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(54) **Metal coordination compound, luminescence device and display apparatus**

Metallkoordinationsverbindung, Lumineszente Vorrichtung und Bildanzeigevorrichtung

Composé complexe d'un métal, dispositif luminescent et dispositif d'affichage

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- **BALDO M A ET AL: "VERY HIGH-EFFICIENCY GREEN ORGANIC LIGHT-EMITTING DEVICES BASED ON ELECTROPHOSPHORESCENCE" APPLIED PHYSICS LETTERS, AMERICAN INSTITUTE OF PHYSICS. NEW YORK, US, vol. 75, no. 1, 5 July 1999 (1999-07-05), pages 4-6, XP002949187 ISSN: 0003-6951**
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- **SERGEY LAMANSKY: "Molecularly doped polymer light emitting diodes utilizing phosphorescent Pt(II) and Ir(III) dopants" ORGANIC ELECTRONICS, ELSEVIER, AMSTERDAM, NL, no. 2, 2001, pages 53-62, XP002196402 ISSN: 1566-1199**

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Description

FIELD OF THE INVENTION AND RELATED ART

[0001] The present invention relates to an organic luminescence device (also called an organic electroluminescence device or organic EL device) for use in a planar light source, a planar display, etc. Particularly, the present invention relates to a novel metal coordination compound and a luminescence device having a high luminescence efficiency and causing little change with time by using a metal coordination compound represented by formula (1) appearing hereinafter.

[0002] An old example of organic luminescence device is, e.g., one using luminescence of a vacuum-deposited anthracene film (Thin Solid Films, 94 (1982) 171). In recent years, however, in view of advantages, such as easiness of providing a large-area device compared with an inorganic luminescence device, and possibility of realizing desired luminescence colors by development of various new materials and drivability at low voltages, an extensive study thereon for device formation as a luminescence device of a high-speed responsiveness and a high efficiency, has been conducted.

[0003] As precisely described in Macromol. Symp. 125, 1 - 48 (1997), for example, an organic EL device generally has an organization comprising a pair of upper and lower electrodes formed on a transparent substrate, and organic material layers including a luminescence layer disposed between the electrodes.

[0004] In the luminescence layer, aluminum quinolinol complexes (inclusive of Alq3 shown hereinafter as a representative example) having an electron-transporting characteristic and a luminescence characteristic, are used for example. In a hole-transporting layer, a material having an electron-donative property, such as a triphenyldiamine derivative (inclusive of α-NPD shown hereinafter as a representative example), is used for example.

[0005] Such a device shows a current-rectifying characteristic such that when an electric field is applied between the electrodes, holes are injected from the anode and electrons are injected from the cathode.

[0006] The injected holes and electrons are recombined in the luminescence layer to form excitons, which emit luminescence when they are transitioned to the ground state.

[0007] In this process, the excited states include a singlet state and a triplet state and a transition from the former to the ground state is called fluorescence and a transition from the latter is called phosphorescence. Materials in theses states are called singlet excitons and triplet excitons, respectively.

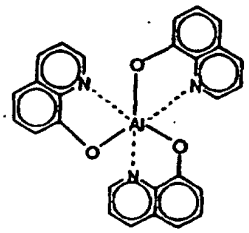
[0008] In most of the organic luminescence devices studied heretofore, fluorescence caused by the transition of a singlet exciton to the ground state, has been utilized. On the other hand, in recent years, devices utilizing phosphorescence via triplet excitons have been studied.

[0009] Representative published literature may include:

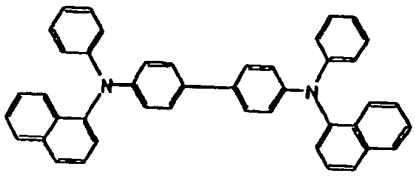
Article 1: Improved energy transfer in electrophosphorescent device (D.F. O'Brien, et al., Applied Physics Letters, Vol. 74, No. 3, p. 422 (1999)); and
Article 2: Very high-efficiency green organic light-emitting devices based on electrophosphorescence (M.A. Baldo, et al., Applied Physics Letters, Vol.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

[0010] In these articles, a structure including four organic layers sandwiched between the electrodes, and the materials used therein include carrier-transporting materials and phosphorescent materials, of which the names and structures are shown below together with their abbreviations.

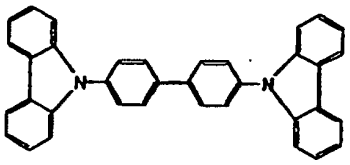
Alq3: aluminum quinolinol complex
α-NPD: N4,N4'-di-naphthalene-1-yl-N4,N4'-diphenyl-biphenyl-4,4'-diamine
CBP: 4,4'-N,N'-dicarbazole-biphenyl
BCP: 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline
PtOEP: platinum-octaethylporphyrin complex
$Ir(ppy)_3$: iridium-phenylpyridine complex



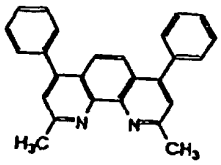
Alq3



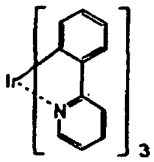
α-NPD



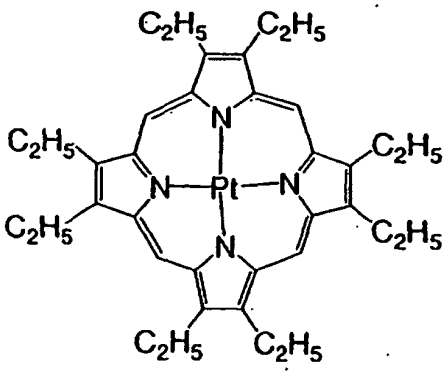
CBP



BCP



Ir(ppy)$_3$



PtOEP

[0011] The above-mentioned Articles 1 and 2 both have reported structures, as exhibiting a high efficiency, including a hole-transporting layer comprising α-NPD, an electron-transporting layer comprising Alq3, an exciton diffusion-preventing layer comprising BCP, and a luminescence layer comprising CBP as a host and ca. 6 % of PtOEP or Ir(ppy)$_3$ as a phosphorescent material dispersed in mixture therein.

[0012] Such a phosphorescent material is particularly noted at present because it is expected to provide a high luminescence efficiency in principle for the following reasons. More specifically, excitons formed by carrier recombination comprise singlet excitons and triplet excitons in a probability ratio of 1:3. Conventional organic EL devices have utilized fluorescence of which the luminescence efficiency is limited to at most 25 %. On the other hand, if phosphorescence generated from triplet excitons is utilized, an efficiency of at least three times is expected, and even an efficiency of 100 %, i.e., four times, can be expected in principle, if a transition owing to intersystem crossing from a singlet state having a higher energy to a triplet state is taken into account.

[0013] However, like a fluorescent-type device, such an organic luminescence device utilizing phosphorescence is generally required to be further improved regarding the deterioration of luminescence efficiency and device stability.

[0014] The reason of the deterioration has not been fully clarified, but the present inventors consider as follows based on the mechanism of phosphorescence.

[0015] In the case where the luminescence layer comprises a host material having a carrier-transporting function and a phosphorescent guest material, a process of phosphorescence via triplet excitons may include unit processes

as follows:

1. transportation of electrons and holes within a luminescence layer,
2. formation of host excitons,
3. excitation energy transfer between host molecules,
4. excitation energy transfer from the host to the guest,
5. formation of guest triplet excitons, and
6. transition of the guest triplet excitons to the ground state and phosphorescence.

[0016] Desirable energy transfer in each unit process and luminescence are caused in competition with various energy deactivation processes.

[0017] Needless to say, a luminescence efficiency of an organic luminescence device is increased by increasing the luminescence quantum yield of a luminescence center material.

[0018] Particularly, in a phosphorescent material, this may be attributable to a life of the triplet excitons which is longer by three or more digits than the life of a singlet exciton. More specifically, because it is held in a high-energy excited state for a longer period, it is liable to react with surrounding materials and cause polymer formation among the excitons, thus incurring a higher probability of deactivation process resulting in a material change or life deterioration.

[0019] A luminescence device is desired to exhibit high efficiency luminescence and show a high stability. Particularly, it is strongly desired to provide a luminescence material compound which is less liable to cause energy deactivation in a long life of excited energy state and is also chemically stable, thus providing a longer device life.

[0020] Baldo M A, et al, Applied Physics Letters, Vol. 75, No. 1, 1999, p. 4-6 is directed to light-emitting devices based on electrophosphorescence, disclosing the compound $Ir(ppy)_3$.

[0021] Polymer Preprints 2000, 41 (1), 770-771 describes the use of Ir(III) cyclometalated complexes as phosphorescent emitters in polymer blend LEDs. Specifically, a blend of poly (N-vinylcarbazole) (PVK) and 2-(4-biphenyl)-5-(4-tert-butylphenyl)-1,3,4-oxadiazole (PBD) with FIrppy is described, wherein a weight concentration of 2-3.5% of FIrppy results in a good quantum efficiency.

SUMMARY OF THE INVENTION

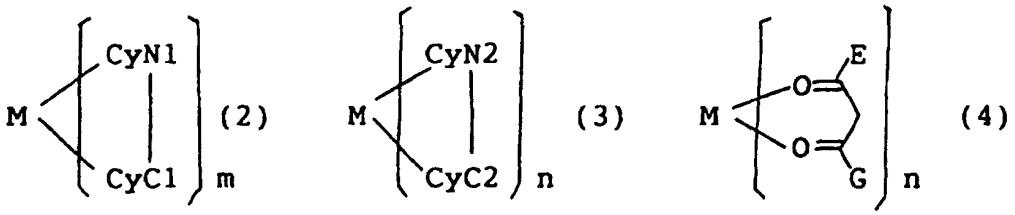
[0022] Accordingly, principal objects of the present invention are to provide a luminescence material which exhibits a high luminescence efficiency and retains a high luminance for a long period, and also provide a luminescence device and a display apparatus using the same.

[0023] In the present invention, a metal complex is used as a luminescence material, particularly a novel luminescent metal complex compound comprising iridium as a center metal and an aromatic group of formula (5) appearing hereinafter as a part of a ligand or as a substituent of a ligand.

[0024] More specifically, the present invention provides as a luminescence material a metal coordination compound represented by formula (1) 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 and n is 0, 1 or 2 with the proviso that m+n is 2 or 3; a partial structure MLm is represented by formula (2) shown below and a partial structure ML'_n is represented by formula (3) or (4) shown below:



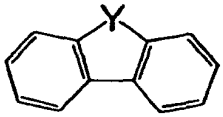
wherein CyN1 and CyN2 are each cyclic group capable of having a substituent, including a nitrogen atom and bonded to the metal atom M via the nitrogen atom; CyC1 and CyC2 are each cyclic group capable of having a substituent,

including a carbon atom and bonded to the metal atom M via the carbon atom with the proviso that the cyclic group CyN1 and the cyclic group CyC1 are bonded to each other via a covalent bond and the cyclic group CyN2 and the cyclic group CyC2 are bonded to each other via a covalent bond;

the optional substituent of the cyclic groups is selected from a halogen atom, 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 optionally replaced with a fluorine atom, or an aromatic group capable of having a substituent (that is a halogen atom, a cyano atom, a nitro atom, 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 optionally 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 group capable of having a substituent (that is a halogen atom, a cyano atom, a nitro atom, a trialkylsilyl group of which the alkyl groups are independently a linear or branched alkyl group having 1 - 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 optionally replaced with a fluorine atom; and

at least one of the substituent(s) of the cyclic groups, and the cyclic groups CyC1 and CyC2 include an aromatic group capable of having a substituent represented by the following formula (5):



(5)

wherein the aromatic group of the formula (5) is bonded to CyN1, CyN2, CyC1 or CyC2 via a single bond when the aromatic group is the substituent(s) of the cyclic groups, and the aromatic group of the formula (5) is bonded to CyN1 or CyN2 via a single bond and bonded to the metal atom M via a single bond when the aromatic group is CyC1 or CyC2;

Y denotes C=O, CRR', $C=C(CN)_2$, O or S wherein R and R' are independently a hydrogen atom, 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 optionally replaced with a fluorine atom, or an aromatic group capable of having a substituent (that is a halogen atom, a cyano atom, a nitro atom, a trialkylsilyl group of which the alkyl groups are independently a linear or branched alkyl group having 1 - 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 optionally replaced with a fluorine atom); and

the substituent of the aromatic group of the formula (5) is selected from a halogen atom, 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 optionally replaced with a fluorine atom, or an aromatic group capable of having a substituent (that is a halogen atom, a cyano atom, a nitro atom, 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 optionally replaced with a fluorine atom) with the proviso that an adjacent pair of substituents can be bonded to form a cyclic structure.

[0025] Preferred embodiments of the metal coordination compound of the formula (1) according to the present invention include the following:

A metal coordination compound having a partial structure ML'_n represented by the formula (3) in the formula (1).

A metal coordination compound having a partial structure ML'_n represented by the formula (4) in the formula (1).

A metal coordination compound, wherein n is 0 in the formula (1).

A metal coordination compound, wherein the group Y in the formula (5) is C=O or CRR'.

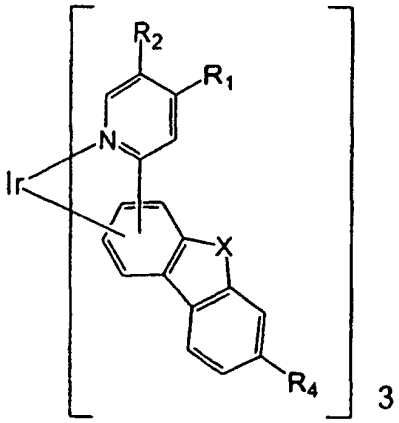
[0026] A metal coordination compound wherein the cyclic groups CyC1 in the formula (1) and CyC2 in the formula (3) are independently selected from phenyl group, thienyl group, thianaphthyl group, naphthyl group, pyrenyl group, 9-fluorenonyl group, fluorenyl group, dibenzofuryl group, dibenzothienyl group, or carbazolyl group, as an aromatic cyclic group capable of having a substituent with the proviso that the aromatic cyclic group can include one or two CH groups that can be replaced with a nitrogen atom, particularly selected from phenyl group or 2-fluorenyl group.

[0027] A metal coordination compound, wherein the cyclic groups CyN1 in the formula (2) and CyN2 in the formula (3) are independently selected from pyridyl group, pyridazinyl group, and pyrimidinyl group, particularly pyridyl group, as an aromatic cyclic group capable of having a substituent.

[0028] A metal coordination compound, wherein the cyclic groups CyN1, CyN2, CyC1 and CyC2 are independently non-substituted, or have a substituent selected from a halogen atom and 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-, -C≡C-, or a divalent aromatic group capable of having a substituent (that is a halogen atom 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-, and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom)), and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom}.

[0029] A metal coordination compound, wherein M in the formula (1) is iridium.

[0030] A metal coordination compound represented by the following formula (6):



(6)

wherein X denotes CRR', O or S where R and R' are independently a linear or branched alkyl group of formula: C_nH_{2n+1}- in which n is an integer of 1 - 20, the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O- and also can include a hydrogen atom that can be optionally replaced with a fluorine atom;

R2 denotes a hydrogen atom; a fluorine atom; a linear or branched alkyl group of formula: C_nH_{2n+1}- in which n is an integer of 1 - 20, the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O- and also can include a hydrogen atom that can be optionally replaced with a fluorine atom; a phenyl group capable of having a substituent; a 9,9-dialkylfluorenyl group (of which the alkyl groups are independently a linear or branched alkyl group of formula: C_nH_{2n+1}- in which n is an integer of 1 - 20, the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O- and also can include a hydrogen atom that can be optionally replaced with a fluorine atom); a dibenzofuranyl group capable of having a substituent; and a dibenzothienyl group capable of having a substituent; the optional substituent of phenyl group, 9,9-dialkylfluorenyl group, dibenzofuranyl group and dibenzothienyl group is a fluorine atom or a linear or branched alkyl group of formula: C_nH_{2n+1}- in which n is an integer of 1 - 20, the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O- and also can include a hydrogen atom that can be optionally replaced with a fluorine atom.

[0031] The present invention also provides an electroluminescence device, comprising: a pair of electrodes disposed on a substrate, and a luminescence unit comprising at least one organic compound disposed between the electrodes, wherein the organic compound comprises a metal coordination compound represented by the formula (1) described above.

[0032] In the luminescence device, a voltage is applied between the electrodes to emit light.

[0033] In a preferred embodiment of the electroluminescence device, a voltage is applied between the electrodes to emit phosphorescence.

[0034] The present invention further provides a picture display apparatus, comprising an electroluminescence device described above and a means for supplying electric signals to the electroluminescence device.

[0035] These and other objects, features and advantages of the present invention will become more apparent upon a consideration of the following description of the preferred embodiments of the present invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036]

Figures 1A, 1B and 1C illustrate embodiments of the luminescence device according to the present invention, respectively.

Figure 2 schematically illustrates a panel structure including an EL device and drive means.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0037] Basic structures of organic luminescence (EL) devices formed according to the present invention are illustrated in Figures 1A, 1B and 1C.

[0038] As shown in these figures, an organic luminescence device generally comprises, on a transparent substrate 15, a 50 to 200 nm-thick transparent electrode 14, a plurality of organic film layers and a metal electrode 11 formed so as to cover the organic layers.

[0039] Figure 1A shows an embodiment wherein the organic luminescence device comprises a luminescence layer 12 and a hole-transporting layer 13. The transparent electrode 14 may comprise ITO, etc., having a large work function so as to facilitate hole injection from the transparent electrode 14 to the hole-transporting layer 13. The metal electrode 11 comprises a metal material having a small work function, such as aluminum, magnesium or alloys of these elements, so as to facilitate electron injection into the organic luminescence device.

[0040] The luminescence layer 12 comprises a compound (metal coordination compound) according to the present invention. The hole-transporting layer 13 may comprise, e.g., a triphenyldiamine derivative, as represented by α-NPD mentioned above, and also a material having an electron-donative property as desired.

[0041] A device organized above exhibits a current-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 in the luminescence layer 12 to form excitons having high energy potential, which cause luminescence during transition to the ground state. In this instance, the hole-transporting layer 13 functions as an electron-blocking layer to increase the recombination efficiency at the boundary between the luminescence layer layer 12 and the hole-transporting layer 13, thereby providing an enhanced luminescence efficiency.

[0042] Further, in the structure of Figure 1B, an electron-transporting layer 16 is disposed between the metal electrode 11 and the luminescence layer 12 in Figure 1A. As a result, the luminescence function is separated from the functions of electron transportation and hole transportation to provide a structure exhibiting more effective carrier blocking, thus increasing the luminescence efficiency. The electron-transporting layer 16, may comprise, e.g., an oxadiazole derivative.

[0043] Figure 1C shows another desirable form of a four-layer structure, including a hole-transporting layer 13, a luminescence layer 12, an exciton diffusion prevention layer 17 and an electron-transporting layer 16, successively from the side of the transparent electrode 14 as the anode.

[0044] The luminescence materials used in the present invention are most suitably metal coordination compounds represented by the above-mentioned formulae (1) to (5), which are found to cause high-efficiency luminescence, retain high luminance for a long period and show little deterioration by current passage.

[0045] The metal coordination compound of 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 caused at the time of transition from such a state to the ground state.

[0046] Hereinbelow, methods for measurement of some properties and physical values described herein for characterizing the luminescence material of the present invention will be described.

(1) Judgment between phosphorescence and fluorescence

The identification of phosphorescence was effected depending on whether deactivation with oxygen was caused or not. A solution of a sample compound in chloroform after aeration with oxygen or with nitrogen is subjected to photoillumination to cause photoluminescence. The luminescence is judged to be phosphorescence if almost no luminescence attributable to the compound is observed with respect to the solution aerated with oxygen but photo-luminescence is confirmed with respect to the solution aerated with nitrogen. The phosphorescence of all the compounds of the present invention has been confirmed by this method unless otherwise noted specifically.

(2) Phosphorescence yield (a relative quantum yield, i.e., a ratio of an objective sample's quantum yield Φ(sample) to a standard sample's quantum yield Φ(st)) is determined according to the following formula:

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

$$[\text{Sem(sample)/Iabs(sample)}]/[\text{Sem(st)/Iabs(st)}],$$

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 to a phosphorescence yield Φ = 1 of $Ir(ppy)_3$ as a standard sample.

(3) A method of measurement of phosphorescence life is as follows.

[0047] 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 characteristic of luminescence intensity is measured.

