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(54) ORGANIC ELECTROLUMINESCENT MATERIALS AND DEVICES

ORGANISCHE ELEKTROLUMINESZENTE MATERIALIEN UND VORRICHTUNGEN

MATÉRIAUX ET DISPOSITIFS ÉLECTROLUMINESCENTS ORGANIQUES

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EP 2 940 098 B1

Description

[0001] The claimed invention was made by, on behalf of, and/or in connection with one or more of the following parties to a joint university corporation research agreement: Regents of the University of Michigan, Princeton University, University of Southern California, and the Universal Display Corporation. The agreement was in effect on and before the date the claimed invention was made, and the claimed invention was made as a result of activities undertaken within the scope of the agreement.

FIELD OF THE INVENTION

[0002] The present invention relates to compounds for use as emitters and devices, such as organic light emitting diodes, including the same.

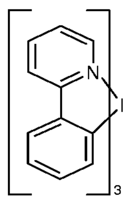
BACKGROUND

[0003] Opto-electronic devices that make use of organic materials are becoming increasingly desirable for a number of reasons. Many of the materials used to make such devices are relatively inexpensive, so organic opto-electronic devices have the potential for cost advantages over inorganic devices. In addition, the inherent properties of organic materials, such as their flexibility, may make them well suited for particular applications such as fabrication on a flexible substrate. Examples of organic opto-electronic devices include organic light emitting devices (OLEDs), organic phototransistors, organic photovoltaic cells, and organic photodetectors. For OLEDs, the organic materials may have performance advantages over conventional materials. For example, the wavelength at which an organic emissive layer emits light may generally be readily tuned with appropriate dopants.

[0004] OLEDs make use of thin organic films that emit light when voltage is applied across the device. OLEDs are becoming an increasingly interesting technology for use in applications such as flat panel displays, illumination, and backlighting. Several OLED materials and configurations are described in U.S. Pat. Nos. 5,844,363, 6,303,238, 5,707,745, and WO 2010/118029 A1.

[0005] One application for phosphorescent emissive molecules is a full color display. Industry standards for such a display call for pixels adapted to emit particular colors, referred to as "saturated" colors. In particular, these standards call for saturated red, green, and blue pixels. Color may be measured using CIE coordinates, which are well known to the art.

[0006] One example of a green emissive molecule is tris(2-phenylpyridine) iridium, denoted $Ir(ppy)_3$, which has the following structure:



[0007] In this, and later figures herein, we depict the dative bond from nitrogen to metal (here, Ir) as a straight line.

[0008] As used herein, the term "organic" includes polymeric materials as well as small molecule organic materials that may be used to fabricate organic opto-electronic devices. "Small molecule" refers to any organic material that is not a polymer, and "small molecules" may actually be quite large. Small molecules may include repeat units in some circumstances. For example, using a long chain alkyl group as a substituent does not remove a molecule from the "small molecule" class. Small molecules may also be incorporated into polymers, for example as a pendent group on a polymer backbone or as a part of the backbone. Small molecules may also serve as the core moiety of a dendrimer, which consists of a series of chemical shells built on the core moiety. The core moiety of a dendrimer may be a fluorescent or phosphorescent small molecule emitter. A dendrimer may be a "small molecule," and it is believed that all dendrimers currently used in the field of OLEDs are small molecules.

[0009] As used herein, "top" means furthest away from the substrate, while "bottom" means closest to the substrate. Where a first layer is described as "disposed over" a second layer, the first layer is disposed further away from substrate. There may be other layers between the first and second layer, unless it is specified that the first layer is "in contact with" the second layer. For example, a cathode may be described as "disposed over" an anode, even though there are various organic layers in between.

[0010] As used herein, "solution processible" means capable of being dissolved, dispersed, or transported in and/or deposited from a liquid medium, either in solution or suspension form.

[0011] A ligand may be referred to as "photoactive" when it is believed that the ligand directly contributes to the photoactive properties of an emissive material. A ligand may be referred to as "ancillary" when it is believed that the ligand does not contribute to the photoactive properties of an emissive material, although an ancillary ligand may alter the properties of a photoactive ligand.

[0012] As used herein, and as would be generally understood by one skilled in the art, a first "Highest Occupied Molecular Orbital" (HOMO) or "Lowest Unoccupied Molecular Orbital" (LUMO) energy level is "greater than" or "higher than" a second HOMO or LUMO energy level if the first energy level is closer to the vacuum energy level. Since ionization potentials (IP) are measured as a negative energy relative to a vacuum level, a higher HOMO energy level corresponds to an IP having a smaller absolute value (an IP that is less negative). Similarly, a higher LUMO energy level corresponds to an electron affinity (EA) having a smaller absolute value (an EA that is less negative). On a conventional energy level diagram, with the vacuum level at the top, the LUMO energy level of a material is higher than the HOMO energy level of the same material. A "higher" HOMO or LUMO energy level appears closer to the top of such a diagram than a "lower" HOMO or LUMO energy level.

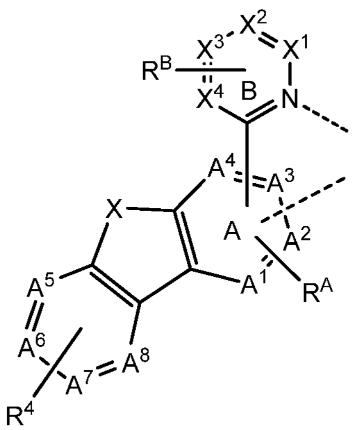
[0013] As used herein, and as would be generally understood by one skilled in the art, a first work function is "greater than" or "higher than" a second work function if the first work function has a higher absolute value. Because work functions are generally measured as negative numbers relative to vacuum level, this means that a "higher" work function is more negative. On a conventional energy level diagram, with the vacuum level at the top, a "higher" work function is illustrated as further away from the vacuum level in the downward direction. Thus, the definitions of HOMO and LUMO energy levels follow a different convention than work functions.

[0014] More details on OLEDs, and the definitions described above, can be found in US Pat. No. 7,279,704.

SUMMARY OF THE INVENTION

[0015] According to an embodiment, a compound is provided that has the structure of Formula $M(L_A)_x(L_B)_y(L_C)_z$:

wherein ligand L_A is



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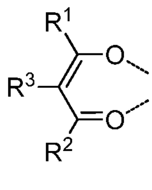
ligand L_B is



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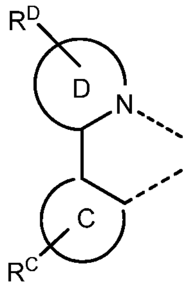
and

ligand L_C is



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[0016] In the compound of Formula $M(L_A)_x(L_B)_y(L_C)_z$:

M is a metal having an atomic number greater than 40;
x is 1, or 2;
y is 0, 1, or 2;
z is 0, 1, or 2;
x+y+z is the oxidation state of the metal M;
X^1, X^2, X^3, X^4, A^1, A^2, A^3, A^4, A^5, A^6, A^7, and A^8 are C or N;
at least one of A^1, A^2, A^3, A^4, A^5, A^6, A^7, and A^8 is N;
ring B is bonded to ring A through a C-C bond;
M is bonded to ring A through a M-C bond;
X is O, S, or Se;
rings C, and D are each independently a 5 or 6-membered carbocyclic or heterocyclic ring;
R^A represents mono, or di-substitution, or no substitution;
R^B represents di, tri, or tetra-substitution;
R^C, R^D, and R^4 each independently represent mono, di, tri, or tetra-substitution, or no substitution;
two adjacent R^B form a six-member aromatic carbocyclic or heterocyclic ring E fused to ring B; wherein, when ring E is heterocyclic, the only heteroatom is nitrogen; wherein ring E can be further substituted by R^E; and wherein R^E represents mono, di, tri, or tetra-substitution, or no substitution;
each of R^A, R^B, R^C, R^D, R^E, R^1, R^2, R^3, and R^4 are independently selected from the group consisting of hydrogen, deuterium, halide, alkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, aryloxy, amino, silyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, and combinations thereof; and
any adjacent substitutents of R^C, and R^D are optionally joined to form a fused ring.

[0017] According to another embodiment, a first device comprising a first organic light emitting device is also provided. The first organic light emitting device can include an anode, a cathode, and an organic layer, disposed between the anode and the cathode. The organic layer can include a compound of Formula $M(L_A)_x(L_B)_y(L_C)_z$. The first device can be a consumer product, an organic light-emitting device, and/or a lighting panel.
[0018] According to another embodiment, a formulation that includes a compound of Formula $M(L_A)_x(L_B)_y(L_C)_z$ is also provised.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

FIG. 1 shows an organic light emitting device.

FIG. 2 shows an inverted organic light emitting device that does not have a separate electron transport layer.

FIG. 3 shows ligands L_A, L_B, and L_C as disclosed herein.

DETAILED DESCRIPTION

[0020] Generally, an OLED comprises at least one organic layer disposed between and electrically connected to an anode and a cathode. When a current is applied, the anode injects holes and the cathode injects electrons into the organic layer(s). The injected holes and electrons each migrate toward the oppositely charged electrode. When an electron and hole localize on the same molecule, an "exciton," which is a localized electron-hole pair having an excited energy state, is formed. Light is emitted when the exciton relaxes via a photoemissive mechanism. In some cases, the exciton may be localized on an excimer or an exciplex. Non-radiative mechanisms, such as thermal relaxation, may also occur, but are generally considered undesirable.

[0021] The initial OLEDs used emissive molecules that emitted light from their singlet states ("fluorescence") as disclosed, for example, in U.S. Pat. No. 4,769,292. Fluorescent emission generally occurs in a time frame of less than 10 nanoseconds.

[0022] More recently, OLEDs having emissive materials that emit light from triplet states ("phosphorescence") have been demonstrated. Baldo et al., "Highly Efficient Phosphorescent Emission from Organic Electroluminescent Devices," Nature, vol. 395, 151-154, 1998; ("Baldo-I") and Baldo et al., "Very high-efficiency green organic light-emitting devices based on electrophosphorescence," Appl. Phys. Lett., vol. 75, No. 3, 4-6 (1999) ("Baldo-II"). Phosphorescence is described in more detail in US Pat. No. 7,279,704 at cols. 5-6.

[0023] FIG. 1 shows an organic light emitting device 100. The figures are not necessarily drawn to scale. Device 100 may include a substrate 110, an anode 115, a hole injection layer 120, a hole transport layer 125, an electron blocking layer 130, an emissive layer 135, a hole blocking layer 140, an electron transport layer 145, an electron injection layer 150, a protective layer 155, a cathode 160, and a barrier layer 170. Cathode 160 is a compound cathode having a first conductive layer 162 and a second conductive layer 164. Device 100 may be fabricated by depositing the layers described, in order. The properties and functions of these various layers, as well as example materials, are described in more detail in US 7,279,704 at cols. 6-10.

[0024] More examples for each of these layers are available. For example, a flexible and transparent substrate-anode combination is disclosed in U.S. Pat. No. 5,844,363. An example of a p-doped hole transport layer is m-MTDATA doped with F_4-TCNQ at a molar ratio of 50:1, as disclosed in U.S. Patent Application Publication No. 2003/0230980. Examples of emissive and host materials are disclosed in U.S. Pat. No. 6,303,238 to Thompson et al. An example of an n-doped electron transport layer is BPhen doped with Li at a molar ratio of 1:1, as disclosed in U.S. Patent Application Publication No. 2003/0230980. U.S. Pat. Nos. 5,703,436 and 5,707,745 disclose examples of cathodes including compound cathodes having a thin layer of metal such as Mg:Ag with an overlying transparent, electrically-conductive, sputter-deposited ITO layer. The theory and use of blocking layers is described in more detail in U.S. Pat. No. 6,097,147 and U.S. Patent Application Publication No. 2003/0230980. Examples of injection layers are provided in U.S. Patent Application Publication No. 2004/0174116. A description of protective layers may be found in U.S. Patent Application Publication No. 2004/0174116.

[0025] FIG. 2 shows an inverted OLED 200. The device includes a substrate 210, a cathode 215, an emissive layer 220, a hole transport layer 225, and an anode 230. Device 200 may be fabricated by depositing the layers described, in order. Because the most common OLED configuration has a cathode disposed over the anode, and device 200 has cathode 215 disposed under anode 230, device 200 may be referred to as an "inverted" OLED. Materials similar to those described with respect to device 100 may be used in the corresponding layers of device 200. FIG. 2 provides one example of how some layers may be omitted from the structure of device 100.

[0026] The simple layered structure illustrated in FIGS. 1 and 2 is provided by way of nonlimiting example, and it is understood that embodiments of the invention may be used in connection with a wide variety of other structures. The specific materials and structures described are exemplary in nature, and other materials and structures may be used. Functional OLEDs may be achieved by combining the various layers described in different ways, or layers may be omitted entirely, based on design, performance, and cost factors. Other layers not specifically described may also be included. Materials other than those specifically described may be used. Although many of the examples provided herein describe various layers as comprising a single material, it is understood that combinations of materials, such as a mixture of host and dopant, or more generally a mixture, may be used. Also, the layers may have various sublayers. The names given to the various layers herein are not intended to be strictly limiting. For example, in device 200, hole transport layer 225 transports holes and injects holes into emissive layer 220, and may be described as a hole transport layer or a hole injection layer. In one embodiment, an OLED may be described as having an "organic layer" disposed between a cathode and an anode. This organic layer may comprise a single layer, or may further comprise multiple layers of different organic materials as described, for example, with respect to FIGS. 1 and 2.

[0027] Structures and materials not specifically described may also be used, such as OLEDs comprised of polymeric materials (PLEDs) such as disclosed in U.S. Pat. No. 5,247,190 to Friend et al., which is incorporated by reference in its entirety. By way of further example, OLEDs having a single organic layer may be used. OLEDs may be stacked, for example as described in U.S. Pat. No. 5,707,745 to Forrest et al. The OLED structure may deviate from the simple layered structure illustrated in FIGS. 1 and 2. For example, the substrate may include an angled reflective surface to improve out-coupling, such as a mesa structure as described in U.S. Pat. No. 6,091,195 to Forrest et al., and/or a pit structure as described in U.S. Pat. No. 5,834,893 to Bulovic et al.

[0028] Unless otherwise specified, any of the layers of the various embodiments may be deposited by any suitable method. For the organic layers, preferred methods include thermal evaporation, ink-jet, such as described in U.S. Pat.

Nos. 6,013,982 and 6,087,196, organic vapor phase deposition (OVPD), such as described in U.S. Pat. No. 6,337,102 to Forrest et al., and deposition by organic vapor jet printing (OVJP), such as described in U.S. Pat. No. 7,431,968. Other suitable deposition methods include spin coating and other solution based processes. Solution based processes are preferably carried out in nitrogen or an inert atmosphere. For the other layers, preferred methods include thermal evaporation. Preferred patterning methods include deposition through a mask, cold welding such as described in U.S. Pat. Nos. 6,294,398 and 6,468,819, and patterning associated with some of the deposition methods such as ink-jet and OVJD. Other methods may also be used. The materials to be deposited may be modified to make them compatible with a particular deposition method. For example, substituents such as alkyl and aryl groups, branched or unbranched, and preferably containing at least 3 carbons, may be used in small molecules to enhance their ability to undergo solution processing. Substituents having 20 carbons or more may be used, and 3-20 carbons is a preferred range. Materials with asymmetric structures may have better solution processibility than those having symmetric structures, because asymmetric materials may have a lower tendency to recrystallize. Dendrimer substituents may be used to enhance the ability of small molecules to undergo solution processing.

[0029] Devices fabricated in accordance with embodiments of the present invention may further optionally comprise a barrier layer. One purpose of the barrier layer is to protect the electrodes and organic layers from damaging exposure to harmful species in the environment including moisture, vapor and/or gases, etc. The barrier layer may be deposited over, under or next to a substrate, an electrode, or over any other parts of a device including an edge. The barrier layer may comprise a single layer, or multiple layers. The barrier layer may be formed by various known chemical vapor deposition techniques and may include compositions having a single phase as well as compositions having multiple phases. Any suitable material or combination of materials may be used for the barrier layer. The barrier layer may incorporate an inorganic or an organic compound or both. The preferred barrier layer comprises a mixture of a polymeric material and a non-polymeric material as described in U.S. Pat. No. 7,968,146, PCT Pat. Application Nos. PCT/US2007/023098 and PCT/US2009/042829. To be considered a "mixture", the aforesaid polymeric and non-polymeric materials comprising the barrier layer should be deposited under the same reaction conditions and/or at the same time. The weight ratio of polymeric to non-polymeric material may be in the range of 95:5 to 5:95. The polymeric material and the non-polymeric material may be created from the same precursor material. In one example, the mixture of a polymeric material and a non-polymeric material consists essentially of polymeric silicon and inorganic silicon.

[0030] Devices fabricated in accordance with embodiments of the invention may be incorporated into a wide variety of consumer products, including flat panel displays, computer monitors, medical monitors, televisions, billboards, lights for interior or exterior illumination and/or signaling, heads up displays, fully transparent displays, flexible displays, laser printers, telephones, cell phones, personal digital assistants (PDAs), laptop computers, digital cameras, camcorders, viewfinders, micro-displays, 3-D displays, vehicles, a large area wall, theater or stadium screen, or a sign. Various control mechanisms may be used to control devices fabricated in accordance with the present invention, including passive matrix and active matrix. Many of the devices are intended for use in a temperature range comfortable to humans, such as 18 degrees C. to 30 degrees C., and more preferably at room temperature (20-25 degrees C), but could be used outside this temperature range, for example, from -40 degree C to + 80 degree C.

[0031] The materials and structures described herein may have applications in devices other than OLEDs. For example, other optoelectronic devices such as organic solar cells and organic photodetectors may employ the materials and structures. More generally, organic devices, such as organic transistors, may employ the materials and structures.

[0032] The term "halo" or "halogen" as used herein includes fluorine, chlorine, bromine, and iodine.

[0033] The term "alkyl" as used herein contemplates both straight and branched chain alkyl radicals. Preferred alkyl groups are those containing from one to fifteen carbon atoms and includes methyl, ethyl, propyl, isopropyl, butyl, isobutyl, tert-butyl, and the like. Additionally, the alkyl group may be optionally substituted.

[0034] The term "cycloalkyl" as used herein contemplates cyclic alkyl radicals. Preferred cycloalkyl groups are those containing 3 to 7 carbon atoms and includes cyclopropyl, cyclopentyl, cyclohexyl, and the like. Additionally, the cycloalkyl group may be optionally substituted.

[0035] The term "alkenyl" as used herein contemplates both straight and branched chain alkene radicals. Preferred alkenyl groups are those containing two to fifteen carbon atoms. Additionally, the alkenyl group may be optionally substituted.

[0036] The term "alkynyl" as used herein contemplates both straight and branched chain alkyne radicals. Preferred alkyl groups are those containing two to fifteen carbon atoms. Additionally, the alkynyl group may be optionally substituted.

[0037] The terms "aralkyl" or "arylalkyl" as used herein are used interchangeably and contemplate an alkyl group that has as a substituent an aromatic group. Additionally, the aralkyl group may be optionally substituted.

[0038] The term "heterocyclic group" as used herein contemplates aromatic and non-aromatic cyclic radicals. Heteroaromatic cyclic radicals also means heteroaryl. Preferred hetero-non-aromatic cyclic groups are those containing 3 or 7 ring atoms which includes at least one hetero atom, and includes cyclic amines such as morpholino, piperdino, pyrrolidino, and the like, and cyclic ethers, such as tetrahydrofuran, tetrahydropyran, and the like. Additionally, the heterocyclic group may be optionally substituted.

[0039] The term "aryl" or "aromatic group" as used herein contemplates single-ring groups and polycyclic ring systems. The polycyclic rings may have two or more rings in which two carbons are common to two adjoining rings (the rings are "fused") wherein at least one of the rings is aromatic, e.g., the other rings can be cycloalkyls, cycloalkenyls, aryl, heterocycles, and/or heteroaryls. Additionally, the aryl group may be optionally substituted, and may comprise, e.g., six to twenty carbon atoms.

[0040] The term "heteroaryl" as used herein contemplates single-ring hetero-aromatic groups that may include from one to three heteroatoms and three to twenty carbon atoms, for example, pyrrole, furan, thiophene, imidazole, oxazole, thiazole, triazole, pyrazole, pyridine, pyrazine and pyrimidine, and the like. The term heteroaryl also includes polycyclic hetero-aromatic systems having two or more rings in which two atoms are common to two adjoining rings (the rings are "fused") wherein at least one of the rings is a heteroaryl, e.g., the other rings can be cycloalkyls, cycloalkenyls, aryl, heterocycles, and/or heteroaryls. Additionally, the heteroaryl group may be optionally substituted.

[0041] The alkyl, cycloalkyl, alkenyl, alkynyl, aralkyl, heterocyclic group, aryl, and heteroaryl may be optionally substituted with one or more substituents selected from the group consisting of hydrogen, deuterium, halogen, alkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, aryloxy, amino, cyclic amino, silyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acid, ether, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, and combinations thereof.

[0042] As used herein, "substituted" indicates that a substituent other than H is bonded to the relevant position, such as carbon. Thus, for example, where R^1 is mono-substituted, then one R^1 must be other than H. Similarly, where R^1 is di-substituted, then two of R^1 must be other than H. Similarly, where R^1 is unsubstituted, R^1 is hydrogen for all available positions.

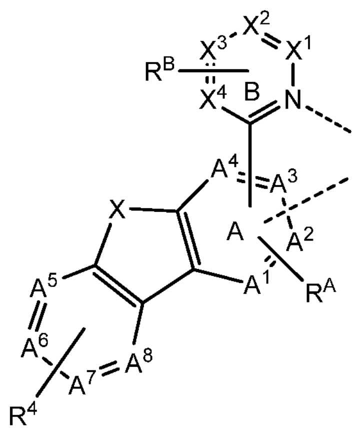
[0043] The "aza" designation in the fragments described herein, i.e. aza-dibenzofuran, azadibenzonethiophene, etc. means that one or more of the C-H groups in the respective fragment can be replaced by a nitrogen atom, for example, and without any limitation, azatriphenylene encompasses both dibenzo[*f,h*]quinoxaline and dibenzo[*f,h*]quinoline. One of ordinary skill in the art can readily envision other nitrogen analogs of the aza-derivatives described above, and all such analogs are intended to be encompassed by the terms as set forth herein.

[0044] It is to be understood that when a molecular fragment is described as being a substituent or otherwise attached to another moiety, its name may be written as if it were a fragment (e.g. naphthyl, dibenzofuryl) or as if it were the whole molecule (e.g. naphthalene, dibenzofuran). As used herein, these different ways of designating a substituent or attached fragment are considered to be equivalent.

[0045] The novel ligands disclosed herein can be used to produce metal complexes that are useful in emissive devices. The incorporation of these ligands allows red phosphorescent materials with good external quantum efficiency (EQE), good color, and good lifetime.

[0046] According to one embodiment, a compound is disclosed that has a structure according to Formula $M(L_A)_x(L_B)_y(L_C)_z$:

wherein ligand L_A is



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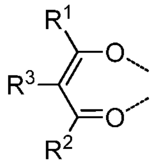
ligand L_B is



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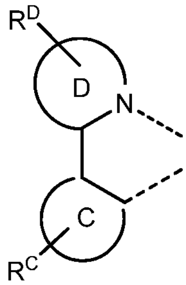
and

ligand L_C is



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[0047] In the compound of Formula $M(L_A)_x(L_B)_y(L_C)_z$:

M is a metal having an atomic number greater than 40;
x is 1, or 2;
y is 0, 1, or 2;
z is 0, 1, or 2;
x+y+z is the oxidation state of the metal M;
X^1, X^2, X^3, X^4, A^1, A^2, A^3, A^3, A^4, A^5, A^6, A^7 and A^8 are C or N;
at least one of A^1, A^2, A^3, A^4, A^5, A^6, A^7, and A^8 is N;
ring B is bonded to ring A through a C-C bond;
M is bonded to ring A through a M-C bond;
X is O, S, or Se;
rings C, and D are each independently a 5 or 6-membered carbocyclic or heterocyclic ring;
R^A represents mono, or di-substitution, or no substitution;
R^B represents di, tri, or tetra-substitution;
R^C, R^D, and R^4 each independently represent mono, di, tri, or tetra-substitution, or no substitution;
two adjacent R^B form a six-member aromatic carbocyclic or heterocyclic ring E fused to ring B; wherein, when ring E is heterocyclic, the only heteroatom is nitrogen; wherein ring E can be further substituted by R^E; and wherein R^E represents mono, di, tri, or tetra-substitution, or no substitution;
each of R^A, R^B, R^C, R^D, R^E, R^1, R^2, R^3, and R^4 are independently selected from the group consisting of hydrogen, deuterium, halide, alkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, aryloxy, amino, silyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, and combinations thereof; and
any adjacent substitutents of R^C, and R^D are optionally joined to form a fused ring.

[0048] In some embodiments, none of the adjacent R^E substituents are fused (*i.e.*, all R^E are unfused). In some embodiments, each R^E is independently selected from the group consisting of hydrogen, deuterium, alkyl, cycloalkyl, aryl, while each R^E is independently selected from the group consisting of hydrogen or alkyl in other embodiments. In some embodiments, at least one R^E has at least two carbons, while at least one R^E has at least three carbons or at least four carbons in other embodiments. In some embodiments, at least one R^E has at least one branched alkyl.

[0049] In some embodiments, each R^4 is independently selected from the group consisting of H, D, alkyl, and combinations thereof. In some embodiments, each R^4 is independently selected from the group consisting of H, D, methyl, ethyl, isopropyl, propyl, butyl, isobutyl, and combinations thereof.

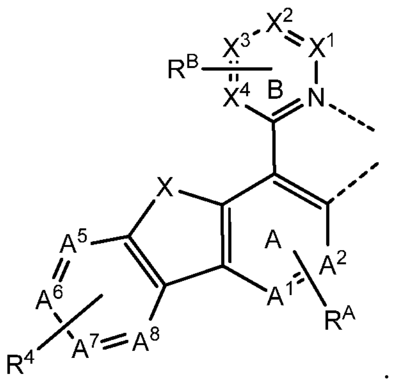
[0050] In some embodiments, each R^A is independently selected from the group consisting of H, D, alkyl, and combinations thereof. In some embodiments, each R^A is independently selected from the group consisting of H, D, methyl, ethyl, and combinations thereof.

[0051] In some embodiments, M is selected from the group consisting of Ir, Rh, Re, Ru, Os, Pt, Au, and Cu. In some embodiments, M is Ir. In some embodiments, X is O.

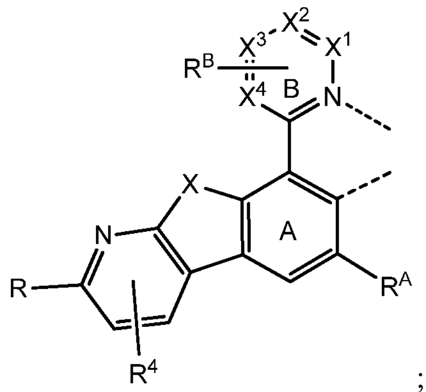
[0052] In some embodiments, the compound has the formula $M(L_A)_2(L_B)$. In other embodiments, the compound has the formula $M(L_A)(L_C)_2$.

[0053] In some embodiments, only one of A^1 to A^8 is N. In some embodiments, only one of A^5 to A^8 is N. In some embodiments, X^1, X^2, X^3, and X^4 are C, and ring E is benzene. In other embodiments, (a) at least one of X^1, X^2, X^3, and X^4 is N, (b) ring E is heterocylic, or (c) both. In some embodiments, ring C is benzene and ring D is pyridine.

