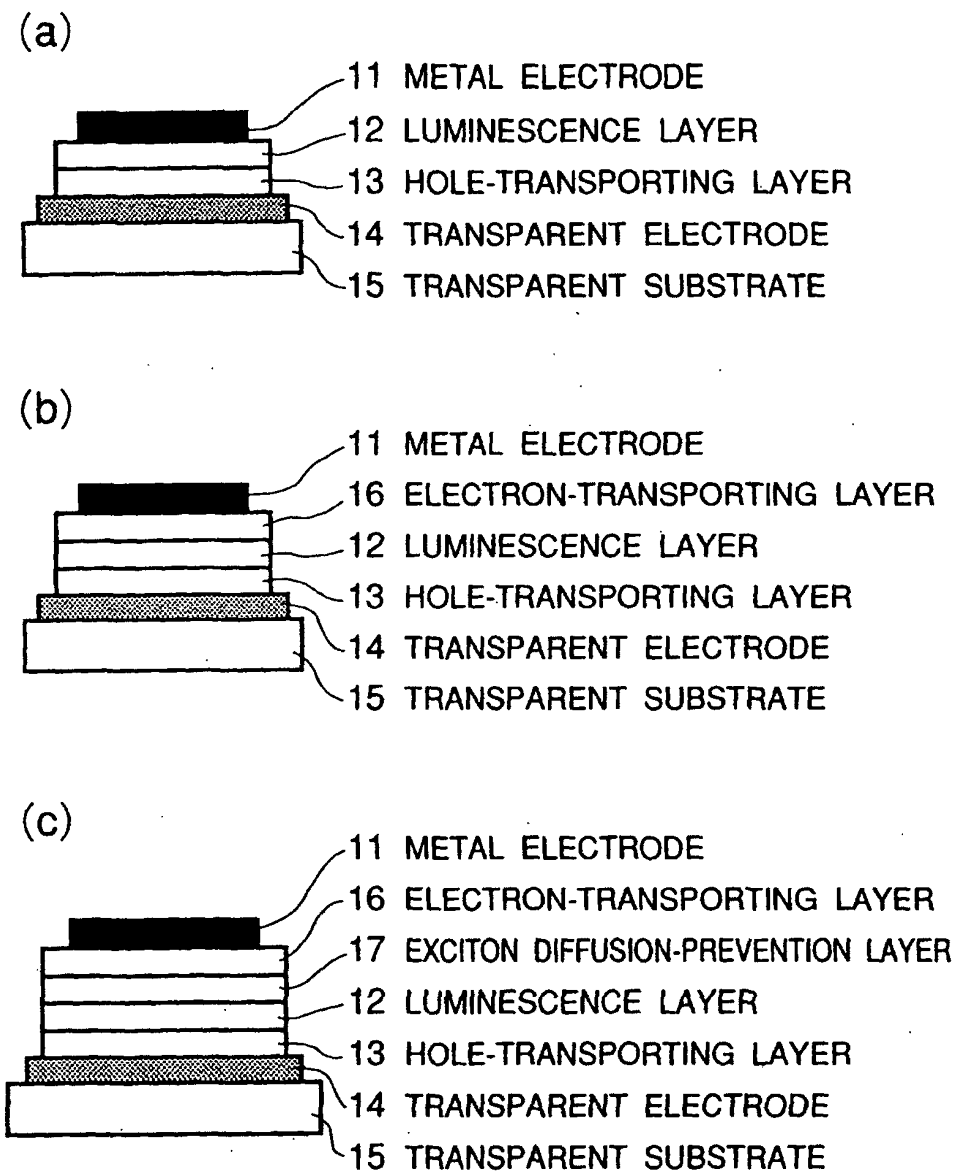

(a)
11 METAL ELECTRODE
12 LUMINESCENCE LAYER
13 HOLE-TRANSPORTING LAYER
14 TRANSPARENT ELECTRODE
15 TRANSPARENT SUBSTRATE
(b)
11 METAL ELECTRODE
16 ELECTRON-TRANSPORTING LAYER
12 LUMINESCENCE LAYER
13 HOLE-TRANSPORTING LAYER
14 TRANSPARENT ELECTRODE
15 TRANSPARENT SUBSTRATE
(c)
11 METAL ELECTRODE
16 ELECTRON-TRANSPORTING LAYER
17 EXCITON DIFFUSION-PREVENTION LAYER
12 LUMINESCENCE LAYER
13 HOLE-TRANSPORTING LAYER
14 TRANSPARENT ELECTRODE
15 TRANSPARENT SUBSTRATE