[0048] 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):

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

[0049] The luminescence material (metal coordination compound) of the present invention exhibited high phosphorescence quantum yields of 0.11 to 0.9 and short phosphorescence lives of 0.1 to 40 μsec. A short phosphorescence life becomes a condition for causing little energy deactivation and exhibiting an enhanced luminescence efficiency. More specifically if the phosphorescence life is long, the number of triplet state molecules maintained for luminescence is increased, and the deactivation process is liable to occur, thus resulting in a lower luminescence efficiency particularly at the time of a high-current density. The material of the present invention has a relatively short phosphorescence life thus exhibiting a high phosphorescence quantum yield, and is therefore suitable as a luminescence material for an EL device.

[0050] As a result of various studies of ours, it has been found that an organic EL device using the metal coordination compound of the formula (1) as a principal luminescence material causes high-efficiency luminescence, retains high luminance for a long period and shows little deterioration by current passage.

[0051] In the formula (1) representing the metal coordination compound of the present invention, n may preferably 0 or 1, more preferably 0. Further, the partial structure ML'n comprise the aromatic group represented by the above-mentioned formula (5). In the formula (5), Y may preferably comprise C=O or CRR'. When Y is CRR' where R and R' are CH_3, the metal coordination compound of the formula (I) may preferably have no substituent. Particularly, when CyC1 is FL2 (appearing hereinafter) where R and R' are CH_3 and CyN1 is Pi, R1 to R4 (as substituents for Pi and FL2) may preferably be hydrogen atom at the same time.

[0052] In the present invention, by incorporating the aromatic group of the formula (5) into the metal coordination compound of the formula (1), it becomes possible to control an emission wavelength (particularly to provide a long emission wavelength). The presence of the aromatic group of the formula (5) is effective in enhancing a solubility of the metal coordination compound of the present invention in an organic solvent, thus facilitating a purification thereof by recrystallization or column chromatography. As a result, the metal coordination compound of the present invention is suitable as a luminescence material for the organic EL device.

[0053] Further, as shown in Examples appearing hereinafter, it has been substantiated that the metal coordination compound of the present invention exhibited an excellent stability in a continuous current passage test. This may be attributable to incorporation of the aromatic group of the formula (5) into the molecular structure of the metal coordination compound of the formula (1) according to the present invention. More specifically, a change in intermolecular interaction due to the introduction of the aromatic group of the formula (5) allows an intermolecular interaction of the metal coordination compound with, e.g., a host material to suppress formation of exciton associates causing thermal deactivation, thus reducing a quenching process thereby to improve phosphorescence yield and device characteristics.

[0054] The luminescence device according to the present invention may preferably be an electroluminescence device of the type wherein a layer of the metal coordination compound of the formula (1) is disposed between opposing two

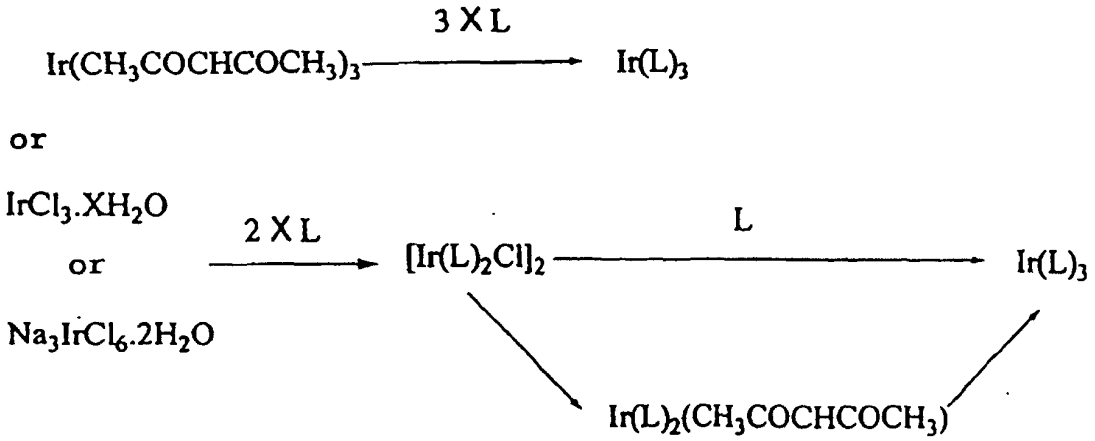
electrodes and a voltage is applied between the electrodes to cause luminescence, as shown in Figures 1A, 1B and 1C.

[0055] For the application to a display, a drive system using a thin-film transistor (TFT) drive circuit according to an active matrix-scheme may be used. Hereinbelow, an embodiment of using a device of the present invention in combination with an active matrix substrate is briefly described with reference to Figure 2.

[0056] Figure 2 illustrates an embodiment of panel structure comprising an EL device and drive means. The panel is provided with a scanning signal driver, a data signal driver and a current supply source which are connected to gate selection lines, data signal lines and current supply lines, respectively. At each intersection of the gate selection lines and the data signal lines, a display pixel electrode is disposed. The scanning signal drive sequentially selects the gate selection lines G1, G2, G3 ... Gn, and in synchronism herewith, picture signals are supplied from the data signal driver to display a picture (image).

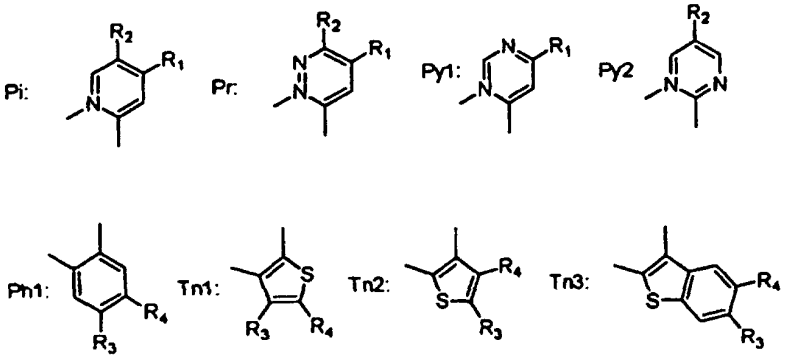
[0057] By driving a display panel including a luminescence layer comprising a luminescence material of the present invention, it becomes possible to provide a display which exhibits a good picture quality and is stable even for a long period display.

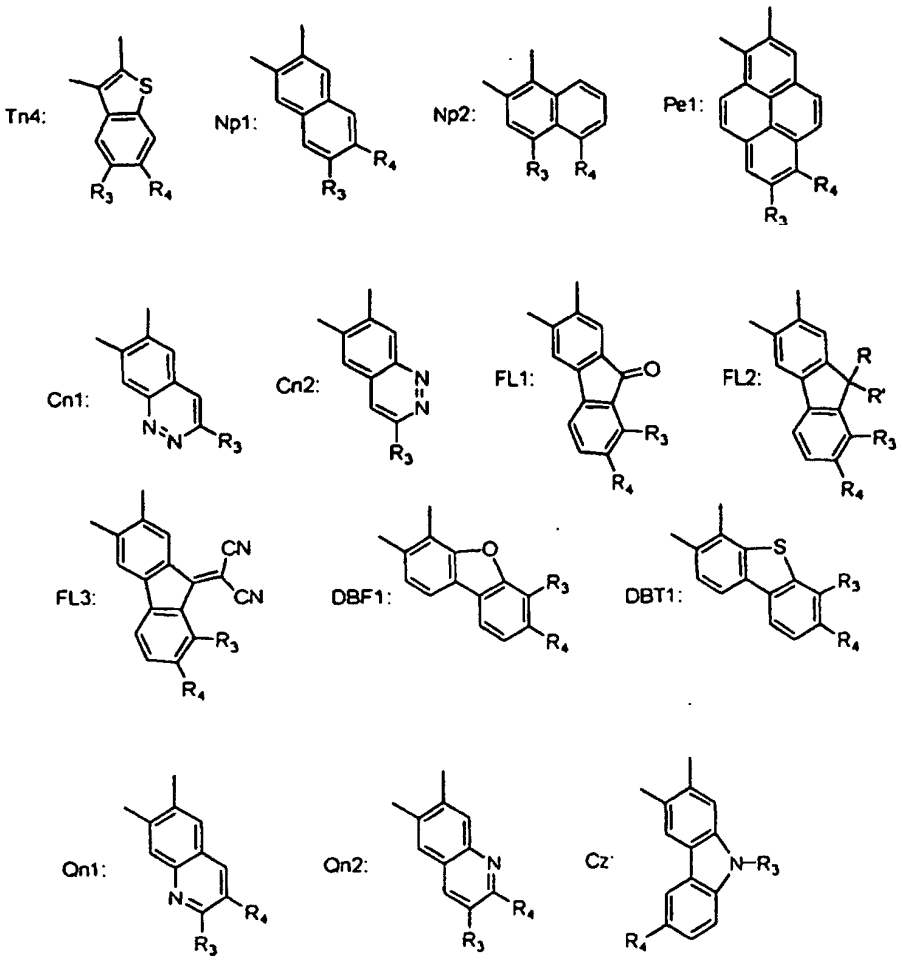
[0058] Some synthetic paths for providing a metal coordination compound represented by the above-mentioned formula (1) are illustrated below with reference to an iridium coordination compound (m+n = 3) for example:



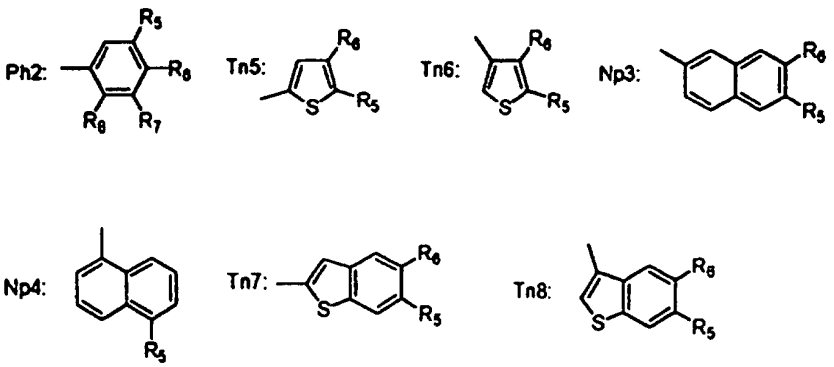
[0059] Other metal coordination compound (M = Pt, Rh and Pd) can also be synthesized in a similar manner.

[0060] Some specific structural examples of metal coordination compounds used in the present invention are shown in Tables 1 to Tables 42 appearing hereinafter, which are however only representative examples and are not exhaustive. Pi to Cz for CyN1, CyN2, CyC1 ahd CyC2 shown in Tables 1 to 42 represent partial structures shown below.





[0061] Further, aromatic group Ph2 to DBT3 as substituents for CyN1, CyN2, CyC1 and CyC2 shown in Tables 1 to42 represent partial structures shown below, with the proviso that substituents R5 to R8 of the aromatic groups represent hydrogen atoms when they are not specifically indicated.



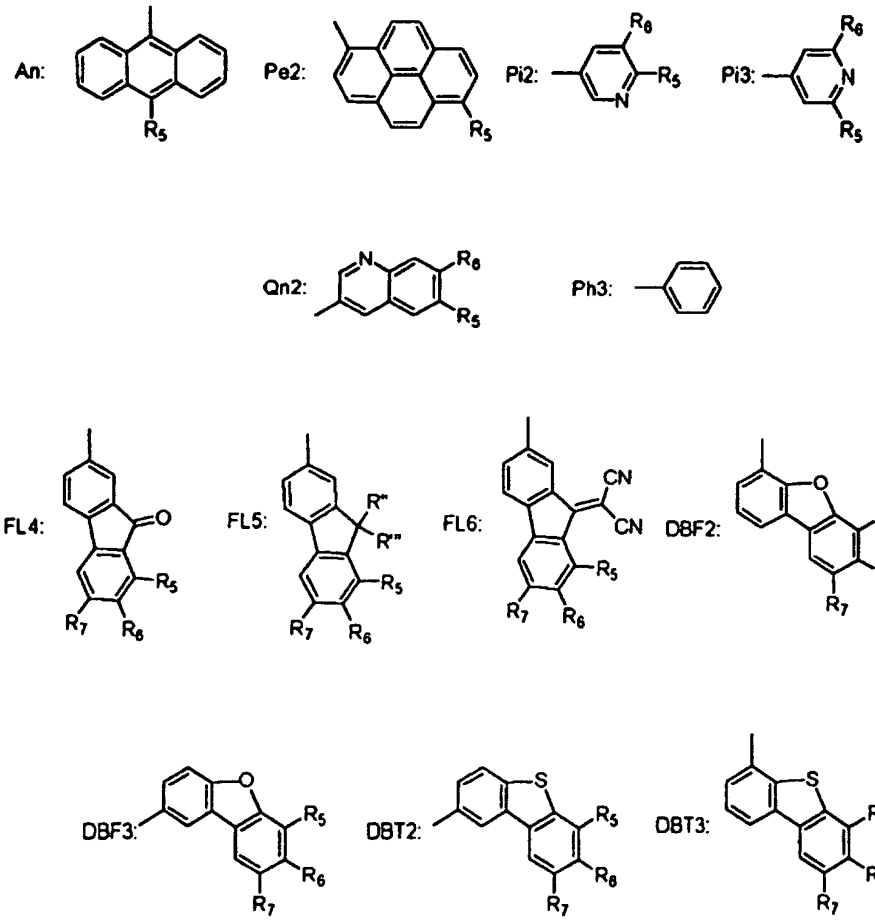


Table 1

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
t	Ir	3	0	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
2	Ir	3	0	Pi	FL1	-	-	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
3	Ir	3	0	Pi	FL1	-	-	CF_3	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
4	Ir	3	0	Pi	FL1	-	-	H	CH_3	-	H	-	-
						-	-	H	H	-	-	-	-
5	Ir	3	0	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	OC_4H_9	-	-	-	-

Table 1 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
6	Ir	3	0	Pi	FL1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
7	Ir	3	0	Pi	FL1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
8	Ir	3	0	Pi	FL1	-	-	H	FL6	H	H	H	-
						-	-	H	H	-	-	-	-
9	Ir	3	0	Pi	FL1	-	-	H	DBF2	H	H	H	-
						-	-	H	H	-	-	-	-
10	Ir	3	0	Pi	FL1	-	-	H	DBT3	H	H	H	-
						-	-	H	H	-	-	-	-
11	Ir	3	0	Pi	FL1	-	-	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
12	Ir	3	0	Pi	FL1	-	-	H	Ph2	H	C_3H_7	H	H
						-	-	H	H	-	-	-	-
13	Ir	3	0	Pi	FL1	-	-	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
14	Ir	3	0	Pi	FL1	-	-	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
15	Ir	3	0	Pi	FL1	-	-	H	Tn7	H	H	-	-
						-	-	H	H	-	-	-	-
16*	Ir	3	0	Pi	Ph1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-

* Reference compound (outside the scope of the invention)

Table 2

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
17*	Ir	3	0	Pi	Np2	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
18	Ir	3	0	Pi	FL1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-

* Reference compound

Table 2 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
19*	Ir	3	0	Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	FL4	H	H	H	H	-
20*	Ir	3	0	Pi	Ph1	-	-	H	H	-	-	-	-
						C_2H_5	C_2H_5	FL5	H	H	H	H	-
21*	Ir	3	0	Pi	Ph1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
22*	Ir	3	0	Pi	Np2	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
23	Ir	3	0	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
24	Ir	3	0	Pi	FL2	CH_3	CH_3	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
25	Ir	3	0	Pi	FL2	CH_3	CH_3	CF_3	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
26	Ir	3	0	Pi	FL2	CH_3	CH_3	H	CH_3	-	-	-	-
						-	-	H	H	-	-	-	-
27	Ir	3	0	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	OC_4H_9	-	-	-	-
28	Ir	3	0	Pi	FL2	C_2H_5	C_2H_5	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
29	Ir	3	0	Pi	FL2	C_3H_7	C_3H_7	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
30	Ir	3	0	Pi	FL2	C_4H_9	C_4H_9	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
31	Ir	3	0	Pi	FL2	C_5H_{11}	C_5H_{11}	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
32	Ir	3	0	Pi	FL2	C_6H_{13}	C_6H_{13}	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

* Reference compound

Table 3

No	M	m	n	CyN1	CyC1	R		R'		CyN1-R1	CyN1-R2	CyN1			
												R5	R6	R7	R8
						R"		R'''		CyC1-R3	CyC1-R4	CyC1			
												R5	R6	R7	R8
33	Ir	3	0	Pi	FL2	C_7H_{15}	C_7H_{15}	C_7H_{15}	C_7H_{15}	H	H	-	-	-	-
						-	-	-	-	H	H	-	-	-	-
34	Ir	3	0	Pi	FL2	C_8H_{17}	C_8H_{17}	C_8H_{17}	C_8H_{17}	H	H	-	-	-	-
						-	-	-	-	H	H	-	-	-	-
35	Ir	3	0	Pi	FL2	$C_{10}H_{21}$	$C_{10}H_{21}$	$C_{10}H_{21}$	$C_{10}H_{21}$	H	CF_3	-	-	-	-
						-	-	-	-	H	H	-	-	-	-
36	Ir	3	0	Pi	FL2	$C_{15}H_{31}$	$C_{15}H_{31}$	$C_{15}H_{31}$	$C_{15}H_{31}$	H	H	-	-	-	-
						-	-	-	-	H	OC_4H_9	-	-	-	-
37	Ir	3	0	Pi	FL2	$C_{20}H_{41}$	$C_{20}H_{41}$	$C_{20}H_{41}$	$C_{20}H_{41}$	H	H	-	-	-	-
						-	-	-	-	H	H	-	-	-	-
38	Ir	3	0	Pi	FL2	Ph3	Ph3	Ph3	Ph3	H	H	-	-	-	-
						-	-	-	-	H	H	-	-	-	-
39	Ir	3	0	Pi	FL2	CH_3	CH_3	Ph3	Ph3	H	H	-	-	-	-
						-	-	-	-	H	H	-	-	-	-
40	Ir	3	0	Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	H	-	-	-	-
						-	-	-	-	H	H	-	-	-	-
41	Ir	3	0	Pi	FL2	CH_3	CH_3	CH_3	CH_3	H	FL4	H	H	H	-
						-	-	-	-	H	H	-	-	-	-
42	Ir	3	0	Pi	FL2	H	H	H	H	H	FL5	H	H	H	-
						CH_3	CH_3	CH_3	CH_3	H	H	-	-	-	-
43	Ir	3	0	Pi	FL2	CH_3	CH_3	CH_3	CH_3	H	FL5	H	H	H	-
						CH_3	CH_3	CH_3	CH_3	H	H	-	-	-	-

Table 3 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R'"	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
44	Ir	3	0	Pi	FL2	C_2H_5	C_2H_5	H	FL5	H	H	H	-
						C_2H_5	C_2H_5	H	H	-	-	-	-
45	Ir	3	0	Pi	FL2	C_5H_{11}	C_5H_{11}	H	FL5	H	H	H	-
						C_5H_{11}	C_5H_{11}	H	H	-	-	-	-
46	Ir	3	0	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						C_8H_{17}	C_8H_{17}	H	H	-	-	-	-
47	Ir	3	0	Pi	FL2	$C_{15}H_{31}$	$C_{15}H_{31}$	H	FL5	H	H	H	-
						$C_{15}H_{31}$	$C_{15}H_{31}$	H	H	-	-	-	-
48	Ir	3	0	Pi	FL2	Ph3	Ph3	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-

Table 4

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
49	Ir	3	0	Pi	FL2	CH_3	Ph3	H	FL5	H	H	H	-
						CH_3	Ph3	H	H	-	-	-	-
50	Ir	3	0	Pi	FL2	$(GH_2)_5Ph3$	$(CH_2)_5Ph3$	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
51	Ir	3	0	Pi	FL2	CH_3	CH_3	H	FL6	H	H	H	-
						-	-	H	H	-	-	-	-
52	Ir	3	0	Pi	FL2	C_2H_5	C_2H_5	H	DBF2	H	H	H	-
						-	-	H	H	-	-	-	-
53	Ir	3	0	Pi	FL2	CH_3	CH_3	H	DBT3	H	H	H	-
						-	-	H	H	-	-	-	-
54	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
55	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Ph2	CF_3	H	H	H
						-	-	H	H	-	-	-	-
56	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OCH_2C_5F_{11}$	H	H
						-	-	H	H	-	-	-	-
57	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OC{\equiv}C\text{-}C_7H_{15}$	H	H
						-	-	H	H	-	-	-	-
58	Ir	3	0	Pi	FL2	C_3H_7	C_3H_7	H	Tn5	H	H	-	-
						-	-	H	H	-	-	-	-
59	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Tn6	H	H	-	-
						-	-	H	H	-	-	-	-