[0054] In some embodiments, L_A has the formula:

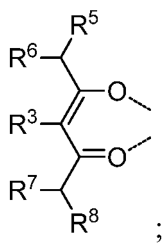


[0055] In some more specific embodiments, wherein L_A has the formula:



wherein R is selected from the group consisting of alkyl, cycloalkyl, and combinations thereof. In some embodiments, R is selected from the group consisting of methyl, ethyl, propyl, 1-methylethyl, butyl, 1-methylpropyl, 2-methylpropyl, pentyl, 1-methylbutyl, 2-methylbutyl, 3-methylbutyl, 1,1-dimethylpropyl, 1,2-dimethylpropyl, 2,2-dimethylpropyl, cyclopentyl, cyclohexyl, partially or fully deuterated variants thereof, and combinations thereof.

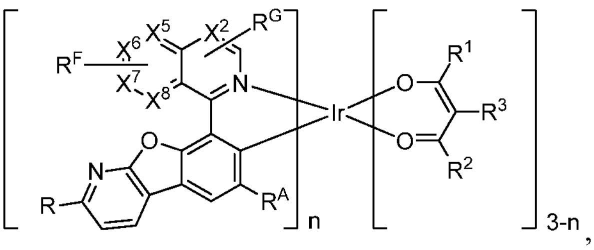
[0056] In some embodiments, L_B has the formula:



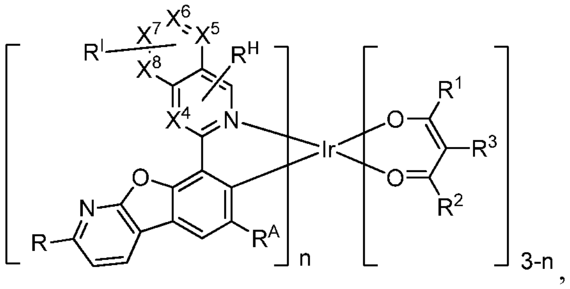
wherein R^5, R^6, R^7, and R^8 are independently selected from group consisting of alkyl, cycloalkyl, aryl, and heteroaryl; and wherein at least one of R^5, R^6, R^7, and R^8 has at least two C atoms.

[0057] In some embodiments, each R^1, R^2, R^3, R^C, and R^D is independenly selected from group consisting of hydrogen, deuterium, alkyl, cycloalkyl, and combinations thereof. In some embodiments, R^3 is hydrogen. In some embodiments, each R^1, R^2, R^3, R^C, and R^D is independently selected from the group consisting of methyl, ethyl, propyl, 1-methylethyl, butyl, 1-methylpropyl, 2-methylpropyl, pentyl, 1-methylbutyl, 2-methylbutyl, 3-methylbutyl, 1,1-dimethylpropyl, 1,2-dimethylpropyl, 2,2-dimethylpropyl, cyclobutyl, cyclopentyl, cyclohexyl, partially or fully deuterated variants thereof, and combinations thereof.

[0058] In some more specific embodiments, the compound is selected from the group consisting of:

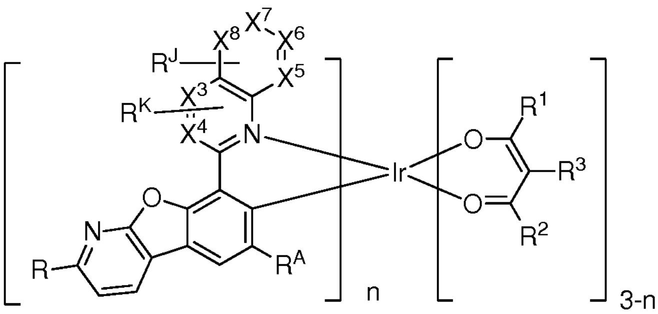


,



,

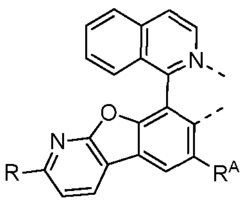
and



wherein each of R^F, R^G, R^H, R^I, R^J, and R^K are independently selected from the group consisting of hydrogen, deuterium, halide, alkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, aryloxy, amino, silyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, and combinations thereof; and wherein X^5, X^6, X^7, and X^8 are C or N.

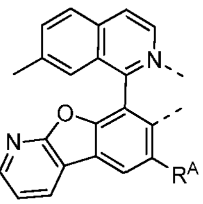
[0059] In some specific embodiments, L_A is selected from the group consisting of:

L_{A1} through L_{A13}, each represented by the formula



wherein in L_{A1}, R = H, and R^A = H,
in L_{A2}, R = H, and R^A = CH_3,
in L_{A3}, R = H, and R^A = CD_3,
in L_{A4}, R = CH_3, and R^A = H,
in L_{A5}, R = CD_3, and R^A = H,
in L_{A6}, R = CH_3, and R^A = CH_3,
in L_{A7}, R = CD_3, and R^A = CD_3,
in L_{A8}, R = Ethyl, and R^A = H,
in L_{A9}, R = Ethyl, and R^A = CH_3,
in L_{A10}, R = Ethyl-*d5*, and R^A = CD_3,
in L_{A11}, R = isopropyl, and R^A = H,
in L_{A12}, R = isopropyl, and R^A CH_3,

L_{A14} through L_{A26}, each represented by the formula



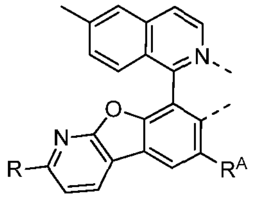
wherein in L_{A14}, R = H, and R^A = H,
in L_{A15}, R = H, and R^A = CH_3,
in L_{A16}, R = H, and R^A = CD_3,
in L_{A17}, R = CH_3, and R^A = H,
in L_{A18}, R = CD_3, and R^A = H,
in L_{A19}, R = CH_3, and R^A = CH_3,
in L_{A20}, R = CD_3, and R^A = CD_3,
in L_{A21}, R = Ethyl, and R^A = H,
in L_{A22}, R = Ethyl, and R^A = CH_3,
in L_{A23}, R = Ethyl-*d5*, and R^A = CD_3,
in L_{A24}, R = isopropyl, and R^A = H,
in L_{A25}, R = isopropyl, and R^A = CH_3,

(continued)

in L_{A13}, R = isopropyl-*d7*, and $R^A = CD_3$,

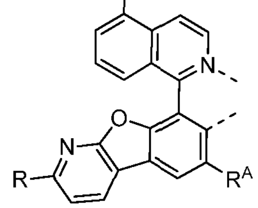
in L_{A26}, R = isopropyl-*d7*, and $R^A = CD_3$, ,

L_{A27} through L_{A39}, each represented by the formula



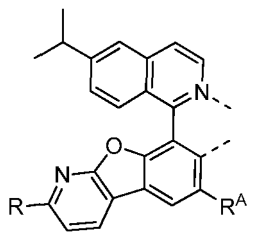
wherein in L_{A27}, R = H, and R^A = H,
in L_{A28}: R = H, and $R^A = CH_3$,
in L_{A29}: R = H, and $R^A = CD_3$,
in L_{A30}: R = CH_3, and R^A = H,
in L_{A31}: R = CD_3, and R^A = H,
in L_{A32}: R = CH_3, and $R^A = CH_3$,
in L_{A33}: R = CD_3, and $R^A = CD_3$,
in L_{A34}: R = Ethyl, and R^A = H,
in L_{A35}: R = Ethyl, and $R^A = CH_3$,
in L_{A36}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A37}: R = isopropyl, and R^A = H,
in L_{A38}: R = isopropyl, and $R^A = CH_3$,
in L_{A39}: R = isopropyl-*d7*, and $R^A = CD_3$,

L_{A40} through L_{A52}, each represented by the formula



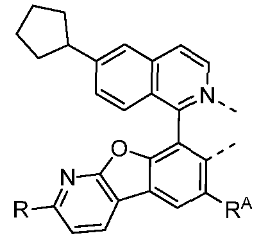
wherein in L_{A40}: R = H, and R^A = H,
in L_{A41}: R = H, and $R^A = CH_3$,
in L_{A42}: R = H, and $R^A = CD_3$,
in L_{A43}: R = CH_3, and R^A = H,
in L_{A44}: R = CD_3, and R^A = H,
in L_{A45}: R = CH_3, and $R^A = CH_3$,
in L_{A46}: R = CD_3, and $R^A = CD_3$,
in L_{A47}: R = Ethyl, and R^A = H,
in L_{A48}: R = Ethyl, and $R^A = CH_3$,
in L_{A49}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A50}: R = isopropyl, and R^A = H,
in L_{A51}: R = isopropyl, and $R^A = CH_3$,
in L_{A52}: R = isopropyl-*d7*, and $R^A = CD_3$,

L_{A53} through L_{A65}, each represented by the formula



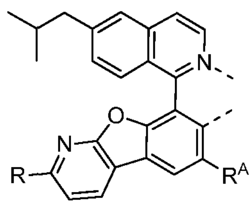
wherein in L_{A53}: R = H, and R^A = H,
in L_{A54}: R = H, and $R^A = CH_3$,
in L_{A55}: R = H, and $R^A = CD_3$,
in L_{A56}: R = CH_3, and R^A = H,
in L_{A57}: R = CD_3, and R^A = H,
in L_{A58}: R = CH_3, and $R^A = CH_3$,
in L_{A59}: R = CD_3, and $R^A = CD_3$,
in L_{A60}: R = Ethyl, and R^A = H,
in L_{A61}: R = Ethyl, and $R^A = CH_3$,
in L_{A62}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A63}: R = isopropyl, and R^A = H,
in L_{A64}: R = isopropyl, and $R^A = CH_3$,
in L_{A65}: R = isopropyl-*d7*, and $R^A = CD_3$,

L_{A66} through L_{A78}, each represented by the formula



wherein in L_{A66}: R = H, and R^A = H,
in L_{A67}: R = H, and $R^A = CH_3$,
in L_{A68}: R = H, and $R^A = CD_3$,
in L_{A69}: R = CH_3, and R^A = H,
in L_{A70}: R = CD_3, and R^A = H,
in L_{A71}: R = CH_3, and $R^A = CH_3$,
in L_{A72}: R = CD_3, and $R^A = CD_3$,
in L_{A73}: R = Ethyl, and R^A = H,
in L_{A74}: R = Ethyl, and $R^A = CH_3$,
in L_{A75}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A76}: R = isopropyl, and R^A = H,
in L_{A77}: R = isopropyl, and $R^A = CH_3$,
in L_{A78}: R = isopropyl-*d7*, and $R^A = CD_3$,

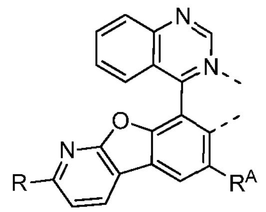
L_{A79} through L_{A91}, each represented by the formula



wherein in L_{A79}: R = H, and R^A = H,
in L_{A80}: R = H, and R^A = CH_3,
in L_{A81}: R = H, and R^A = CD_3,
in L_{A82}: R = CH_3, and R^A = H,
in L_{A83}: R = CD_3, and R^A = H,
in L_{A84}: R = CH_3, and R^A = CH_3,
in L_{A85}: R = CD_3, and R^A = CD_3,
in L_{A86}: R = Ethyl, and R^A = H,
in L_{A87}: R = Ethyl, and R^A = CH_3,
in L_{A88}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A89}: R = isopropyl, and R^A = H,
in L_{A90}: R = isopropyl, and R^A = CH_3,
in L_{A91}: R = isopropyl-*d7*, and R^A = CD_3

,

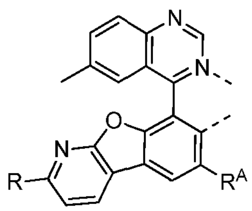
L_{A92} through L_{A104}, each represented by the formula



wherein in L_{A92}: R = H, and R^A = H,
in L_{A93}: R = H, and R^A = CH_3,
in L_{A94}: R = H, and R^A = CD_3,
in L_{A95}: R = CH_3, and R^A = H,
in L_{A96}: R = CD_3, and R^A = H,
in L_{A97}: R = CH_3, and R^A = CH_3,
in L_{A98}: R = CD_3, and R^A = CD_3,
in L_{A99}: R = Ethyl, and R^A = H,
in L_{A100}: R = Ethyl, and R^A = CH_3,
in L_{A101}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A102}: R = isopropyl, and R^A = H,
in L_{A103}: R = isopropyl, and R^A = CH_3,
in L_{A104}: R = isopropyl-*d7*, and R^A = CD_3

,

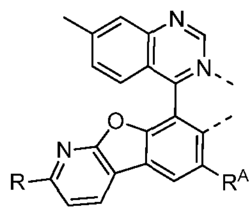
L_{A105} through L_{A117}, each represented by the formula



wherein in L_{A105}: R = H, and R^A = H,
in L_{A106}: R = H, and R^A = CH_3,
in L_{A107}: R = H, and R^A = CD_3,
in L_{A108}: R = CH_3, and R^A = H,
in L_{A109}: R = CD_3, and R^A = H,
in L_{A110}: R = CH_3, and R^A = CH_3,
in L_{A111}: R = CD_3, and R^A = CD_3,
in L_{A112}: R = Ethyl, and R^A = H,
in L_{A113}: R = Ethyl, and R^A = CH_3,
in L_{A114}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A115}: R = isopropyl, and R^A = H,
in L_{A116}: R = isopropyl, and R^A = CH_3,
in L_{A117}: R = isopropyl-*d7*, and R^A = CD_3

,

L_{A118} through L_{A130}, each represented by the formula



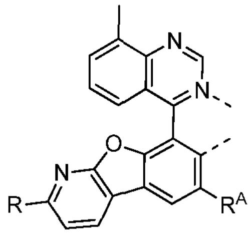
wherein in L_{A118}: R = H, and R^A = H,
in L_{A119}: R = H, and R^A = CH_3,
in L_{A120}: R = H, and R^A = CD_3,
in L_{A121}: R = CH_3, and R^A = H,
in L_{A122}: R = CD_3, and R^A = H,
in L_{A123}: R = CH_3, and R^A = CH_3,
in L_{A124}: R = CD_3, and R^A = CD_3,,
in L_{A125}: R = Ethyl, and R^A = H,
in L_{A126}: R = Ethyl, and R^A = CH_3,
in L_{A127}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A128}: R = isopropyl, and R^A = H,
in L_{A129}: R = isopropyl, and R^A = CH_3,
in L_{A130}: R = isopropyl-*d7*, and R^A = CD_3,

,

L_{A131} through L_{A143}, each represented by the formula

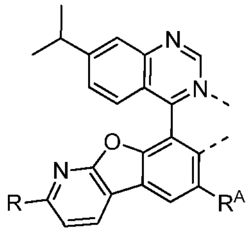
L_{A144} through L_{A156}, each represented by the formula

(continued)



wherein in L_{A131}: R = H, and R^A = H,
in L_{A132}: R = H, and R^A = $CH_{3,}$
in L_{A133}: R = H, and R^A = $CD_{3,}$
in L_{A134}: R = CH_3, and R^A = H,
in L_{A135}: R = CD_3, and R^A = H,
in L_{A136}: R = CH_3, and R^A = $CH_{3,}$
in L_{A137}: R = CD_3, and R^A = $CD_{3,}$
in L_{A138}: R = Ethyl, and R^A = H,
in L_{A139}: R = Ethyl, and R^A = $CH_{3,}$
in L_{A140}: R = Ethyl-*d5*, and R^A = $CD_{3,}$
in L_{A141}: R = isopropyl, and R^A = H,
in L_{A142}: R = isopropyl, and R^A = $CH_{3,}$
in L_{A143}: R = isopropyl-*d7*, and R^A = $CD_{3,}$

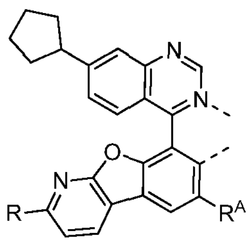
,



wherein in L_{A144}: R = H, and R^A = H,
in L_{A145}: R = H, and R^A = $CH_{3,}$
in L_{A146}: R = H, and R^A = $CD_{3,}$
in L_{A147}: R = CH_3, and R^A = H,
in L_{A148}: R = CD_3, and R^A = H,
in L_{A149}: R = CH_3, and R^A = $CH_{3,}$
in L_{A150}: R = CD_3, and R^A = $CD_{3,}$
in L_{A151}: R = Ethyl, and R^A = H,
in L_{A152}: R = Ethyl, and R^A = $CH_{3,}$
in L_{A153}: R = Ethyl-*d5*, and R^A = $CD_{3,}$
in L_{A154}: R = isopropyl, and R^A = H,
in L_{A155}: R = isopropyl, and R^A = $CH_{3,}$
in L_{A156}: R = isopropyl-*d7*, and R^A = CD_3

,

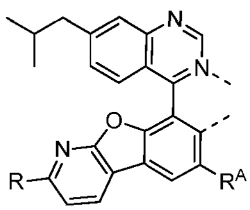
L_{A157} through L_{A169}, each represented by the formula



wherein in L_{A157}: R = H, and R^A = H,
in L_{A158}: R = H, and R^A = CH_3,
in L_{A159}: R = H, and R^A = CD_3,
in L_{A160}: R = CH_3, and R^A = H,
in L_{A161}: R = CD_3, and R^A = H,
in L_{A162}: R = CH_3, and R^A = CH_3,
in L_{A163}: R = CD_3, and R^A = CD_3,
in L_{A164}: R = Ethyl, and R^A = H,
in $L_{A165:}$ R = Ethyl, and R^A = CH_3,
in $L_{A166:}$ R = Ethyl-*d5*, and R^A = CD_3,
in L_{A167}: R = isopropyl, and R^A = H,
in L_{A168}: R = isopropyl, and R^A = CH_3,
in L_{A169}: R = isopropyl-*d7*, and R^A = CD3

,

L_{A170} through L_{A182}, each represented by the formula



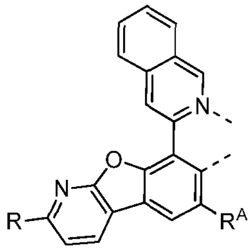
wherein in L_{A170}: R = H, and R^A = H,
in L_{A171}: R = H, and R^A = CH_3,
in L_{A172}: R = H, and R^A = CD_3,
in L_{A173}: R = CH_3, and R^A = H,
in L_{A174}: R = CD_3, and R^A = H,
in L_{A175}: R = CH_3, and R^A = CH_3,
in L_{A176}: R = CD_3, and R^A = CD_3,
in L_{A177}: R = Ethyl, and R^A = H,
in L_{A178}: R = Ethyl, and R^A = CH_3,
in L_{A179}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A180}: R = isopropyl, and R^A = H,
in L_{A181}: R = isopropyl, and R^A = CH_3,
in L_{A182}: R = isopropyl-*d7*, and R^A = CD_3

,

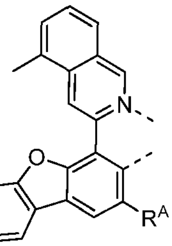
L_{A183} through L_{A195}, each represented by the formula

L_{A196} through L_{A208}, each represented by the formula

(continued)

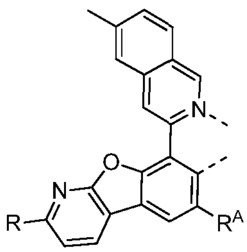


wherein in L_{A183}: R = H, and R^A = H,
in L_{A84}: R = H, and R^A = CH_3,
in L_{A185}: R = H, and R^A = CD_3,
in L_{A186}: R = CH_3, and R^A = H,
in L_{A187}: R = CD_3, and R^A = H,
in L_{A188}: R = CH_3, and R^A = CH_3,
in L_{A189}: R = CD_3, and R^A = CD_3,
in L_{A190}: R = Ethyl, and R^A = H,
in L_{A191}: R = Ethyl, and R^A = CH_3,
in L_{A192}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A193}: R = isopropyl, and R^A = H,
in L_{A194}: R = isopropyl, and R^A = CH_3,
in L_{A195}: R = isopropyl-*d7*, and R^A = CD_3
,



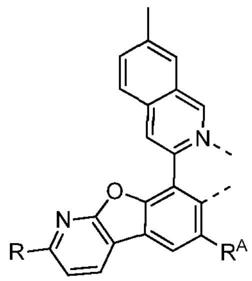
wherein in L_{A196}: R = H, and R^A = H,
in L_{A197}: R = H, and R^A = CH_3,
in L_{A198}: R = H, and R^A = CD_3,
in L_{A199}: R = CH_3, and R^A H,
in L_{A200}: R = CD_3, and R^A = H,
in L_{A201}: R = CH_3, and R^A = CH_3,
in L_{A202}: R = CD_3, and R^A = CD_3,
in L_{A203}: R = Ethyl, and R^A = H,
in L_{A204}: R = Ethyl, and R^A = CH_3,
in L_{A205}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A206}: R = isopropyl, and R^A = H,
in L_{A207}: R = isopropyl, and R^A = CH_3,
in L_{A208}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A209} through L_{A221}, each represented by the formula



wherein in L_{A209}: R = H, and R^A = H,
in L_{A210}: R = H, and R^A = CH_3,
in L_{A211}: R = H, and R^A = CD_3,
in L_{A212}: R = CH_3, and R^A = H,
in L_{A213}: R = CD_3, and R^A = H,
in L_{A214}: R = CH_3, and R^A = CH_3,
in L_{A215}: R = CD_3, and R^A = CD_3,
in L_{A216}: R = Ethyl, and R^A = H,
in L_{A217}: R = Ethyl, and R^A = CH_3,
in L_{A218}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A219}: R = isopropyl, and R^A = H,
in L_{A220}: R = isopropyl, and R^A = CH_3,
in L_{A221}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A222} through L_{A234}, each represented by the formula

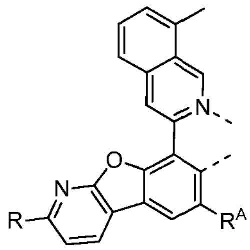


wherein in L_{A222}: R = H, and R^A = H,
in L_{A223}: R = H, and R^A = CH_3,
in L_{A224}: R = H, and R^A = CD_3,
in L_{A225}: R = CH_3, and R^A = H,
in L_{A226}: R = CD_3, and R^A = H,
in L_{A227}: R = CH_3, and R^A = CH_3,
in L_{A228}: R = CD_3, and R^A = CD_3,
in L_{A229}: R = Ethyl, and R^A = H,
in L_{A230}: R = Ethyl, and R^A = CH_3,
in L_{A231}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A232}: R = isopropyl, and R^A = H,
in L_{A233}: R = isopropyl, and R^A = CH_3,
in L_{A234}: R = isopropyl-*d7*, and R^A = CD_3
,

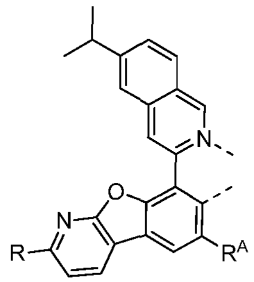
L_{A235} through L_{A247}, each represented by the formula

L_{A248} through L_{A260}, each represented by the formula

(continued)

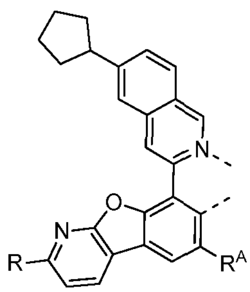


wherein in L_{A235}: R = H, and R^A = H,
in L_{A236}: R = H, and R^A = CH_3,
in L_{A237}: R = H, and R^A = CD_3,
in L_{A238}: R = CH_3, and R^A = H,
in L_{A239}: R = CD_3, and R^A = H,
in L_{A240}: R = CH_3, and R^A = CH_3,
in L_{A241}: R = CD_3, and R^A = CD_3,
in L_{A242}: R = Ethyl, and R^A = H,
in L_{A243}: R = Ethyl, and R^A = CH_3,
in L_{A244}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A245}: R = isopropyl, and R^A = H,
in L_{A246}: R = isopropyl, and R^A = CH_3,
in L_{A247}: R = isopropyl-*d7*, and R^A = CD_3
,



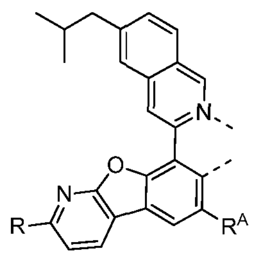
wherein in L_{A248}: R = H, and R^A = H,
in L_{A249}: R = H, and R^A = CH_3,
in L_{A250}: R = H, and R^A = CD_3,
in L_{A251}: R = CH_3, and R^A = H,
in L_{A252}: R = CD_3, and R^A = H,
in L_{A253}: R = CH_3, and R^A = CH_3,
in L_{A254}: R = CD_3, and R^A = CD_3,
in L_{A255}: R = Ethyl, and R^A = H,
in L_{A256}: R = Ethyl, and R^A = CH_3,
in L_{A257}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A258}: R = isopropyl, and R^A = H,
in L_{A259}: R = isopropyl, and R^A = CH_3,
in L_{A260}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A261} through L_{A273}, each represented by the formula



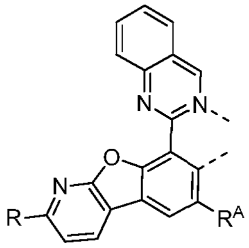
wherein in L_{A261}: R = H, and R^A = H,
in L_{A262}: R = H, and R^A = CH_3,
in L_{A263}: R = H, and R^A = CD_3,
in L_{A264}: R = CH_3, and R^A = H,
in L_{A265}: R = CD_3, and R^A = H,
in L_{A266}: R = CH_3, and R^A = CH_3,
in L_{A267}: R = CD_3, and R^A = CD_3,
in L_{A268}: R = Ethyl, and R^A = H,
in L_{A269}: R = Ethyl, and R^A = CH_3,
in L_{A270}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A271}: R = isopropyl, and R^A = H,
in L_{A272}: R = isopropyl, and R^A = CH_3,
in L_{A273}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A274} through L_{A286}, each represented by the formula



wherein in L_{A274}: R = H, and R^A = H,
in L_{A275}: R = H, and R^A = CH_3,
in L_{A276}: R = H, and R^A = CD_3,
in L_{A277}: R = CH_3, and R^A = H,
in L_{A278}: R = CD_3, and R^A = H,
in L_{A279}: R = CH_3, and R^A = CH_3,
in L_{A280}: R = CD_3, and R^A = CD_3,
in L_{A281}: R = Ethyl, and R^A = H,
in L_{A282}: R = Ethyl, and R^A = CH_3,
in L_{A283}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A284}: R = isopropyl, and R^A = H,
in L_{A285}: R = isopropyl, and R^A = CH_3,
in L_{A286}: R = isopropyl-*d7*, and R^A = CD_3
,

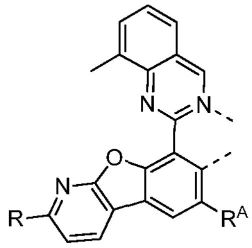
L_{A287} through L_{A299}, each represented by the formula



wherein in L_{A287}: R = H, and R^A = H,
in L_{A288}: R = H, and R^A = CH_3,
in L_{A289}: R = H, and R^A = CD_3
in L_{A290}: R = CH_3, and R^A = H,
in L_{A291}: R = CD_3, and R^A = H,
in L_{A292}: R = CH_3, and R^A = CH_3,
in L_{A293}: R = CD_3, and R^A = CD_3,
in L_{A294}: R = Ethyl, and R^A = H,
in L_{A295}: R = Ethyl, and R^A = CH_3,
in L_{A296}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A297}: R = isopropyl, and R^A = H,
in L_{A298}: R = isopropyl, and R^A = CH_3,
in L_{A299}: R = isopropyl-*d7*, and R^A = CD_3