FIG. 1

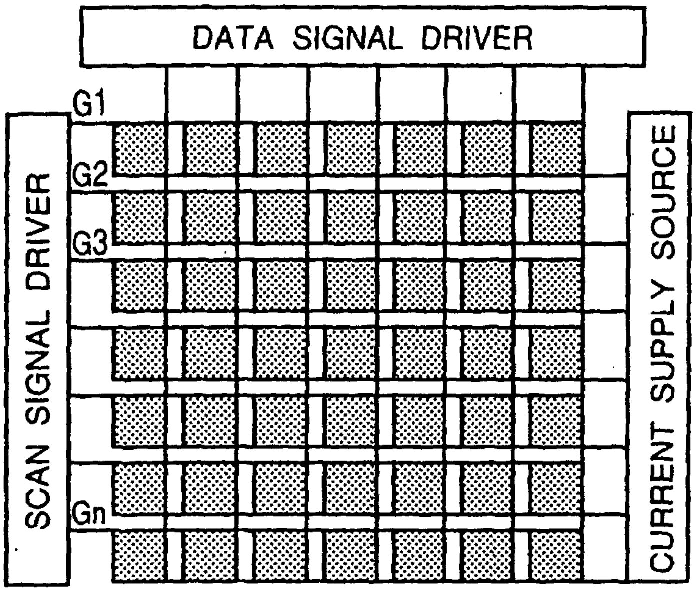

DATA SIGNAL DRIVER
G1
G2
G3
Gn
SCAN SIGNAL DRIVER
CURRENT SUPPLY SOURCE

FIG. 2

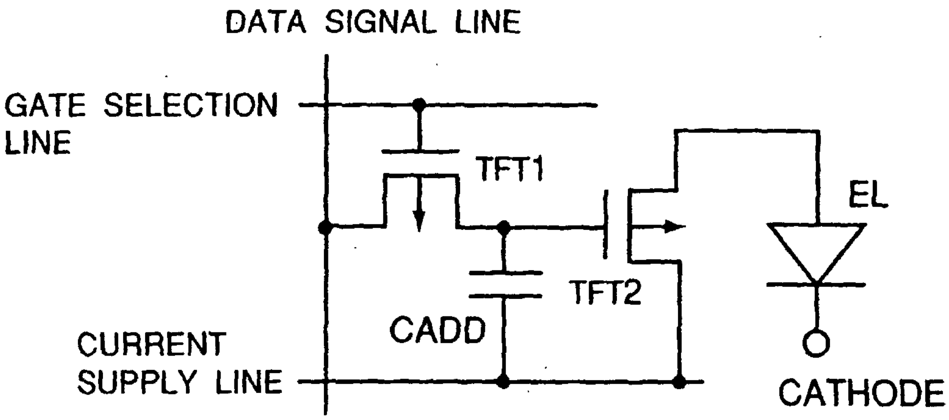

DATA SIGNAL LINE
GATE SELECTION LINE
TFT1
EL
TFT2
CADD
CURRENT SUPPLY LINE
CATHODE

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/06001

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] C07D221/10, C07D221/16, C09F11/06, H05B33/14, H05B33/12, C07F15/00

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] C07D221/10, C07D221/16, C09F11/06, H05B33/14, H05B33/12, C07F15/00

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	CORNIOLEY-DEUSCHEL Christine et al., 15. Complexes with a Pincers. 2, 6-Diphenylpyridine as Twofold-Deprotonated (CΛNΛC) Terdentate Ligand in C,C-trans-, and as Monodeprotonated (CΛN)Chelate Ligand in Chiral C, C-cis-Complexes of Platinum (II), and Palladium(II), Helv. Chim. Acta, 1988, Vol.71, Vol.1, pages 130 to 133	1,2,6 3-5,7-9
X Y	DEUSCHEL-CORNIOLEY Christine et al., A New Type of 'Square Planar' Platinum(II) Complex showing Helical Chirality, J. Chem. Soc., Chem. Commun., 1990, Vol.2, pages 121 to 122	1,2,6 3-5,7-9

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

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

Date of the actual completion of the international search	Date of mailing of the international search report
15 August, 2002 (15.08.02)	27 August, 2002 (27.08.02)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/06001

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	MACSTRI Macstri et al., Spectroscopic and electrochemical properties of Pt(II) complex with aromatic terdendate (C^N^C) cyclometallating ligands, J. Photochem. Photobiol. A: Chem., 1992, Vol.67, pages 173 to 179	1,2,6 3-5,7-9
Y A	WO 01/41512 A1 (THE TRUSTEES OF PRINCETON UNIVERSITY), 07 June, 2001 (07.06.01), Full text & AU 200118072 A	3-5,7-9 1,2,6
A	LAMANSKY Sergey et al., Synthesis and Characterization of Phosphorescent Cyclometalated Iridium Compleses, Inorg. Chem., 26 March, 2001 (26.03.01), Vol.40, pages 1704 to 1711	1-9
A	LAMANSKY Sergey et al., Highly Phosphorescent Bis-Cyclometalated Iridium Complexes: Synthesis, Photophysical Characterization, and Use in Organic Light Emitting Diodes, J. Am. Chem. Soc., 09 May, 2001 (09.05.01), Vol.123, pages 4304 to 4312	1-9
A	WO 00/57676 A1 (THE UNIVERSITY OF SOUTHERN CALIFORNIA), 28 September, 2000 (28.09.00), Full text & AU 200039084 A & EP 1181842 A1 & BR 200009215 A & KR 2002004982 A	1-9
A	JOLLIET Philippe et al., Cyclometalated Complexes of Palladium(II) and Platinum(II): cis-Configured Homoleptic and Heteroleptic Compounds with Aromatic C N Ligands, Inorg. Chem., 1996, Vol.35, pages 4883 to 4888	1-9
A	OHSAWA Y. et al., Electrochemistry and Spectroscopy of Ortho-Metalated Complexes of Ir(III) and Rh(III), J. Phys. Chem., 1987, Vol.91, pages 1047 to 1054	1-9
P,A	JP 2001-181617 A (Fuji Photo Film Co., Ltd.), 03 July, 2001 (03.07.01), Full text (Family: none)	1-9
P,A	WO 02/44189 A1 (CANON KABUSHIKI KAISHA), 06 June, 2002 (06.06.02), Full text (Family: none)	1-9