Table 4 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
60	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Np3	H	H	-	-
						-	-	H	H	-	-	-	-
61	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
62	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Tn7	H	H	-	-
						-	-	H	H	-	-	-	-
63	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Tn8	H	H	-	-
						-	-	H	H	-	-	-	-
64	Ir	3	0	Pi	FL2	CH_3	CH_3	H	An	H	-	-	-
						-	-	H	H	-	-	-	-

Table 5

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
65	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Pe2	H	-	-	-
						-	-	H	H	-	-	-	-
66	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Pi2	H	H	-	-
						-	-	H	H	-	-	-	-
67	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Pi3	H	H	-	-
						-	-	H	H	-	-	-	-
68	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Qn2	H	H	-	-
						-	-	H	H	-	-	-	-
69	Ir	3	0	Pi	FL2	Ph3	Ph3	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
70	Ir	3	0	Pi	FL2	CH_3	Ph3	H	An	H	-	-	-
						-	-	H	H	-	-	-	-
71	Ir	3	0	Pi	FL2	CH_3	CH_3	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
72	Ir	3	0	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Ph2	H	H	H	H
73	Ir	3	0	Pi	FL2	Ph3	Ph3	H	FL5	H	Ph3	H	-
						Ph3	Ph3	H	Ph2	H	H	H	H
74	Ir	3	0	Pi	FL2	CH_3	Ph3	H	FL5	H	Ph3	H	-
						CH_3	Ph3	H	Ph2	H	H	H	H
75	Ir	3	0	Pi	FL2	CH_3	Ph3	H	FL5	H	Ph3	H	-
						CH_3	Ph3	H	Ph2	H	H	H	H

Table 5 (continued)

No	M	m	n	CyN1	CyC1	R		R'	CyN1-R1	CyN1-R2	CyN1			
						R''		R'''	CyC1-R3	CyC1-R4	R5	CyC1		
											R5	R6	R7	R8
76	Ir	3	0	Pi	FL2	$(CH_2)_3Ph3$		$(CH_2)_3Ph3$	H	FL5	H	Ph3	H	-
						CH_3		CH_3	H	Ph2	H	H	H	H
77	Ir	3	0	Pi	FL2	CH_3		CH_3	H	FL5	H	Ph3	H	-
						CH_3		CH_3	H	Tn5	C_3H_7	H	-	-
78	Ir	3	0	Pi	FL2	CH_3		CH_3	H	FL5	H	Ph3	H	-
						CH_3		CH_3	H	Tn6	H	H	-	-
79	Ir	3	0	Pi	FL2	CH_3		CH_3	H	FL5	H	Ph3	H	-
						CH_3		CH_3	H	Np3	H	H	-	-
80	Ir	3	0	Pi	FL2	CH_3		CH_3	H	FL5	H	Ph3	H	-
						CH_3		CH_3	H	Np4	H	-	-	-

Table 6

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R'"	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
81	Ir	3	0	PI	FL2	CH_3	Ph3	H	FL5	H	Ph3	H	-
						CH_3	Ph3	H	Tn7	H	H	-	-
82	Ir	3	0	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Tn8	H	H	-	-
83	Ir	3	0	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	An	H	-	-	-
84	Ir	3	0	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Pe2	H	-	-	-
85	Ir	3	0	Pi	FL2	CH_3	Ph3	H	FL5	H	Ph3	H	-
						CH_3	Ph3	H	Pi2	C_2H_5	H	-	-
86	Ir	3	0	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Pi3	H	H	-	-
87	Ir	3	0	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Qn2	H	H	-	-
88	Ir	3	0	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	DBT3	H	H	-	-
89*	Ir	3	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
90*	Ir	3	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						C_5H_{11}	C_5H_{11}	H	H	-	-	-	-
91*	Ir	3	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	CF3	-	-	-	-
92*	Ir	3	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
93*	Ir	3	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH_3	Ph3	H	H	-	-	-	-
94*	Ir	3	0	Pi	Tn1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
95*	Ir	3	0	Pi	Tn2	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
96*	Ir	3	0	Pi	Tn3	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-

* Reference compound

Table 7

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
97*	Ir	3	0	Pi	Tn4	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
98*	Ir	3	0	Pi	Np1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
99*	Ir	3	0	Pi	Np2	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
100*	Ir	3	0	Pi	Pe1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
101*	Ir	3	0	Pi	Np2	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
102*	Ir	3	0	Pi	Pe2	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
103*	Ir	3	0	Pi	Cn1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	-	-	-	-	-
104*	Ir	3	0	Pi	Cn2	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	-	-	-	-	-
105	Ir	3	0	Pi	FL3	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
106	Ir	3	0	Pi	DBF1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
107	Ir	3	0	Pi	DBT1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
108*	Ir	3	0	Pi	Qn1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
109*	Ir	3	0	Pi	Qn2	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
110*	Ir	3	0	Pi	Cz	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	Ph3	H	-	-	-	-
111	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Ph2	H	FL5	H	H
						CH_3	CH_3	H	H	-	-	-	-
112	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Tn5	FL5	H	-	-
						CH_3	CH_3	H	H	-	-	-	-

* Reference compound

Table 8

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R'"	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
113	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Tn6	FL5	H	-	-
						CH_3	CH_3	H	H	-	-	-	-
114	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Np3	FL5	H	-	-
						CH_3	CH_3	H	H	-	-	-	-
115	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Np4	FL5	-	-	-
						CH_3	CH_3	H	H	-	-	-	-
116	Ir	3	0	Pi	FL2	Ph3	Ph3	H	Tn7	FL5	H	-	-
						Ph3	Ph3	H	H	-	-	-	-
117	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Tn8	FL5	H	-	-
						Ph3	Ph3	H	H	-	-	-	-
118	Ir	3	0	Pi	FL2	CH_3	CH_3	H	An	FL5	-	-	-
						CH_3	CH_3	H	H	-	-	-	-
119	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Pe2	FL5	-	-	-
						CH_3	CH_3	H	H	-	-	-	-
120	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Qn2	FL5	H	-	-
						CH_3	CH_3	H	H	-	-	-	-
121	Ir	3	0	Pi	FL2	CH_3	CH_3	H	FL4	FL5	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
122	Ir	3	0	Pi	FL2	CH_3	CH_3	H	FL5	FL5	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
123	Ir	3	0	Pi	FL2	CH_3	CH_3	H	FL6	FL5	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
124	Ir	3	0	Pi	FL2	CH_3	CH_3	H	DBF2	FL5	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
125	Ir	3	0	Pi	FL2	CH_3	CH_3	H	DBF3	FL5	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
126	Ir	3	0	Pi	FL2	CH_3	CH_3	H	DBT2	FL5	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
127	Ir	3	0	Pi	FL2	CH_3	CH_3	H	DBT3	FL5	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
128*	Ir	3	0	Pi	Ph1	-	-	H	H	-	-	-	-
						C_8H_{17}	C_8H_{17}	FL5	H	H	H	H	-

* Reference compound

Table 9

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
129*	Ir	3	0	Pi	Tn1	-	-	H	H	-	-	-	-
						CH_3	CH_3	FL5	H	H	H	H	-
130*	Ir	3	0	Pi	Tn2	-	-	H	H	-	-	-	-
						CH_3	CH_3	FL5	H	H	H	H	-
131*	Ir	3	0	Pi	Tn3	-	-	H	H	-	-	-	-
						CH_3	CH_3	FL5	H	H	H	H	-
132*	Ir	3	0	Pi	Tn4	-	-	H	H	-	-	-	-
						CH_3	CH_3	FL5	H	H	H	H	-
133*	Ir	3	0	Pi	Np2	-	-	H	H	-	-	-	-
						CH_3	CH_3	FL5	H	H	H	H	-
134*	Ir	3	0	Pi	Pe1	-	-	H	H	-	-	-	-
						CH_3	CH_3	FL5	H	H	H	H	-
135*	Ir	3	0	Pi	Cn1	-	-	H	H	-	-	-	-
						CH_3	CH_3	FL5	-	H	H	H	-
136*	Ir	3	0	Pi	Cn2	-	-	H	H	-	-	-	-
						CH_3	CH_3	FL5	-	H	H	H	-
137	Ir	3	0	Pi	FL3	-	-	H	H	-	-	-	-
						CH_3	CH_3	FL5	H	H	H	H	-
138	Ir	3	0	Pi	DBF1	-	-	H	H	-	-	-	-
						CH_3	CH_3	FL5	H	H	H	H	-
139	Ir	3	0	Pi	DBT1	-	-	H	H	-	-	-	-
						CH_3	CH_3	FL5	H	H	H	H	-
140*	Ir	3	0	Pi	Qn1	-	-	H	H	-	-	-	-
						CH_3	Ph3	FL5	H	H	H	H	-
141*	Ir	3	0	Pi	Qn2	-	-	H	H	-	-	-	-
						C_5H_{11}	C_5H_{11}	FL5	H	H	H	H	-
142*	Ir	3	0	Pi	Cz	-	-	H	H	-	-	-	-
						CH_3	CH_3	FL5	H	H	H	H	-
143*	Ir	3	0	Pi	Ph1	-	-	H	Ph2	H	FL5	H	H
						CH_3	CH_3	H	H	-	-	-	-
144	Ir	3	0	Pi	FL3	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

* Reference compound

Table 10

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
145	Ir	3	0	Pi	FL3	-	-	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
146	Ir	3	0	Pi	DBF1	-	-	CF_3	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
147	Ir	3	0	Pi	DBT1	-	-	H	CH_3	-	-	-	-
						-	-	H	H	-	-	-	-
148	Ir	3	0	Pi	FL3	-	-	H	FL6	H	H	H	-
							-	H	H	-	-	-	-
149	Ir	3	0	Pi	DBF1	-	-	H	DBF2	H	H	H	-
						-	-	H	H	-	-	-	-
150	Ir	3	0	Pi	DBT1	-	-	H	DBT3	H	H	H	-
						-	-	H	H	-	-	-	-
151	Rh	3	0	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
152	Rh	3	0	Pi	FL1	-	-	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
153	Rh	3	0	Pi	FL1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
154	Rh	3	0	Pi	FL1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
155	Rh	3	0	Pi	FL1	-	-	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
156	Rh	3	0	Pi	FL1	-	-	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
157	Rh	3	0	Pi	FL1	-	-	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
158*	Rh	3	0	Pi	Ph1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
159*	Rh	3	0	Pi	Np2	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
160	Rh	3	0	Pi	FL1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-

* Reference compound

Table 11

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
161*	Rh	3	0	Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	FL4	H	H	H	H	-
162*	Rh	3	0	Pi	Ph1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
163	Rh	3	0	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
164	Rh	3	0	Pi	FL2	CH_3	CH_3	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
165	Rh	3	0	Pi	FL2	CH_3	CH_3	CF_3	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
166	Rh	3	0	Pi	FL2	C_2H_5	C_2H_5	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
167	Rh	3	0	Pi	FL2	C_3H_7	C_3H_7	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
168	Rh	3	0	Pi	FL2	C_4H_9	C_4H_9	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
169	Rh	3	0	Pi	FL2	C_5H_{11}	C_5H_{11}	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
170	Rh	3	0	Pi	FL2	C_6H_{13}	C_6H_{13}	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

* Reference compound

Table 11 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
171	Rh	3	0	Pi	FL2	$C_{15}H_{31}$	$C_{15}H_{31}$	H	H	-	-	-	-
						-	-	H	OC_4H_9	-	-	-	-
172	Rh	3	0	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
173	Rh	3	0	Pi	FL2	CH_3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
174	Rh	3	0	Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
175	Rh	3	0	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
176	Rh	3	0	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-

Table 12

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
177	Rh	3	0	Pi	FL2	C_2H_5	C_2H_5	H	FL5	H	H	H	-
						C_2H_5	C_2H_5	H	H	-	-	-	-
178	Rh	3	0	Pi	FL2	C_5H_{11}	C_5H_{11}	H	FL5	H	H	H	-
						C_5H_{11}	C_5H_{11}	H	H	-	-	-	-
179	Rh	3	0	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						C_8H_{17}	C_8H_{17}	H	H	-	-	-	-
180	Rh	3	0	Pi	FL2	$C_{15}H_{31}$	$C_{15}H_{31}$	H	FL5	H	H	H	-
						$C_{15}H_{31}$	$C_{15}H_{31}$	H	H	-	-	-	-
181	Rh	3	0	Pi	FL2	Ph3	Ph3	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
182	Rh	3	0	Pi	FL2	CH_3	Ph3	H	FL5	H	H	H	-
						CH_3	Ph3	H	H	-	-	-	-
183	Rh	3	0	Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
184	Rh	3	0	Pi	FL2	CH_3	CH_3	H	FL6	H	H	H	-
						-	-	H	H	-	-	-	-
185	Rh	3	0	Pi	FL2	CH_3	CH_3	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
186	Rh	3	0	Pi	FL2	CH_3	CH_3	H	Ph2	CF_3	H	H	H
						-	-	H	H	-	-	-	-
187	Rh	3	0	Pi	FL2	C_3H_7	C_3H_7	H	Tn5	H	H	-	-
						-	-	H	H	-	-	-	-

Table 12 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1				CyC1				
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8	R5	R6	R7	R8	
188	Rh	3	0	Pi	FL2	CH_3	CH_3	H	Np3	H	H	-	-	H	H	-	-	
						-	-	H	H	-	-	-	-	-	-	-	-	
189	Rh	3	0	Pi	FL2	CH_3	CH_3	H	Np4	H	-	-	-	H	-	-	-	
						-	-	H	H	-	-	-	-	-	-	-	-	
190	Rh	3	0	Pi	FL2	CH_3	CH_3	H	Tn8	H	H	-	-	H	H	-	-	
						-	-	H	H	-	-	-	-	-	-	-	-	
191	Rh	3	0	Pi	FL2	CH_3	CH_3	H	An	H	-	-	-	H	-	-	-	
						-	-	H	H	-	-	-	-	-	-	-	-	
192	Rh	3	0	Pi	FL2	CH_3	CH_3	H	Pe2	H	-	-	-	H	-	-	-	
						-	-	H	H	-	-	-	-	-	-	-	-	

Table 13

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
193	Rh	3	0	Pi	FL2	CH_3	CH_3	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
194	Rh	3	0	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Ph2	H	H	H	H
195	Rh	3	0	Pi	FL2	Ph3	Ph3	H	FL5	H	Ph3	H	-
						Ph3	Ph3	H	Ph2	H	H	H	H
196	Rh	3	0	Pi	FL2	CH_3	Ph3	H	FL5	H	Ph3	H	-
						CH_3	Ph3	H	Ph2	H	H	H	H
197	Rh	3	0	Pi	FL2	$(CH_2)_3Ph3$	$(CH_2)_3Ph3$	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Ph2	H	H	H	H
198	Rh	3	0	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Tn5	C_3H_7	H	-	-
199*	Rh	3	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
200*	Rh	3	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						C_5H_{11}	C_5H_{11}	H	H	-	-	-	-
201*	Rh	3	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	CF3	-	-	-	-
202*	Rh	3	0	Pi	Tn4	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-

* Reference compound

Table 13 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R''	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
203*	Rh	3	0	Pi	Np2	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
204	Rh	3	0	Pi	FL2	CH_3	CH_3	H	Ph2	H	FL5	H	H
						CH_3	CH_3	H	H	-	-	-	-
205	Rh	3	0	Pi	FL2	CH_3	CH_3	H	Tn5	FL5	H	-	-
						CH_3	CH_3	H	H	-	-	-	-
206	Rh	3	0	Pi	FL2	CH_3	CH_3	H	Tn6	FL5	H	-	-
						CH_3	CH_3	H	H	-	-	-	-
207	Rh	3	0	Pi	FL2	CH_3	CH_3	H	Np3	FL5	H	-	-
						CH_3	CH_3	H	H	-	-	-	-
208*	Rh	3	0	Pi	Ph1	-	-	H	H	-	-	-	-
						C_8H_{17}	C_8H_{17}	FL5	H	H	H	H	-

* Reference compound

Table 14

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
209*	Rh	3	0	Pi	Tn1	-	-	H	H	-	-	-	-
						CH_3	CH_3	FL5	H	H	H	H	-
210*	Rh	3	0	Pi	Ph1	-	-	H	Ph2	H	FL5	H	H
						CH_3	CH_3	H	H	-	-	-	-
211	Pt	2	0	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
212	Pt	2	0	Pi	FL1	-	-	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
213	Pt	2	0	Pi	FL1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
214	Pt	2	0	Pi	FL1	-	-	H	DBT3	H	H	H	-
						-	-	H	H	-	-	-	-
215	Pt	2	0	Pi	FL1	-	-	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
216	Pt	2	0	Pi	FL1	-	-	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
217	Pt	2	0	Pi	FL1	-	-	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
218*	Pt	2	0	Pi	Ph1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
219*	Pt	2	0	Pi	Np2	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
220	Pt	2	0	Pi	FL1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
221*	Pt	2	0	Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	FL4	H	H	H	H	-
222*	Pt	2	0	Pi	Ph1	-	-	H	H	-	-	-	-
						C_2H_5	C_2H_5	FL5	H	H	H	H	-
223*	Pt	2	0	Pi	Np2	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
224	Pt	2	0	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

* Reference compound

Table 15

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
225	Pt	2	0	Pi	FL2	CH_3	CH_3	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
226	Pt	2	0	Pi	FL2	CH_3	CH_3	CF_3	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
227	Pt	2	0	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
228	Pt	2	0	Pi	FL2	CH_3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
229	Pt	2	0	Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
230	Pt	2	0	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
231	Pt	2	0	Pi	FL2	C_5H_{11}	C_5H_{11}	H	FL5	H	H	H	-
						C_5H_{11}	C_5H_{11}	H	H	-	-	-	-
232	Pt	2	0	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						C_8H_{17}	C_8H_{17}	H	H	-	-	-	-
233	Pt	2	0	Pi	FL2	Ph3	Ph3	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
234	Pt	2	0	Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
235	Pt	2	0	Pi	FL2	CH_3	CH_3	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-

Table 15 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
236	Pt	2	0	Pi	FL2	CH_3	CH_3	H	Ph2	CF_3	H	H	H
						-	-	H	H	-	-	-	-
237	Pt	2	0	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OCH_2C_5F_{11}$	H	H
						-	-	H	H	-	-	-	-
238	Pt	2	0	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OC{\equiv}C\text{-}C_7H_{15}$	H	H
						-	-	H	H	-	-	-	-
239	Pt	2	0	Pi	FL2	CH_3	Ph3	H	An	H	-	-	-
						-	-	H	H	-	-	-	-
240	Pt	2	0	Pi	FL2	CH_3	CH_3	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H

Table 16

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
241	Pt	2	0	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Ph2	H	H	H	H
242	Pt	2	0	Pi	FL2	Ph3	Ph3	H	FL5	H	Ph3	H	-
						Ph3	Ph3	H	Ph2	H	H	H	H
243	Pt	2	0	Pi	FL2	$(CH_2)_3$Ph3	$(CH_2)_3$Ph3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Ph2	H	H	H	H
244	Pt	2	0	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Tn5	C_3H_7	H	-	-
245	Pt	2	0	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	DBT3	H	H	-	-
246*	Pt	2	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
247*	Pt	2	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						C_5H_{11}	C_5H_{11}	H	H	-	-	-	-
248*	Pt	2	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	CF3	-	-	-	-
249*	Pt	2	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
250*	Pt	2	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH_3	Ph3	H	H	-	-	-	-

* Reference compound

Table 16 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R''	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
251*	Pt	2	0	Pi	Tn1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
252*	Pt	2	0	Pi	Np2	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
253*	Pt	2	0	Pi	Pe2	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
254*	Pt	2	0	Pi	Cn1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	-	-	-	-	-
255	Pt	2	0	Pi	FL2	CH_3	CH_3	H	Ph2	H	FL5	H	H
						CH_3	CH_3	H	H	-	-	-	-
256	Pt	2	0	Pi	FL2	CH_3	CH_3	H	Tn5	FL5	H	-	-
						CH_3	CH_3	H	H	-	-	-	-