,

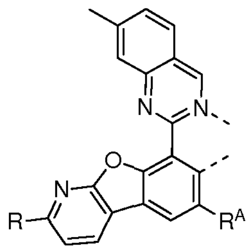
L_{A300} through L_{A312}, each represented by the formula



wherein in L_{A300}: R = H, and R^A = H,
in L_{A301}: R = H, and R^A = CH_3,
in L_{A302}: R = H, and R^A = CD_3,
in L_{A303}: R = CH_3, and R^A = H,
in L_{A304}: R = CD_3, and R^A = H,
in L_{A305}: R = CH_3, and R^A = CH_3,
in L_{A306}: R = CD_3, and R^A = CD_3
in L_{A307}: R = Ethyl, and R^A = H,
in L_{A308}: R = Ethyl, and R^A = CH_3,
in L_{A309}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A310}: R = isopropyl, and R^A = H,
in L_{A311}: R = isopropyl, and R^A = CH_3,
in L_{A312}: R = isopropyl-*d7*, and R^A = CD_3

,

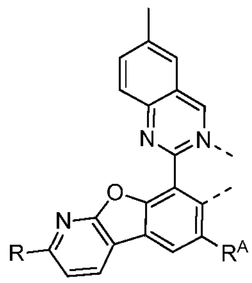
L_{A313} through L_{A325}, each represented by the formula



wherein in L_{A313}: R = H, and R^A = H,
in L_{A314}: R = H, and R^A = CH_3,
in L_{A315}: R = H, and R^A = CD_3,
in L_{A316}: R = CH_3, and R^A = H,
in L_{A317}: R = CD_3, and R^A = H,
in L_{A318}: R = CH_3, and R^A = CH_3,
in L_{A319}: R = CD_3, and R^A = CD_3,
in L_{A320}: R = Ethyl, and R^A = H,
in L_{A321}: R = Ethyl, and R^A = CH_3,
in L_{A322}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A323}: R = isopropyl, and R^A = H,
in L_{A324}: R = isopropyl, and R^A = CH_3,
in L_{A325}: R = isopropyl-*d7*, and R^A = CD_3

,

L_{A326} through L_{A338}, each represented by the formula



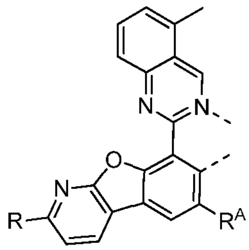
wherein in L_{A326}: R = H, and R^A = H,
in L_{A327}: R = H, and R^A = CH_3,
in L_{A328}: R = H, and R^A = CD_3,
in L_{A329}: R = CH_3, and R^A = H,
in L_{A330}: R = CD_3, and R^A = H,
in L_{A331}: R = CH_3, and R^A = CH_3,
in L_{A332}: R = CD_3, and R^A = CD_3,
in L_{A333}: R = Ethyl, and R^A = H,
in L_{A334}: R = Ethyl, and R^A = CH_3,
in L_{A335}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A336}: R = isopropyl, and R^A = H,
in L_{A337}: R = isopropyl, and R^A = CH_3,
in L_{A338}: R = isopropyl-*d7*, and R^A = CD_3

,

L_{A339} through L_{A351}, each represented by the formula

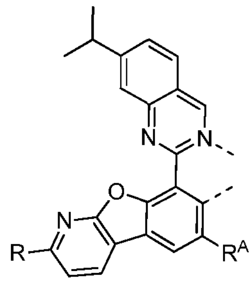
L_{A352} through L_{A364}, each represented by the formula

(continued)



wherein in L_{A339}: R = H, and R^A = H,
in L_{A340}: R = H, and R^A = CH_3,
in L_{A341}: R = H, and R^A = CD_3,
in L_{A342}: R = CH_3, and R^A = H,
in L_{A343}: R = CD_3, and R^A = H,
in L_{A344}: R = CH_3, and R^A = CH_3,
in L_{A345}: R = CD_3, and R^A = CD_3,
in L_{A346}: R = Ethyl, and R^A = H,
in L_{A347}: R = Ethyl, and R^A = CH_3,
in L_{A348}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A349}: R = isopropyl, and R^A = H,
in L_{A350}: R = isopropyl, and R^A = CH_3,
in L_{A351}: R = isopropyl-*d7*, and R^A = CD_3

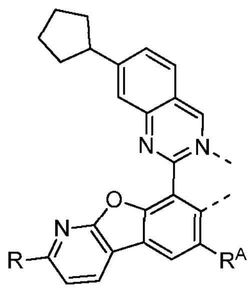
,



wherein in L_{A352}: R = H, and R^A = H,
in L_{A353}: R = H, and R^A = CH_3,
in L_{A354}: R = H, and R^A = CD_3,
in L_{A355}: R = CH_3, and R^A = H,
in L_{A356}: R = CD_3, and R^A = H,
in L_{A357}: R = CH_3, and R^A = CH_3,
in L_{A358}: R = CD_3, and R^A = CD_3,
in L_{A359}: R = Ethyl, and R^A = H,
in L_{A360}: R = Ethyl, and R^A = CH_3,
in L_{A361}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A362}: R = isopropyl, and R^A = H,
in L_{A363}: R = isopropyl, and R^A = CH_3,
in L_{A364}: R = isopropyl-*d7*, and R^A = CD_3

,

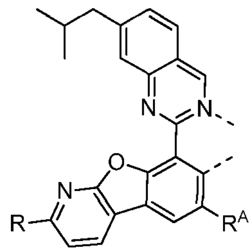
L_{A365} through L_{A377}, each represented by the formula



wherein in L_{A365}: R = H, and R^A = H,
in L_{A366}: R = H, and R^A = CH_3,
in L_{A367}: R = H, and R^A = CD_3
in L_{A368}: R = CH_3, and R^A = H,
in L_{A369}: R = CD_3, and R^A = H,
in L_{A370}: R = CH_3, and R^A = CH_3,
in L_{A371}: R = CD_3, and R^A = CD_3,
in L_{A372}: R = Ethyl, and R^A = H,
in L_{A373}: R = Ethyl, and R^A = CH_3,
in L_{A374}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A375}: R = isopropyl, and R^A = H,
in L_{A376}: R = isopropyl, and R^A = CH_3,
in L_{A377}: R = isopropyl-*d7*, and R^A = CD_3

,

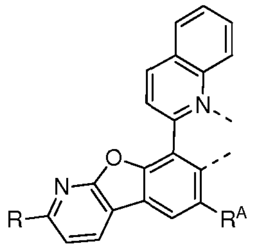
L_{A378} through L_{A390}, each represented by the formula



wherein in L_{A378}: R = H, and R^A = H,
in L_{A379}: R = H, and R^A = CH_3,
in L_{A380}: R = H, and R^A = CD_3,
in L_{A381}: R = CH_3, and R^A = H,
in L_{A382}: R = CD_3, and R^A = H,
in L_{A383}: R = CH_3, and R^A = CH_3,
in L_{A384}: R = CD_3, and R^A = CD_3,
in L_{A385}: R = Ethyl, and R^A = H,
in L_{A386}: R = Ethyl, and R^A = CH_3,
in L_{A387}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A388}: R = isopropyl, and R^A = H,
in L_{A389}: R = isopropyl, and R^A = CH_3,
in L_{A390}: R = isopropyl-*d7*, and R^A = CD_3

,

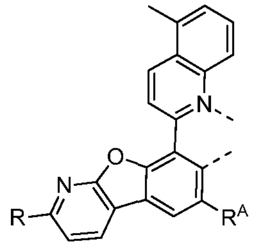
L_{A391} through L_{A403}, each represented by the formula



wherein in L_{A391}: R = H, and R^A = H,
in L_{A392}: R = H, and R^A = CH_3,
in L_{A393}: R = H, and R^A = CD_3,
in L_{A394}: R = CH_3, and R^A = H,
in L_{A395}: R = CD_3, and R^A = H,
in L_{A396}: R = CH_3, and R^A = CH_3,
in L_{A397}: R = CD_3, and R^A = CD_3,
in L_{A398}: R = Ethyl, and R^A = H,
in L_{A399}: R = Ethyl, and R^A = CH_3
in L_{A400}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A401}: R = isopropyl, and R^A = H,
in L_{A402}: R = isopropyl, and R^A = CH_3
in L_{A403}: R = isopropyl-*d7*, and R^A = CD_3

,

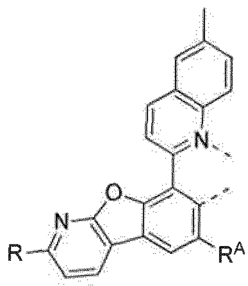
L_{A404} through L_{A416}, each represented by the formula



wherein in L_{A404}: R = H, and R^A = H,
in L_{A405}: R = H, and R^A = CH_3,
in L_{A406}: R = H, and R^A = CD_3,
in L_{A407}: R = CH_3, and R^A = H,
in L_{A408}: R = CD_3, and R^A = H,
in L_{A409}: R = CH_3, and R^A = CH_3,
in L_{A410}: R = CD_3, and R^A = CD_3,
in L_{A411}: R = Ethyl, and R^A = H,
in L_{A412}: R = Ethyl, and R^A = CH_3,
in L_{A413}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A414}: R = isopropyl, and R^A = H,
in L_{A415}: R = isopropyl, and R^A = CH_3,
in L_{A416}: R = isopropyl-*d7*, and R^A = CD_3

,

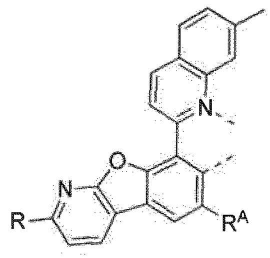
L_{A417} through L_{A429}, each represented by the formula



wherein in L_{A417}: R = H, and R^A = H,
in L_{A418}: R = H, and R^A = CH_3,
in L_{A419}: R = H, and R^A = CD_3,
in L_{A420}: R = CH_3, and R^A = H,
in L_{A421}: R = CD_3, and R^A = H,
in L_{A422}: R = CH_3, and R^A = CH_3,
in L_{A423}: R = CD_3, and R^A = CD_3,
in L_{A424}: R = Ethyl, and R^A = H,
in L_{A425}: R = Ethyl, and R^A = CH_3,
in L_{A426}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A427}: R = isopropyl, and R^A = H,
in L_{A428}: R = isopropyl, and R^A = CH_3,
in L_{A429}: R = isopropyl-*d7*, and R^A = CD_3

,

L_{A430} through L_{A442}, each represented by the formula



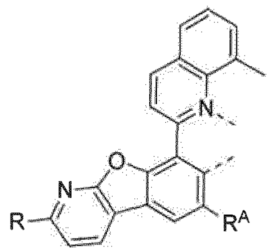
wherein in L_{A430}: R = H, and R^A = H,
in L_{A431}: R = H, and R^A = CH_3,
in L_{A432}: R = H, and R^A = CD_3,
in L_{A433}: R = CH_3, and R^A = H,
in L_{A434}: R = CD_3, and R^A = H,
in L_{A435}: R = CH_3, and R^A = CH_3,
in L_{A436}: R = CD_3, and R^A = CD_3,
in L_{A437}: R = Ethyl, and R^A = H,
in L_{A438}: R = Ethyl, and R^A = CH_3,
in L_{A439}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A440}: R = isopropyl, and R^A = H,
in A441: R = isopropyl, and R^A = CH_3,
in L_{A442}: R = isopropyl-*d7*, and R^A = CD_3,

,

L_{A443} through L_{A455}, each represented by the formula

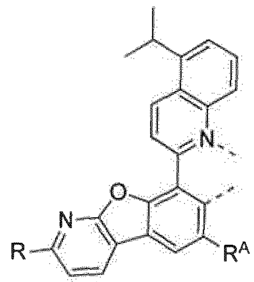
L_{A456} through L_{A468}, each represented by the formula

(continued)



wherein in L_{A443}: R = H, and R^A = H,
in L_{A444}: R = H, and R^A = CH_3,
in LA_{445}: R = H, and R^A = CD_3,
in L_{A446}: R = CH_3, and R^A = H,
in L_{A447}: R = CD_3, and R^A = H,
in L_{A448}: R = CH_3, and R^A = CH_3,
in L_{A449}: R = CD_3, and R^A = CD_3,
in L_{A450}: R = Ethyl, and R^A = H,
in L_{A451}: R = Ethyl, and R^A = CH_3,
in L_{A452}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A453}: R = isopropyl, and R^A = H,
in L_{A454}: R = isopropyl, and R^A = CH_3,
in L_{A455}: R = isopropyl-*d7*, and R^A = CD_3

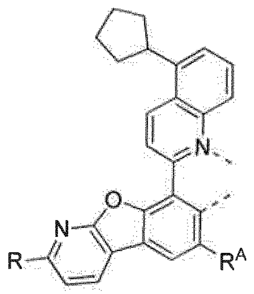
,



wherein in L_{A456}: R = H, and R^A = H,
in L_{A457}: R = H, and R^A = CH_3,
in L_{A458}: R = H, and R^A = CD_3,
in L_{A459}: R = CH_3, and R^A = H,
in L_{A460}: R = CD_3, and R^A = H,
in L_{A461}: R = CH_3, and R^A = CH_3,
in L_{A462}: R = CD_3, and R^A = CD_3,
in L_{A463}: R = Ethyl, and R^A = H,
in L_{A464}: R = Ethyl, and R^A = CH_3,
in L_{A465}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A466}: R = isopropyl, and R = H,
in L_{A467}: R = isopropyl, and R^A = CH_3,
in L_{A468}: R = isopropyl-*d7*, and R^A = CD_3

,

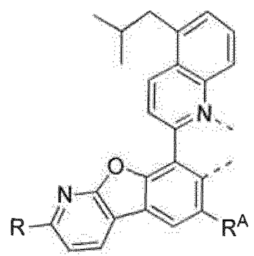
L_{A469} through L_{A481}, each represented by the formula



wherein in L_{A469}: R = H, and R^A = H,
in L_{A470}: R = H, and R^A = CH_3,
in L_{A471}: R = H, and R^A = CD_3,
in L_{A472}: R = CH_3, and R^A = H,
in L_{A473}: R = CD_3, and R^A = H,
in L_{A474}: R = CH_3, and R^A = CH_3,
in L_{A475}: R = CD_3, and R^A = CD_3,
in L_{A476}: R = Ethyl, and R^A = H,
in L_{A477}: R = Ethyl, and R^A = CH_3,
in L_{A478}: R = Ethyl-*d*5, and R^A = CD_3,
in L_{A479}: R = isopropyl, and R^A = H,
in L_{A480}: R = isopropyl, and R^A = CH_3,
in L_{A481}: R = isopropyl-d7, and R^A = CD_3

,

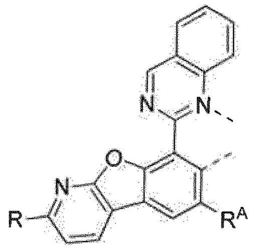
L_{A482} through L_{A494}, each represented by the formula



wherein in L_{A482}: R = H, and R^A = H,
in L_{A483}: R = H, and R^A = CH_3,
in L_{A484}: R = H, and R^A = CD_3,
in L_{A485}: R = CH_3, and R^A = H,
in L_{A486}: R = CD_3, and R^A = H,
in L_{A487}: R = CH_3, and R^A = CH_3,
in L_{A488}: R = CD_3, and R^A = CD_3,
in L_{A489}: R = Ethyl, and R^A = H,
in L_{A490}: R = Ethyl, and R^A = CH_3,
in L_{A491}: R = Ethyl-d5, and R^A = CD_3,
in L_{A492}: R = isopropyl, and R^A = H,
in L_{A493}: R = isopropyl, and R^A = CH_3,
in L_{A494}: R = isopropyl-*d7*, and R^A = CD_3

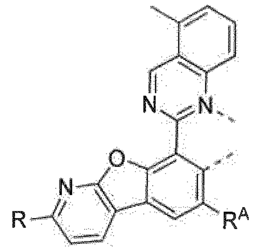
,

L_{A495} through L_{A507}, each represented by the formula



wherein in L_{A495}: R = H, and R^A = H,
in L_{A496}: R = H, and R^A = CH_3,
in L_{A497}: R = H, and R^A = CD_3,
in L_{A498}: R = CH_3, and R^A = H,
in L_{A499}: R = CD_3, and R^A = H,
in L_{A500}: R = CH_3, and R^A = CH_3,
in L_{A501}: R = CD_3, and R^A = CD_3,
in L_{A502}: R = Ethyl, and R^A = H,
in L_{A503}: R = Ethyl, and R^A = CH_3,
in L_{A504}: R = Ethyl-d5, and R^A = CD_3,
in L_{A505}: R = isopropyl, and R^A = H,
in L_{A506}: R = isopropyl, and R^A = CH_3,
in $L_{A507:}$ R = isopropyl-d7, and R^A = CD_3

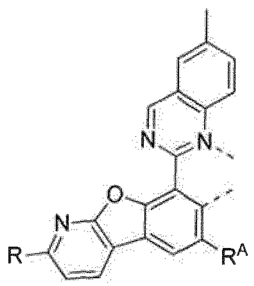
L_{A508} through L_{A520}, each represented by the formula



wherein in L_{A508}: R = H, and R^A = H,
in L_{A509}: R = H, and R^A = CH_3,
in L_{A510}: R = and R^A = CD_3,
H, in L_{A511}: R = CH_3, and R^A = H ,
in L_{A512}: R = CD_3, and R^A = H,
in L_{A513}: R = CH_3, and R^A = CH_3,
in L_{A514}: R = CD_3, and R^A = CD_3,
in L_{A515}: R = Ethyl, and R^A = H,
in L_{A516}: R = Ethyl, and R^A = CH_3,
in L_{A517}: R = Ethyl-d5, and R^A = CD_3,
in L_{A518}: R = isopropyl, and R^A = H,
in L_{A519}: R = isopropyl, and R^A = CH_3,
in L_{A520}: R = isopropyl-*d*7, and R^A = CD_3

,

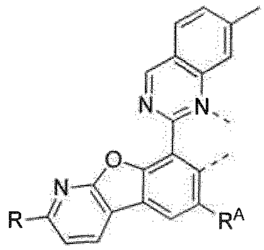
L_{A521} through L_{A533}, each represented by the formula



wherein in L_{A521}: R = H, and R^A = H,
in L_{A522}: R = H, and R^A = CH_3,
in L_{A523}: R = H, and R^A = CD_3,
in L_{A524}: R = CH_3, and R^A = H,
in L_{A525}: R = CD_3, and R^A = H,
in L_{A526}: R = CH_3, and R^A = CH_3,
in L_{A527}: R = CD_3, and R^A = CD_3,
in L_{A528}: R = Ethyl, and R^A = H,
in L_{A529}: R = Ethyl, and R^A = CH_3,
in L_{A530}: R = Ethyl-*d*5, and R^A = CD_3,
in L_{A531}: R = isopropyl, and R^A = H,
in L_{A532}: R = isopropyl, and R^A = CH_3,
in L_{A533}: R = isopropyl-d7, and R^A = CD_3

,

L_{A534} through L_{A546}, each represented by the formula



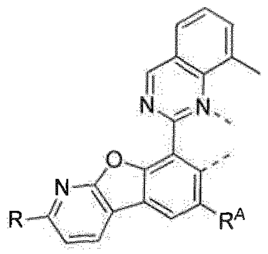
wherein in L_{A534}: R = H, and R^A = H,
in L_{A535}: R = H, and R^A = CH_3,
in L_{A536}: R = H, and R^A = CD_3,
in L_{A537}: R = CH_3, and R^A = H,
in L_{A538}: R = CD_3, and R^A = H,
in L_{A539}: R = CH_3, and R^A = CH_3,
in L_{A540}: R = CD_3, and R^A = CD_3,
in L_{A541}: R = Ethyl, and R^A = H,
in L_{A542}: R = Ethyl, and R^A = CH_3,
in L_{A543}: R = Ethyl-d5, and R^A = CD_3,
in L_{A544}: R = isopropyl, and R^A = H,
in L_{A545}: R = isopropyl, and R^A = CH_3,
in L_{A546}: R = isopropyl-d7, and R^A = CD_3

,

L_{A547} through L_{A559}, each represented by the formula

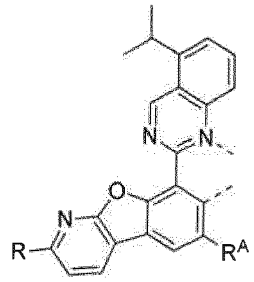
L_{A560} through L_{A572}, each represented by the formula

(continued)



wherein in L_{A547}: R = H, and R^A = H,
in L_{A548}: R = H, and R^A = CH_3,
in L_{A549}: R = H, and R^A = CD_3,
in L_{A550}: R = CH_3, and R^A = H,
in L_{A551}: R = CD_3, and R^A = H,
in L_{A552}: R = CH_3, and R^A = CH_3,
in L_{A553}: R = CD_3, and R^A = CD_3
in L_{A554}: R = Ethyl, and R^A = H,
in L_{A555}: R = Ethyl, and R^A = CH_3,
in L_{A556}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A557}: R = isopropyl, and R^A = H,
in L_{A558}: R = isopropyl, and R^A = CH_3,
in L_{A559}: R = isopropyl-*d7*, and R^A = CD_3

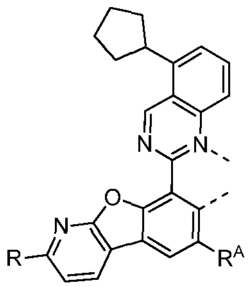
,



wherein in L_{A560}: R = H, and R^A = H,
in L_{A561}: R = H, and R^A = CH_3,
in L_{A562}: R = H, and R^A = CD_3,
in L_{A563}: R = CH_3, and R^A = H,
in L_{A564}: R = CD_3, and R^A = H,
in L_{A565}: R = CH_3, and R^A = CH_3,
in L_{A566}: R = CD_3, and R^A = CD_3,
in L_{A567}: R = Ethyl, and R^A = H,
in L_{A568}: R = Ethyl, and R^A = CH_3,
in L_{A569}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A570}: R = isopropyl, and R^A = H,
in L_{A571}: R = isopropyl, and R^A = CH_3,
in L_{A572}: R = isopropyl-*d7*, and R^A = CD_3

,

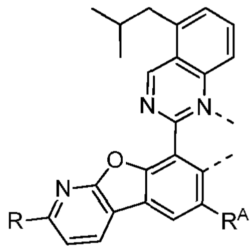
L_{A573} through L_{A585}, each represented by the formula



wherein in L_{A573}: R = H, and R^A = H,
in L_{A574}: R = H, and R^A = CH_3,
in L_{A575}: R = H, and R^A = CD_3,
in L_{A576}: R = CH_3, and R^A = H,
in L_{A577}: R = CD_3, and R^A = H,
in L_{A578}: R = CH_3, and R^A = CH_3,
in L_{A579}: R = CD_3, and R^A = CD_3,
in L_{A580}: R = Ethyl, and R^A = H,
in L_{A581}: R = Ethyl, and R^A = CH_3,
in L_{A582}: R Ethyl-*d5*, and R^A = CD_3,
in L_{A583}: R = isopropyl, and R^A = H,
in L_{A584}: R = isopropyl, and R^A = CH_3,
in L_{A585}: R = isopropyl-*d7*, and R^A = CD_3

,

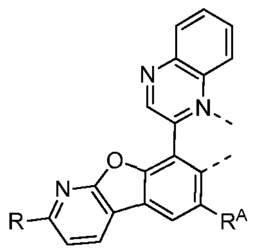
L_{A586} through L_{A598}, each represented by the formula



wherein in L_{A586}: R = H, and R^A = H,
in L_{A587}: R = H, and R^A = CH_3,
in L_{A588}: R = H, and R^A = CD_3,
in L_{A589}: R = CH_3, and R^A = H,
in L_{A590}: R = CD_3, and R^A = H,
in L_{A591}: R = CH_3, and R^A = CH_3,
in L_{A592}: R = CD_3, and R^A = CD_3,
in L_{A593}: R = Ethyl, and R^A = H,
in L_{A594}: R = Ethyl, and R^A = CH_3,
in L_{A595}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A596}: R = isopropyl, and R^A = H,
in L_{A597}: R = isopropyl, and R^A = CH_3,
in L_{A598}: R = isopropyl-*d7*, and R^A = CD_3

,

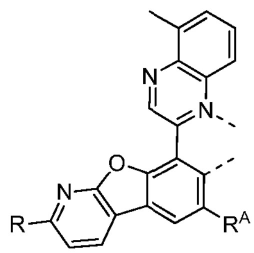
L_{A599} through L_{A611}, each represented by the formula



wherein in L_{A599}: R = H, and R^A = H,
in L_{A600}: R = H, and R^A = CH_3,
in L_{A601}: R = H, and R^A = CD_3,
in L_{A602}: R = CH_3, and R^A = H,
in L_{A603}: R = CD_3, and R^A = H,
in L_{A604}: R = CH_3, and R^A = CH_3,
in L_{A605}: R = CD_3, and R^A = CD_3,
in L_{A606}: R = Ethyl, and R^A = H,
in L_{A607}: R = Ethyl, and R^A = CH_3,
in L_{A608}: R = Ethyl-*d*5, and R^A = CD_3,
in L_{A609}: R = isopropyl, and R^A = H,
in L_{A610}: R = isopropyl, and R^A = CH_3,
in L_{A611}: R = isopropyl-*d7*, and R^A = CD_3

,

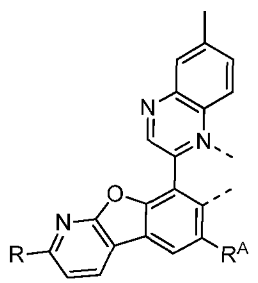
L_{A612} through L_{A624}, each represented by the formula



wherein in L_{A612}: R = H, and R^A = H,
in L_{A613}: R = H, and R^A = CH_3,
in L_{A614}: R = H, and R^A = CD_3,
in L_{A415}: R = CH_3, and R^A = H,
in L_{A616}: R = CD_3, and R^A = H,
in L_{A617}: R = CH_3, and R^A = CH_3,
in L_{A618}: R = CD_3, and R^A = CD_3,
in L_{A619}: R = Ethyl, and R^A = H,
in L_{A620}: R = Ethyl, and R^A = CH_3,
in L_{A621}: R = Ethyl-*d*5, and R^A = CD_3,
in L_{A622}: R = isopropyl, and R^A = H,
in L_{A623}: R = isopropyl, and R^A = CH_3,
in L_{A624}: R = isopropyl-*d7*, and R^A = CD_3

,

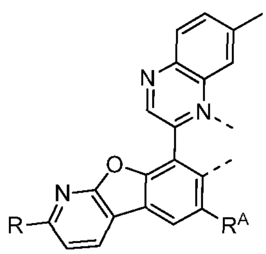
L_{A625} through L_{A637}, each represented by the formula



wherein in L_{A625}: R = H, and R^A = H,
in L_{A626}: R = H, and R^A = CH_3,
in L_{A627}: R = H, and R^A = CD_3,
in L_{A628}: R = CH_3, and R^A = H,
in L_{A629}: R = CD_3, and R^A = H,
in L_{A630}: R = CH_3, and R^A = CH_3,
in L_{A631}: R = CD_3, and R^A = CD_3,
in L_{A632}: R = Ethyl, and R^A = H,
in L_{A633}: R = Ethyl, and R^A = CH_3,
in L_{A634}: R = Ethyl-*d*5, and R^A = CD_3,
in L_{A635}: R = isopropyl, and R^A = H,
in L_{A636}: R = isopropyl, and R^A = CH_3,
in L_{A637}: R = isopropyl-*d7*, and R^A = CD3