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/06001

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,A	EP 1211257 A2 (CANON KABUSHIKI KAISHA), 05 June, 2002 (05.06.02), Full text (Family: none)	1-9
P,A	JP 2002-105055 A (Fuji Photo Film Co., Ltd.), 10 April, 2002 (10.04.02), Full text (Family: none)	1-9
P,A	JP 2001-181616 A (Fuji Photo Film Co., Ltd.), 03 July, 2001 (03.07.01), Full text (Family: none)	1-9
P,A	US 2001/19782 A1 (Tatsuya IGARASHI), 06 September, 2001 (06.09.01), Full text & JP 2001-247859 A Full text & JP 2001-345183 A	1-9
P,A	JP 2002-175884 A (CANON KABUSHIKI KAISHA), 21 June, 2002 (21.06.02), Full text (Family: none)	1-9

Form PCT/ISA/210 (continuation of second sheet) (July 1998) patsnap

专利名称(译)	金属配位化合物和电致发光器件
公开(公告)号	EP1400514A1
公开(公告)日	2004-03-24
申请号	EP2002738730
申请日	2002-06-17
[标]申请(专利权)人(译)	佳能株式会社
申请(专利权)人(译)	佳能株式会社
当前申请(专利权)人(译)	佳能株式会社
[标]发明人	TAKIGUCHI TAKAO TSUBOYAMA AKIRA OKADA SHINJIRO KAMATANI JUN MIURA SEISHI MORIYAMA TAKASHI IGAWA SATOSHI FURUGORI MANABU MIZUTANI HIDEMASA
发明人	TAKIGUCHI, TAKAO TSUBOYAMA, AKIRA OKADA, SHINJIRO KAMATANI, JUN MIURA, SEISHI MORIYAMA, TAKASHI IGAWA, SATOSHI FURUGORI, MANABU MIZUTANI, HIDEMASA
IPC分类号	H01L51/50 C07D221/10 C07D221/16 C07F15/00 C09K11/06 G09F9/30 H01L27/32 H01L51/00 H01L51/30 H05B33/14 H05B33/12
CPC分类号	C07D221/16 C07D221/10 C09K11/06 C09K2211/1007 C09K2211/1011 C09K2211/1014 C09K2211/1018 C09K2211/1029 C09K2211/1044 C09K2211/1088 C09K2211/1092 C09K2211/181 C09K2211/185 H01L27/3244 H01L51/0059 H01L51/0062 H01L51/0081 H01L51/0084 H01L51/0085 H01L51/0087 H01L51/5016 H05B33/14 Y10S428/917
代理机构(译)	VOLLNHALS，奥里尔
优先权	2001190662 2001-06-25 JP
其他公开文献	EP1400514B1 EP1400514A4
外部链接	Espacenet

摘要(译)

具有由通式MLmL'n（1）表示的基本结构的金属配位化合物（其中M是Ir，Pt，Rh或Pd的金属原子; L和L'表示相互不同的二齿配位体; m是1,2或3; n为0,1或2，条件是m + n为2或3）其中至少一个二齿配位体L的碱性结构具有通过具有2-10个碳原子的亚烷基缩合形成的部分结构原子。在由设置在阴极和阳极之间的一个或多个有机膜构成的电致发光器件中，至少一个层是通过混合由具有由式（1）表示的结构的金属配位化合物组成的发光分子而形成的发光层， 1）作为主体材料中的客体材料。通过该发光层，可以提供产生高效率的发光并且长时间稳定地保持高亮度的电致发光器件。

(b)

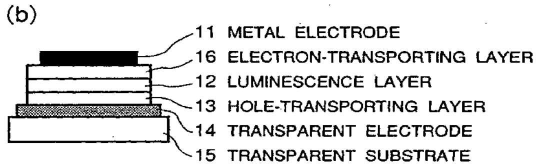
11 METAL ELECTRODE
16 ELECTRON-TRANSPORTING LAYER
12 LUMINESCENCE LAYER
13 HOLE-TRANSPORTING LAYER
14 TRANSPARENT ELECTRODE
15 TRANSPARENT SUBSTRATE

FIG. 1