* Reference compound

Table 17

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R'"	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
257	Pt	2	0	Pi	FL2	CH_3	CH_3	H	Tn6	FL5	H	-	-
						CH_3	CH_3	H	H	-	-	-	-
258	Pt	2	0	Pi	FL2	CH_3	CH_3	H	FL4	FL5	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
259	Pt	2	0	Pi	FL2	CH_3	CH_3	H	FL5	FL5	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
260	Pt	2	0	Pi	FL2	CH_3	CH_3	H	FL6	FL5	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
261	Pt	2	0	Pi	FL2	CH_3	CH_3	H	DBF2	FL5	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
262	Pt	2	0	Pi	FL2	CH_3	CH_3	H	DBF3	FL5	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
263*	Pt	2	0	Pi	Ph1	-	-	H	H	-	-	-	-
						C_8H_{17}	C_8H_{17}	FL5	H	H	H	H	-
264*	Pt	2	0	Pi	Tn1	-	-	H	H	-	-	-	-
						CH_3	CH_3	FL5	H	H	H	H	-
265*	Pt	2	0	Pi	Tn2	-	-	H	H	-	-	-	-
						CH_3	CH_3	FL5	H	H	H	H	-
266*	Pt	2	0	Pi	Ph1	-	-	H	Ph2	H	FL5	H	H
						CH_3	CH_3	H	H	-	-	-	-
267	Pt	2	0	Pi	FL3	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
268	Pt	2	0	Pi	FL3	-	-	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
269	Pt	2	0	Pi	DBF1	-	-	CF_3	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
270	Pt	2	0	Pi	DBT1	-	-	H	CH_3	-	-	-	-
						-	-	H	H	-	-	-	-
271	Pd	2	0	Pi	FL1	-	-	H	H	-	-	-	-
							-	H	H	-	-	-	-
272	Pd	2	0	Pi	FL1	-	-	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-

* Reference compound

Table 18

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R"	R'"	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
273	Pd	2	0	Pi	FL1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
274	Pd	2	0	Pi	FL1	-	-	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
275	Pd	2	0	Pi	FL1	-	-	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
276	Pd	2	0	Pi	FL1	-	-	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
277	Pd	2	0	Pi	Ph1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
278*	Pd	2	0	Pi	Np2	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
279	Pd	2	0	Pi	FL1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
280*	Pd	2	0	Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	FL4	H	H	H	H	-
281*	Pd	2	0	Pi	Np2	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
282	Pd	2	0	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

* Reference compound

Table 18 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
						R''	R'''	CyC1-R3	CyC1-R4	R5	R6	R7	R8
										CyC1			
										R5	R6	R7	R8
283	Pd	2	0	Pi	FL2	CH_3	CH_3	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
284	Pd	2	0	Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
285	Pd	2	0	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
286	Pd	2	0	Pi	FL2	C_5H_{11}	C_5H_{11}	H	FL5	H	H	H	-
						C_5H_{11}	C_5H_{11}	H	H	-	-	-	-
287	Pd	2	0	Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
288	Pd	2	0	Pi	FL2	CH_3	CH_3	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-

Table 19

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
289	Pd	2	0	Pi	FL2	CH_3	CH_3	H	Ph2	CF_3	H	H	H
						-	-	H	H	-	-	-	-
290	Pd	2	0	Pi	FL2	CH_3	CH_3	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
291	Pd	2	0	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Ph2	H	H	H	H
292	Pd	2	0	Pi	FL2	Ph3	Ph3	H	FL5	H	Ph3	H	-
						Ph3	Ph3	H	Ph2	H	H	H	H
293	Pd	2	0	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	DBT3	H	H	-	-
294*	Pd	2	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
295*	Pd	2	0	Pi	Ph1	-	-	H	FL5	H	H	H	-
						C_5H_{11}	C_5H_{11}	H	H	-	-	-	-
296	Pd	2	0	Pi	FL2	CH_3	CH_3	H	Ph2	H	FL5	H	H
						CH_3	CH_3	H	H	-	-	-	-
297	Pd	2	0	Pi	FL2	CH_3	CH_3	H	Tn5	FL5	H	-	-
						CH_3	CH_3	H	H	-	-	-	-
298*	Pd	2	0	Pi	Ph1	-	-	H	H	-	-	-	-
						C_8H_{17}	C_8H_{17}	FL5	H	H	H	H	-
299*	Pd	2	0	Pi	Ph1	-	-	H	Ph2	H	FL5	H	H
						CH_3	CH_3	H	H	-	-	-	-
300	Pd	2	0	Pi	DBT1	-	-	H	CH_3	-	-	-	-
						-	-	H	H	-	-	-	-

* Reference compound

Table 20

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
301	Ir	2	1	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
302	Ir	2	1	Pi	FL1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
303	Ir	2	1	Pi	FL1	-	-	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
304	Ir	2	1	Pi	FL1	-	-	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
305	Ir	2	1	Pi	FL1	-	-	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
306*	Ir	2	1	Pi	Ph1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
307*	Ir	2	1	Pi	Np2	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

* Reference compound

Table 20 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
308	Ir	2	1	Pi	FL1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
309*	Ir	2	1	Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	FL4	H	H	H	H	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
310*	Ir	2	1	Pi	Ph1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

* Reference compound

Table 21

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
311	Ir	2	1	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
312	Ir	2	1	Pi	FL2	CH_3	CH_3	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
313	Ir	2	1	Pi	FL2	CH_3	CH_3	CF_3	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
314	Ir	2	1	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	OC_4H_9	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 21 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R''	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R''	R'''	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
315	Ir	2	1	Pi	FL2	C_8H_{17}	C_8H_{17}	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
316	Ir	2	1	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
317	Ir	2	1	Pi	FL2	CH_3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
318	Ir	2	1	Pi	FL2	$(CH_2)_5Ph_3$	$(CH_2)_5Ph_3$	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 21 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
319	Ir	2	1	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
320	Ir	2	1	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

Table 22

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
321	Ir	2	1	Pi	FL2	C_2H_5	C_2H_5	H	FL5	H	H	H	-
						C_2H_5	C_2H_5	H	H	-	-	-	-
				Pr	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
322	Ir	2	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pr	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
323	Ir	2	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OCH_2C_5F_{11}$	H	H
						-	-	H	H	-	-	-	-
				Py1	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
324	Ir	2	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OC{\equiv}C\text{-}C_7N_{15}$	H	H
						-	-	H	H	-	-	-	-
				Py2	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 22 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1		
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
						R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
325	Ir	2	1	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Ph2	H	H	H	H
					Ph1	-	-	H	H	-	-	-	-
						-	-	CH_3	H	-	-	-	-
326	Ir	2	1	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Tn8	H	H	-	-
					Ph1	-	-	H	H	-	-	-	-
						-	-	Br	H	-	-	-	-
327*	Ir	2	1	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
					Ph1	-	-	H	H	-	-	-	-
						-	-	CF_3	H	-	-	-	-
328*	Ir	2	1	Pi	Ph1	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
					Ph1	-	-	H	H	-	-	-	-
						-	-	C_5H_{11}	H	-	-	-	-

* Reference compound

Table 22 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
329*	Ir	2	1	Pi	Np2	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	OCH_3	H	-	-	-	-
330	Ir	2	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	FL5	H	H
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

* Reference compound

Table 23

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R'''	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
331	Ir	2	1	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn1	-	-	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
332	Ir	2	1	Pi	FL2	CH_3	CH_3	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	--
333	Ir	2	1	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	OC_4H_9	-	-	-	-
				Pi	Tn2	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
334	Ir	2	1	Pi	FL2	C_4H_9	C_4H_9	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn3	-	-	H	H	-	-	-	-
						-	-	H	CH_3	-	-	-	-

Table 23 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R''	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R''	R'''	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
335	Ir	2	1	Pi	FL2	C_8H_{17}	C_8H_{17}	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn4	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
336	Ir	2	1	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Np1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
337	Ir	2	1	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Np2	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
338	Ir	2	1	Pi	FL2	$C_{15}H_{31}$	$C_{15}H_{31}$	H	FL5	H	H	H	-
						$C_{15}H_{31}$	$C_{15}H_{31}$	H	H	-	-	-	-
				Pi	Pe1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 23 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R''	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R''	R'''	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
339	Ir	2	1	Pi	FL2	CH_3	Ph3	H	FL5	H	H	H	-
						CH_3	Ph3	H	H	-	-	-	-
				Pi	Cn1	-	-	H	H	-	-	-	-
						-	-	H	-	-	-	-	-
340	Ir	2	1	Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Cn2	-	-	H	H	-	-	-	-
						-	-	H	-	-	-	-	-

Table 24

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
341	Ir	2	1	Pi	FL2	CH_3	CH_3	H	DBT3	H	H	H	-
						-	-	H	H	-	-	-	-
				Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
342	Ir	2	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
343	Ir	2	1	Pi	FL2	C_3H_7	C_3H_7	H	Tn5	H	H	-	-
						-	-	H	H	-	-	-	-
				Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
344	Ir	2	1	Pi	FL2	CH_3	CH_3	H	Np3	H	H	-	-
						-	-	H	H	-	-	-	-
				Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 24 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
345	Ir	2	1	Pi	FL2	C_8H_{17}	C_8H_{17}	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
346	Ir	2	1	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	FL2	C_3H_7	C_3H_7	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
347	Ir	2	1	Pi	FL2	CH_3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	FL3	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
348	Ir	2	1	Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	DBF1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 24 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
349	Ir	2	1	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	DBT1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
350	Ir	2	1	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Qn1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

Table 25

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
351	Ir	2	1	Pi	FL2	C_2H_5	C_2H_5	H	FL5	H	H	H	-
						C_2H_5	C_2H_5	H	H	-	-	-	-
				Pr	Qn2	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
352	Ir	2	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pr	Cz	-	-	H	H	-	-	-	-
						-	-	Ph3	H	-	-	-	-
353	Rh	2	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OCH_2C_5F_{11}$	H	H
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
354	Rh	2	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OC{\equiv}C\text{-}C_7H_{15}$	H	H
						-	-	H	H	-	-	-	-
				Py2	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 25 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
355	Rh	2	1	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Ph2	H	H	H	H
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CH_3	H	-	-	-	-
356	Rh	2	1	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Tn8	H	H	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Br	H	-	-	-	-
357*	Rh	2	1	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CF_3	H	-	-	-	-
358*	Rh	2	1	Pi	Ph1	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	C_5H_{11}	H	-	-	-	-

* Reference compound

Table 25 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
359*	Rh	2	1	Pi	Np2	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	OCH_3	H	-	-	-	-
360	Rh	2	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	FL5	H	H
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

* Reference compound

Table 26

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
361	Ir	1	2	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
362	Ir	1	2	Pi	FL1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
363	Ir	1	2	Pi	FL1	-	-	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
364	Ir	1	2	Pi	FL1	-	-	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
365	Ir	1	2	Pi	FL1	-	-	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
366*	Ir	1	2	Pi	Ph1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
367*	Ir	1	2	Pi	Np2	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

* Reference compound

Table 26 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
368	Ir	1	2	Pi	FL1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
369*	Ir	1	2	Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	FL4	H	H	H	H	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
370*	Ir	1	2	Pi	Ph1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

* Reference compound

Table 27

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
371	Ir	1	2	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
372	Ir	1	2	Pi	FL2	CH_3	CH_3	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
373	Ir	1	2	Pi	FL2	CH_3	CH_3	CF_3	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
374	Ir	1	2	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	OC_4H_9	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 27 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R'''	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
375	Ir	1	2	Pi	FL2	C_8H_{17}	C_8H_{17}	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
376	Ir	1	2	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
377	Ir	1	2	Pi	FL2	CH_3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
378	Ir	1	2	Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 27 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
379	Ir	1	2	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
380	Ir	1	2	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

Table 28

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
381	Ir	1	2	Pi	FL2	C_2H_5	C_2H_5	H	FL5	H	H	H	-
						C_2H_5	C_2H_5	H	H	-	-	-	-
				Pr	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
382	Ir	1	2	Pi	FL2	CH_3	CH_3	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pr	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
383	Ir	1	2	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OCH_2C_5F_{11}$	H	H
						-	-	H	H	-	-	-	-
				Py1	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
384	Ir	1	2	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OC{\equiv}C\text{-}C_7H_{15}$	H	H
						-	-	H	H	-	-	-	-
				Py2	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 28 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1		
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
						R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
385	Ir	1	2	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Ph2	H	H	H	H
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CH_3	H	-	-	-	-
386	Ir	1	2	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Tn8	H	H	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Br	H	-	-	-	-
387*	Ir	1	2	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CF_3	H	-	-	-	-
388*	It	1	2	Pi	Ph1	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	C_5H_{11}	H	-	-	-	-

* Reference compound

Table 28 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
389*	Ir	1	2	Pi	Np2	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	OCH_3	H	-	-	-	-
390	Ir	1	2	Pi	FL2	CH_3	CH_3	H	Ph2	H	FL5	H	H
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

* Reference compound

Table 29

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R'''	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
391	Ir	1	2	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn1	-	-	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
392	Ir	1	2	Pi	FL2	CH_3	CH_3	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
393	Ir	1	2	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	OC_4H_9	-	-	-	-
				Pi	Tn2	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
394	Ir	1	2	Pi	FL2	C_4H_9	C_4H_9	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn3	-	-	H	H	-	-	-	-
						-	-	H	CH_3	-	-	-	-

Table 29 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R''	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R''	R'''	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
395	Ir	1	2	Pi	FL2	C_8H_{17}	C_8H_{17}	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn4	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
396	Ir	1	2	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Np1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
397	Ir	1	2	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Np2	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
398	Ir	1	2	Pi	FL2	$C_{15}H_{31}$	$C_{15}H_{31}$	H	FL5	H	H	H	-
						$C_{15}H_{31}$	$C_{15}H_{31}$	H	H	-	-	-	-
				Pi	Pe 1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 29 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
399	Ir	1	2	Pi	FL2	CH_3	Ph3	H	FL5	H	H	H	-
						CH_3	Ph3	H	H	-	-	-	-
				Pi	Cn1	-	-	H	H	-	-	-	-
						-	-	H	-	-	-	-	-
400	Ir	1	2	Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Cn2	-	-	H	H	-	-	-	-
						-	-	H	-	-	-	-	-

Table 30

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R'''	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
401	Ir	1	2	Pi	FL2	CH_3	CH_3	H	DBT3	H	H	H	-
						-	-	H	H	-	-	-	-
				Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
402	Ir	1	2	Pi	FL2	CH_3	CH_3	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
403	Ir	1	2	Pi	FL2	C_3H_7	C_3H_7	H	Tn5	H	H	-	-
						-	-	H	H	-	-	-	-
				Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
404	Ir	1	2	Pi	FL2	CH_3	CH_3	H	Np3	H	H	-	-
						-	-	H	H	-	-	-	-
				Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 30 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
405	Ir	1	2	Pi	FL2	C_8H_{17}	C_8H_{17}	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
406	Ir	1	2	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	FL2	C_3H_7	C_3H_7	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
407	Ir	1	2	Pi	FL2	CH_3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	FL3	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
408	Ir	1	2	Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	DBF1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 30 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
409	Ir	1	2	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	DBT1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
410	Ir	1	2	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Qn1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

Table 31

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1		
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
						R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
411	Ir	1	2	Pi	FL2	C_2H_5	C_2H_5	H	FL5	H	H	H	-
						C_2H_5	C_2H_5	H	H	-	-	-	-
				Pr	Qn2	-	-	H	H	-	-	-	-
						-	-	H H	H	-	-	-	-
412	Ir	1	2	Pi	FL2	CH_3	CH_3	H	Ph2	H	H	H	H
						-	-	H H	H	-	-	-	-
				Pr	Cz	-	-	H	H	-	-	-	-
						-	-	Ph3	H	-	-	-	-
413	Rh	1	2	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OCH_2C_5F_{11}$	H	H
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
414	Rh	1	2	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OC{\equiv}C\text{-}C_7H_{15}$	H	H
						-	-	H	H	-	-	-	-
				Py2	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 31 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
415	Rh	1	2	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Ph2	H	H	H	H
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CH_3	H	-	-	-	-
416	Rh	1	2	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Tn8	H	H	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Br	H	-	-	-	-
417*	Rh	1	2	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CF_3	H	-	-	-	-
418*	Rh	1	2	Pi	Ph1	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	C_5H_{11}	H	-	-	-	-

* Reference compound

Table 31 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
419*	Rh	1	2	Pi	Np2	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	OCH_3	H	-	-	-	-
420	Rh	1	2	Pi	FL2	CH_3	CH_3	H	Ph2	H	FL5	H	H
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

* Reference compound

Table 32

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
421	Pt	1	1	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
422	Pt	1	1	Pi	FL1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
423	Pt	1	1	Pi	FL1	-	-	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
424	Pt	1	1	Pi	FL1	-	-	H	FL4	H	Ph3	H	-
						-	-	H	Ph2	H	H	H	H
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
425	Pt	1	1	Pi	FL1	-	-	H	Np4	H	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
426	Pt	1	1	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
427	Pt	1	1	Pi	FL2	CH_3	CH_3	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 32 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
428	Pt	1	1	Pi	FL2	CH_3	CH_3	CF_3	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
429	Pt	1	1	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	OC_4H_9	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
430	Pt	1	1	Pi	FL2	C_8H_{17}	C_8H_{17}	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 33

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R'"	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R'"	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
431	Pt	1	1	Pi	FL2	C_2H_5	C_2H_5	H	FL5	H	H	H	-
						C_2H_5	C_2H_5	H	H	-	-	-	-
				Pr	Ph1 -	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
432	Pt	1	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pr	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
433	Pt	1	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OCH_2C_5F_{11}$	H	H
						-	-	H	H	-	-	-	-
				Py1	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
434	Pt	1	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OC\equiv C\text{-}C_7H_{15}$	H	H
						-	-	H	H	-	-	-	-
				Py2	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 33 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R'''	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
435	Pt	1	1	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Ph2	H	H	H	H
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CH_3	H	-	-	-	-
436	Pt	1	1	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn1	-	-	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
437	Pt	1	1	Pi	FL2	CH_3	CH_3	CF_3	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
438	Pt	1	1	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	OC_4H_9	-	-	-	-
				Pi	Tn2	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 33 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
						R"	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R'''	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
439	Pt	1	1	Pi	FL2	C_4H_9	C_4H_9	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn3	-	-	H	H	-	-	-	-
						-	-	H	CH_3	-	-	-	-
440	Pt	1	1	Pi	FL2	C_8H_{17}	C_8H_{17}	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Tn4	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 34

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R'''	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
441	Pt	1	1	Pi	FL2	CH_3	CH_3	H	DBT3	H	H	H	-
						-	-	H	H	-	-	-	-
				Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
442	Pt	1	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
443	Pt	1	1	Pi	FL2	C_3H_7	C_3H_7	H	Tn5	H	H	-	-
						-	-	H	H	-	-	-	-
				Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
444	Pt	1	1	Pi	FL2	CH_3	CH_3	H	Np3	H	H	-	-
						-	-	H	H	-	-	-	-
				Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 34 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
445	Pt	1	1	Pi	FL2	C_8H_{17}	C_8H_{17}	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
446	Pt	1	1	Pi	FL2	C_2H_5	C_2H_5	H	FL5	H	H	H	-
						C_2H_5	C_2H_5	H	H	-	-	-	-
				Pr	Qn2	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
447	Pt	1	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Pr	Cz	-	-	H	H	-	-	-	-
						-	-	Ph3	H	-	-	-	-
448	Pt	1	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OCH_2C_5F_{11}$	H	H
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 34 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
449	Pt	1	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OC{\equiv}C\text{-}C_7H_{15}$	H	H
						-	-	H	H	-	-	-	-
				Py2	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
450	Pt	1	1	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Ph2	H	H	H	H
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CH_3	H	-	-	-	-

Table 35

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
				R"		R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
451*	Pt	1	1	Pi	Ph1	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
452*	Pt	1	1	Pi	Np2	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
453	Pt	1	1	Pi	FL1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
454*	Pt	1	1	Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	FL4	H	H	H	H	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

* Reference compound

Table 35 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
455*	Pt	1	1	Pi	Ph1	-	-	H	Ph2	H	FL4	H	H
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
456	Pt	1	1	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
457	Pt	1	1	Pi	FL2	CH_3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
458	Pt	1	1	Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

* Reference compound

Table 35 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
459	Pt	1	1	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
460	Pt	1	1	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