,

L_{A638} through L_{A650}, each represented by the formula



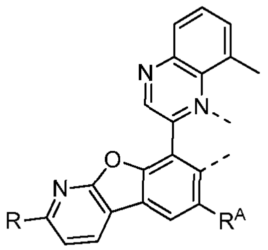
wherein in L_{A638}: R = H, and R^A = H,
in L_{A639}: R = H, and R^A = CH_3,
in L_{A640}: R = H, and R^A = CD_3,
in L_{A641}: R = CH_3, and R^A = H,
in L_{A642}: R = CD_3, and R^A = H,
in L_{A643}: R = CH_3, and R^A = CH_3,
in L_{A644}: R = CD_3, and R^A = CD_3,
in L_{A645}: R = Ethyl, and R^A = H,
in L_{A646}: R = Ethyl, and R^A = CH_3,
in L_{A647}: R = Ethyl-*d*5, and R^A = CD_3,
in L_{A648}: R = isopropyl, and R^A = H,
in L_{A649}: R = isopropyl, and R^A = CH_3,
in L_{A650}: R = isopropyl-*d7*, and R^A = CD_3

,

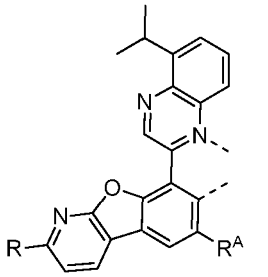
L_{A651} through L_{A663}, each represented by the formula

L_{A664} through L_{A676}, each represented by the formula

(continued)

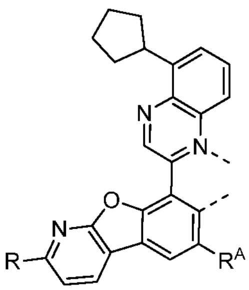


wherein in L_{A651}: R = H, and R^A = H,
in L_{A652}: R = H, and R^A = CH_3,
in L_{A653}: R = H, and R^A = CD_3,
in L_{A654}: R = CH_3, and R^A = H,
in L_{A655}: R = CD_3, and R^A = H,
in L_{A656}: R = CH_3, and R^A = CH_3,
in L_{A657}: R = CD_3, and R^A = CD_3,
in L_{A658}: R = Ethyl, and R^A = H,
in L_{A659}: R = Ethyl, and R^A = CH_3,
in L_{A660}: R = Ethyl-*d*5, and R^A = CD_3,
in L_{A661}: R = isopropyl, and R^A = H,
in L_{A662}: R = isopropyl, and R^A = CH_3,
in L_{A663}: R = isopropyl-*d7*, and R^A = CD_3
,



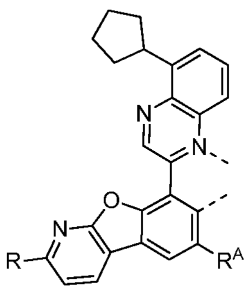
wherein in L_{A664}: R = H, and R^A = H,
in L_{A665}: R = H, and R^A = CH_3,
in L_{A666}: R = H, and R^A = CD_3,
in L_{A667}: R = CH_3, and R^A = H,
in L_{A668}: R = CD_3, and R^A = H,
in L_{A669}: R = CH_3, and R^A = CH_3,
in L_{A670}: R = CD_3, and R^A = CD_3,
in L_{A671}: R = Ethyl, and R^A = H,
in L_{A672}: R = Ethyl, and R^A = CH_3,
in L_{A673}: R = Ethyl-*d*5, and R^A = CD_3,
in L_{A674}: R = isopropyl, and R^A = H,
in L_{A675}: R = isopropyl, and R^A = CH_3,
in L_{A676}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A677} through L_{A689}, each represented by the formula



wherein in L_{A677}: R = H, and R^A = H,
in L_{A678}: R = H, and R^A = CH_3,
in L_{A679}: R = H, and R^A = CD_3,
in L_{A680}: R = CH_3, and R^A = H,
in L_{A681} R = CD_3, and R^A = H,
in L_{A682}: R = CH_3, and R^A = CH_3,
in L_{A683}: R = CD_3, and R^A = CD_3,
in L_{A684}: R = Ethyl, and R^A = H,
in L_{A685}: R = Ethyl, and R^A = CH_3,
in L_{A686}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A687}: R = isopropyl, and R^A = H,
in L_{A688}: R = isopropyl, and R^A = CH_3,
in L_{A689}: R = isopropyl-*d7*, and R^A = CD3,

L_{A690} through L_{A702}, each represented by the formula

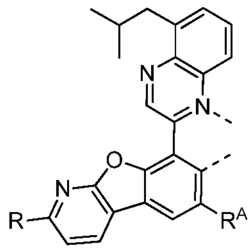


wherein in L_{A690}: R = H, and R^A = H,
in L_{A691}: R = H, and R^A = CH_3,
in L_{A692}: R = H, and R^A = CD_3,
in L_{A693}: R = CH_3, and R^A = H,
in L_{A694}: R = CD_3, and R^A = H,
in L_{A695}: R = CH_3, and R^A = CH_3,
in L_{A696}: R = CD_3, and R^A = CD_3,
in L_{A697}: R = Ethyl, and R^A = H,
in L_{A698}: R = Ethyl, and R^A = CH_3,
in L_{A699}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A700}: R = isopropyl, and R^A = H,
in L_{A701}: R = isopropyl, and R^A = CH_3,
in L_{A702}: R = isopropyl-*d7*, and R^A = CD3,

and

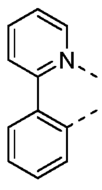
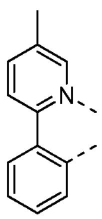
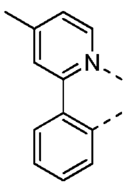
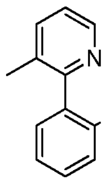
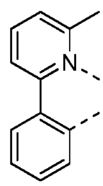
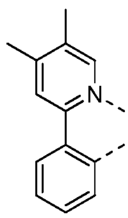
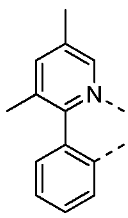
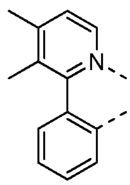
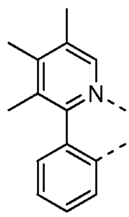
L_{A703} through L_{A715}, each represented by the formula

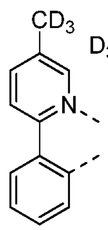
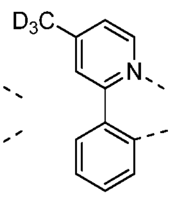
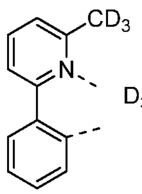
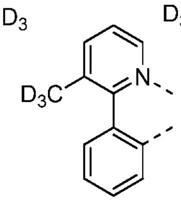
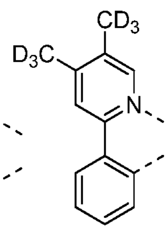
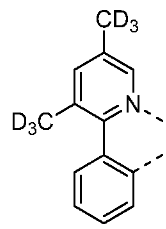
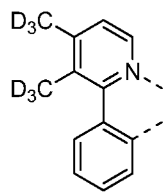
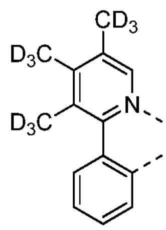
(continued)

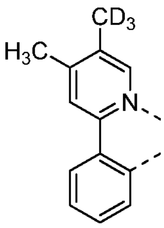
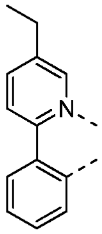
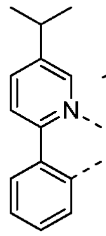
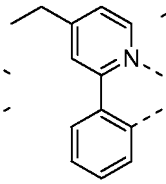
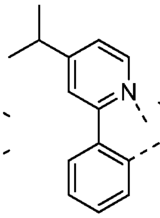
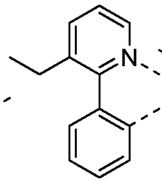
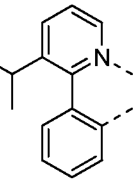
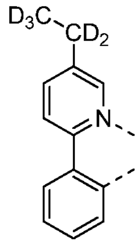


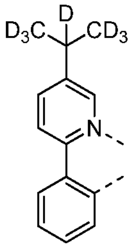
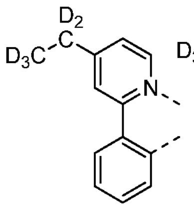
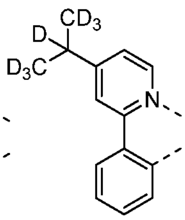
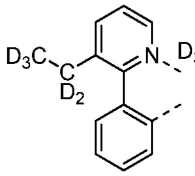
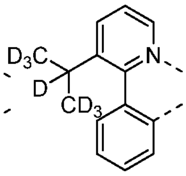
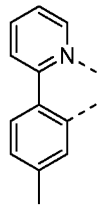
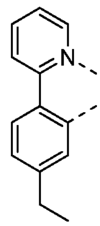
wherein in L_{A703}: R = H, and R^A = H,
in L_{A704}: R = H, and R^A = CH_3,
in L_{A705}: R = H, and R^A = CD_3,
in L_{A706}: R = CH_3, and R^A = H,
in L_{A707}: R = CD_3, and R^A = H,
in L_{A708}: R = CH_3, and R^A = CH_3,
in L_{A709}: R = CD_3, and R^A = CD_3,
in L_{A710}: R = Ethyl, and R^A = H,
in L_{A711}: R = Ethyl, and R^A = CH_3,
in LA_{712}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A713}: R = isopropyl, and R^A = H,
in L_{A714}: R = isopropyl, and R^A = CH_3,
in L_{A715}: R = isopropyl-*d7*, and R^A = CD_3.

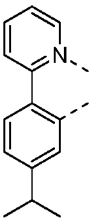
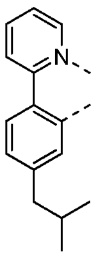
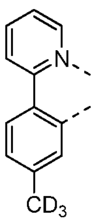
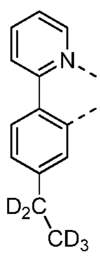
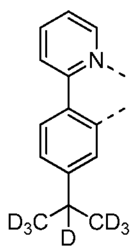
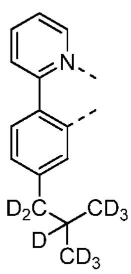
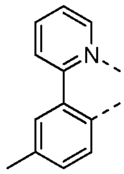
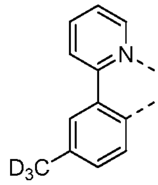
[0060] In some specific embodiments, L_C is selected from the group consisting of:


L_{C1} ,

L_{C2} ,

L_{C3} ,

L_{C4} ,

L_{C5} ,

L_{C6} ,

L_{C7} ,

L_{C8} ,

L_{C9} ,

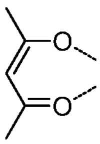
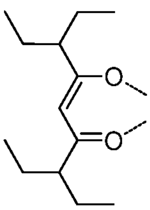
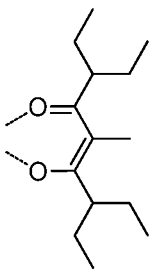
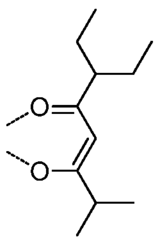
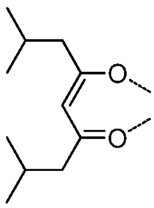
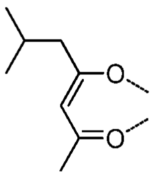
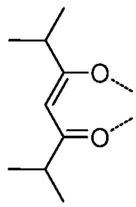

L_{C10} ,

L_{C11} ,

L_{C12} ,

L_{C13} ,

L_{C14} ,

L_{C15} ,

L_{C16} ,

L_{C17} ,

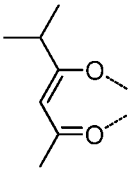
 L_{C18} ,  L_{C19} ,  L_{C20} ,  L_{C21} ,  L_{C22} ,  L_{C23} ,  L_{C24} ,  L_{C25} ,

 L_{C26} ,  L_{C27} ,  L_{C28} ,  L_{C29} ,  L_{C30} ,  L_{C31} ,  L_{C32} ,

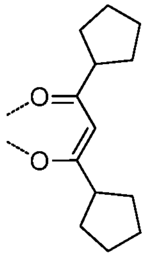
 L_{C33} ,  L_{C34} ,  L_{C35} ,  L_{C36} ,  L_{C37} ,  L_{C38} ,  L_{C39} , and  L_{C40} .

[0061] In some embodiments, L_B is selected from the group consisting of:

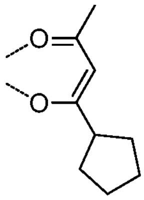
 L_{B42} ,  L_{B43} ,  L_{B44} ,  L_{B45} ,  L_{B46} ,  L_{B47} ,  L_{B48} ,



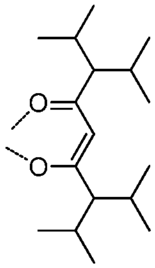
L_{B49} ,



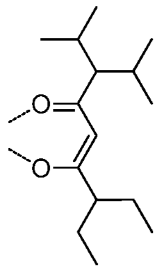
L_{B50} ,



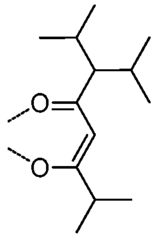
L_{B51} ,



L_{B52} ,

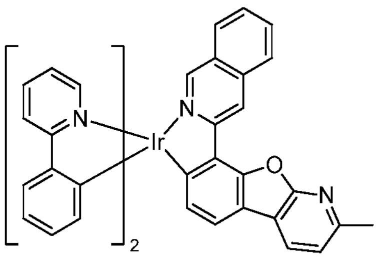


L_{B53} , and

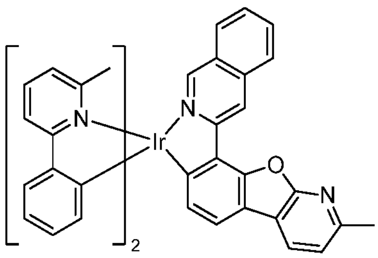


L_{B54} .

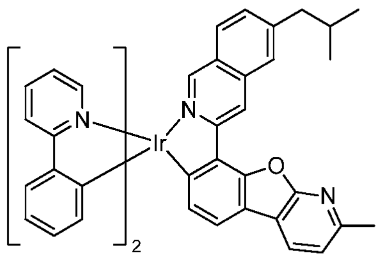
[0062] In some specific embodiments, the compound is selected from the group consisting of:



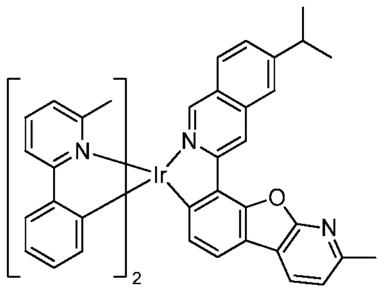
Compound 1 ,



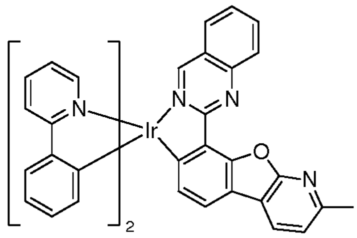
Compound 2 ,



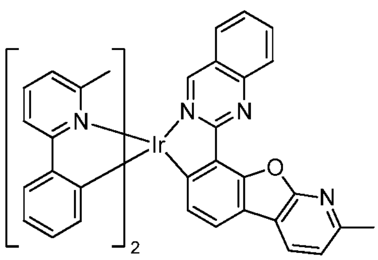
Compound 3 ,



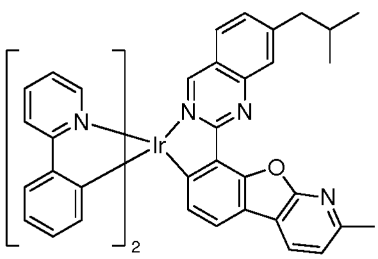
Compound 4 ,



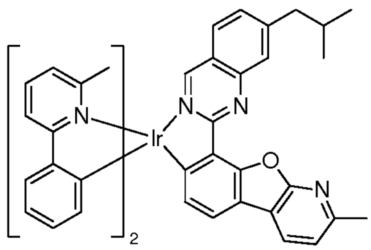
Compound 5 ,



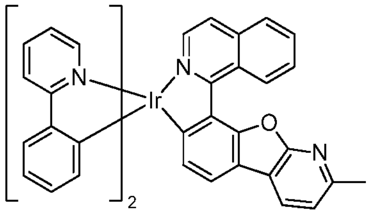
Compound 6 ,

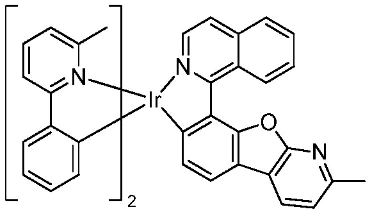


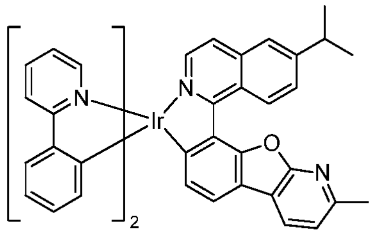
Compound 7 ,

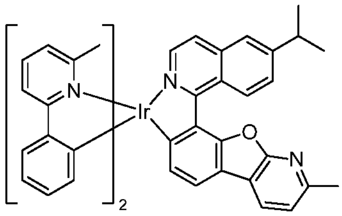


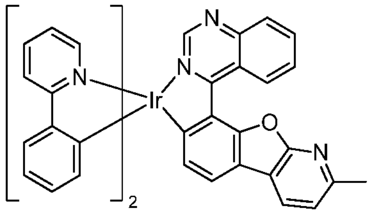
Compound 8 ,

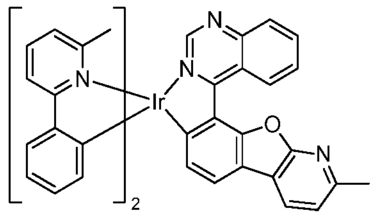

Compound 9 ,

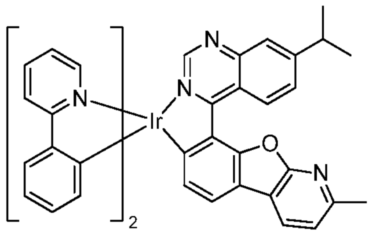

Compound 10 ,

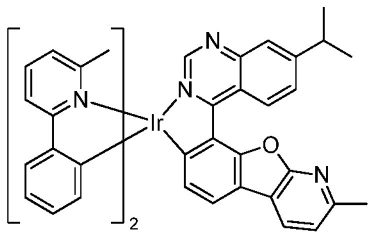

Compound 11 ,

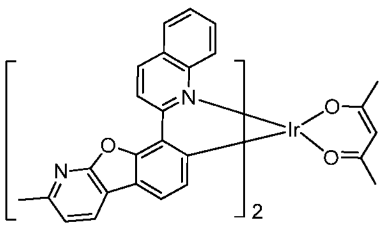

Compound 12 ,

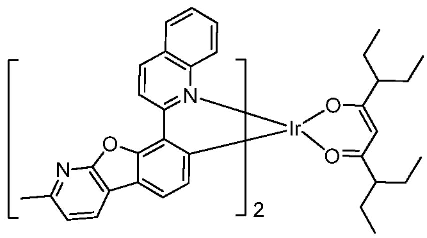

Compound 13 ,

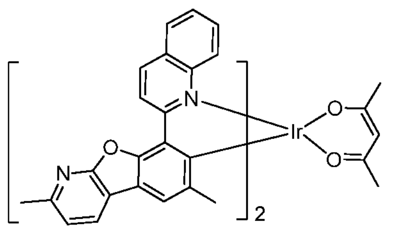

Compound 14 ,

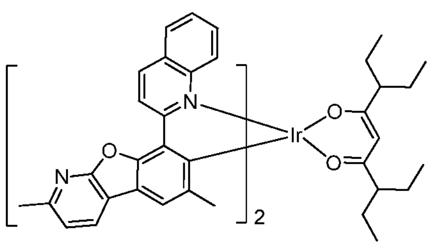

Compound 15 ,


Compound 16 ,


Compound 17 ,


Compound 18 ,


Compound 19 ,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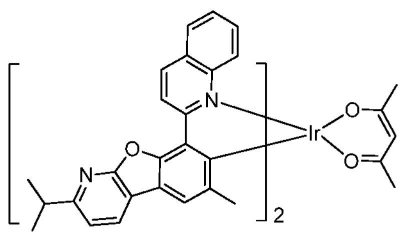
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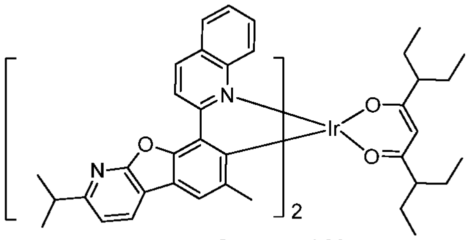
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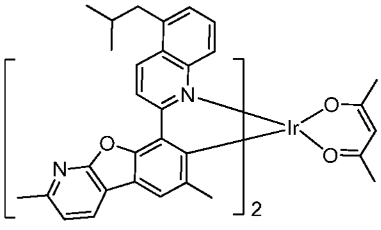
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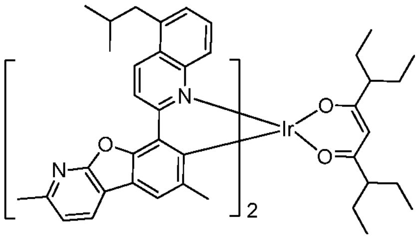
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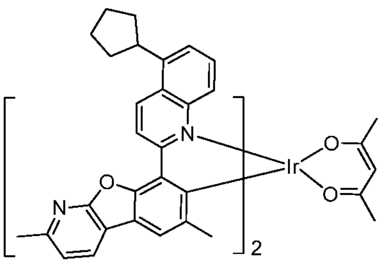
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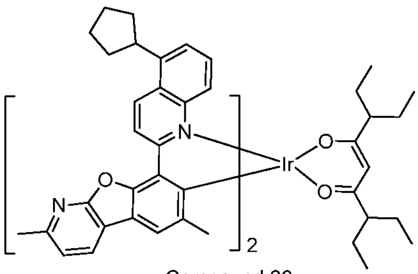
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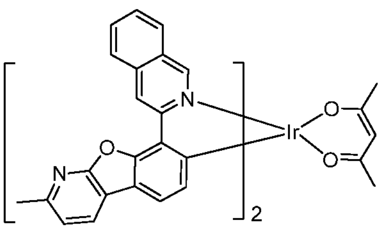
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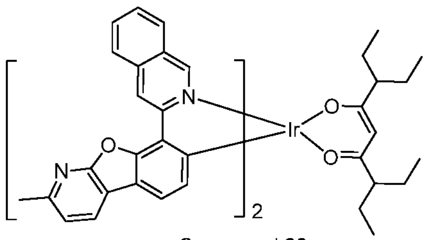
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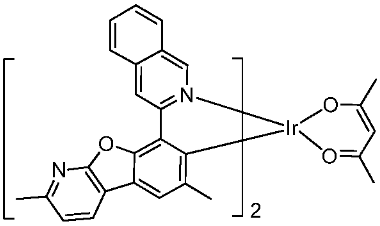
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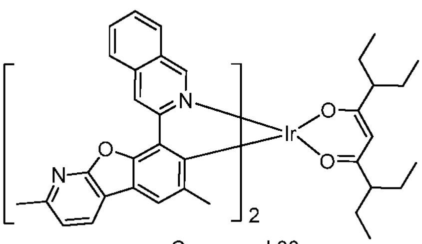
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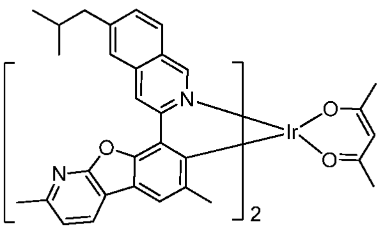
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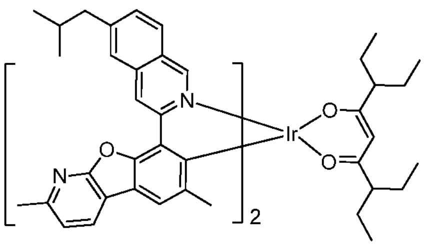

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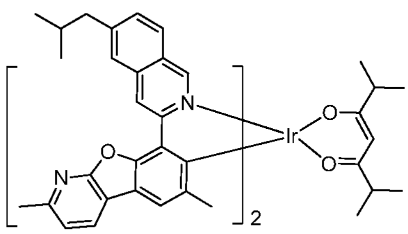

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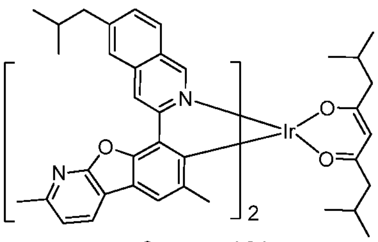

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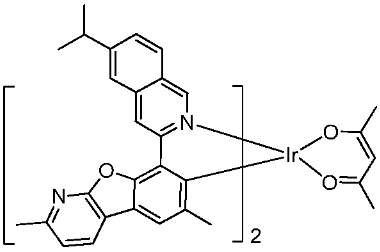

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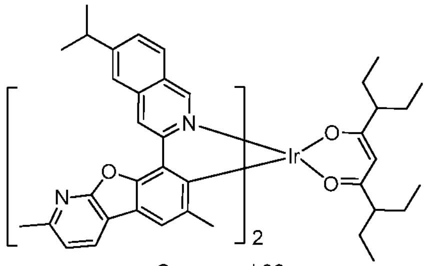

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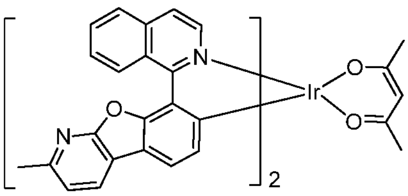

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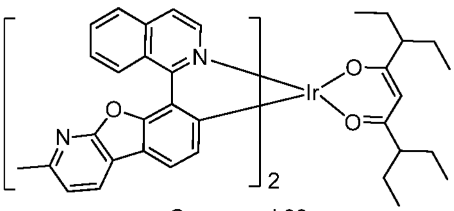

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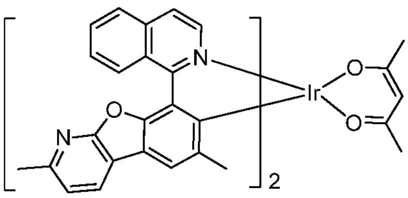

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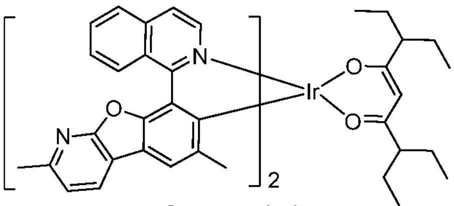

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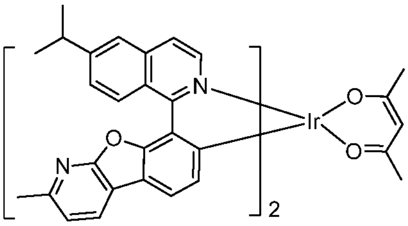

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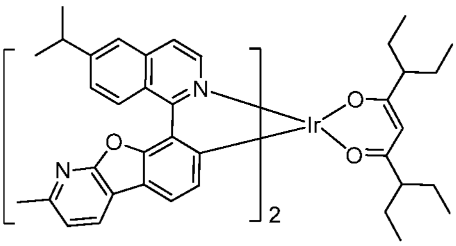

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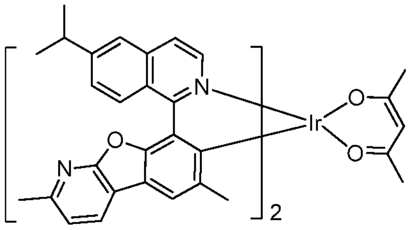