Table 36

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
461	Pt	1	1	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Tn8	H	H	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Br	H	-	-	-	-
462*	Pt	1	1	Pi	Ph1	-	-	H	FL5	H	H	H	-
						-	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CF_3	H	-	-	-	-
463*	Pt	1	1	Pi	Ph1	-	-	H	FL5	H	H	H	-
						-	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	C_5H_{11}	H	-	-	-	-
464 *	Pt	1	1	Pi	Np2	-	-	H	FL5	H	H	H	-
						-	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	OCH_3	H	-	-	-	-

* Reference compound

Table 36 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
465	Pt	1	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	FL5	H	H
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-
466	Pd	1	1	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Np1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
467	Pd	1	1	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Np2	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
468	Pd	1	1	Pi	FL2	$C_{15}H_{31}$	$C_{15}H_{31}$	H	FL5	H	H	H	-
						$C_{15}H_{31}$	$C_{15}H_{31}$	H	H	-	-	-	-
				Pi	Pe1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 36 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
469	Pd	1	1	Pi	FL2	CH_3	Ph3	H	FL5	H	H	H	-
						CH_3	Ph3	H	H	-	-	-	-
				Pi	Cn1	-	-	H	H	-	-	-	-
						-	-	H	-	-	-	-	-
470	Pd	1	1	Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph_3$	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Cn2	-	-	H	H	-	-	-	-
						-	-	H	-	-	-	-	-

Table 37

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
471	Pd	1	1	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	FL2	C_3H_7	C_3H_7	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
472	Pd	1	1	Pi	FL2	CH_3	Ph3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	FL3	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
473	Pd	1	1	Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				Pi	DBF1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
474	Pd	1	1	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	DBT1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-

Table 37 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
475	Pd	1	1	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Qn1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-
476	Pd	1	1	Pi	FL2	CH_3	CH_3	H	FL5	H	Ph3	H	-
						CH_3	CH_3	H	Tn8	H	H	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Br	H	-	-	-	-
477*	Pd	1	1 .	Pi	Ph1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	CF_3	H	-	-	-	-
478*	Pd	1	1	Pi	Ph1	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	C_5H_{11}	H	-	-	-	-

* Reference compound

Table 37 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				CyN2	CyC2	R	R'	CyN2-R1	CyN2-R2	CyN2			
										R5	R6	R7	R8
						R"	R"'	CyC2-R3	CyC2-R4	CyC2			
										R5	R6	R7	R8
479*	Pd	1	1	Pi	Np2	-	-	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	OCH_3	H	-	-	-	-
480	Pd	1	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	FL5	H	H
						CH_3	CH_3	H	H	-	-	-	-
				Pi	Ph1	-	-	H	H	-	-	-	-
						-	-	Cl	H	-	-	-	-

* Reference compound

Table 38

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
481	Ir	3	0	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
482	Ir	3	0	Pi	FL1	-	-	H	CF_3	-	-	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
483	IT	3	0	Pi	FL1	-	-	H	FL4	H	H	H	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
484	Ir	3	0	Pi	FL1	-	-	H	Ph2	H	H	H	H
						-	-	-CH=CH-CH=CH-		-	-	-	-
485	Ir	3	0	Pi	FL1	-	-	H	FL4	H	Ph3	H	-
						-	-	-CH=CH-CH=CH-		H	H	H	H
486	Ir	3	0	Pi	FL1	-	-	H	Np4	H	-	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
487	Ir	3	0	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
488	Ir	3	0	Pi	FL2	CH_3	CH_3	H	CF_3	-	-	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
489	Ir	3	0	Pi	FL2	CH_3	CH_3	CF_3	CF_3	-	-	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
490	Ir	3	0	Pi	FL2	CH_3	CH_3	H	CH_3	-	-	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
491	Ir	3	0	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	-CH=CH-CH=CH-		-	-	. -	-
492	Ir	3	0	Pi	FL2	C_2H_5	C_2H_5	H	H	-	-	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
493	Ir	3	0	Pi	FL2	C_3H_7	C_3H_7	H	H	-	-	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
494	Ir	3	0	Pi	FL2	C_4H_9	C_4H_9	H	H	-	-	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
495	Ir	3	0	Pi	FL2	Ph3	Ph3	H	H	-	-	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
496	Ir	3	0	Pi	FL2	CH_3	Ph3	H	H	-	-	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
497	Ir	3	0	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH_3	CH_3	-CH=CH-CH=CH-		-	-	-	-

Table 38 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
498	Ir	3	0	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						CH_3	CH_3	-CH=CH-CH=CH-		-	-	-	-
499	Ir	3	0	Pi	FL2	C_2H_5	C_2H_5	H	FL5	H	H	H	-
						C_2H_5	C_2H_5	-CH=CH-CH=CH-		-	-	-	-
500	Ir	3	0	Pi	FL2	C_5H_{11}	C_5H_{11}	H	FL5	H	H	H	-
						C_5H_{11}	C_5H_{11}	-CH=CH-CH=CH-		-	-	-	-
501	Ir	3	0	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						C_8H_{17}	C_8H_{17}	-CH=CH-CH=CH-		-	-	-	-
502	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Ph2	H	H	H	H
						-	-	-CH=CH-CH=CH-		-	-	-	-

Table 39

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R'''	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
503	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Ph2	CF_3	H	H	H
						-	-	-CH=CH-CH=CH-		-	-	-	-
504	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OCH_2C_5F_{11}$	H	H
						-	-	-CH=CH-CH=CH-		-	-	-	-
505	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OC\equiv C\text{-}C_7H_{15}$	H	H
						-	-	-CH=CH-CH=CH-		-	-	-	-
506	Ir	3	0	Pi	FL2	C_3H_7	C_3H_7	H	Tn5	H	H	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
507	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Tn6	H	H	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
508	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Np3	H	H	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
509	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Np4	H	H	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-
510	Ir	3	0	Pi	FL2	CH_3	CH_3	H	Tn7	H	H	-	-
						-	-	-CH=CH-CH=CH-		-	-	-	-

Table 40

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				E		R"	R"'			E			
										R5	R6	R7	R8
				G		R"	R"'			G			
										R5	R6	R7	R8
511	Ir	2	1	Pi	FL1	-	-	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				CH_3		-	-			-	-	-	-
				CH_3		-				-	-	-	-
512	Ir	2	1	Pi	FL1	-	-	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
				CF_3		-	-			-	-	-	-
				CF_3		-	-			-	-	-	-
513	Ir	2	1	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				CH_3		-	-			-	-	-	-
				CH_3		-	-			-	-	-	-
514	Ir	2	1	Pi	FL2	CH_3	CH_3	H	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
				Ph2		-	-			H	H	H	H
				Ph2		-	-			H	H	H	H
515	Ir	2	1	Pi	FL2	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	OC_4H_9	-	-	-	-
				Ph2		-	-			H	C_3H_7	H	H
				Ph2		-	-			H	C_3H_7	H	H
516	Ir	2	1	Pi	FL2	C_6H_{13}	C_6H_{13}	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				CH_3		-	-			-	-	-	-
				FL5		CH_3	CH_3			H	H	H	-
517	Ir	2	1	Pi	FL2	H	H	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Tn5		-	-			H	H	-	-
				Tn5		-	-			H	H	-	-

Table 40 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				E		R"	R"'			E			
										R5	R6	R7	R8
				G		R"	R"'			G			
										R5	R6	R7	R8
518	Ir	2	1	Pi	FL2	CH_3	CH_3	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Tn6		-	-			H	H	-	-
				Tn6		-	-			H	H	-	-
519	Ir	2	1	Pi	FL2	Ph3	Ph3	H	FL5	H	H	H	-
						Ph3	Ph3	H	H	-	-	-	-
				CH_3		-	-			-	-	-	-
				CH_3		-	-			-	-	-	-
520	Ir	2	1	Pi	FL2	CH_3	Ph3	H	FL5	H	H	H	-
						CH_3	Ph_3	H	H	-	-	-	-
				CF_3		-	-			-	-	-	-
				CF_3		-	-			-	-	-	-

Table 41

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
								CyC1-R3	CyC1-R4	R5	R6	R7	R8
						R"	R'''				CyC1		
										R5	R6	R7	R8
				E		R"	R'''				E		
										R5	R6	R7	R8
				G		R"	R'''				G		
										R5	R6	R7	R8
521	Ir	2	1	Pi	FL2	$(CH_2)_5Ph3$	$(CH_2)_5Ph3$	H FL5		H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Np3		-	-			CH_3O	H	-	-
				Np3		-	-			CH_3O	H	-	-
522	Ir	2	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	H	H	H
						-	-	H	H	-	-	-	-
				Np4		-	-			F	-	-	-
				Np4		-	-			F	-	-	-
523	Ir	2	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OCH_2C_5F_{11}$	H	H
						-	-	H	H	-	-	-	-
				Tn7		-	-			CH_3	-	-	-
				Tn7		-	-			CH_3	-	-	-
524	Ir	2	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	$OC\equiv C\text{-}C_7H_{15}$	H	H
						-	-	H	H	-	-	-	-
				Tn8		-	-			H	-	-	-
				Tn8		-	-			H	-	-	-

Table 41 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyC1-R3	CyC1-R4	CyN1 R5	CyN1 R6	CyN1 R7	CyN1 R8
						R"	R'''			CyC1		R5	R6	R7	R8
				E		R"	R'''					R5	R6	R7	R8
				G		R"	R'''					R5	R6	R7	R8
525	Ir	2	1	Pi	FL2	C_3H_7	C_3H_7	H	Tn5			H	H	-	-
						-	-	H	H			-	-	-	-
				Pe2		-	-					H	-	-	-
				Pe2		-	-					H	-	-	-
526	Ir	2	1	Pi	FL2	CH_3	CH_3	H	FL4			H	Ph3	H	-
						-	-	H	Ph2			H	H	H	H
				Pi2		-	-					H	H	-	-
				Pi2		-	-					H	H	-	-
527	Ir	2	1	Pi	FL2	CH_3	CH_3	H	FL5			H	Ph3	H	-
						CH_3	CH_3	H	Ph2			H	H	H	H
				Pi3		-	-					CH_3	CH_3	H	H
				Pi3		-	-					CH_3	CH_3	H	H
528	Ir	2	1	Pi	Ph1	-	-	H	FL5			H	H	H	-
						CH_3	CH_3	H	H			-	-	-	-
				FL4		-	-					H	H	H	-
				FL4		-	-					H	H	H	-

Table 41 (continued)

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				E		R"	R"'			E			
										R5	R6	R7	R8
				G		R"	R"'			G			
										R5	R6	R7	R8
529	Ir	2	1	Pi	FL2	CH_3	CH_3	H	Ph2	H	FL5	H	H
						CH_3	CH_3	H	H	-	-	-	-
				FL5		C_2H_5	C_2H_5			H	H	H	-
				FL5		$(CH_2)_5Ph3$	$(CH_2)_5Ph3$			H	H	H	-
530	Ir	2	1	Pi	Ph1	-	-	H	H	-	-	-	-
						C_8H_{17}	C_8H_{17}	FL5	H	H	H	H	-
				DBF2		-	-			H	H	H	-
				DBF2		-	-			H	H	H	-

Table 42

No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				E		R"	R"'			E			
										R5	R6	R7	R8
				G		R"	R"'			G			
										R5	R6	R7	R8
531	Ir	2	1	Pi	Ph1	-	-	H	Ph2	H	FL5	H	H
						CH_3	CH_3	H	H	-	-	-	-
				DBT3		-	-			H	H	H	-
				DBT3		-	-			H	H	H	-
532	Rh	2	1	Pi	FL3	CH_3	CH_3	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				CH_3		-	-			-	-	-	-
				CH_3		-	-			-	-	-	-
533	Rh	2	1	Pi	DBF1	CH_3	CH_3	CF_3	CF_3	-	-	-	-
						-	-	H	H	-	-	-	-
				CF_3		-	-			-	-	-	-
				CF_3		-	-			-	-	-	-
534	Rh	2	1	Pi	FL1	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				Qn2		-	-			H	H	-	-
				Qn2		-	-			H	H	-	-
535*	Rh	2	1	Pi	Np2	-	-	H	FL4	H	H	H	-
						-	-	H	H	-	-	-	-
				Np3		-	-			H	H	-	-
				Np3		-	-			H	H	-	-
536	Pt	1	1	Pi	FL2	C_3H_7	C_3H_7	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				CH_3		-	-			-	-	-	-
				CH_3		-	-			-	-	-	-
537	Pt	1	1	Pi	FL2	C_5H_{11}	C_5H_{11}	H	H	-	-	-	-
						-	-	H	H	-	-	-	-
				CF_3		-	-			-	-	-	-
				CF_3		-	-			-	-	-	-

* Reference compound

Table 42 (continued)

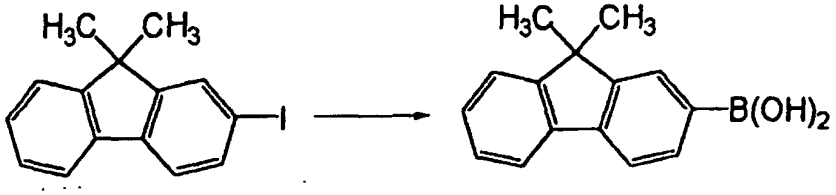
No	M	m	n	CyN1	CyC1	R	R'	CyN1-R1	CyN1-R2	CyN1			
										R5	R6	R7	R8
						R"	R"'	CyC1-R3	CyC1-R4	CyC1			
										R5	R6	R7	R8
				E		R"	R"'			E			
										R5	R6	R7	R8
				G		R"	R"'			G			
										R5	R6	R7	R8
538	Pd	1	1	Pi	FL2	$C_{15}H_{31}$	$C_{15}H_{31}$	H	FL5	H	H	H	-
						$C_{15}H_{31}$	$C_{15}H_{31}$	H	H	-	-	-	-
				CH_3		-	-			-	-	-	-
				CH_3		-	-			-	-	-	-
539	Pd	1	1	Pi	FL2	CH_3	CH_3	H	Np3	H	H	-	-
						-	-	H	H	-	-	-	-
				CF_3		-	-			-	-	-	-
				CF_3		-	-			-	-	-	-
540*	Ir	1	2	Pi	Tn4	-	-	H	FL5	H	H	H	-
						CH_3	CH_3	H	H	-	-	-	-
				CH_3		-	-			-	-	-	-
				CH_3		-	-			-	-	-	-

* Reference compound

[0062] Hereinbelow, the present invention will be described more specifically based on Examples.

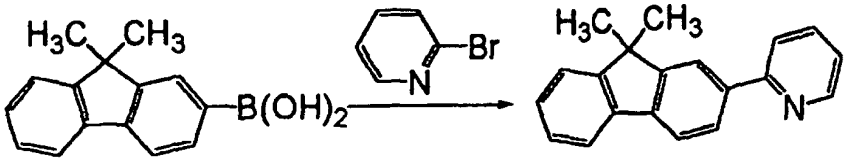
Example 1 (Synthesis of Example Compound No. 23)

[0063]

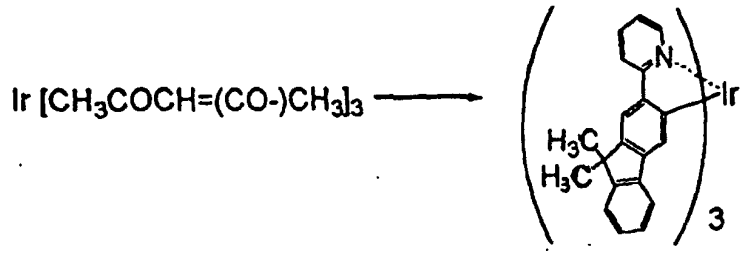


[0064] In a 30 liter-three-necked flask, 307.3 g (960 mM) of 2-iodo-9,9-dimethylfluorene and 10 liters of dry THF (tetrahydrofuran) were placed and cooled to -72 to 70 °C under stirring in an argon gas stream atmosphere. To the mixture, a 1.6M solution of n-butyllithium in hexane was added dropwise in 1 hour, followed by further stirring for 2 hours at the temperature. Thereafter, under stirring at -73 to -71 °C, to the system, a solution of 209.5 g (2016 mM) of trimethyl borate in 1.3 liters of dry THT was added dropwise in 2 hours. The reaction mixture was left standing overnight on an ice water bath. To the mixture, 1.6 liters of 4N-hydrochloric acid was added in 0.5 hour at 0 - 7 °C, followed by stirring for 1 hour at room temperature and extraction with toluene. The organic layer was washed with saturated saline water, followed by distilling-off of the solvent under a reduced pressure to obtain a residue. To the residue, hexane was added and heated under heating, followed by cooling to precipitate a crystal. The crystal was recovered by filtration and purified by silica gel column chromatography (eluent: toluene/ethyl acetate = 1/1), followed by successive recrys-

tallization from a chloroform-hexane mixture solvent, toluene, an ethyl acetate-toluene-THF mixture solvent, and toluene to obtain 32.0 g of 2-(9,9-dimethylfluorenyl)boronic acid (colorless crystal) (Yield: 14.0 %).



[0065] In a 300 ml-three-necked flask, 8.5 g (53.8 mM) of 2-bromopyridine, 12.8 g (53.8 mM) of 2-(9,9-dimethylfluorenyl)boronic acid, 55 ml of toluene, 27 ml of ethanol and 55 ml of 2M-sodium carbonate aqueous solution were placed and stirred at room temperature under nitrogen stream, and 1.97 g (1.70 mM) of tetrakis(triphenylphosphine) palladium (0) was added thereto. Thereafter, reflux under stirring for 5.5 hours was performed under nitrogen stream. After the reaction, the reaction mixture was cooled and extracted by addition of cold water and toluene. The organic layer was washed with water until neutrality, and the solvent was removed under reduced pressure to obtain a residue. The residue was successively purified by silica gel column chromatography (eluent: toluene/THF = 10/1) and that (eluent: hexane/ethyl acetate = 8/1) to obtain 12.2 g of 2-{2-(9,9-dimethylfluorenyl)}pyridine (pale brown viscous liquid) (Yield: 83.6 %).



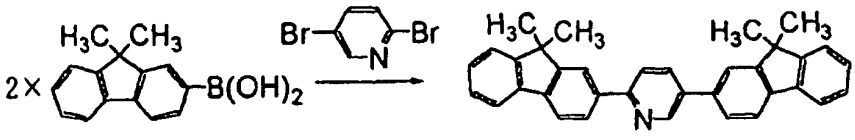
[0066] In a 100 ml-four-necked flask, 50 ml of glycerol was placed and heated at 130 - 140 °C under stirring and bubbling with nitrogen for 2 hours. Then, the glycerol was cooled by standing down to 100 °C, and 1.69 g (6.23 mM) of 2-(2-(9,9-dimethylfluorenyl)}pyridine and 0.50 g (1.02 mM) of iridium (III) acetylacetonate were added, followed by 5 hours of heating at 176 - 219 °C under stirring and nitrogen stream. The reaction product was cooled to room temperature and injected into 300 ml of 1N-hydrochloric acid to form a precipitate, which was filtered out and washed with water, followed by drying for 5 hours at 100 °C under reduced pressure. The precipitate was purified by silica gel column chromatography with chloroform as the eluent to obtain 0.17 g (yield = 21.3 %) of orange powdery tris[2-(9,9-dimethylfluorene-2-yl)pyridine-C^3,N]iridium (III). According to MALDI-TOF MS (matrix-assisted laser desorption ionization-time of fight mass spectroscopy), the compound exhibited M^+ (mass number of the corresponding cation formed by removal of 1 electron) of 1003.4.

[0067] A toluene solution of the compound exhibited a photoluminescence spectrum showing λmax (maximum emission wavelength) = 545 nm and a quantum yield of 0.23.

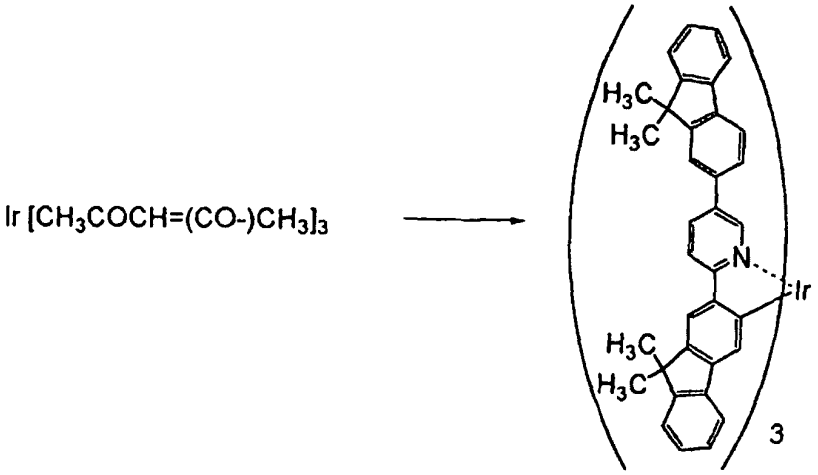
[0068] The compound (Ex. Comp. No. 23) exhibited better synthesis yield and quantum yield, thus being most suitable luminescence material in the present invention.