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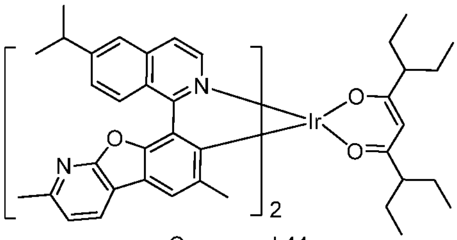

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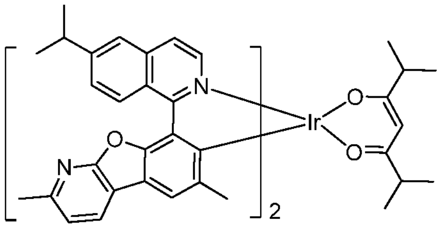

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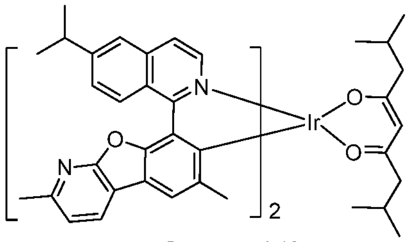

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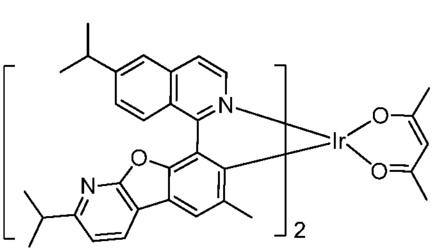

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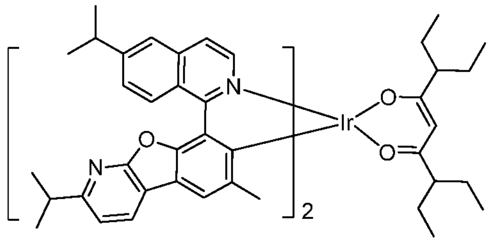

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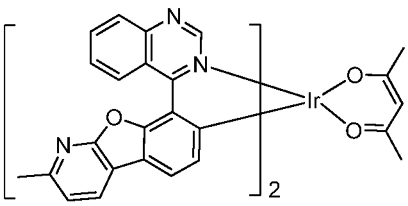

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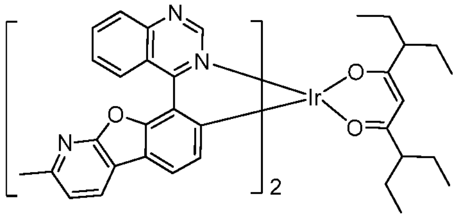

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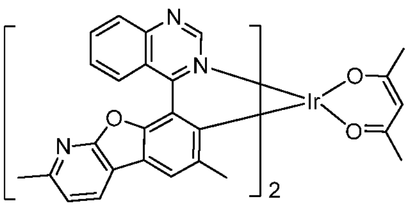

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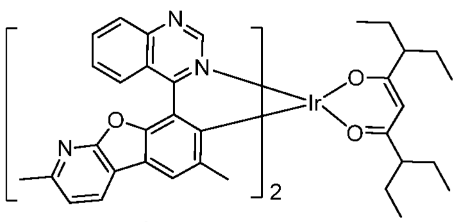

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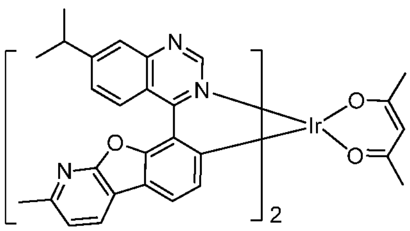

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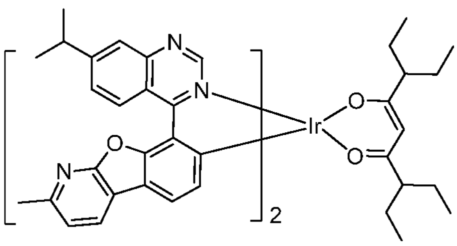

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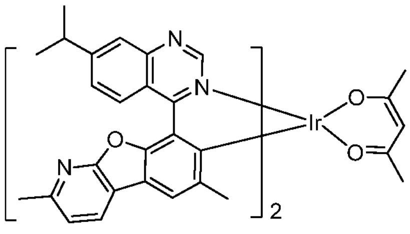

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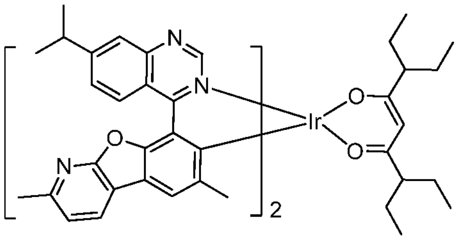

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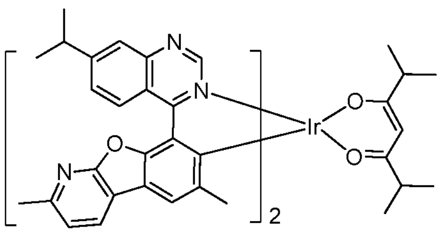

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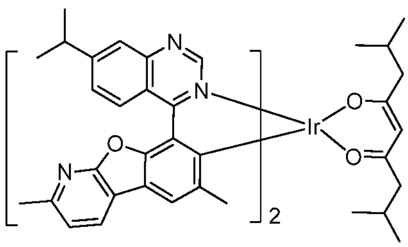

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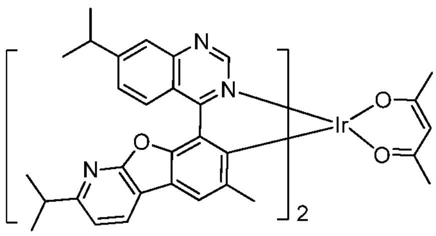
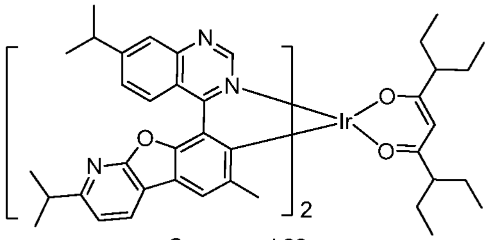


Compound 59 , and



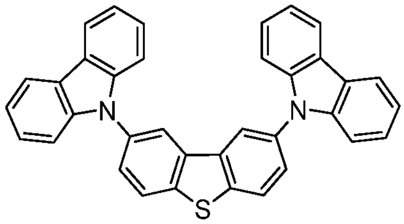
Compound 60 .

[0063] According to another aspect of the present disclosure, a first device is also provided. The first device includes a first organic light emitting device, that includes an anode, a cathode, and an organic layer disposed between the anode and the cathode. The organic layer may include a host and a phosphorescent dopant. The organic layer can include a compound according to Formula $M(L_A)_x(L_B)y(L_C)_z$, and its variations as described herein.

[0064] The first device can be one or more of a consumer product, an organic light-emitting device and a lighting panel. The organic layer can be an emissive layer and the compound can be an emissive dopant in some embodiments, while the compound can be a non-emissive dopant in other embodiments.

[0065] The organic layer can also include a host. In some embodiments, the host can include a metal complex. The host can be a triphenylene containing benzo-fused thiophene or benzo-fused furan. Any substituent in the host can be an unfused substituent independently selected from the group consisting of C_nH_{2n+1}, OC_nH_{2n+1}, OAr_1, $N(C_nH_{2n+1})_2$, $N(Ar_1)(Ar_2)$, $CH=CH-C_nH_{2n+1}$, $C\equiv C-C_nH_{2n+1}$, Ar_1, Ar_1-Ar_2, $C_nH_{2n}-Ar_1$, or no substitution. In the preceding substituents n can range from 1 to 10; and Ar_1 and Ar_2 can be independently selected from the group consisting of benzene, biphenyl, naphthalene, triphenylene, carbazole, and heteroaromatic analogs thereof.

[0066] The host can be a compound selected from the group consisting of carbazole, dibenzothiphene, dibenzofuran, dibenzoselenophene, azacarbazole, aza-dibenzothiophene, aza-dibenzofuran, and aza-dibenzoselenophene. The host can include a metal complex. The host can be a specific compound selected from the group consisting of: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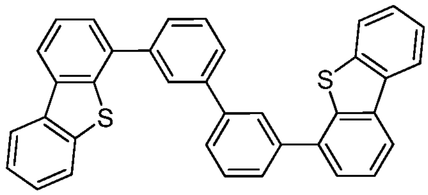
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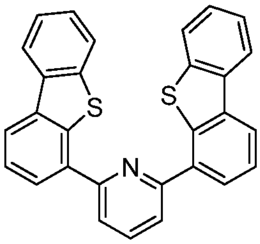
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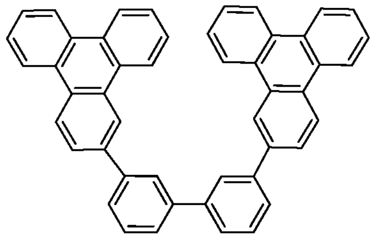
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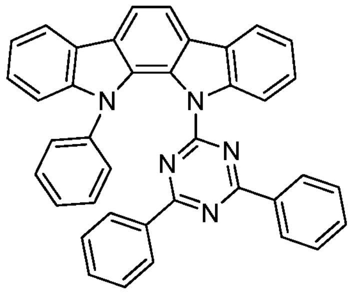
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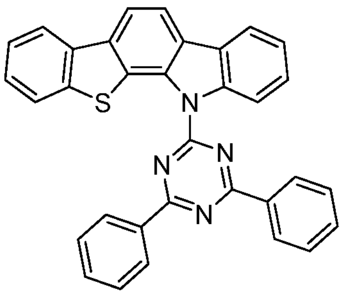
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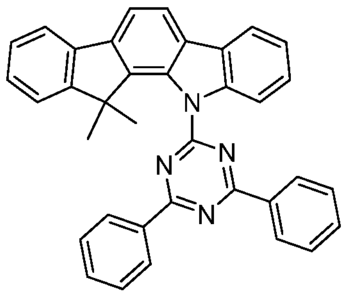
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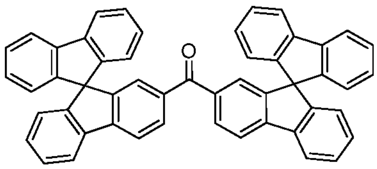
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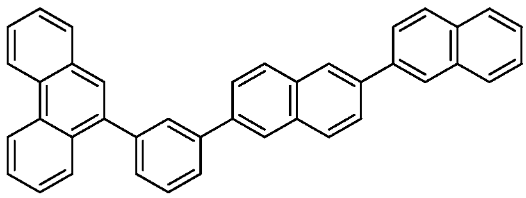
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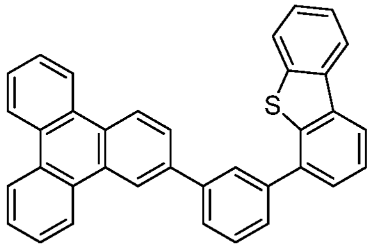
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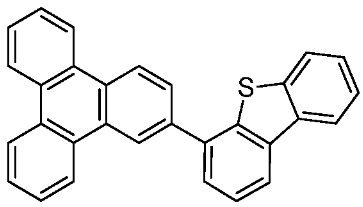

,

and combinations thereof.

[0067] In yet another aspect of the present disclsoure, a formulation that comprises a compound according to Formula $M(L_A)_x(L_B)y(L_C)_z$ is described. The formulation can include one or more components selected from the group consisting of a solvent, a host, a hole injection material, hole transport material, and an electron transport layer material, disclosed herein.

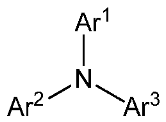
COMBINATION WITH OTHER MATERIALS

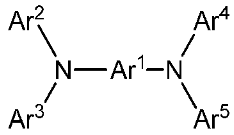
[0068] The materials described herein as useful for a particular layer in an organic light emitting device may be used in combination with a wide variety of other materials present in the device. For example, emissive dopants disclosed herein may be used in conjunction with a wide variety of hosts, transport layers, blocking layers, injection layers, electrodes and other layers that may be present. The materials described or referred to below are non-limiting examples of materials that may be useful in combination with the compounds disclosed herein, and one of skill in the art can readily consult the literature to identify other materials that may be useful in combination.

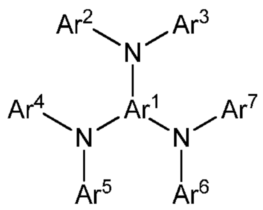
HIL/HTL:

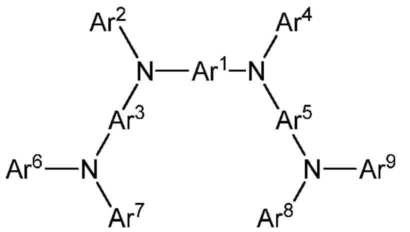
[0069] A hole injecting/transporting material to be used in the present invention is not particularly limited, and any compound may be used as long as the compound is typically used as a hole injecting/transporting material. Examples of the material include, but not limit to: a phthalocyanine or porphyrin derivative; an aromatic amine derivative; an indolocarbazole derivative; a polymer containing fluorohydrocarbon; a polymer with conductivity dopants; a conducting polymer, such as PEDOT/PSS; a self-assembly monomer derived from compounds such as phosphonic acid and silane derivatives; a metal oxide derivative, such as MoO_x; a p-type semiconducting organic compound, such as 1,4,5,8,9,12-Hexaazatriphenylenehexacarbonitrile; a metal complex, and a cross-linkable compounds.

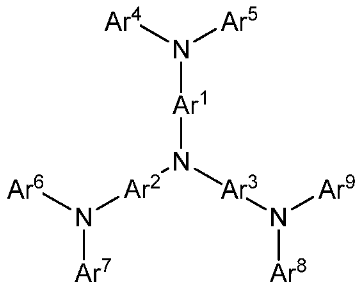
[0070] Examples of aromatic amine derivatives used in HIL or HTL include, but not limit to the following general structures:





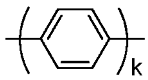


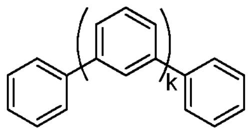


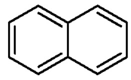
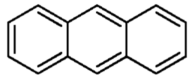


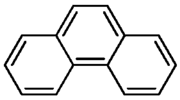
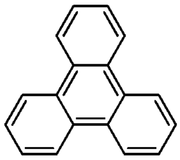
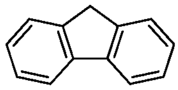
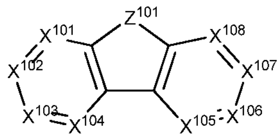
[0071] Each of Ar^1 to Ar^9 is selected from the group consisting aromatic hydrocarbon cyclic compounds such as benzene, biphenyl, triphenyl, triphenylene, naphthalene, anthracene, phenalene, phenanthrene, fluorene, pyrene, chrysene, perylene, azulene; group consisting aromatic heterocyclic compounds such as dibenzothiophene, dibenzofuran, dibenzoselenophene, furan, thiophene, benzofuran, benzothiophene, benzoselenophene, carbazole, indolocarbazole, pyridylindole, pyrrolodipyridine, pyrazole, imidazole, triazole, oxazole, thiazole, oxadiazole, oxatriazole, dioxazole, thiadiazole, pyridine, pyridazine, pyrimidine, pyrazine, triazine, oxazine, oxathiazine, oxadiazine, indole, benzimidazole, indazole, indoxazine, benzoxazole, benzisoxazole, benzothiazole, quinoline, isoquinoline, cinnoline, quinazoline, quinoxaline, naphthyridine, phthalazine, pteridine, xanthene, acridine, phenazine, phenothiazine, phenoxazine, benzofuropyridine, furodipyridine, benzothienopyridine, thienodipyridine, benzoselenophenopyridine, and selenophenodipyridine; and group consisting 2 to 10 cyclic structural units which are groups of the same type or different types selected from the aromatic hydrocarbon cyclic group and the aromatic heterocyclic group and are bonded to each other directly or via at least one of oxygen atom, nitrogen atom, sulfur atom, silicon atom, phosphorus atom, boron atom, chain structural unit and the aliphatic cyclic group. Wherein each Ar is further substituted by a substituent selected from the group consisting of hydrogen, deuterium, halide, alkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, aryloxy, amino, silyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, and combinations thereof.

[0072] In one aspect, Ar^1 to Ar^9 is independently selected from the group consisting of:



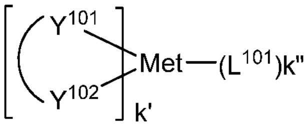


wherein k is an integer from 1 to 20; X^{101} to X^{108} is C (including CH) or N; Z^{101} is NAr^1, O, or S; Ar^1 has the same group defined above.

[0073] Examples of metal complexes used in HIL or HTL include, but not limit to the following general formula:



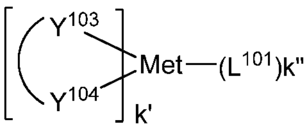
wherein Met is a metal, which can have an atomic weight greater than 40; (Y^{101}-Y^{102}) is a bidentate ligand, Y^{101} and Y^{102} are independently selected from C, N, O, P, and S; L^{101} is an ancillary ligand; k' is an integer value from 1 to the maximum number of ligands that may be attached to the metal; and k'+k" is the maximum number of ligands that may be attached to the metal.

[0074] In one aspect, (Y^{101}-Y^{102}) is a 2-phenylpyridine derivative. In another aspect, (Y^{101}-Y^{102}) is a carbene ligand. In another aspect, Met is selected from Ir, Pt, Os, and Zn. In a further aspect, the metal complex has a smallest oxidation potential in solution vs. Fc^+/Fc couple less than about 0.6 V.

Host:

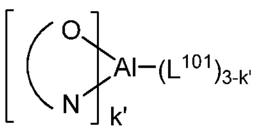
[0075] The light emitting layer of the organic EL device of the present invention preferably contains at least a metal complex as light emitting material, and may contain a host material using the metal complex as a dopant material. Examples of the host material are not particularly limited, and any metal complexes or organic compounds may be used as long as the triplet energy of the host is larger than that of the dopant. While the Table below categorizes host materials as preferred for devices that emit various colors, any host material may be used with any dopant so long as the triplet criteria is satisfied.

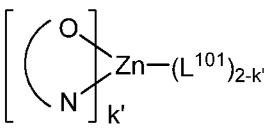
[0076] Examples of metal complexes used as host are preferred to have the following general formula:



wherein Met is a metal; (Y^{103}-Y^{104}) is a bidentate ligand, Y^{103} and Y^{104} are independently selected from C, N, O, P, and S; L^{101} is an another ligand; k' is an integer value from 1 to the maximum number of ligands that may be attached to the metal; and k'+k" is the maximum number of ligands that may be attached to the metal.

[0077] In one aspect, the metal complexes are:



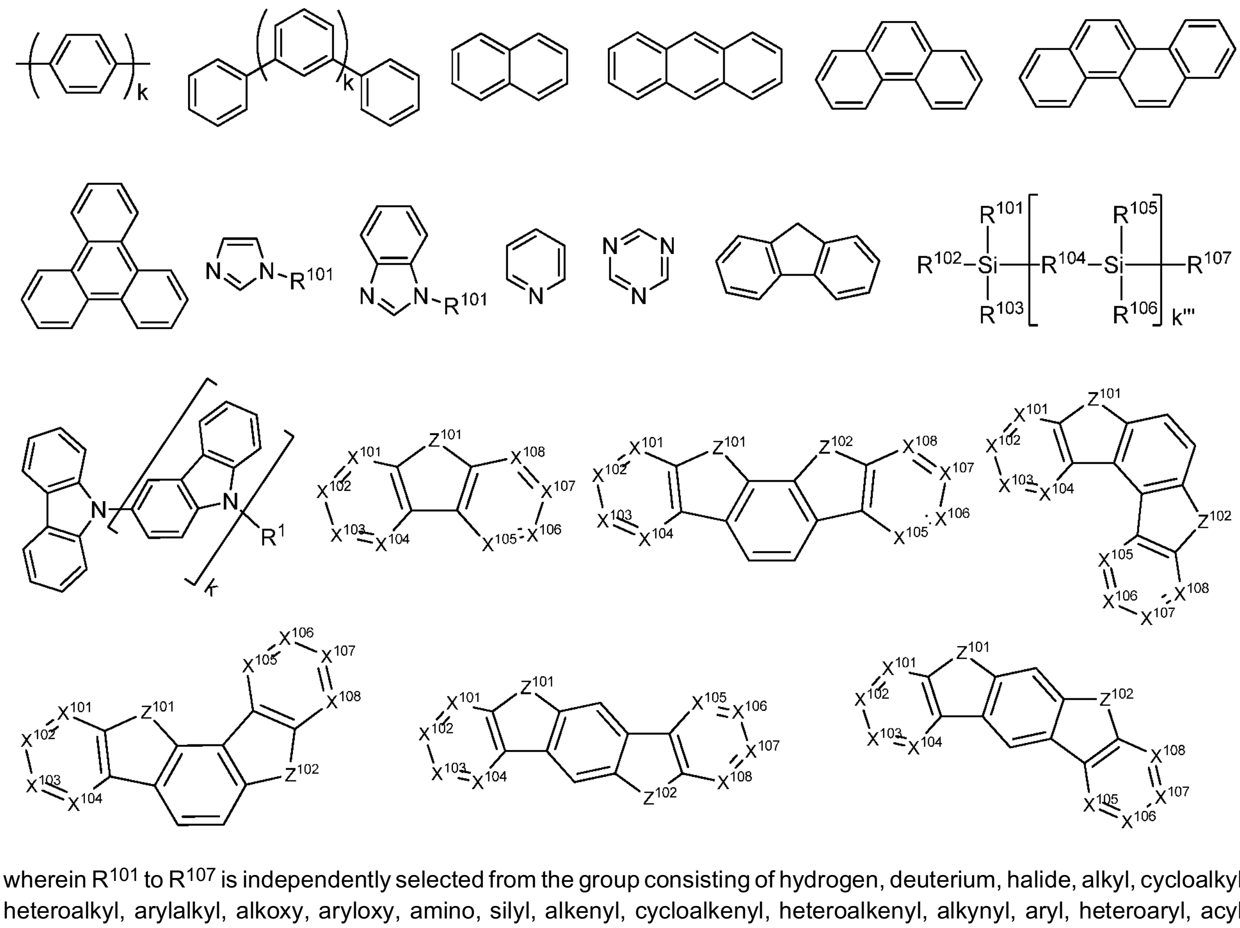


wherein (O-N) is a bidentate ligand, having metal coordinated to atoms O and N.

[0078] In another aspect, Met is selected from Ir and Pt. In a further aspect, (Y^{103}-Y^{104}) is a carbene ligand.

[0079] Examples of organic compounds used as host are selected from the group consisting aromatic hydrocarbon cyclic compounds such as benzene, biphenyl, triphenyl, triphenylene, naphthalene, anthracene, phenalene, phenanthrene, fluorene, pyrene, chrysene, perylene, azulene; group consisting aromatic heterocyclic compounds such as dibenzothiophene, dibenzofuran, dibenzoselenophene, furan, thiophene, benzofuran, benzothiophene, benzoselenophene, carbazole, indolocarbazole, pyridylindole, pyrrolodipyridine, pyrazole, imidazole, triazole, oxazole, thiazole, oxadiazole, oxatriazole, dioxazole, thiadiazole, pyridine, pyridazine, pyrimidine, pyrazine, triazine, oxazine, oxathiazine, oxadiazine, indole, benzimidazole, indazole, indoxazine, benzoxazole, benzisoxazole, benzothiazole, quinoline, isoquinoline, cinnoline, quinazoline, quinoxaline, naphthyridine, phthalazine, pteridine, xanthene, acridine, phenazine, phenothiazine, phenoxazine, benzofuropyridine, furodipyridine, benzothienopyridine, thienodipyridine, benzoselenophenopyridine, and selenophenodipyridine; and group consisting 2 to 10 cyclic structural units which are groups of the same type or different types selected from the aromatic hydrocarbon cyclic group and the aromatic heterocyclic group and are bonded to each other directly or via at least one of oxygen atom, nitrogen atom, sulfur atom, silicon atom, phosphorus atom, boron atom, chain structural unit and the aliphatic cyclic group. Wherein each group is further substituted by a substituent selected from the group consisting of hydrogen, deuterium, halide, alkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, aryloxy, amino, silyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, and combinations thereof.

[0080] In one aspect, host compound contains at least one of the following groups in the molecule:



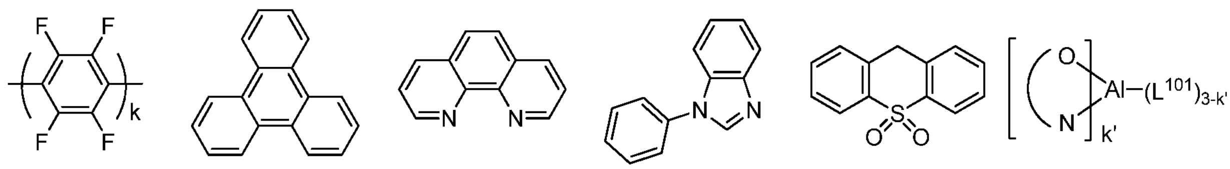
wherein R^{101} to R^{107} is independently selected from the group consisting of hydrogen, deuterium, halide, alkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, aryloxy, amino, silyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, and combinations thereof, when it is aryl or heteroaryl, it has the similar definition as Ar's mentioned above. k is an integer from 0 to 20 or 1 to 20; k''' is an integer from 0 to 20. X^{101} to X^{108} is selected from C (including CH) or N. Z^{101} and Z^{102} is selected from NR^{101}, O, or S.

HBL:

[0081] A hole blocking layer (HBL) may be used to reduce the number of holes and/or excitons that leave the emissive layer. The presence of such a blocking layer in a device may result in substantially higher efficiencies as compared to a similar device lacking a blocking layer. Also, a blocking layer may be used to confine emission to a desired region of an OLED.

[0082] In one aspect, compound used in HBL contains the same molecule or the same functional groups used as host described above.

[0083] In another aspect, compound used in HBL contains at least one of the following groups in the molecule:

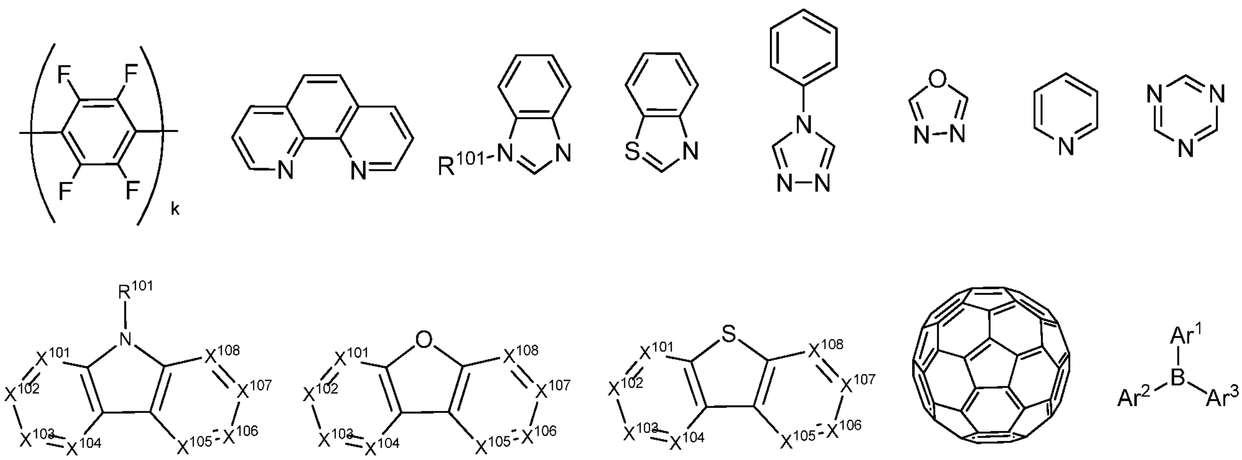


wherein k is an integer from 1 to 20; L^{101} is an another ligand, k' is an integer from 1 to 3.

ETL:

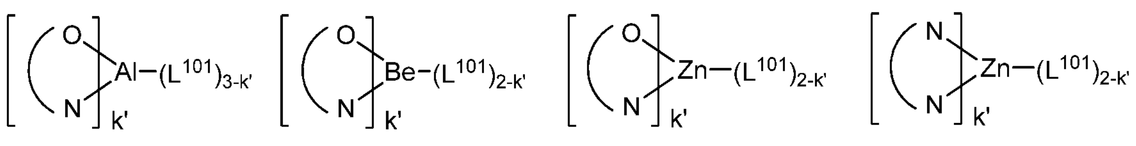
[0084] Electron transport layer (ETL) may include a material capable of transporting electrons. Electron transport layer may be intrinsic (undoped), or doped. Doping may be used to enhance conductivity. Examples of the ETL material are not particularly limited, and any metal complexes or organic compounds may be used as long as they are typically used to transport electrons.

[0085] In one aspect, compound used in ETL contains at least one of the following groups in the molecule:



wherein R^{101} is selected from the group consisting of hydrogen, deuterium, halide, alkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, aryloxy, amino, silyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, and combinations thereof, when it is aryl or heteroaryl, it has the similar definition as Ar's mentioned above. Ar^1 to Ar^3 has the similar definition as Ar's mentioned above. k is an integer from 1 to 20. X^{101} to X^{108} is selected from C (including CH) or N.

[0086] In another aspect, the metal complexes used in ETL contains, but not limit to the following general formula:

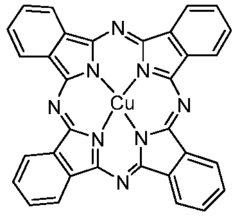
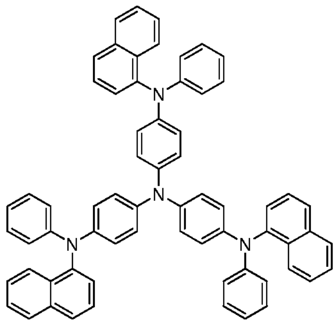
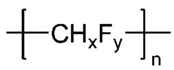
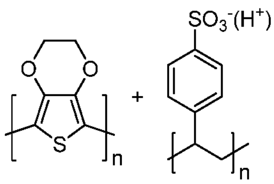
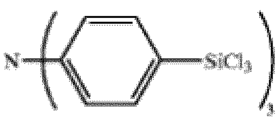
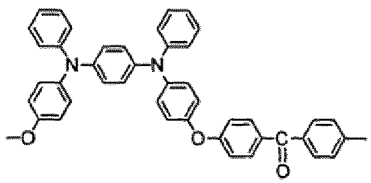
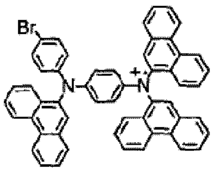


wherein (O-N) or (N-N) is a bidentate ligand, having metal coordinated to atoms O, N or N, N; L^{101} is another ligand; k' is an integer value from 1 to the maximum number of ligands that may be attached to the metal.

[0087] In any above-mentioned compounds used in each layer of the OLED device, the hydrogen atoms can be partially or fully deuterated. Thus, any specifically listed substituent, such as, without limitation, methyl, phenyl, pyridyl, etc. encompasses undeuterated, partially deuterated, and fully deuterated versions thereof. Similarly, classes of substituents such as, without limitation, alkyl, aryl, cycloalkyl, heteroaryl, etc. also encompass undeuterated, partially deuterated, and fully deuterated versions thereof.

[0088] In addition to and / or in combination with the materials disclosed herein, many hole injection materials, hole transporting materials, host materials, dopant materials, exiton/hole blocking layer materials, electron transporting and electron injecting materials may be used in an OLED. Non-limiting examples of the materials that may be used in an OLED in combination with materials disclosed herein are listed in Table 1 below. Table 1 lists non-limiting classes of materials, non-limiting examples of compounds for each class, and references that disclose the materials.

TABLE 1

MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Hole injection materials		
Phthalocyanine and porphryin compounds		Appl. Phys. Lett. 69, 2160 (1996)
Starburst triarylamines		J. Lumin. 72-74, 985 (1997)
CF_x Fluorohydrocarbon polymer		Appl. Phys. Lett. 78, 673 (2001)
Conducting polymers (e.g., PEDOT:PSS, polyaniline, polypthiophene)		Synth. Met. 87, 171 (1997) WO2007002683
Phosphonic acid and silane SAMs		US20030162053
Triarylamine or polythiophene polymers with conductivity dopants	 and 	EP1725079A1

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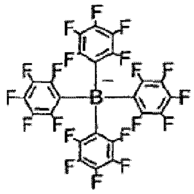
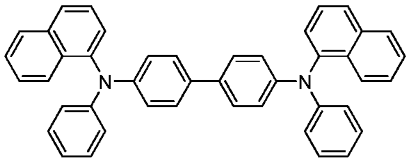
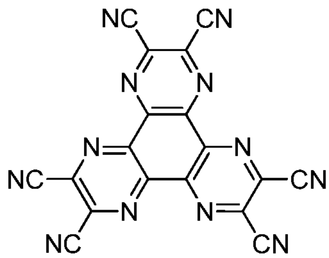
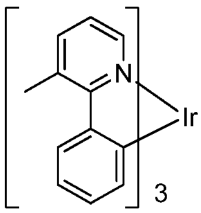
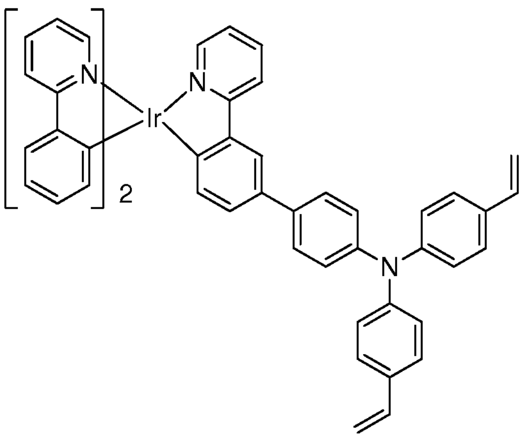
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Hole injection materials		
		
Organic compounds with conductive inorganic compounds, such as molybdenum and tungsten oxides	 + MoO_x	US20050123751 SID Symposium Digest, 37, 923 (2006) WO2009018009
n-type semiconducting organic complexes		US20020158242
Metal organometallic complexes		US20060240279
Cross-linkable compounds		US20080220265

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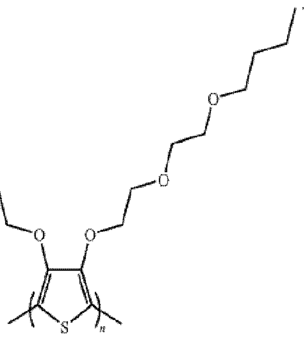
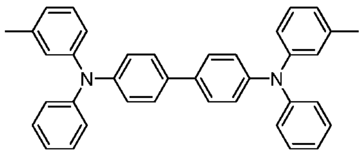
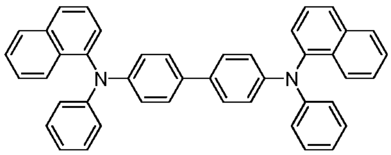
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Hole injection materials		
Polythiophene based polymers and copolymers		WO 2011075644 EP2350216
Hole transporting materials		
Triarylamines (e.g., TPD, α-NPD)		Appl. Phys. Lett. 51, 913 (1987)
		US5061569

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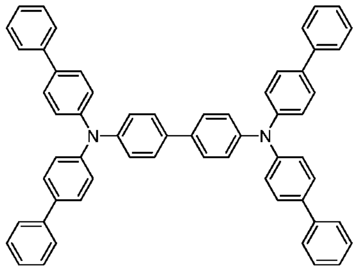
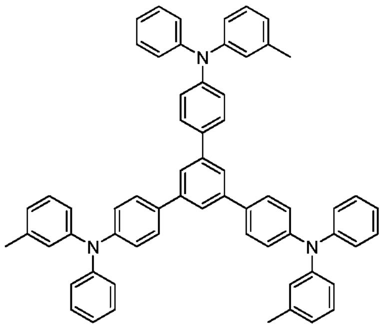
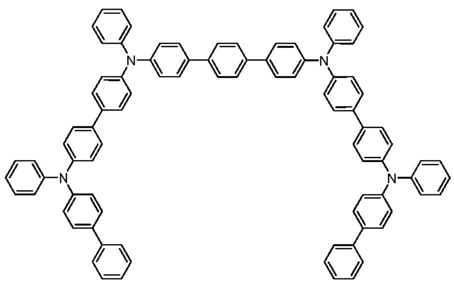
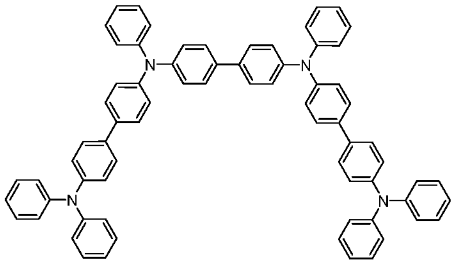
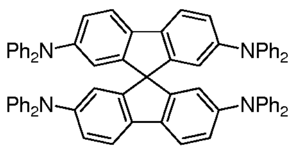
Hole transporting materials		
		EP650955
		J. Mater. Chem. 3, 319 (1993)
		Appl. Phys. Lett. 90, 183503 (2007)
		Appl. Phys. Lett. 90, 183503 (2007)
Triaylamine on spirofluorene core		Synth. Met. 91, 209 (1997)

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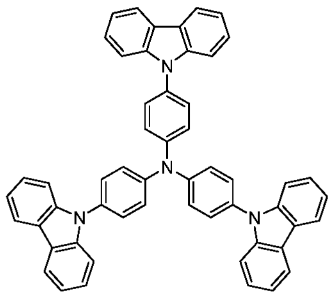
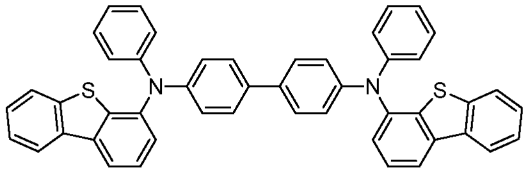
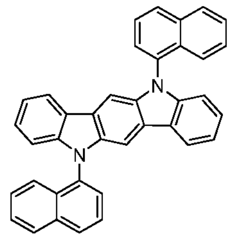
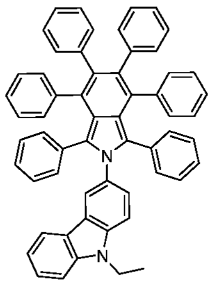
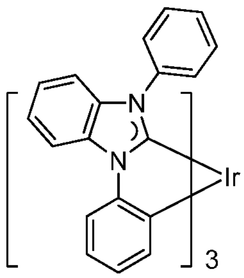
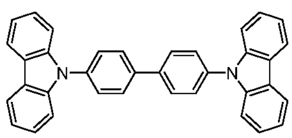
Hole transporting materials		
Arylamine carbazole compounds		Adv. Mater. 6, 677 (1994), US20080124572
Triarylamine with (di) benzothiophene/(di)benzofuran		US20070278938, US20080106190 US20110163302
Indolocarbazoles		Synth. Met. 111, 421 (2000)
Isoindole compounds		Chem. Mater. 15, 3148 (2003)
Metal carbene complexes		US20080018221
Phosphorescent OLED host materials		
Red hosts		
Arylcarbazoles		Appl. Phys. Lett. 78, 1622 (2001)

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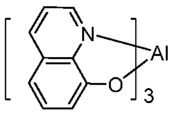
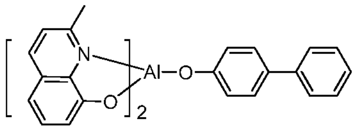
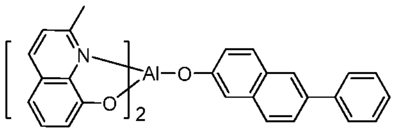
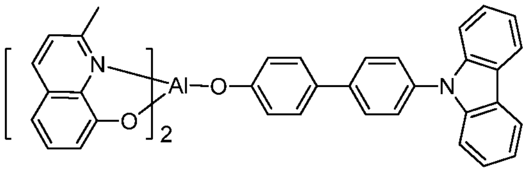
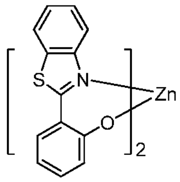
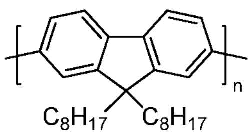
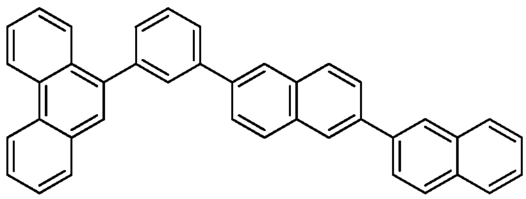
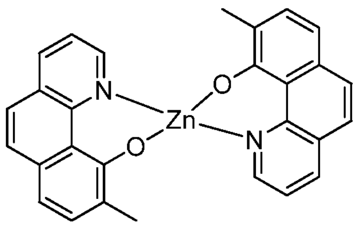
Phosphorescent OLED host materials		
Red hosts		
Metal 8-hydroxyquinolates (e.g., Alq_3, BAlq)		Nature 395, 151 (1998)
		US20060202194
		WO2005014551
		WO2006072002
Metal phenoxybenzothiazole compounds		Appl. Phys. Lett. 90, 123509 (2007)
Conjugated oligomers and polymers (e.g., polyfluorene)		Org. Electron. 1, 15 (2000)
Aromatic fused rings		WO2009066779, WO2009066778, WO2009063833, US20090045731, US20090045730, WO2009008311, US20090008605, US20090009065
Zinc complexes		WO2010056066

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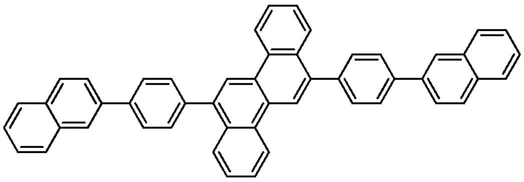
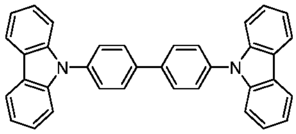
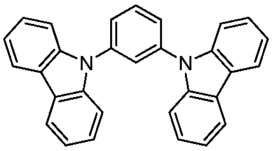
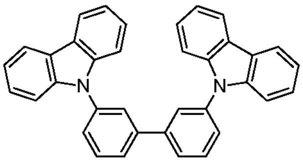
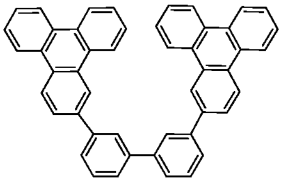
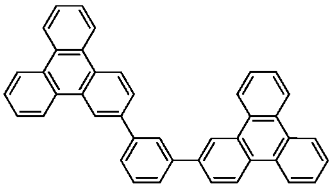
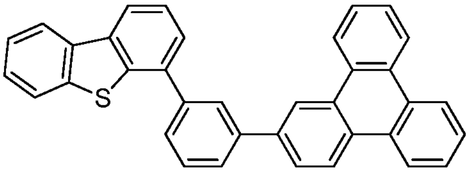
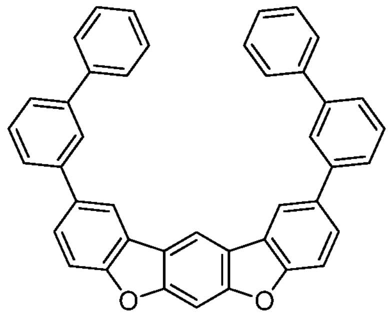
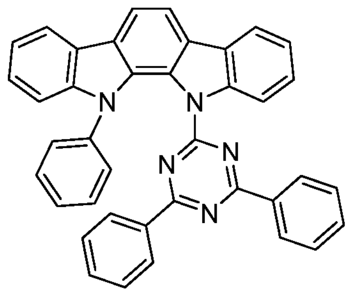
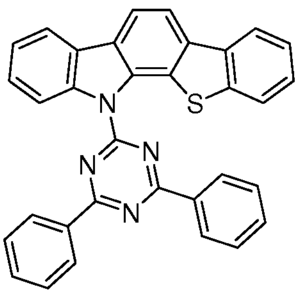
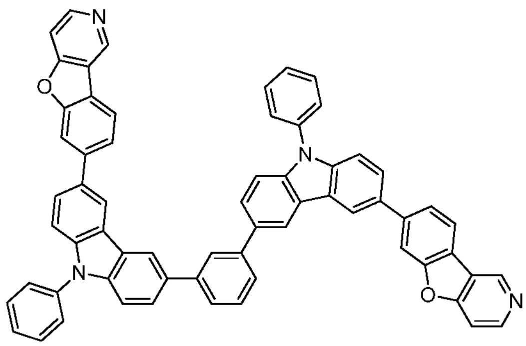
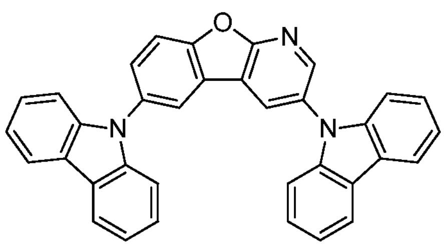
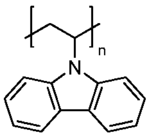
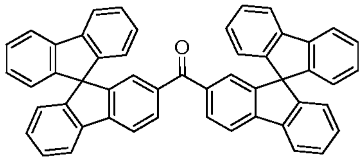
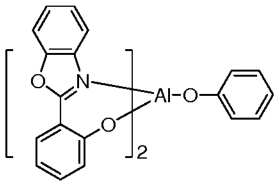
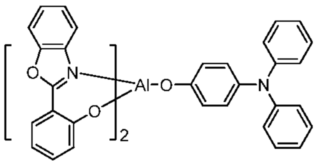
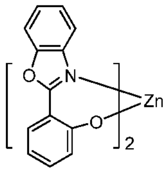
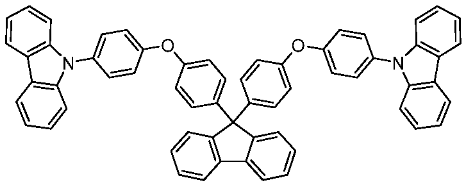
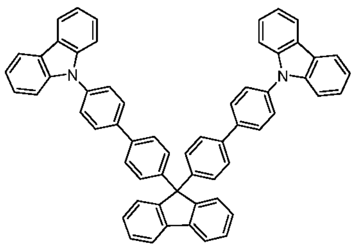
Phosphorescent OLED host materials		
Red hosts		
Chrysene based compounds		WO2011086863
Green hosts		
Arylcarbazoles		Appl. Phys. Lett. 78, 1622 (2001)
		US20030175553
		WO2001039234
Aryltriphenylene compounds		US20060280965
		US20060280965
		WO2009021126

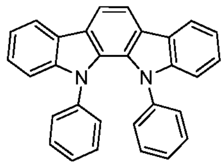
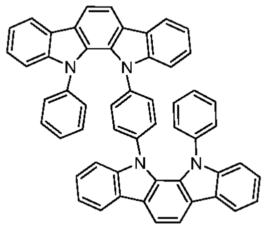
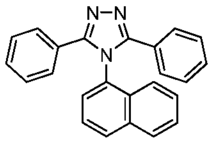
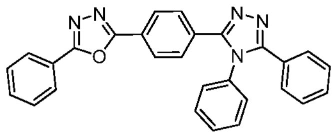
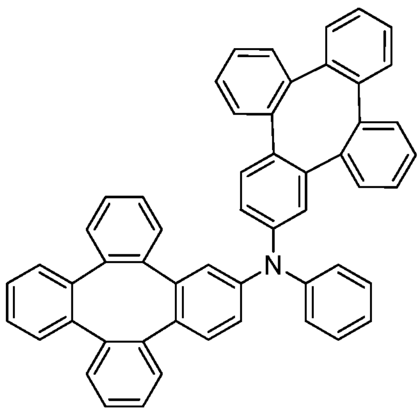
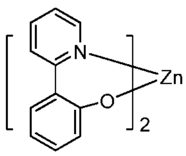
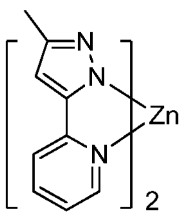
(continued)

Green hosts		
Poly-fused heteroaryl compounds		US20090309488 US20090302743 US20100012931
Donor acceptor type molecules		WO2008056746
		WO2010107244
Aza-carbazole/DBT/DBF		JP2008074939
		US20100187984

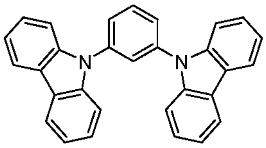
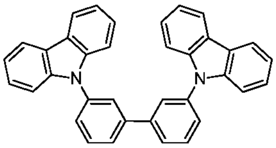
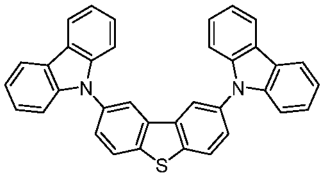
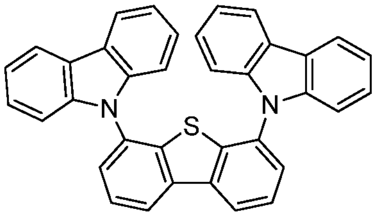
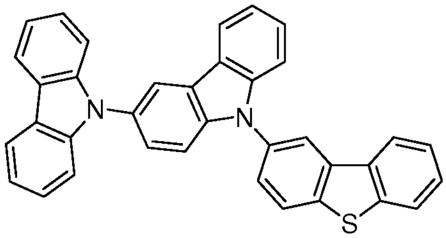
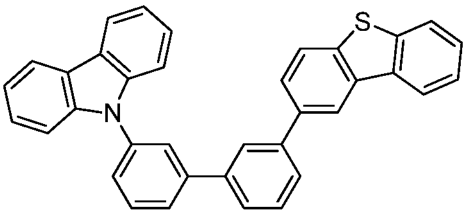
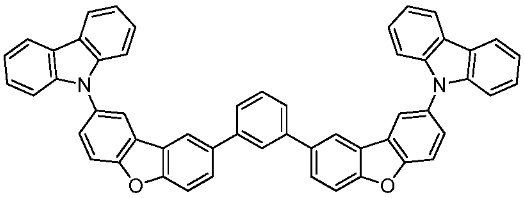
(continued)

Green hosts		
Polymers (e.g., PVK)		Appl. Phys. Lett. 77, 2280 (2000)
Spirofluorene compounds		WO2004093207
Metal phenoxybenzooxazole compounds		WO2005089025
		WO2006132173
		JP200511610
Spirofluorene-carbazole compounds		JP2007254297
		JP2007254297

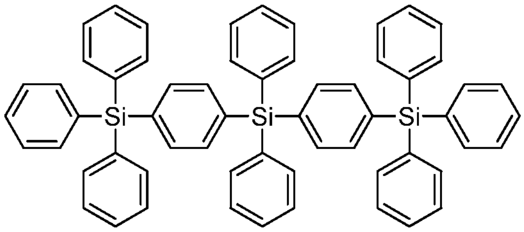
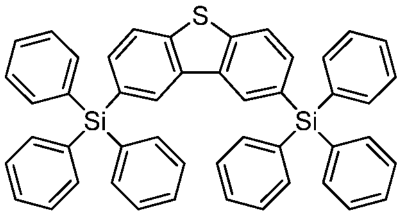
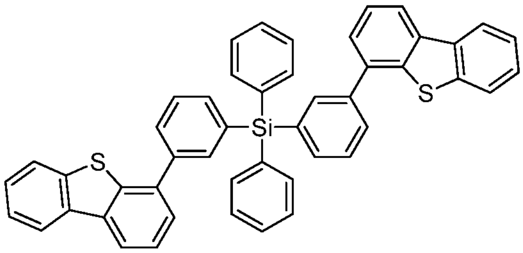
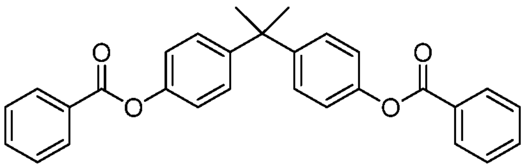
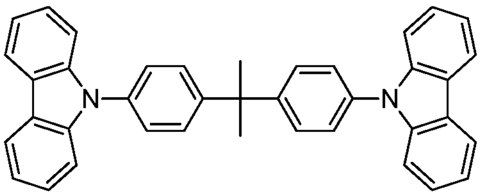
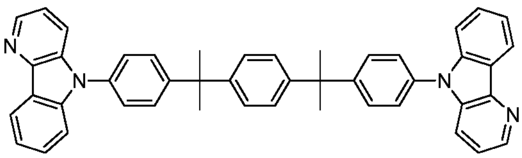
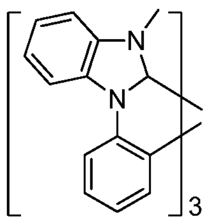
(continued)

Green hosts		
Indolocarbazoles		WO2007063796
		WO2007063754
5-member ring electron deficient heterocycles (e.g., triazole, oxadiazole)		J. Appl. Phys. 90, 5048 (2001)
		WO2004107822
Tetraphenylene complexes		US20050112407
Metal phenoxypyridine compounds		WO2005030900
Metal coordination complexes (e.g., Zn, Al with N^N ligands)		US20040137268, US20040137267

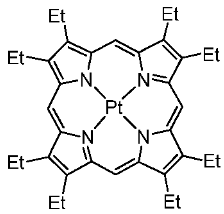
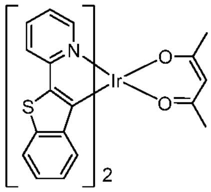
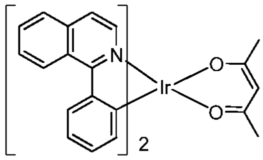
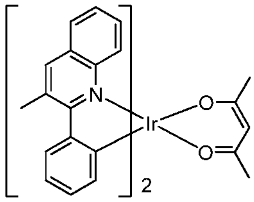
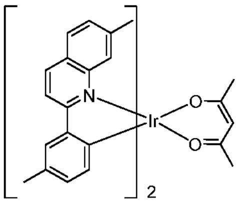
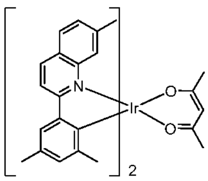
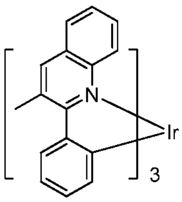
(continued)

Blue hosts		
Arylcarbazoles		Appl. Phys. Lett, 82, 2422 (2003)
		US20070190359
Dibenzothiophene/Dibenzofuran-carbazole compounds		WO2006114966, US20090167162
		US20090167162
		WO2009086028
		US20090030202, US20090017330
		US20100084966