Example 2 (Synthesis of Example Compound No. 43)

[0069]



[0070] In a 100 ml-three-necked flask, 1.18 g (4.98 mM) of 2,5-dibromopyridine, 3.57 g (15.0 mM) 2-(9,9-dimethylfluorenyl)boronic acid prepared in Example 1, 10 ml of toluene, 5 ml of ethanol and 10 ml of 2M-sodium carbonate aqueous solution were placed and stirred at room temperature under nitrogen stream, and 0.35 g (0.30 mM) of tetrakis (triphenylphosphine)-palladium (0) was added thereto. Thereafter, reflux under stirring was performed for 12 hours under nitrogen stream. After completion of the reaction, the reaction product was cooled on an ice bath to precipitate a crystal, which was then filtered out and washed with water. To the crystal, 100 ml of methanol was added and washed at room temperature under stirring, and then was recovered by filtration. The resultant crystal was purified by silica gel column chromatography (eluent: chloroform) to obtain 2.10 g (yield = 91.0 %) of 2,5-bis{2-(9,9-dimethylfluorenyl)} pyridine (colorless crystal).



[0071] In a 100 ml-four-necked flask, 50 ml of glycerol was placed and heated at 130 - 140 °C under stirring and bubbling with nitrogen for 2 hours. Then, the glycerol was cooled by standing down to 100 °C, and 1.85 g (3.99 mM) of 2,5-bis{2-(9,9-dimethylfluorenyl)}pyridine and 0.40 g (0.82 mM) of iridium (III) acetylacetonate were added, followed by 5 hours of reflux at 180 - 235 °C under stirring and nitrogen stream. The reaction product was cooled to room temperature and injected into 300 ml of 1N-hydrochloric acid to form a precipitate, which was filtered out and washed with water, followed by drying for 5 hours at 100 °C under reduced pressure. The precipitate was purified by silica gel column chromatography with chloroform as the eluent and recrystallized from a chloroform-methanol mixture solvent to obtain 0.10 g (yield = 7.7 %) of red powdery tris[2,5-bis(9,9-dimethylfluorene-2-yl)pyridine-C^3,N]iridium (III). According to MALDI-TOF MS, the compound exhibited M^+ of 1589.6.

[0072] A toluene solution of the compound exhibited a photoluminescence spectrum showing λmax = 591 nm and a quantum yield of 0.12.

Examples 3 - 11

[0073] Each of luminescence devices having a layer structure shown in Figure 1B were prepared in the following manner.

[0074] On a 1.1 mm-thick glass substrate (transparent substrate 15), a 100 nm-thick film (transparent electrode 14) of ITO (indium tin oxide) was formed by sputtering, followed by patterning to form a stripe electrode including 100 lines each having a width of 100 nm and a spacing with an adjacent line of 10 nm (i.e., electrode pitch of 110 nm).

[0075] On the ITO-formed substrate, three organic layers and two metal electrode layers shown below were successively formed by vacuum (vapor) deposition using resistance heating in a vacuum chamber (10^{-4} Pa).

[0076] Organic layer 1 (hole transport layer 13) (40 nm): α-NPD

[0077] Organic layer 2 (luminescence layer 12) (30 nm): co-deposited film of CBP:metal complex (metal coordination compound shown in Table 45) (95:5 by weight)

[0078] Organic layer 3 (electron transport layer 16) (30 nm): Alq3

[0079] Metal electrode layer 1 (metal electrode 11) (15 nm): Al-Li alloy (Li = 1.8 wt. %)

[0080] Metal electrode layer 2 (metal electrode 11) (100 nm): Al

[0081] The above-deposited metal electrode layers 1 and 2 (Al-Li layer and Al layer) had a stripe electrode pattern including 100 lines each having a width of 100 nm and a spacing of 10 nm (electrode pitch = 110 nm) and arranged

so that the stripe electrode pattern intersected with that of the ITO electrode at right angles to form a matrix of pixels each having an effective electrode area of 3 mm^2 comprising 20 ITO lines bundled together at a lead-out portion and 15 Al (Al-Li) lines bundled together at a lead-out portion.

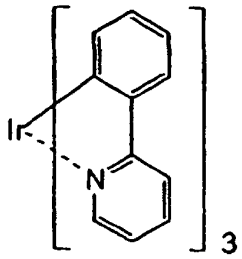
[0082] Each of the thus-prepared luminescence devices was taken out of the vacuum chamber and was subjected to a continuous energization (current passage) test in an atmosphere of dry nitrogen gas stream so as to remove device deterioration factors, such as oxygen and moisture (water content).

[0083] The continuous energization test was performed by continuously applying a voltage at a constant current density of 70 mA/cm^2 to the luminescence device having the ITO (transparent) electrode (as an anode) and the Al (metal) electrode (as a cathode), followed by measurement of emission luminance (brightness) with time so as to determine a time (luminance half-life) required for decreasing an initial luminance (60 - 220 cd/m^2) to 1/2 thereof.

[0084] The results are shown in Table 45 appearing hereinafter.

Comparative Example 1

[0085] A comparative luminescence device was prepared and evaluated in the same manner as in Examples 3 - 11 except that the Ir complexes (metal coordination compounds shown in Table 45) was changed to Ir-phenylpyridine complex ($Ir(ppy)_3$) shown below.



[0086] The results are also also shown in Table 45 below.

Table 45

Ex. No.	Compound No.	Luminance half-life (Hr)
Ex. 3	6	700
Ex. 4	23	850
Ex. 5	43	950
Ex. 6	54	800
Ex. 7	72	850
Ex. 8*	99	750
Ex. 9	118	600
Ex.10	153	700
Ex.11	440	650
Comp.Ex. 1	$Ir(ppy)_3$	350

* Reference Example (outside the scope of the invention)

[0087] As is apparent from Table 45, compared with the conventional luminescence device using $Ir(ppy)_3$, the luminescence devices using the metal coordination compounds of formula (1) according to the present invention provide longer luminance half-lives, thus resulting in an EL device having a high durability (luminance stability) based on a good stability of the metal coordination compound of formula (1) of the present invention.

Example 12

[0088] A color organic EL display apparatus shown in Figure 2 was prepared in the following manner.

[0089] An active matrix substrate had a planar structure basically similar to a structure described in U.S. Patent No. 6,114,715.

[0090] Specifically, on a 1.1 mm-thick glass substrate, top gate-type TFTs of polycrystalline silicon were formed in an ordinary manner and thereon, a flattening film was formed with contact holes for electrical connection with a pixel electrode (anode) at respective source regions, thus preparing an active matrix substrate with a TFT circuit.

[0091] On the active matrix substrate, a 700 nm-thick pixel electrode (anode) of ITO having a large work function was formed in a prescribed pattern. On the ITO electrode, prescribed organic layers and a 100 nm-thick Al electrode (cathode) were successively formed by vacuum deposition with a hard mask, followed by patterning to form a matrix of color pixels (128x128 pixels).

[0092] The respective organic layers corresponding to three color pixels (red (R) green (G) and blue (B)) were consisting of the following layers.

<R pixel region>
α-NPD (40 nm)/CBP: Ex. Comp. No. 487 (93:7 by weight) (30 nm)/BCP (20 nm)/Alq 3 (40 nm)
<G pixel region>
α-NPD (50 nm)/Alq 3 (50 nm)
<B pixel region>
α-NPD (50 nm)/BCP (20 nm)/Alq 3 (50 nm)

[0093] When the thus-prepared color organic EL display apparatus was driven, desired color image data can be displayed stably with good image qualities.

Example 13 (Synthesis of Ex. Comp. No. 24)

[0094] It is easy to synthesize the following compound in the same manner as in Example 1 except for using 2-chloro-5-trifluoromethylpyridine (made by Tokyo Kasei Kogyo K.K.) instead of 2-bromopyridine in Example 1.

[0095] Tris[2-(9,9-dimethylfluorene-2-yl)-5-trifluoromethylpyridine-C^3,N]iridium (III).

Example 14 (Synthesis of Ex. Comp. No. 25)

[0096] It is easy to synthesize the following compound in the same manner as in Example 1 except for using 2-chloro-4,5-bis(trifluoromethyl)pyridine (made by Oakwood Products Inc.) instead of 2-bromopyridine in Example 1.

[0097] Tris[2-(9,9-dimethylfluorene-2-yl)-4,5-bis(trifluoromethyl)pyridine-C^3,N]iridium (III).

Example 15 (Synthesis of Ex. Comp. No. 26)

[0098] It is easy to synthesize the following compound in the same manner as in Example 1 except for using 2-chloro-5-methylpyridine (made by Aldrich Co.) instead of 2-bromopyridine in Example 1.

[0099] Tris[2-(9,9-dimethylfluorene-2-yl)-5-methylpyridine-C^3,N]iridium (III).

Example 16 (Synthesis of Ex. Comp. No. 28)

[0100] It is easy to synthesize the following compound in the same manner as in Example 1 except that 2-bromo-9,9-diethylfluorene was synthesized from 2-bromofluorene and iodoethane in the same manner as the process described in Example 1 at page 32 of Japanese Laid-Open Patent Application (Tokuhyo Hei) 11-510535 (corr. to U.S. Patent No. 5,708,130) and was modified ito 2-(9,9-diethylfluorenyl)borate in the same manner as in Example 1 (of the present application), followed by reaction with 2-bromopyridine to synthesize 2-(2-(9,9-diethylfluorenyl)pyridine and then reaction with iridium (III) acetylacetonate in the same manner as in Example 1.

[0101] Tris[2-(9,9-diethylfluorene-2-yl)pyridine-C^3,N]iridium (III).

Example 17 (Synthesis of Ex. Comp. No. 29)

[0102] It is easy to synthesize the following compound in the same manner as in Example 16 except for using 1-iodopropane (made by Aldrich Co.) instead of iodoethane in Example 16.

[0103] Tris{2-[9,9-di(1-propyl)fluorene-2-yl]pyridine-C^3,N}iridium (III).

Example 18 (Synthesis of Ex. Comp. No. 30)

[0104] It is easy to synthesize the following compound in the same manner as in Example 16 except for using 1-iodobutane (made by Aldrich Co.) instead of iodoethane in Example 16.

[0105] Tris{2-[9,9-di(1-butyl)fluorene-2-yl]pyridine-C^3,N}iridium (III).

Example 19 (Synthesis of Ex. Comp. No. 31)

[0106] It is easy to synthesize the following compound in the same manner as in Example 16 except for using 1-iodopentane (made by Aldrich Co.) instead of iodoethane in Example 16.
[0107] Tris{2-[9,9-di(1-pentyl)fluorene-2-yl]pyridine-C^3,N}iridium (III).

Example 20 (Synthesis of Ex. Comp. No. 32)

[0108] It is easy to synthesize the following compound in the same manner as in Example 16 except for using 1-iodohexane (made by Aldrich Co.) instead of iodoethane in Example 16.
[0109] Tris{2-[9,9-di(1-hexyl)fluorene-2-yl]pyridine-C^3,N}iridium (III).

Example 21 (Synthesis of Ex. Comp. No. 33)

[0110] It is easy to synthesize the following compound in the same manner as in Example 16 except for using 1-iodoheptane (made by Aldrich Co.) instead of iodoethane in Example 16.
[0111] Tris{2-[9,9-di(1-heptyl)fluorene-2-yl]pyridine-C^3,N}iridium (III).

Example 22 (Synthesis of Ex. Comp. No. 34)

[0112] It is easy to synthesize the following compound in the same manner as in Example 16 except for using 1-iodooctane (made by Aldrich Co.) instead of iodoethane in Example 16.
[0113] Tris{2-[9,9-di(1-octyl)fluorene-2-yl]pyridine-C^3,N}iridium (III).

Example 23 (Synthesis of Ex. Comp. No. 35)

[0114] It is easy to synthesize the following compound in the same manner as in Example 16 except for using 1-iododecane (made by Aldrich Co.) instead of iodoethane and using 2-chloro-5-trifluoromethylpyridine (made by Tokyo Kasei Kogyo K.K.) instead of 2-bromopyridine, in Example 16.
[0115] Tris{2-[9,9-di(1-decyl)fluorene-2-yl]-5-trifluoromethylpyridine-C^3,N}iridium (III).

Example 24 (Synthesis of Ex. Comp. No. 37)

[0116] It is easy to synthesize the following compound in the same manner as in Example 16 except for using 1-bromoeicosane (made by Aldrich Co.) instead of iodoethane in Example 16.
[0117] Tris{2-[9,9-di(1-eicosyl)fluorene-2-yl]pyridine-C^3,N}iridium (III).

Example 25 (Synthesis of Ex. Comp. No. 44)

[0118] It is easy to synthesize the following compound in the same manner as in Example 2 except for using 2-(9,9-diethylfluorenyl)boronic acid instead of 2-(9,9-dimethylfluorenyl)boronic acid in Example 2.
[0119] Tris[2,5-bis(9,9-diethylfluorene-2-yl)pyridine-C^3,N]iridium (III).

Example 26 (Synthesis of Ex. Comp. No. 45)

[0120] It is easy to synthesize the following compound in the same manner as in Example 2 except for using 2-[9,9-di(1-pentyl)fluorenyl]boronic acid instead of 2-(9,9-dimethylfluorenyl)boronic acid in Example 2.
[0121] Tris{2,5-bis[9,9-di(1-pentyl)fluorene-2-yl]pyridine-C^3,N}iridium (III).

Example 27 (Synthesis of Ex. Comp. No. 47)

[0122] It is easy to synthesize the following compound in the same manner as in Example 2 except for using 2-[9,9-di(1-pentadecyl)fluorenyl]boronic acid instead of 2-(9,9-dimethylfluorenyl)boronic acid in Example 2.
[0123] Tris{2,5-bis[9,9-di(1-pentadecyl)fluorene-2-yl]pyridine-C^3,N}iridium (III).

Example 28 (Synthesis of Ex. Comp. No. 146)

[0124] It is easy to synthesize the following compound in the same manner as in Example 1 except for using dibenzofuran-4-boronic acid (made by Frontier Scientific Inc.) instead of 2-(9,9-dimethylfluorenyl)-boronic acid in Example 1.

[0125] Tris[2-(dibenzofuran-4-yl)pyridine-C^3,N]iridium (III).

Example 29 (Synthesis of Ex. Comp. No. 147)

[0126] It is easy to synthesize the following compound in the same manner as in Example 1 except for using dibenzothiophene-4-boronic acid (made by Frontier Scientific Inc.) instead of 2-(9,9-dimethylfluorenyl)boronic acid in Example 1.

[0127] Tris[2-(benzothiophene-4-yl)pyridine-C^3,N]iridium (III).

Example 30 (Synthesis of Ex. Comp. No. 149)

[0128] It is easy to synthesize the following compound in the same manner as in Example 2 except for using dibenzofuran-4-boronic acid (made by Frontier Scientific Inc.) instead of 2-(9,9-dimethylfluorenyl)-boronic acid in Example 1.

[0129] Tris[2,5-bis(dibenzofuran-4-yl)pyridine-C^3,N]iridium (III).

Example 31 (Synthesis of Ex. Comp. No. 150)

[0130] It is easy to synthesize the following compound in the same manner as in Example 2 except for using dibenzothiophene-4-boronic acid (made by Frontier Scientific Inc.) instead of 2-(9,9-dimethylfluorenyl)-boronic acid in Example 2.

[0131] Tris[2,5-bis(benzothiophene-4-yl)pyridine-C^3,N]iridium (III).

Example 32

[0132] An organic EL device shown in Figure 1C was prepared in the following manner.

[0133] On a 100 nm-thick patterned ITO electrode (anode) formed on a 1.1 mm-thick no-alkali glass substrate, a 40 nm-thick charge transport layer of α-NPD was formed by vacuum deposition (10^{-4} Pa) at a deposition rate of 0.1 nm/sec. On the charge transport layer, a 40 nm-thick luminescence layer (co-deposited film) of CBP: iridium complex of Ex. Comp. No. 23 (93:7 by weight) was formed by co-vacuum deposition at deposition rates of 0.1 nm/sec (for CBP) and 0.09 nm/sec (for the iridium complex) by controlling heating conditions of deposition vessel. On the luminescence layer, a 40 nm-thick exciton diffusion prevention layer of BCP (Bathocuproine) was formed by vacuum deposition at a deposition rate of 0.1 nm/sec, and or the exciton diffusion prevention layer, a 20 nm-thick electron transport layer of Alq 3 was formed by vacuum deposition at a deposition rate of 0.1 nm/sec. Thereafter, or the electron transport layer, a 150 nm-thick aluminum electrode (cathode) was formed by vacuum deposition at a deposition rate of 1 nm/sec.

[0134] The thus-prepared organic EL device exhibited an EL spectrum showing λmax = 545 nm and luminescent efficiencies of 12.4 lm/W at a luminance of 100 cd/m^2 and 13.6 lm/W at a luminance of 600 cd/m^2.

Example 33

[0135] An organic EL device was prepared and evaluated in the same manner as in Example 32 except for using Tris[2,5-bis(9,9-dimethylfluorene-2-yl)-pyridine-C^3,N]iridium (III) (Ex. Comp. No. 43) in place of Tris[2-(9,9-dimethylfluorene-2-yl)pyridine-C^3,N]iridium (III) (Ex. Comp. No. 23) synthesized in Example 1.

[0136] The thus-prepared organic EL device exhibited an EL spectrum showing λmax = 590 nm and luminescent efficiencies of 2.4 lm/W at a luminance of 100 cd/m^2 and 1.9 lm/W at a luminance of 300 cd/m^2.

Example 34 (Synthesis of Ex. Comp. No. 54)

[0137] It is easy to synthesize the following compound in the same manner as in Example 1 except for using 4-phenyl-1-bromopyridine (made by General Intermediates of Canada) instead of 2-bromopyridine in Example 1.

[0138] Tris[2-(9,9-dimethylfluorene-2-yl)-4-phenylpyridine-C^3,N]iridium (III).

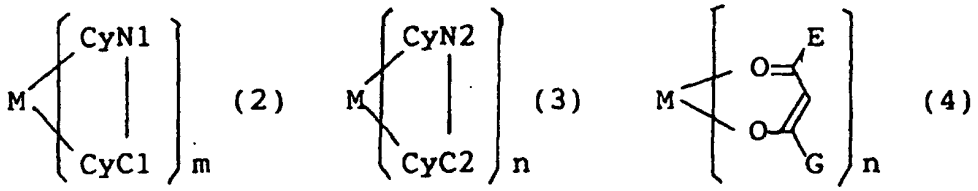
[0139] As described above, according to the present invention, the metal coordination compound of the formula (1) characterized by the aromatic group of the formula (5) as a partial structure is an excellent material which exhibits a high emission quantum efficiency. The electroluminescence device (luminescence device) of the present invention using, as a luminescent center material, the metal coordination compound of the formula (1) is an excellent device

which not only allows high-efficiency luminescence but also retains a high luminance for a long period and shows little deterioration by current passage. Further, the display apparatus using the electroluminescence device of the present invention exhibits excellent display performances.

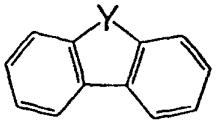
[0140] An electroluminescence device having a layer containing a specific metal coordination compound is provided. The metal coordination compound is represented by formula (1) below:

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

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 and n is 0, 1 or 2 with the proviso that m+n is 2 or 3; a partial structure MLm is represented by formula (2) shown below and a partial structure ML'_n is represented by formula (3) or (4) shown below:



at least one of the optional substituent(s) of the cyclic groups, and the cyclic groups CyC1 and CyC2 include an aromatic group capable of having a substituent represented by the following formula (5):



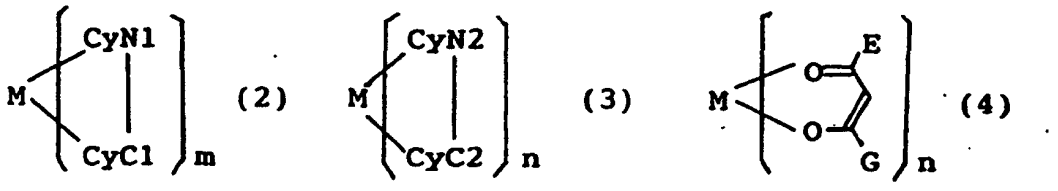
[0141] The metal coordination compound having the aromatic group is effective in providing high-efficiency luminescence and long-term high luminance.