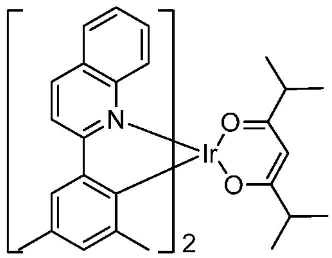
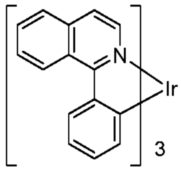
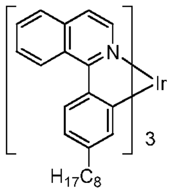
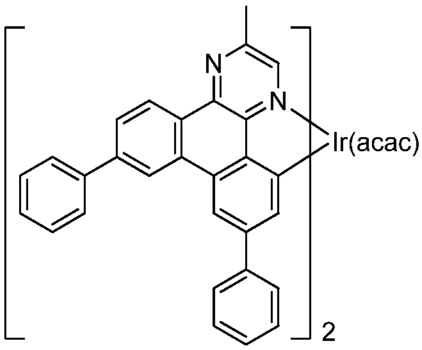
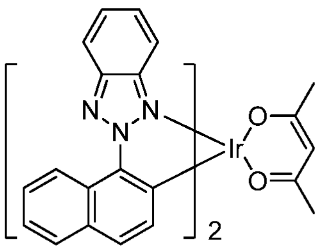
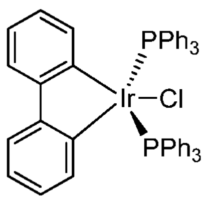
(continued)

Blue hosts		
Silicon aryl compounds		US20050238919
		WO2009003898
Silicon/Germanium aryl compounds		EP2034538A
Aryl benzoyl ester		WO2006100298
Carbazole linked by nonconjugated groups		US20040115476
Aza-carbazoles		US20060121308
High triplet metal organometallic complex		US7154114

(continued)

Phosphorescent dopants		
Red dopants		
Heavy metal porphyrins (e.g., PtOEP)		Nature 395, 151 (1998)
Iridium(III) organometallic complexes		Appl. Phys. Lett. 78, 1622 (2001)
		US20030072964
		US20030072964
		US20060202194
		US20060202194
		US20070087321

(continued)

Phosphorescent dopants		
Red dopants		
		US20080261076 US20100090591
		US20070087321
		Adv. Mater. 19, 739 (2007)
		WO2009100991
		WO2008101842
		US7232618

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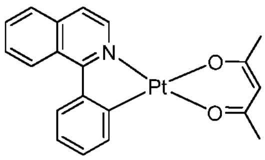
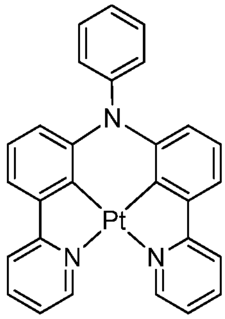
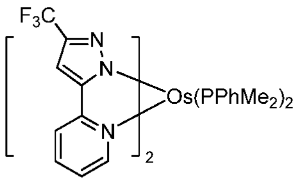
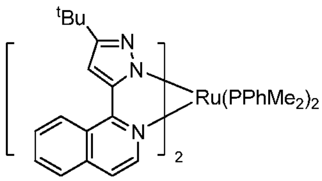
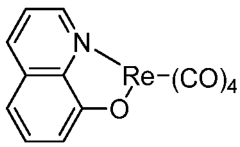
Phosphorescent dopants		
Red dopants		
Platinum(II) organometallic complexes		WO2003040257
		US20070103060
Osminum(III) complexes		Chem. Mater. 17, 3532 (2005)
Ruthenium(II) complexes		Adv. Mater. 17, 1059 (2005)
Rhenium (I), (II), and (III) complexes		US20050244673

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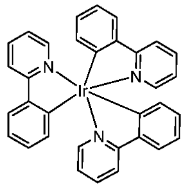
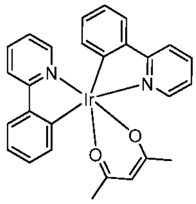
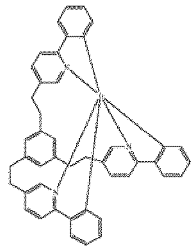
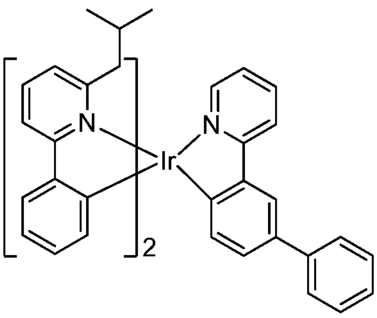
Green dopants		
Iridium(III) organometallic complexes	 and its derivatives	Inorg. Chem. 40, 1704 (2001)
		US20020034656
		US7332232
		US20090108737

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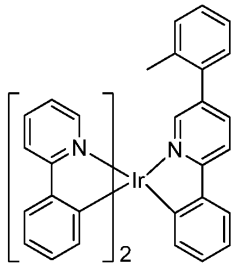
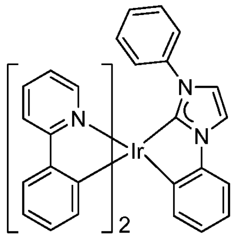
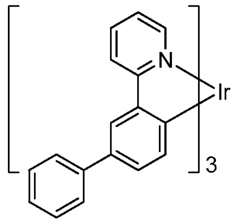
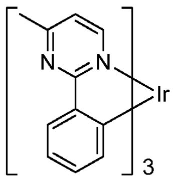
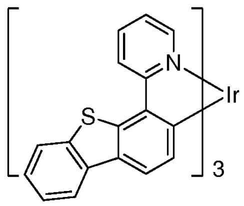
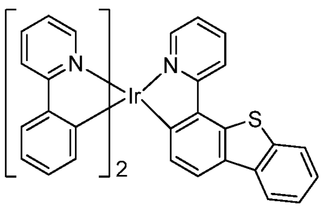
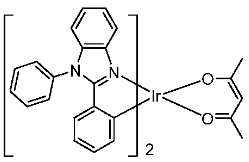
Green dopants		
		WO2010028151
		EP1841834B
		US20060127696
		US20090039776
		US6921915
		US20100244004
		US6687266

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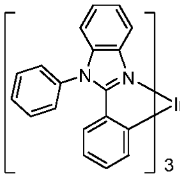
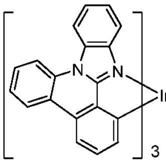
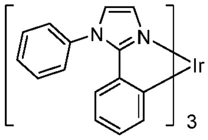
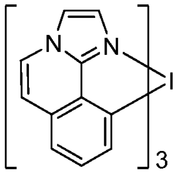
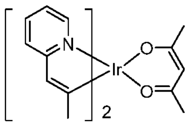
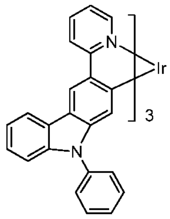
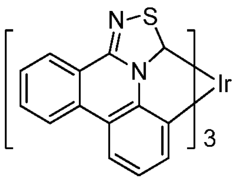
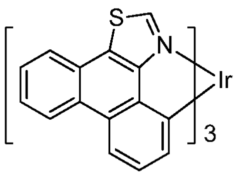
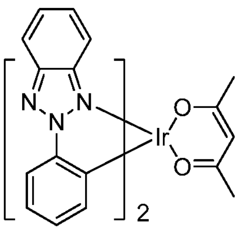
Green dopants		
		Chem. Mater. 16, 2480 (2004)

(continued)

Green dopants		
		US20070190359
		US 20060008670 JP2007123392
		WO2010086089, WO2011044988
		Adv. Mater. 16, 2003 (2004)
		Angew. Chem. Int. Ed. 2006,45,7800
		WO2009050290
		US20090165846
		US20080015355

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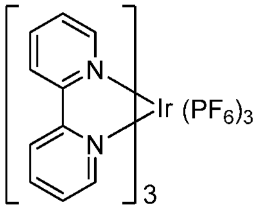
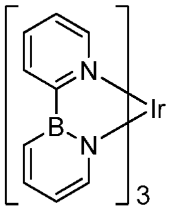
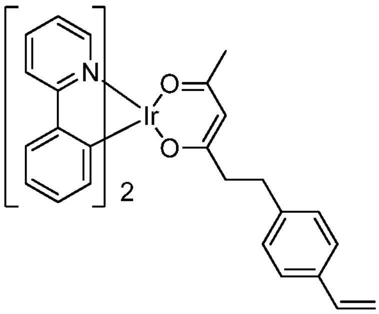
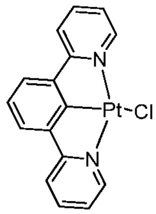
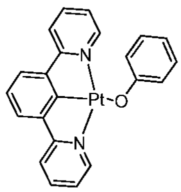
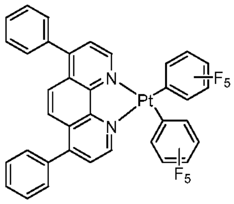
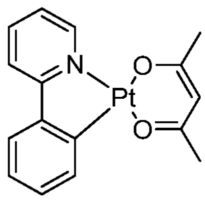
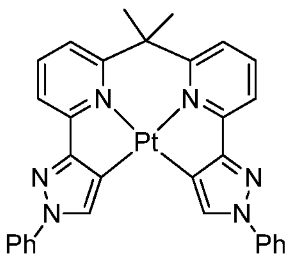
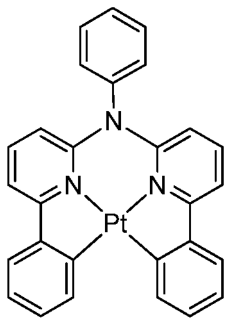
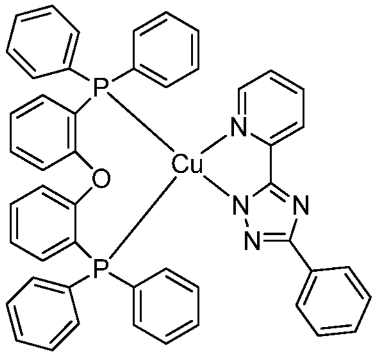
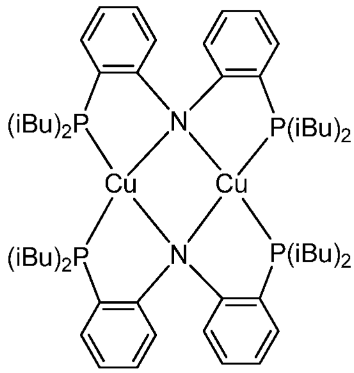
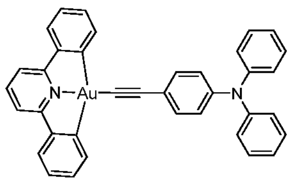
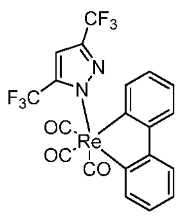
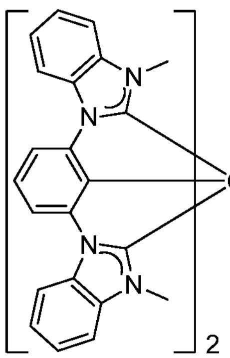
Green dopants		
		US20010015432
		US20100295032
Monomer for polymeric metal organometallic compounds		US7250226, US7396598

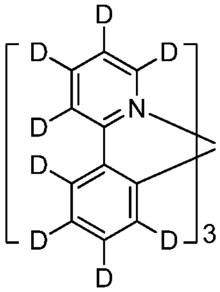
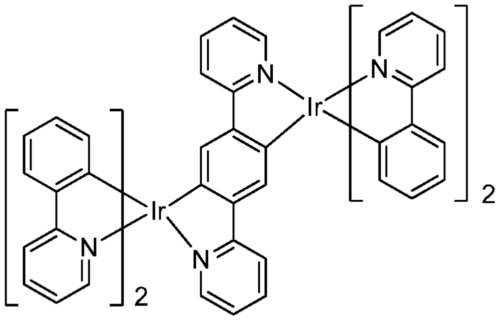
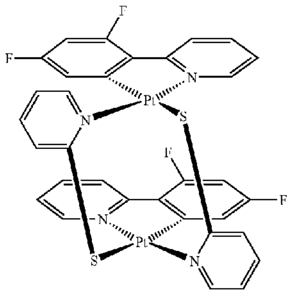
(continued)

Green dopants		
Pt(II) organometallic complexes, including polydentated ligands		Appl. Phys. Lett. 86, 153505 (2005)
		Appl. Phys. Lett. 86, 153505 (2005)
		Chem. Lett. 34, 592 (2005)
		WO2002015645
		US20060263635
		US20060182992 US20070103060

(continued)

Green dopants		
Cu complexes		WO2009000673
		US20070111026
Gold complexes		Chem. Commun. 2906 (2005)
Rhenium(III) complexes		Inorg. Chem. 42, 1248 (2003)
Osmium(II) complexes		US7279704

(continued)

Green dopants		
Deuterated organometallic complexes		US20030138657
Organometallic complexes with two or more metal centers		US20030152802
		US7090928

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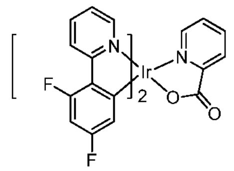
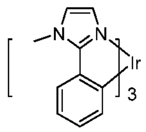
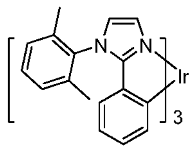
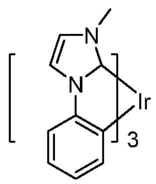
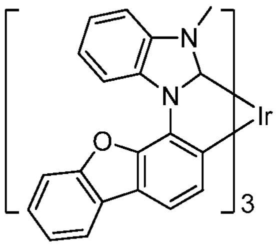
Blue dopants		
Iridium(III) organometallic complexes		WO2002002714
		WO2006009024
		US20060251923 US20110057559 US20110204333
		US7393599, WO2006056418, US20050260441, WO2005019373
		US7534505

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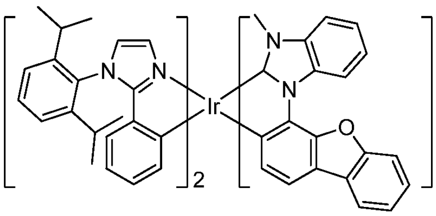
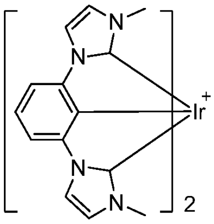
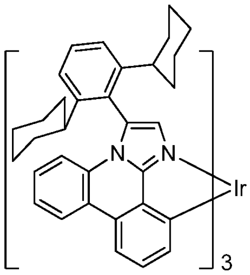
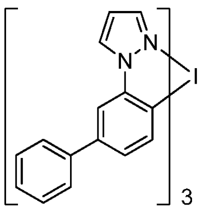
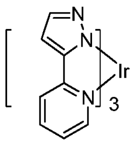
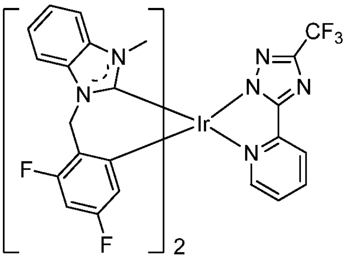
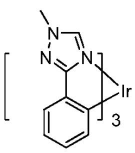
Blue dopants		
		WO2011051404
		US7445855
		US20070190359, US20080297033 US20100148663
		US7338722
		US20020134984
		Angew. Chem. Int. Ed. 47, 4542 (2008)
		Chem. Mater. 18, 5119 (2006)

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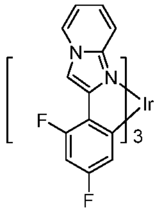
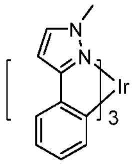
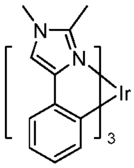
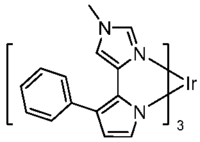
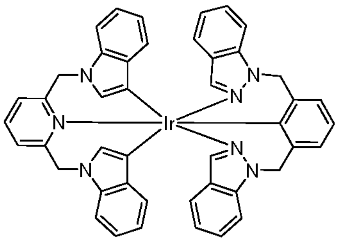
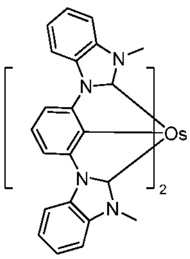
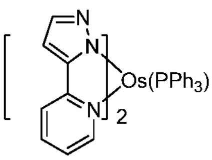
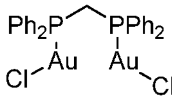
Blue dopants		
		Inorg. Chem. 46, 4308 (2007)
		WO2005123873
		WO2005123873
		WO2007004380
		WO2006082742
Osmium(II) complexes		US7279704
		Organometallics 23, 3745 (2004)
Gold complexes		Appl. Phys. Lett.74,1361 (1999)

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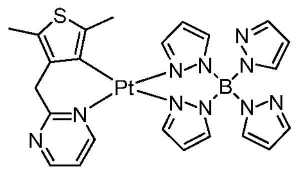
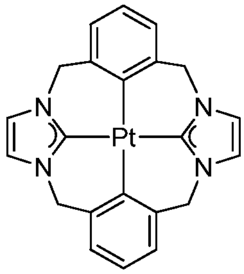
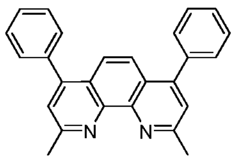
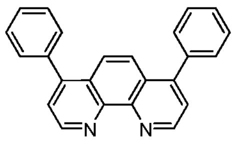
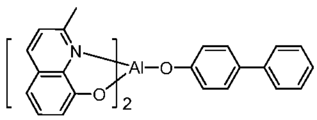
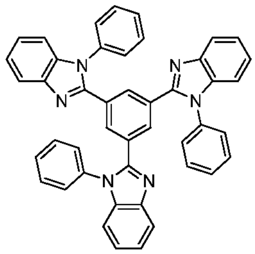
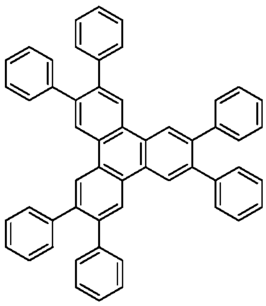
Blue dopants		
Platinum(II) complexes		WO2006098120, WO2006103874
Pt tetradentate complexes with at least one metal-carbene bond		US7655323
Exciton/hole blocking layer materials		
Bathocuprine compounds (e.g., BCP, BPhen)		Appl. Phys. Lett. 75, 4 (1999)
		Appl. Phys. Lett. 79, 449 (2001)
Metal 8-hydroxyquinolates (e.g., BAlq)		Appl. Phys. Lett. 81, 162 (2002)
5-member ring electron deficient heterocycles such as triazole, oxadiazole, imidazole, benzoimidazole		Appl. Phys. Lett. 81, 162 (2002)
Triphenylene compounds		US20050025993

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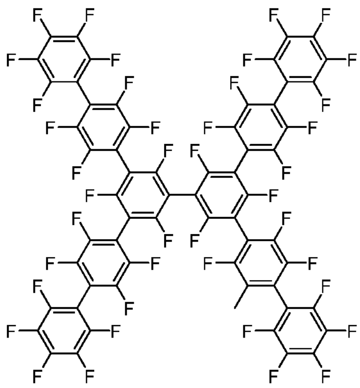
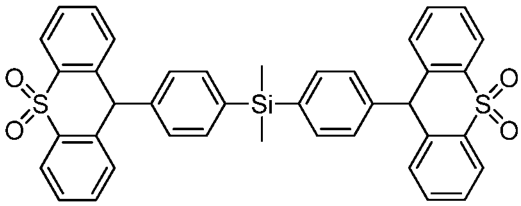
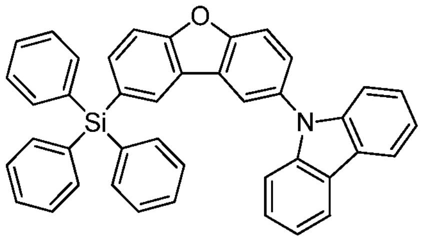
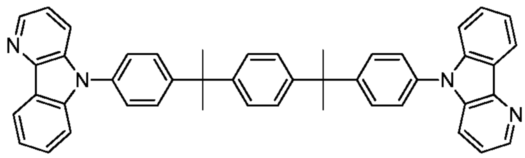
Exciton/hole blocking layer materials		
Fluorinated aromatic compounds		Appl. Phys. Lett. 79, 156 (2001)
Phenothiazine-S-oxide		WO2008132085
Silylated five-membered nitrogen, oxygen, sulfur or phosphorus dibenzoheterocycles		WO2010079051
Aza-carbazoles		US20060121308

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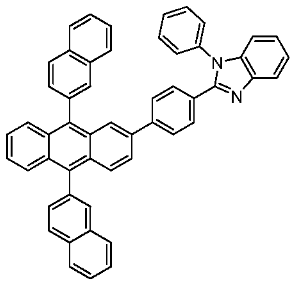
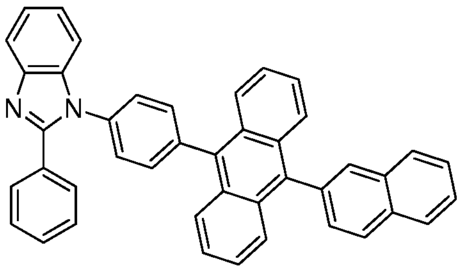
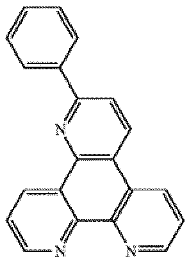
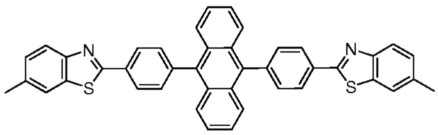
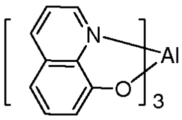
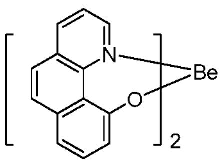
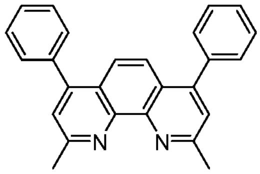
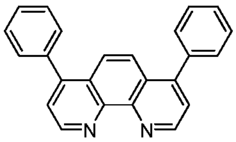
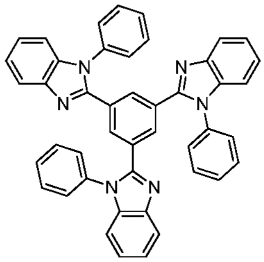
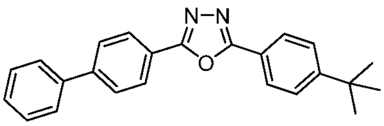
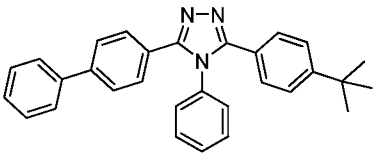
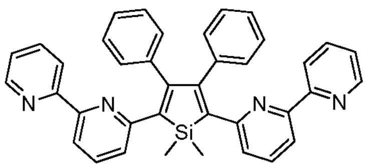
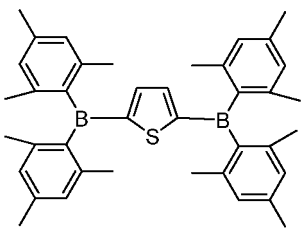
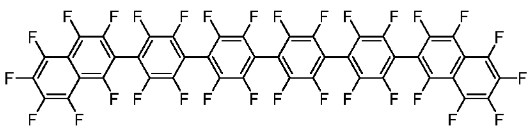
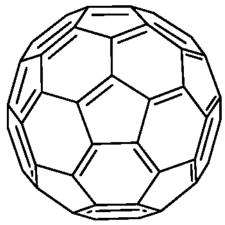
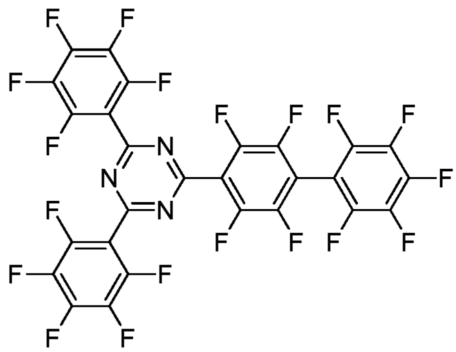
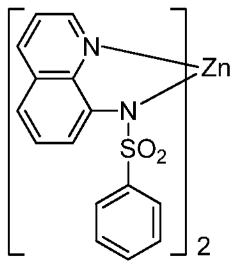
Electron transporting materials		
Anthracene-benzoimidazole compounds		WO2003060956
		US20090179554
Aza triphenylene derivatives		US20090115316
Anthracene-benzothiazole compounds		Appl. Phys. Lett. 89, 063504 (2006)
Metal 8-hydroxyquinolates (e.g., Alq_3, Zrq_4)		Appl. Phys. Lett. 51, 913 (1987) US7230107
Metal hydroxybenoquinolates		Chem. Lett. 5, 905 (1993)

(continued)

Electron transporting materials		
Bathocuprine compounds such as BCP, BPhen, etc		Appl. Phys. Lett. 91, 263503 (2007)
		Appl. Phys. Lett. 79, 449 (2001)
5-member ring electron deficient heterocycles (e.g.,triazole, oxadiazole, imidazole, benzoimidazole)		Appl. Phys. Lett. 74, 865 (1999)
		Appl. Phys. Lett. 55, 1489 (1989)
		Jpn. J. Apply. Phys. 32, L917 (1993)
Silole compounds		Org. Electron. 4, 113 (2003)
Arylborane compounds		J. Am. Chem. Soc. 120, 9714 (1998)
Fluorinated aromatic compounds		J. Am. Chem. Soc. 122, 1832 (2000)

(continued)

Electron transporting materials		
Fullerene (e.g., C60)		US20090101870
Triazine complexes		US20040036077
Zn (N^N) complexes		US6528187

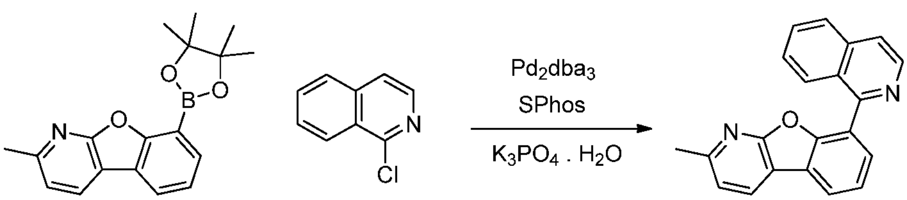
EXPERIMENTAL

Synthetic Examples

[0089] All reactions were carried out under nitrogen protections unless specified otherwise. All solvents for reactions are anhydrous and used as received from commercial sources.

Synthesis of 8-(isoquinolin-1-yl)-2-methylbenzofuro[2,3-b]pyridine

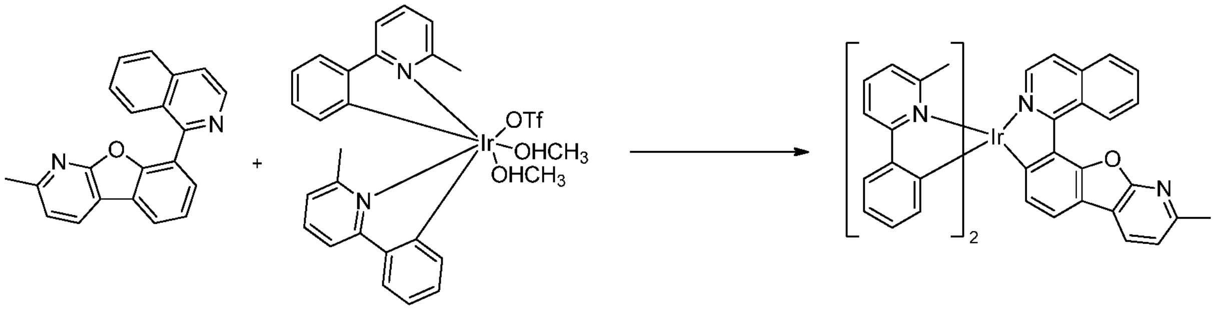
[0090]



[0091] 2-methyl-8-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)benzofuro[2,3-b]pyridine (4.73 g, 15.3 mmol), 1-chloroisoquinoline (2.75 g, 16.8 mmol), Pd_2dba_3 (0.28 g, 0.31 mmol), SPhos (0.50 g, 1.22 mmol), and $K_3PO_4.H_2O$ (10.6 g, 45.9 mmol) were dissolved in toluene (170 mL) and Water (20 mL), degassed by bubbling nitrogen, and heated to 100°C overnight. Upon completion of the reaction, the reaction mixture was cooled to room temperature and extracted with toluene. The crude material was purified via column chromatography using 20% ethyl acetate in 80% heptanes. It was noticed that a lot of deborylated compound was collected. After most of the impurity had come out, the mobile phase was gradually increased to 40% ethyl acetate in heptanes. The material was recrystallized from methanol to obtain the pure product, 8-(isoquinolin-l-yl)-2-methylbenzofuro[2,3-b]pyridine (0.60 g, 13 % yield).