Claims

1. A metal coordination compound represented by formula (1) 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 and n is 0, 1 or 2 with the proviso that m+n is 2 or 3; a partial structure MLm is represented by formula (2) shown below and a partial structure ML'_n is represented by formula (3) or (4) shown below:



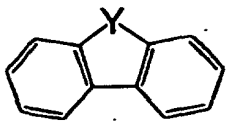
wherein CyN1 and CyN2 are each cyclic group capable of having a substituent, including a nitrogen atom and bonded to the metal atom M via the nitrogen atom; CyC1 and CyC2 are each cyclic group capable of having a

substituent, including a carbon atom and bonded to the metal atom M via the carbon atom with the proviso that the cyclic group CyN1 and the cyclic group CyC1 are bonded to each other via a covalent bond and the cyclic group CyN2 and the cyclic group CyC2 are bonded to each other via covalent bond;

the substituent of the cyclic groups is selected from a halogen atom, 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-neighbouring 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 optionally replaced with a fluorine atom, or an aromatic group capable of having a substituent (that is a halogen atom, a cyano atom, a nitro atom, a linear or branched alkyl group having 1 to 20 carbon atoms of which the alkyl group can include one or non-neighbouring 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 optionally 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 group capable of having a substituent (that is a halogen atom, a cyano atom, a nitro atom, 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-neighbouring 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 optionally replaced with a fluorine atom; and

at least one of the substituent(s) of the cyclic groups, and the cyclic groups CyC1 and CyC2 include an aromatic group capable of having a substituent represented by the following formula (5):



(5)

wherein the aromatic group of the formula (5) is bonded to CyN1, CyN2, CyC1 and CyC2 via a single bond when the aromatic group is the substituent(s) of the cyclic groups, and the aromatic group of the formula (5) is bonded to CyN1 or CyN2 via a single bond and bonded to the metal atom M via a single bond when the aromatic group is CyC1 or CyC2;

Y denotes C=O, CRR', $C=C(CN)_2$, O or S wherein R and R' are independently a hydrogen atom, 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-neighbouring 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 optionally replaced with a fluorine atom, or an aromatic group capable of having a substituent (that is a halogen atom, a cyano atom, a nitro atom, 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-neighbouring 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 optionally replaced with a fluorine atom; and

the optional substituent of the aromatic group of the formula (5) is selected from a halogen atom, cyano group, a nitro group, a trialkylsilyl group of which the alkyl groups are independently a linear or branched 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-neighbouring 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 optionally replaced with a fluorine atom, or an aromatic group capable of having a substituent (that is a halogen atom, a cyano atom, a nitro atom, a linear or branched alkyl group having 1 to 20 carbon atoms of which the alkyl group can include one or non-neighbouring 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 optionally replaced with a fluorine atom with the proviso that an adjacent pair of substituents can be bonded to form a cyclic structure.

2. A metal coordination compound according to Claim 1, including a partial structure ML'_n represented by the formula (3) in the formula (1).

3. A metal coordination compound according to Claim 1, including a partial structure ML'_n represented by the formula

(4) in the formula (1).

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

5. A metal coordination compound according to Claim 1, wherein the group Y in the formula (5) is C=O or CRR'.

6. A metal coordination compound according to Claim 1, wherein the cyclic groups CyC1 and CyC2 are independently selected from phenyl group, thienyl group, thianaphthyl group, naphthyl group, pyrenyl group, 9-fluorenonyl group, fluorenyl group, dibenzofuryl group, dibenzothienyl group, or carbazolyl group, as an aromatic cyclic group capable of having a substituent with the proviso that the aromatic cyclic group can include one or two CH groups that can be replaced with a nitrogen atom.

7. A metal coordination compound according to Claim 6, wherein the cyclic groups CyC1 and Cy2 are independently phenyl group or 2-fluorenyl group.

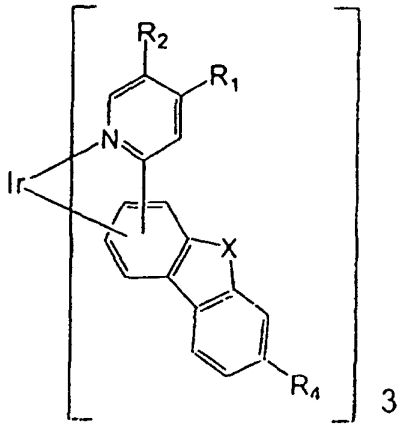
8. A metal coordination compound according to Claim 1, wherein the cyclic groups CyN1 and CyN2 are independently selected from pyridyl group, pyridazinyl group, and pyrimidinyl group, as an aromatic cyclic group capable of having a substituent.

9. A metal coordination compound according to Claim 8, wherein the aromatic cyclic group is pyridyl group.

10. A metal coordination compound according to Claim 1, wherein the cyclic groups CyN1, CyN2, CyC1 and CyC2 are independently non-substituted, or have a substituent selected from a halogen atom and 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-, -C≡C-, or a divalent aromatic group capable of having a substituent (that is a halogen atom 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-, and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom)), and the alkyl group can include a hydrogen atom that can be optionally replaced with a fluorine atom}.

11. A metal coordination compound according to Claim 1, wherein M in the formula (1) is iridium.

12. A metal coordination compound according to Claim 1, which is represented by the following formula (6):



wherein X denotes CRR', O or S where R and R' are independently a linear or branched alkyl group of formula: C_nH_{2n+1}- in which n is an integer of 1 - 20, the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O- and also can include a hydrogen atom that can be optionally replaced with a fluorine atom;

R2 denotes a hydrogen atom; a fluorine atom; a linear or branched alkyl group of formula: C_nH_{2n+1}- in which n is an integer of 1 - 20, the alkyl group can include one or non-neighboring two or more methylene groups that

can be replaced with -O- and also can include a hydrogen atom that can be optionally replaced with a fluorine atom; a phenyl group capable of having a substituent; a 9,9-dialkylfluorenyl group (of which the alkyl groups are independently a linear or branched alkyl group of formula: C_nH_{2n+1}- in which n is an integer of 1 - 20, the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O- and also can include a hydrogen atom that can be optionally replaced with a fluorine atom); a dibenzofuranyl group capable of having a substituent; and a dibenzothienyl group capable of having a substituent; the optional substituent of phenyl group, 9,9-dialkylfluorenyl group, dibenzofuranyl group and dibenzothienyl group is a fluorine atom or a linear or branched alkyl group of formula: C_nH_{2n+1}- in which n is an integer of 1 - 20, the alkyl group can include one or non-neighboring two or more methylene groups that can be replaced with -O- and also can include a hydrogen atom that can be optionally replaced with a fluorine atom.

13. An electroluminescence device, comprising: a pair of electrodes disposed on a substrate, and a luminescence unit comprising at least one organic compound disposed between the electrodes, wherein the organic compound comprises a metal coordination compound represented by the formula (1) in Claim 1.

14. An electroluminescence device according to Claim 13, wherein a voltage is applied between the electrodes to emit light.

15. An electroluminescence device according to Claim 13, wherein a voltage is applied between the electrodes to emit phosphorescence.

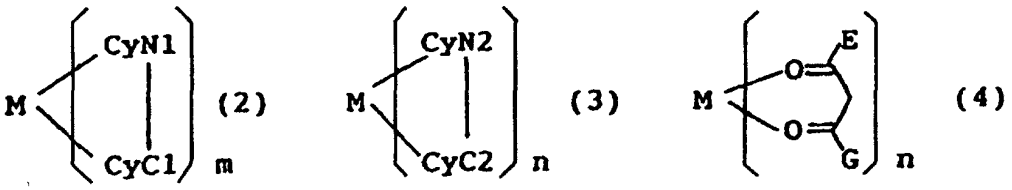
16. A picture display apparatus, comprising an electroluminescence device according to Claim 13, and a means for supplying electric signals to the electroluminescence device.

Patentansprüche

1. Metallkoordinationsverbindung, die durch nachstehende Formel (1) dargestellt wird:

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

worin M ein Metallatom aus Ir, Pt, Rh oder Pd ist; L und L' wechselseitig unterschiedliche bidentate Liganden sind; m 1, 2 oder 3 ist und n 0, 1 oder 2 ist, unter der Voraussetzung, dass m+n 2 oder 3 ist; eine Teilstruktur MLm durch nachstehend gezeigte Formel (2) dargestellt wird und einer Teilstruktur ML'_n durch nachstehend gezeigte Formel (3) oder (4) dargestellt wird:



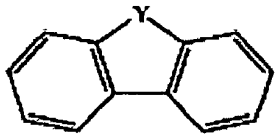
worin CyN1 und CyN2 jeweils eine cyclische Gruppen sind, die einen Substituenten aufweisen können, die ein Stickstoffatom einschließen und an das Metallatom M über das Stickstoffatom gebunden sind; CyC1 und CyC2 jeweils eine cyclische Gruppe sind, die einen Substituenten aufweisen kann, die ein Kohlenstoffatom einschließt und an das Metallatom M über das Kohlenstoffatom gebunden ist, unter der Voraussetzung, dass die cyclische Gruppe CyN1 und die cyclische Gruppe CyC1 aneinander über eine kovalente Bindung gebunden sind und die cyclische Gruppe CyN2 und die cyclische Gruppe CyC2 aneinander über eine kovalente Bindung gebunden sind;

der Substituent der cyclischen Gruppen aus einem Halogenatom, einer Cyanogruppe, einer Nitrogruppe, einer Trialkylsilylgruppe ausgewählt ist, von welcher die Alkylgruppen unabhängig eine lineare oder verzweigte Alkylgruppe mit 1 bis 8 Kohlenstoffatomen, eine lineare oder verzweigte Alkylgruppe mit 1 bis 20 Kohlenstoffatomen, von welcher die Alkylgruppe eine oder nicht benachbarte zwei oder mehrere Methylengruppen beinhalten kann, die durch -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- oder -C≡C- ersetzt werden können, und die Alkylgruppe

kann ein Wasserstoffatom beinhalten, das optional durch ein Fluoratom ersetzt werden kann; oder eine aromatische Gruppe, die einen Substituenten aufweisen kann (d.h. ein Halogenatom, ein Cyanogruppe, ein Nitrogruppe, eine lineare oder verzweigte Alkylgruppe mit 1 bis 20 Kohlenstoffatomen, von welchen die Alkylgruppe eine oder nicht benachbarte zwei oder mehrere Methylengruppen beinhalten kann, die durch -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- oder -C≡C- ersetzt werden können und die Alkylgruppe ein Wasserstoffatom beinhalten kann, das optional durch ein Fluoratom ersetzt werden kann);

E und G sind unabhängig eine lineare oder verzweigte Alkylgruppe mit 1 bis 20 Kohlenstoffatomen, von welchen die Alkylgruppe ein Wasserstoffatom beinhalten kann, das optional durch ein Fluoratom ersetzt werden kann, oder eine aromatische Gruppe, die einen Substituenten aufweisen kann (d.h. ein Halogenatom, ein Cyanogruppe, ein Nitrogruppe, eine Trialkylsilylgruppe, von welcher die Alkylgruppen unabhängig eine lineare oder verzweigte Alkylgruppe mit 1 bis 8 Kohlenstoffatomen, eine lineare oder verzweigte Alkylgruppe mit 1 bis 20 Kohlenstoffatomen sind, von welcher die Alkylgruppe eine oder nicht benachbarte zwei oder mehrere Methylengruppen beinhalten kann, die durch -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- oder -C≡C- ersetzt werden können und die Alkylgruppe ein Wasserstoffatom beinhalten kann, das optional durch ein Fluoratom ersetzt werden kann; und

wenigstens einer der Substituent(en) der cyclischen Gruppen, und die cyclischen Gruppen CyN1 und CyN2 eine aromatische Gruppe beinhalten, die einen Substituenten aufweisen kann, der durch die folgende Formel (5) dargestellt wird:



(5)

worin die aromatische Gruppe der Formel (5) an CyN1, CyN2, CyC1 und CyC2 über eine Einzelbindung gebunden ist, wenn die aromatische Gruppe die Substituent(en) der cyclischen Gruppen ist, und die aromatische Gruppe der Formel (5) an CyN1 oder CyN2 über eine Einzelbindung gebunden ist und an das Metallatom M über eine Einzelbindung gebunden ist, wenn die aromatische Gruppe CyC1 oder CyC2 ist;

Y bezeichnet C=O, CRR', $C=C(CN)_2$, O oder S, worin R und R' unabhängig voneinander ein Wasserstoffatom, eine lineare oder verzweigte Alkylgruppe mit 1 bis 8 Kohlenstoffatomen, eine lineare oder verzweigte Alkylgruppe mit 1 bis 20 Kohlenstoffatomen sind, von welchen die Alkylgruppe eine oder nicht benachbarte zwei oder mehrere Methylengruppen beinhalten kann, die durch -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- oder -C≡C-, und die Alkylgruppe ein Wasserstoffatom beinhalten kann, das optional durch ein Fluoratom ersetzt werden kann, oder eine aromatische Gruppe, die einen Substituenten aufweisen kann (d.h. ein Halogenatom, ein Cyanogruppe, ein Nitrogruppe, eine Trialkylsilylgruppe, von welcher die Alkylgruppen unabhängig eine lineare oder verzweigte Alkylgruppe mit 1 bis 8 Kohlenstoffatomen, eine lineare oder verzweigte Alkylgruppe mit 1 bis 20 Kohlenstoffatomen sind, von welchen die Alkylgruppe eine oder nicht benachbarte zwei oder mehrere Methylengruppen beinhalten kann, die durch -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- oder -C≡C- und die Alkylgruppe ein Wasserstoffatom beinhalten kann, das optional durch ein Fluoratom ersetzt werden kann); und

der optionale Substituent der aromatischen Gruppe der Formel (5) aus einem Halogenatom, einer Cyanogruppe, einer Nitrogruppe, einer Trialkylsilylgruppe ausgewählt ist, von welcher die Alkylgruppen unabhängig eine lineare oder verzweigte Gruppe mit 1 bis 8 Kohlenstoffatomen, eine lineare oder verzweigte Alkylgruppe mit 1 bis 20 Kohlenstoffatomen sind, von welchen die Alkylgruppe eine oder nicht benachbarte zwei oder mehrere Methylengruppen beinhalten kann, die durch -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- oder -C≡C- ersetzt werden können, und die Alkylgruppe ein Wasserstoffatom beinhalten kann, das optional durch ein Fluoratom ersetzt werden kann, oder eine aromatische Gruppe, die einen Substituenten aufweisen kann (d.h. ein Halogenatom, ein Cyanogruppe, eine Nitrogruppe, eine lineare oder verzweigte Alkylgruppe mit 1 bis 20 Kohlenstoffatomen, von welchen die Alkylgruppe eine oder nicht benachbarte zwei oder mehrere Methylengruppen beinhalten kann, die durch -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- oder -C≡C- ersetzt werden können, und die Alkylgruppen ein Wasserstoffatom beinhalten kann, das optional durch ein Fluoratom ersetzt werden kann), unter der Voraussetzung, dass ein benachbartes Paar von Substituenten gebunden werden kann, um eine cyclische Struktur auszubilden.

2. Metallkoordinatsverbindung gemäß Anspruch 1, die eine Teilstruktur ML'_n beinhaltet, die durch die Formel (3) in der Formel (1) dargestellt wird.

3. Metallkoordinatsverbindung gemäß Anspruch 1, die eine Teilstruktur ML'_n beinhaltet, die durch die Formel (4) in der Formel (1) dargestellt wird.

4. Metallkoordinatsverbindung gemäß Anspruch 1, worin n in der Formel (1) 0 beträgt.

5. Metallkoordinatsverbindung gemäß Anspruch 1, worin die Gruppe Y in der Formel (5) C=O oder CRR' beträgt.

6. Metallkoordinatsverbindung gemäß Anspruch 1, wobei die cyclischen Gruppen CyC1 und CyC2 unabhängig ausgewählt sind aus Phenylgruppe, Thienylgruppe, Thianaphthylgruppe, Naphthylgruppe, Pyrenylgruppe, 9-Fluorenonylgruppe, Fluorenylgruppe, Dibenzofurylgruppe, Dibenzothienylgruppe oder Carbazolylgruppe, als eine aromatische cyclische Gruppe, die einen Substituenten aufweisen kann, unter der Voraussetzung, dass die aromatische cyclische Gruppe ein oder zwei CH-Gruppen beinhalten kann, die durch ein Stickstoffatom ersetzt werden können.

7. Metallkoordinatsverbindung gemäß Anspruch 6, wobei die cyclischen Gruppen CyC1 und Cy2 unabhängig voneinander Phenylgruppe oder 2-Fluorenylgruppe sind.

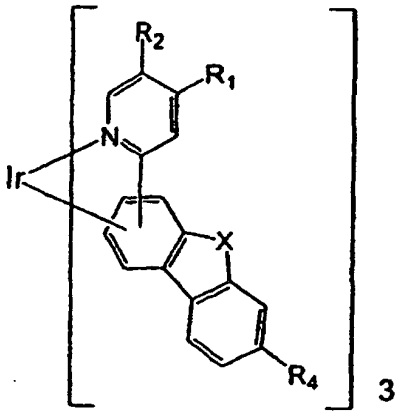
8. Metallkoordinatsverbindung gemäß Anspruch 1, wobei die cyclischen Gruppen CyN1 und CyN2 unabhängig voneinander aus Pyridylgruppe, Pyridazinylgruppe und Pyrimidinylgruppe als eine aromatische cyclische Gruppe ausgewählt sind, die einen Substituenten aufweisen kann.

9. Metallkoordinationsverbindung gemäß Anspruch 8, wobei die aromatische cyclische Gruppe eine Pyridylgruppe ist.

10. Metallkoordinationsverbindung gemäß Anspruch 1, wobei die cyclischen Gruppen CyN1, CyN2, CyC1 und CyC2 unabhängig nicht substituiert sind, oder einen Substituenten besitzen, der aus einem Halogenatom und einer linearen oder verzweigten Alkylgruppe mit 1 bis 20 Kohlenstoffatomen ausgewählt ist {von welchen die Alkylgruppe eine oder nicht benachbarte zwei oder mehrere Methylengruppen beinhalten kann, die ersetzt werden können durch -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH-, -C≡C- oder eine zweiwertige aromatische Gruppe, die einen Substituenten aufweisen kann (d.h. ein Halogenatom oder eine lineare oder verzweigte Alkylgruppe mit 1 bis 20 Kohlenstoffatomen (von welchen die Alkylgruppe eine oder nicht benachbarte zwei oder mehrere Methylengruppen beinhalten kann, die ersetzt werden können durch -O- und die Alkylgruppe ein Wasserstoffatom beinhalten kann, das optional durch ein Fluoratom ersetzt werden kann)), und die Alkylgruppe ein Wasserstoffatom beinhalten kann, das optional durch ein Fluoratom ersetzt werden kann}.

11. Metallkoordinationsverbindung gemäß Anspruch 1, wobei M in der Formel (1) Iridium ist.

12. Metallkoordinationsverbindung gemäß Anspruch 1, welche dargestellt wird durch die folgende Formel (6) :



(6)

worin X bezeichnet CRR', O oder S, wo R und R' unabhängig eine lineare oder verzweigte Alkylgruppe mit folgender Formel sind: C_nH_{2n+1}-, in welcher n eine ganze Zahl von 1 bis 20 ist, die Alkylgruppe eine oder nicht benachbarte zwei oder mehrere Methylengruppen beinhalten können, die durch -O- ersetzt werden können und zudem ein Wasserstoffatom beinhalten können, das optional durch ein Fluoratom ersetzt werden kann;

R2 bezeichnet: ein Wasserstoffatom; ein Fluoratom; eine lineare oder verzweigte Alkylgruppe der Formel: C_nH_{2n+1}-, in welcher n eine ganze Zahl von 1 bis 20 ist, die Alkylgruppe eine oder nicht benachbarte zwei oder mehrere Methylengruppen beinhalten kann, die durch -O- ersetzt werden können und zudem ein Wasserstoff beinhalten kann, das optional durch ein Fluoratom ersetzt werden kann; eine Phenylgruppe, die einen Substituenten aufweisen kann; eine 9,9-Dialkylfluorenylgruppe (von welcher die Alkylgruppen unabhängig eine lineare oder verzweigte Alkylgruppe mit der Formel sind: C_nH_{2n+1}-, in welcher n eine ganze Zahl von 1 bis 20 ist, die Alkylgruppe eine oder nicht benachbarte zwei oder mehrere Methylengruppen beinhalten kann, die durch -O- ersetzt werden kann und zudem ein Wasserstoffatom beinhalten kann, das optional durch ein Fluoratom ersetzt werden kann); eine Dibenzofuranylgruppe, die einen Substituenten aufweisen kann; und eine Dibenzothienylgruppe, die einen Substituenten aufweisen kann; der optionale Substituent der Phenylgruppe, 9,9-Dialkylfluorenylgruppe, Dibenzofuranylgruppe und Dibenzothienylgruppe ist ein Fluoratom oder eine lineare oder verzweigte Alkylgruppe der Formel: C_nH_{2n+1}-, in welcher n eine ganze Zahl von 1 bis 20 ist, die Alkylgruppe eine oder nicht verzweigte zwei oder mehrere Methylengruppen beinhalten kann, die durch -O- ersetzt werden können und zudem ein Wasserstoffatom beinhalten kann, das optional durch ein Fluoratom ersetzt werden kann.

13. Elektrolumineszenzvorrichtung, die umfasst: ein Paar von Elektroden, die auf einem Substrat angeordnet sind, und eine Lumineszeneinheit, die wenigstens eine organische Verbindung umfasst, die zwischen den Elektroden angeordnet ist, wobei die organische Verbindung eine Metallkoordinationsverbindung umfasst, die durch die Formel (1) in Anspruch 1 dargestellt wird.

14. Elektrolumineszenzvorrichtung gemäß Anspruch 13, wobei eine Spannung zwischen den Elektroden angelegt wird, um Licht zu emittieren.

15. Elektrolumineszenzvorrichtung gemäß Anspruch 13, wobei eine Spannung zwischen den Elektroden angelegt wird, um Phosphoreszenz zu emittieren.

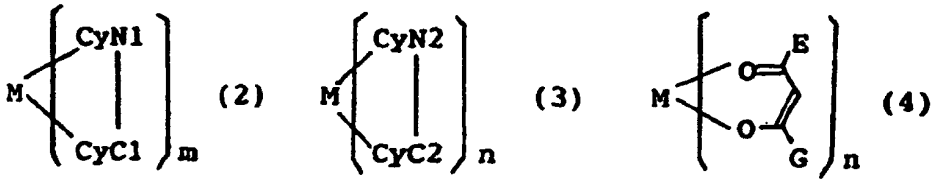
16. Bildanzeigegerät, das eine Elektrolumineszenzvorrichtung gemäß Anspruch 13 und eine Einrichtung zum Zuführen von elektrischen Signalen zu der Elektrolumineszenzvorrichtung umfasst.

Revendications

1. Composé de coordination métallique représenté par la formule (1) ci-dessous :

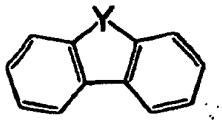
$$ML_mL'_n \quad (1)$$

dans laquelle M est un atome de métal de Ir, Pt, Rh ou Pd ; L et L' sont des ligands bidentates mutuellement différents ; m vaut 1, 2 ou 3 et n vaut 0, 1 ou 2, avec la condition que m+n vaut 2 ou 3 ; une structure partielle ML_m est représentée par la formule (2) indiquée ci-dessous et une structure partielle ML'_n est représentée par les formules (3) ou (4) indiquées ci-dessous :



où chacun de CyN1 et CyN2 est un groupe cyclique pouvant avoir un substituant, incluant un atome d'azote et lié à l'atome de métal M via l'atome d'azote ; chacun de CyC1 et CyC2 est un groupe cyclique pouvant avoir un substituant, incluant un atome de carbone, et lié à l'atome de métal M via l'atome de carbone, avec la condition que le groupe cyclique CyN1 et le groupe cyclique CyC1 sont liés l'un à l'autre via une liaison covalente et le groupe cyclique CyN2 et le groupe cyclique CyC2 sont liés l'un à l'autre via une liaison covalente ;

le substituant des groupes cycliques est choisi parmi un atome d'halogène, un groupe cyano, un groupe nitro, un groupe trialkylsilyle dont les groupes alkyle sont indépendamment un groupe alkyle linéaire ou ramifié ayant de 1 à 8 atomes de carbone, un groupe alkyle linéaire ou ramifié ayant de 1 à 20 atomes de carbone dont le groupe alkyle peut comprendre un ou deux ou plusieurs groupes méthylène non voisins qui peuvent être remplacés par -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- ou -C≡C-, et le groupe alkyle peut contenir un atome d'hydrogène qui peut être éventuellement remplacé par un atome de fluor, ou un groupe aromatique pouvant avoir un substituant (à savoir un atome d'halogène, un groupe cyano, un groupe nitro, un groupe alkyle linéaire ou ramifié ayant de 1 à 20 atomes de carbone dont le groupe alkyle peut contenir un ou deux ou plusieurs groupes méthylène non voisins qui peuvent être remplacés par -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- ou -C≡C-, et le groupe alkyle peut contenir un atome d'hydrogène qui peut être éventuellement remplacé par un atome de fluor) ;
E et G sont indépendamment un groupe alkyle linéaire ou ramifié ayant de 1 à 20 atomes de carbone dont le groupe alkyle peut contenir un atome d'hydrogène qui peut être éventuellement remplacé par un atome de fluor, ou un groupe aromatique pouvant avoir un substituant (à savoir un atome d'halogène, un groupe cyano, un groupe nitro, un groupe trialkylsilyle dont les groupes alkyle sont indépendamment un groupe alkyle linéaire ou ramifié ayant de 1 à 8 atomes de carbone, un groupe alkyle linéaire ou ramifié ayant de 1 à 20 atomes de carbone dont le groupe alkyle peut comprendre un ou deux ou plusieurs groupes méthylène non voisins qui peuvent être remplacés par -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- ou -C≡C-, et le groupe alkyle peut contenir un atome d'hydrogène qui peut être éventuellement remplacé par un atome de fluor ; et
au moins l'un du ou des substituants des groupes cycliques, et les groupes cycliques CyC1 et CyC2 comprennent un groupe aromatique pouvant avoir un substituant représenté par la formule (5) suivante :



(5)

dans laquelle le groupe aromatique de formule (5) est lié à CyN1, CyN2, CyC1 et CyC2 via une liaison simple quand le groupe aromatique est le ou les substituants des groupes cycliques, et le groupe aromatique de formule (5) est lié à CyN1 ou CyN2 via une liaison simple et lié à l'atome de métal M via une liaison simple quand le groupe aromatique est CyC1 ou CyC2 ;
Y désigne C=O, CRR', $C=C(CN)_2$, O ou S, où R et R' sont indépendamment un atome d'hydrogène, un groupe alkyle linéaire ou ramifié ayant de 1 à 8 atomes de carbone, un groupe alkyle linéaire ou ramifié ayant de 1 à 20 atomes de carbone dont le groupe alkyle peut comprendre un ou deux ou plusieurs groupes méthylène non voisins qui peuvent être remplacés par -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- ou -C≡C-, et le groupe alkyle peut contenir un atome d'hydrogène qui peut être éventuellement remplacé par un atome de fluor, ou un groupe aromatique pouvant avoir un substituant (à savoir un atome d'halogène, un groupe cyano, un groupe nitro, un groupe trialkylsilyle dont les groupes alkyle sont indépendamment un groupe alkyle linéaire ou ramifié ayant de 1 à 8 atomes de carbone, un groupe alkyle linéaire ou ramifié ayant de 1 à 20 atomes de carbone dont le groupe alkyle peut comprendre un ou deux ou plusieurs groupes méthylène non voisins qui peuvent être remplacés par -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- ou -C≡C-, et le groupe alkyle peut contenir un atome d'hydrogène qui peut être éventuellement remplacé par un atome de fluor ; et
le substituant facultatif du groupe aromatique de formule (5) est choisi parmi un atome d'halogène, un groupe cyano, un groupe nitro, un groupe trialkylsilyle dont les groupes alkyle sont indépendamment un groupe alkyle linéaire ou ramifié ayant de 1 à 8 atomes de carbone, un groupe alkyle linéaire ou ramifié ayant de 1 à 20 atomes de carbone dont le groupe alkyle peut comprendre un ou deux ou plusieurs groupes méthylène non voisins qui peuvent être remplacés par -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- ou -C≡C-, et le groupe alkyle peut contenir un atome d'hydrogène qui peut être éventuellement remplacé par un atome de fluor, ou un groupe aromatique pouvant avoir un substituant (à savoir un atome d'halogène, un groupe cyano, un groupe nitro, un groupe alkyle linéaire ou ramifié ayant de 1 à 20 atomes de carbone dont le groupe alkyle peut comprendre un ou deux ou plusieurs groupes méthylène non voisins qui peuvent être remplacés par -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- ou -C≡C-, et le groupe alkyle peut contenir un atome d'hydrogène qui peut être éventuellement remplacé par un atome de fluor, avec la condition qu'une paire adjacente de substituants peut être liée pour former une structure cyclique.

2. Composé de coordination métallique selon la revendication 1, comprenant une structure partielle ML'_n représentée par la formule (3) dans la formule (1).

3. Composé de coordination métallique selon la revendication 1, comprenant une structure partielle ML'_n représentée par la formule (4) dans la formule (1).

4. Composé de coordination métallique selon la revendication 1, dans lequel n vaut 0 dans la formule (1).

5. Composé de coordination métallique selon la revendication 1, dans lequel le groupe Y dans la formule (5) est C=O ou CRR'.

6. Composé de coordination métallique selon la revendication 1, dans lequel les groupes cycliques CyC1 et CyC2 sont indépendamment choisis parmi le groupe phényle, le groupe thiényle, le groupe thianaphtyle, le groupe naphtyle, le groupe pyrényle, le groupe 9-fluorénonyle, le groupe fluorényle, le groupe dibenzofuryle, le groupe dibenzothiényle, ou le groupe carbazolyle, en tant que groupe cyclique aromatique pouvant avoir un substituant, avec la condition que le groupe cyclique aromatique peut comprendre un ou deux groupes CH pouvant être remplacés par un atome d'azote.

7. Composé de coordination métallique selon la revendication 6, dans lequel les groupes cycliques CyC1 et CyC2 sont indépendamment le groupe phényle ou le groupe 2-fluorényle.

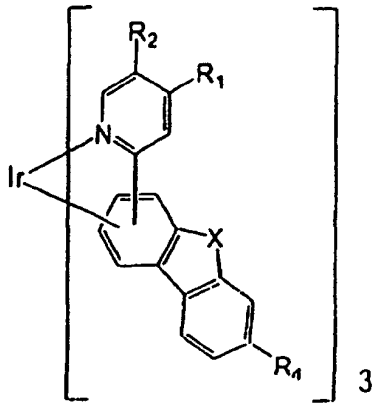
8. Composé de coordination métallique selon la revendication 1, dans lequel les groupes cycliques CyN1 et CyN2 sont indépendamment choisis parmi le groupe pyridyle, le groupe pyridazinyle et le groupe pyrimidinyle, en tant que groupe cyclique aromatique pouvant avoir un substituant.

9. Composé de coordination métallique selon la revendication 8, dans lequel le groupe cyclique aromatique est le groupe pyridyle.

10. Composé de coordination métallique selon la revendication 1, dans lequel les groupes cycliques CyN1, CyN2, CyC1 et CyC2 sont indépendamment non substitués, ou ont un substituant choisi parmi un atome d'halogène ou un groupe alkyle linéaire ou ramifié ayant de 1 à 20 atomes de carbone (dont le groupe alkyle peut comprendre un ou deux ou plusieurs groupes méthylène ou plus qui peuvent être remplacés par -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH- ou -C≡C-, ou un groupe aromatique divalent pouvant avoir un substituant (c'est-à-dire un atome d'halogène ou un groupe alkyle linéaire ou ramifié ayant de 1 à 20 atomes de carbone (dont le groupe alkyle peut comprendre un ou deux ou plusieurs groupes méthylène non voisins qui peuvent être remplacés par -O-, et le groupe alkyle peut comprendre un atome d'hydrogène qui peut être éventuellement remplacé par un atome de fluor)), et le groupe alkyle peut comprendre un atome d'hydrogène qui peut être éventuellement remplacé par un atome de fluor).

11. Composé de coordination métallique selon la revendication 1, dans lequel M dans la formule (1) est l'iridium.

12. Composé de coordination métallique selon la revendication 1, qui est représenté par la formule (6) suivante :



dans laquelle X désigne CRR', O ou S où R et R' sont indépendamment un groupe alkyle linéaire ou ramifié de

formule C_nH_{2n+1}- où n est un entier de 1 à 20, le groupe alkyle peut comprendre un ou deux ou plusieurs groupes méthylène non voisins qui peuvent être remplacés par -O- et peut aussi comprendre un atome d'hydrogène qui peut être éventuellement remplacé par un atome de fluor ;
R2 désigne un atome d'hydrogène ; un atome de fluor ; un groupe alkyle linéaire ou ramifié de formule C_nH_{2n+1}- où n est un entier de 1 à 20, le groupe alkyle peut comprendre un ou deux ou plusieurs groupes méthylène non voisins qui peuvent être remplacés par -O- et peut aussi comprendre un atome d'hydrogène qui peut être éventuellement remplacé par un atome de fluor ; un groupe phényle pouvant avoir un substituant ; un groupe 9,9-dialkylfluorényle (dont les groupes alkyle sont indépendamment un groupe alkyle linéaire ou ramifié de formule C_nH_{2n+1}- où n est un entier de 1 à 20, le groupe alkyle peut comprendre un ou deux ou plusieurs groupes méthylène non voisins qui peuvent être remplacés par -O- et peut aussi comprendre un atome d'hydrogène qui peut être éventuellement remplacé par un atome de fluor) ; un groupe dibenzofuranyle pouvant avoir un substituant ; et un groupe dibenzothiényle pouvant avoir un substituant ; le substituant facultatif du groupe phényle, du groupe 9,9-dialkylfluorényle, du groupe dibenzofuranyle et du groupe dibenzothiényle est un atome de fluor ou un groupe alkyle linéaire ou ramifié de formule C_nH_{2n+1}- où n est un entier de 1 à 20, le groupe alkyle peut comprendre un ou deux ou plusieurs groupes méthylène non voisins qui peuvent être remplacés par -O- et peut aussi comprendre un atome d'hydrogène qui peut être éventuellement remplacé par un atome de fluor.

13. Dispositif à électroluminescence comprenant : une paire d'électrodes disposées sur un substrat, et une unité de luminescence comprenant au moins un composé organique disposé entre les électrodes, où le composé organique comprend un composé de coordination métallique représenté par la formule (1) dans la revendication 1.

14. Dispositif à électroluminescence selon la revendication 13, dans lequel une tension est appliquée entre les électrodes pour émettre une lumière.

15. Dispositif à électroluminescence selon la revendication 13, dans lequel une tension est appliquée entre les électrodes pour émettre une phosphorescence.

16. Dispositif d'affichage d'image, comprenant un dispositif à électroluminescence selon la revendication 13, et un moyen pour délivrer des signaux électriques au dispositif à électroluminescence.

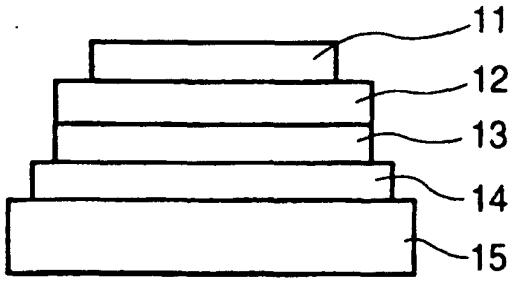


FIG. 1A

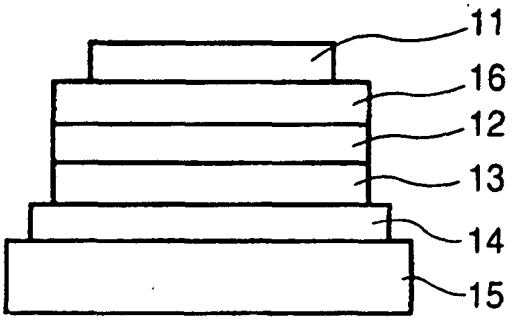


FIG. 1B

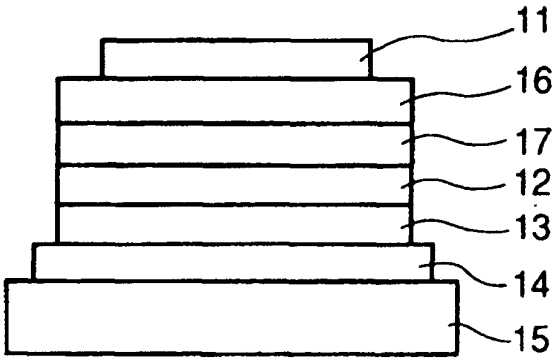


FIG. 1C

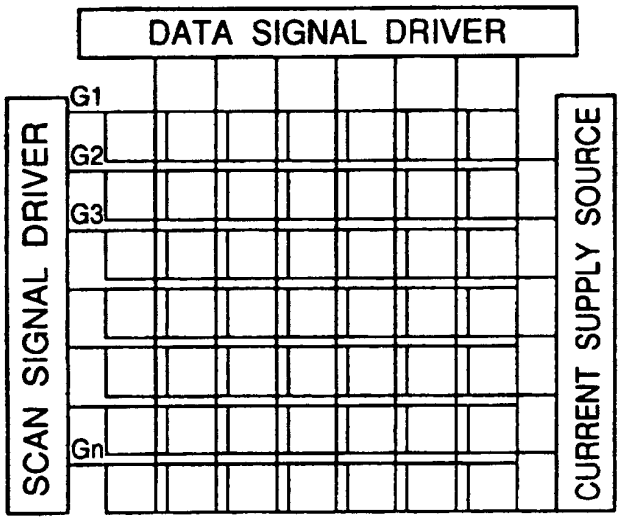
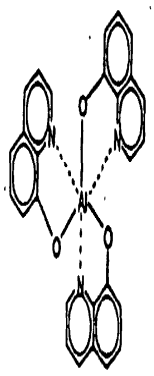

DATA SIGNAL DRIVER
SCAN SIGNAL DRIVER
CURRENT SUPPLY SOURCE
G1
G2
G3
Gn

FIG. 2

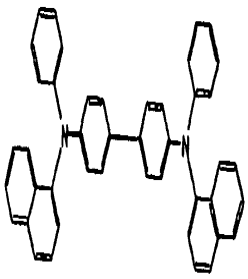
专利名称(译)	金属配位化合物，发光装置和显示装置		
公开(公告)号	EP1238981B1	公开(公告)日	2005-06-15
申请号	EP2002005112	申请日	2002-03-07
[标]申请(专利权)人(译)	佳能株式会社		
申请(专利权)人(译)	佳能株式会社		
当前申请(专利权)人(译)	佳能株式会社		
[标]发明人	TAKIGUCHI TAKAO OKADA SHINJIRO TSUBOYAMA AKIRA MIURA SEISHI MORIYAMA TAKASHI KAMATANI JUN FURUGORI MANABU		
发明人	TAKIGUCHI, TAKAO OKADA, SHINJIRO TSUBOYAMA, AKIRA MIURA, SEISHI MORIYAMA, TAKASHI KAMATANI, JUN FURUGORI, MANABU		
IPC分类号	H01L51/50 C07F15/00 C09K11/06 H01L51/00 H01L51/30		
CPC分类号	H01L51/0085 C07F15/0033 H01L51/0059 H01L51/0081 H01L51/5012		
优先权	2001064254 2001-03-08 JP 2002042522 2002-02-20 JP		
其他公开文献	EP1238981A2 EP1238981A3		
外部链接	Espacenet		

摘要(译)

提供了一种具有含有特定金属配位化合物的层的电致发光器件。金属配位化合物由下式（1）表示：MLmL'n（1），其中M是Ir，Pt，Rh或Pd的金属原子; L和L'是相互不同的二齿配体; m为1,2或3，n为0,1或2，条件是m + n为2或3;部分结构MLm由下面所示的式（2）表示，部分结构ML'n由下面所示的式（3）或（4）表示：至少一个环状基团的任选取代基，和环状基团CyC1和CyC2包括能够具有由下式（5）表示的取代基的芳族基团：具有芳族基团的金属配位化合物可有效地提供高效发光和长期高亮度。



Alq3



α-NPD