Synthesis of Compound 10

[0092]

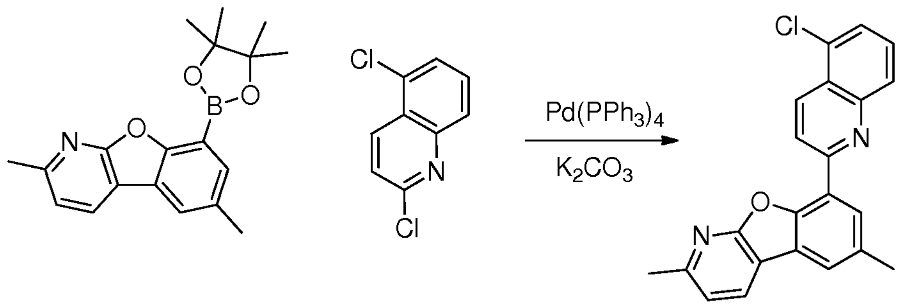


[0093] The Ir(III) intermediate shown above, left, (0.510 g, 0.687 mmol) and 8-(isoquinolin-1-yl)-2-methylbenzofuro[2,3-b]pyridine (0.640 g, 2.062 mmol) were mixed in 7 mL of ethanol and heated to reflux for 36 hours. The reaction was stopped when there was no Ir timer left as shown by HPLC. The mixture was cooled to room temperature and filtered through a pad of Celite. The solid was collected by washing the Celite pad with dichloromethane (DCM). The crude material was purified by column chromatography starting with 50% DCM in heptanes and gradually increasing to 80% DCM in heptanes. The red solid product, compound 10, was collected (0.40 g, 70% yield).

Synthesis of Compound 24

Syntheses of 8-(5-chloroquinolin-2-yl)-2,6-dimethylbenzofuro[2,3-b]pyridine

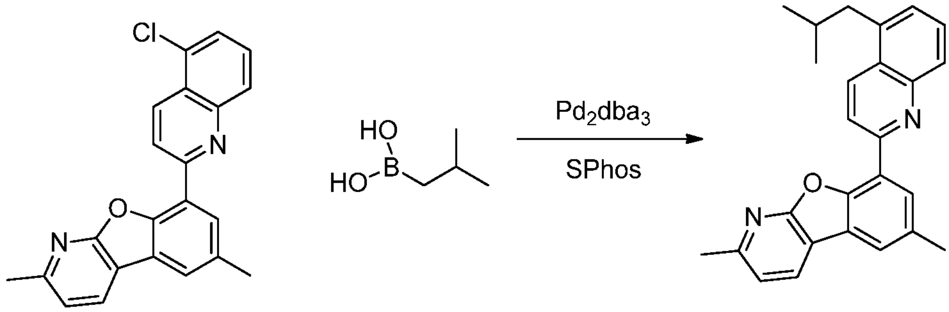
[0094]



[0095] 2,6-dimethyl-8-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)benzofuro[2,3-b]pyridine (7.0 g, 21.7 mmol), 2,5-dichloroquinoline (4.50 g, 22.7 mmol), and K_2CO_3 (5.99 g, 43.3 mmol) were dissolved in toluene (180 mL) and water (36 mL). The mixture was degassed by bubbling with nitrogen for 15 minutes, then $Pd(PPh_3)_4$ (1.25 g, 1.08 mmol) was added and the mixture was heated to reflux overnight. Upon completion, the mixture was cooled to room temperature, extracted using ethyl acetate, and the organic layer was washed with brine ansd water. The crude mixture was filtered through a plug of silica using a dichloromethane and ethyl acetate mixture. After evaporation of the solvent, the product was triturated from heptanes to yield pure 8-(5-chloroquinolin-2-yl)-2,6-dimethylbenzofuro[2,3-b]pyridine (6.0 g, 77% yield).

Synthesis of 8-(5-isobutylquinolin-2-yl)-2,6-dimethylbenzofuro[2,3-b]pyridine

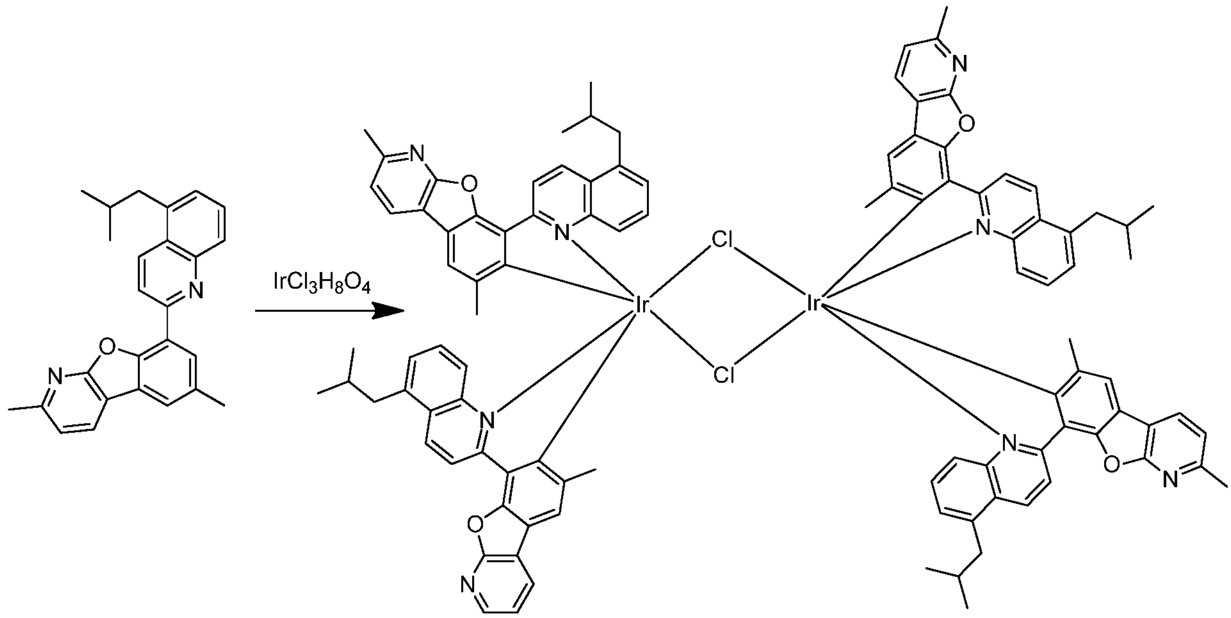
[0096]



[0097] 8-(5-chloroquinolin-2-yl)-2,6-dimethylbenzofuro[2,3-b]pyridine (4.75 g, 13.2 mmol), isobutylboronic acid (2.70 g, 26.5 mmol), Pd_2dba_3 (0.24 g, 0.27 mmol),dicyclohexyl(2',6'-dimethoxy-[1,1'-biphenyl]-2-yl)phosphine (SPhos) (0.44 g, 1.06 mmol), and K_3PO_4 (5.62 g, 26.5 mmol) were dissolved in toluene (150 mL) and water (15 mL). The solution was degassed by bubbling nitrogen for 15 minutes, then refluxed overnight. Upon completion, the mixture was cooled to room temperature, extracted using ethyl acetate, and washed with water. The crude product was purified by column chromatography using 25% ethyl acetate in heptanes. The product was further purified by recrystallization from heptanes to yield 8-(5-isobutylquinolin-2-yl)-2,6-dimethylbenzofuro[2,3-b]pyridine (4.5 g, 89% yield)

Synthesis of Ir(III) Dimer

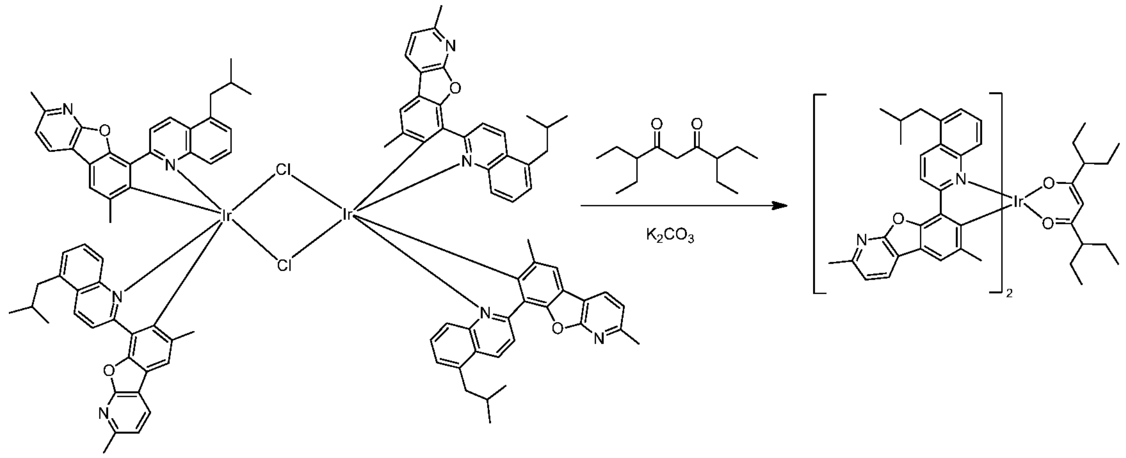
[0098]



[0099] 8-(5-isobutylquinolin-2-yl)-2,6-dimethylbenzofuro[2,3-b]pyridine (3.00 g, 7.88 mmol) was solubilized in ethoxyethanol (25 mL) and water (8 mL), then degassed by bubbling nitrogen for 30 minutes. Iridium chloride (0.97 g, 2.63 mmol) was then added to the solution and the reaction was refluxed under nitrogen for 24h. After cooling to room temperature, the solid was filtered, washed with methanol, and dried to give the Ir(III) Dimer (1.95 g, 0.99 mmol, 75 % yield) as a light orange powder.

Synthesis of Compound 24.

[0100]

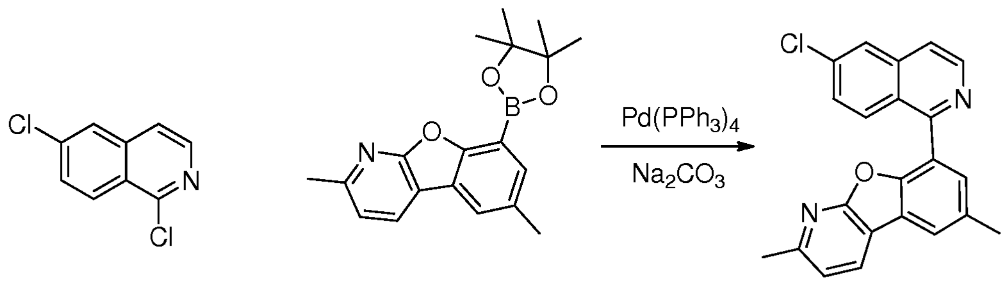


[0101] Ir(III) dimer (0.39 g, 0.20 mmol) and 3,7-diethylnonane-4,6-dione (0.42 g, 1.98 mmol) were added to a flask. The mixture was diluted in ethoxyethanol (6.6 mL) and degassed by bubbling nitrogen for 15 minutes. K_2CO_3 (0.27 g, 1.98 mmol) was then added to the mixture, which was then stirred at room temperature overnight. Upon completion of the reaction, the mixture was diluted in dichloromethane (DCM), filtered through a pad of Celite, and washed with more DCM. The solvents were evaporated and the crude material was purified by column chromatography using triethylamine (TEA) pre-treated silica gel. The mobile phase used was 10% DCM in heptanes. The resulting product - Compound 24 - was purified by recrystallization from a DCM and methanol mixture to afford 0.2 g (44% yield).

Synthesis of Compound 44

Syntheses of 8-(6-chloroisoquinolin-1-yl)-2,6-dimethylbenzofuro[2,3-b]pyridine

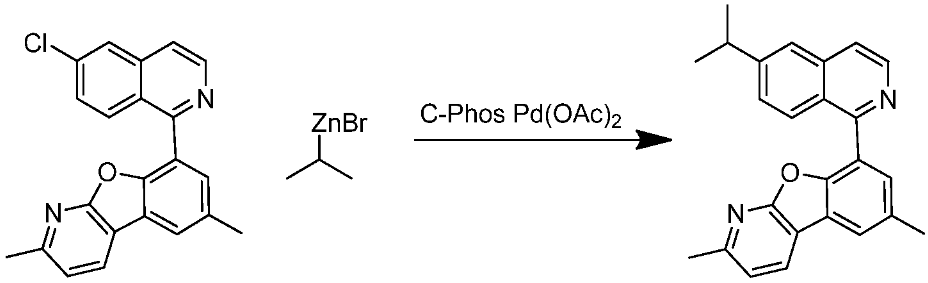
[0102]



[0103] 1,6-dichloroisoquinoline (4.80 g, 24.2 mmol), 2,6-dimethyl-8-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)benzofuro[2,3-b]pyridine (8.22 g, 25.4 mmol), sodium carbonate (6.42 g, 60.6 mmol), palladium tetrakis (0.84 g, 0.73 mmol), 160 mL dimethoxyethane (DME) and 40 mL of water were combined in a round bottom flask. A condenser was attached and then the system was evacuated and purged with nitrogen three times. The reaction mixture was heated to a vigorous reflux overnight. The reaction mixture was diluted with ethyl acetate and water, the suspension was then filtered through Celite and washed with ethyl acetate. The aqueous portion was partitioned off and the organic was washed once with brine, dried with sodium sulfate, filtered, and concentrated down to beige solid. The Celite was further washed with 50/50 DCM/THF and the filtrate was concentrated and combined with the other crude sample. The combined crude sample was dissolved in DCM and purified with silica gel using DCM to 85/15 DCM/ethyl acetate solvent system to get a pale beige solid. The pale beige solid was triturated in 90/10 heptane/ethyl acetate, then filtered to get a white precipitate of 8-(6-chloroisoquinolin-1-yl)-2,6-dimethylbenzofuro[2,3-b]pyridine (7.8 g, 91% yield).

Syuthesis of 8-(6-isopropylisoquinolin-1-yl)-2, 6-dimethylbenzofuro[2,3-b]pyridine

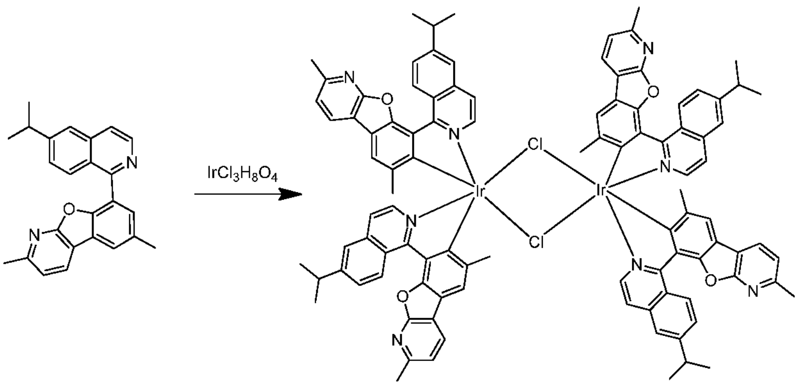
[0104]



[0105] 8-(6-chloroisoquinolin-1-yl)-2,6-dimethylbenzofuro[2,3-b]pyridine (4.0 g, 11.2 mmol), 2'-(dicyclohexylphosphino)-N2,N2,N6,N6-tetramethyl-[1,1'-biphenyl]-2,6-diamine (0.39 g, 0.89 mmol), diacetoxypalladium (0.10 g, 0.45 mmol) and 200 ml anhydrous THF were combined in an oven dried three neck round bottom flask. A condenser was attached then the system was evacuated and purged with nitrogen three times. The reaction was heated to 60° for 15 min to dissolve the reactant and form the catalyst to get a pale brown solution. The reaction was then cooled to 0°C, then isopropylzinc(II) bromide (33 mL, 16.7 mmol) was added rapidly with a syringe through a septum. The reaction mixture was allowed to stir in the ice bath for 30 minutes then removed to let it warm to room temperature.Upon completion of the reaction, it was quenched with ammonium chloride solution then filtered through a Celite plug. The Celite was washed well with ethyl acetate. The aqueous portion was partitioned off and the organic portion was washed once with brine, dried with sodium sulfate, filtered, and then concentrated down to yield 5.5 g of a brown solid. The brown solid was dissolved in DCM and purified with a silica gel cartridge using a DCM to 85/15 DCM/EtOac solvent system to get 3.8 g of an off-white sticky solid. The sample was dissolved in acetonitrile and purified with C18 cartridges using a 50/50 to 85/15 acetonitrile/water solvent system. This produced 1.3 g of pure white solid. The crude fraction were re-purified using the same technique to produce 2.2 g (54% yield) of 8-(6-isopropylisoquinolin-1-yl)-2, 6-dimethylbenzofuro[2,3-b]pyridine, the pure target compound.

Synthesis of Ir(III) Dimer

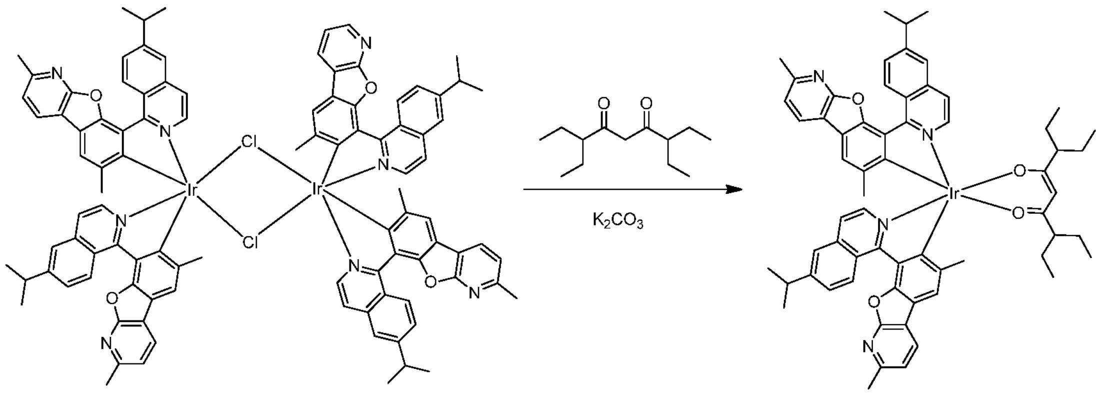
[0106]



[0107] 8-(6-isopropylisoquinolin-1-yl)-2,6-dimethylbenzofuro[2,3-b]pyridine (2.5 g, 6.82 mmol) was solubilized in ethoxyethanol (19 mL) and water (6 mL), then degassed with nitrogen for 30 minutes. Iridium chloride (0.56 g, 1.52 mmol) was then added to the solution and the reaction mixture was refluxed under nitrogen for 24 hours. After cooling to room temperature, the solid was filtered, washed with methanol, and dried to give Ir (III) Dimer (1.9 g, 0.99 mmol, 131 % yield) as a brown powder. The yield was higher than 100% because of the ligand remaining within the solid. The solid was used as is.

Syntheses of Compound 44

[0108]

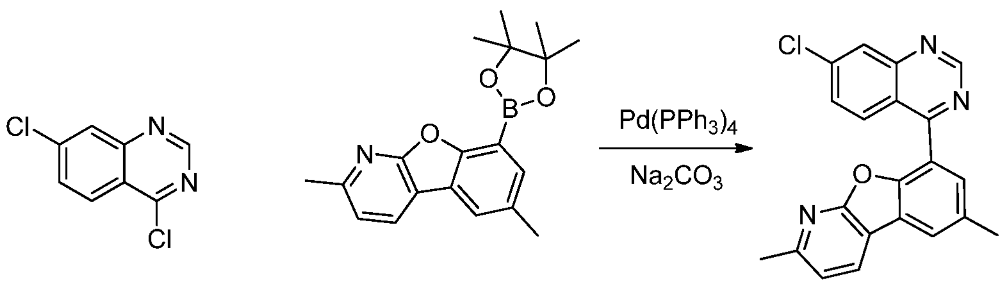


[0109] The Ir(III) Dimer (1.22 g, 0.78 mmol) and 3,7-diethylnonane-4,6-dione (1.66 g, 7.84 mmol) were solubilized in 2-ethoxyethanol (26 mL) and degassed by bubbling nitrogen for 15 minutes. Potassium carbonate (1.08 g, 7.84 mmol) was then added and the mixture was stirred at room temperature overnight. The dimer was not completely consumed, so the mixture was then heated to 50°C for 4 hours. Upon completion, the mixture was diluted in DCM and filtered through a pad of Celite, then washed with DCM. The solvents were evaporated and the crude material was purified by column chromatography (pre-treated with triethylamine) starting from 10% DCM in Heptanes to 40% DCM in Heptanes. The dark red solid weas recrystallized from a mixture of DCM and methanol to yield the pure product, Compound 44 (1.4g, 63% yield).

Synthesis of Compound 56

Syntheses of 8-(7-chloroquinazolin-4-yl)-2,6-dimethylbenzofuro[2,3-b]pyridine

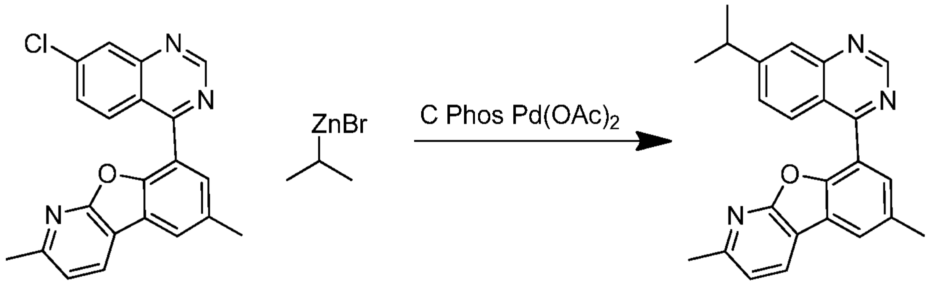
[0110]



[0111] 4,7-dichloroquinazoline (3.00 g, 15.1 mmol) and 2,6-dimethyl-8-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)benzofuro[2,3-b]pyridine (5.11 g, 15.8 mmol), and K_2CO_3 (4.17 g, 30.1 mmol) were dissolved in DME (150 mL) and Water (40 mL). The solution was degassed by bubbling nitrogen gas, $Pd(PPh_3)_4$ (0.70 g, 0.60 mmol) was added and the reaction was heated to reflux overnight. Upon completion of the reaction, the mixture was extracted with three times with ethyl acetate and washed with water. The crude material was purified by column chromatography using Heptanes/EA (90/10 to 80/20) solvent system. The solvent of the combined was removed under vacuum to afford 8-(7-chloroquinazolin-4-yl)-2,6-dimethylbenzofuro[2,3-b]pyridine (5.0 g, 92% yield) as a white solid.

Synthesis of 8-(7-isopropylquinazolin-4-yl)-2,6-dimethylbenzofuro[2,3-b]pyridine

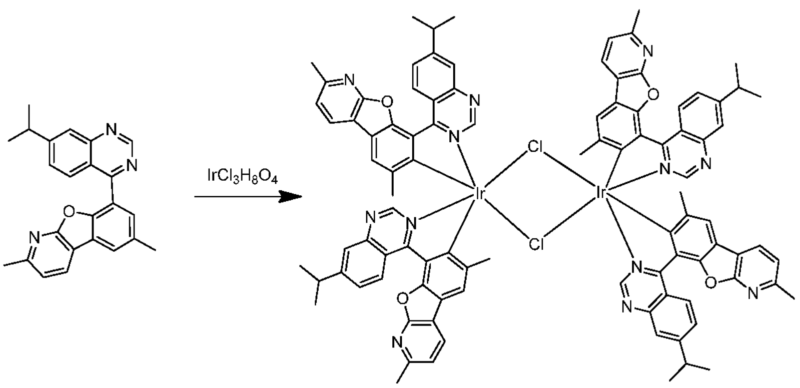
[0112]



[0113] 8-(7-chloroquinazolin-4-yl)-2,6-dimethylbenzofuro[2,3-b]pyridine (3.33 g, 9.25 mmol), 2'-(dicyclohexylphosphino)-N2,N2,N6,N6-tetramethyl-[1,1'-biphenyl]-2,6-diamine (CPhos) (0.32 g, 0.74 mmol) and diacetoxypalladium (0.08 g, 0.37 mmol) were diluted in dry THF (185 mL). The solution was cooled down to 0°C and a solution of isopropylzinc(II) bromide (28 mL, 13.9 mmol) was added dropwise. The reaction was stirred for 30 minutes at this temperature and then stirred overnight at room temperature. Upon completion, the reaction was quenched with a solution of ammonium chloride, extracted with ethyl acetate and washed with Brine and water. The crude material was purified by column chromatography using Heptanes/EA/DCM (60/30/10 to 45/10/45) solvent system.The resulting solid still contained around 1% of *n*-propyl isomer. In order to remove that impurity, the product was purified by reverse phase column chromatography using Acetonitrile/Water (80/20). The removal of the *n*-propyl was successful but there was still some starting material left. The product was further purified two times by column chromatography using the same solvent system as described before. The title compound 8-(7-isopropylquinazolin-4-yl)-2,6-dimethylbenzofuro[2,3-b]pyridine (1.6 g, 47% yield) was afforded as a white powder.

Synthesis of Ir(III) Dimer

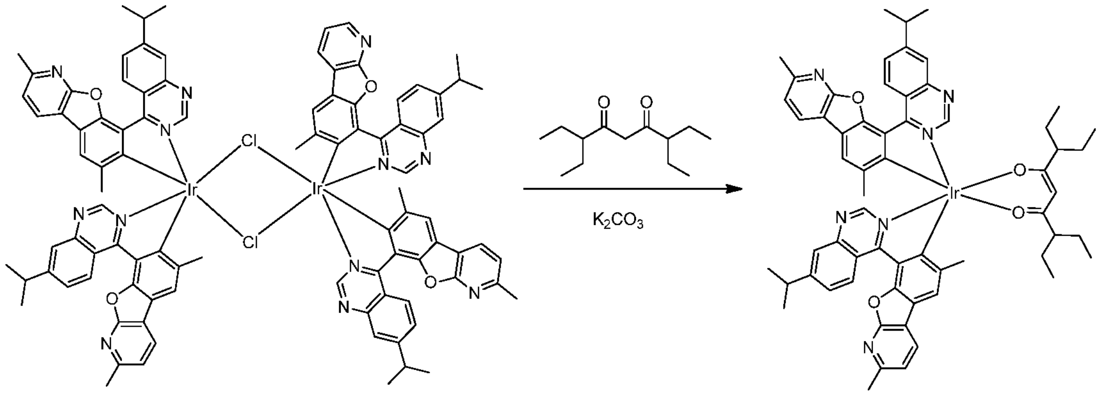
[0114]



[0115] 8-(7-isopropylquinazolin-4-yl)-2,6-dimethylbenzofuro[2,3-b]pyridine (1.6 g, 4.35 mmol) was solubilized in ethoxyethanol (13 mL) and Water (4 mL) and degassed by bubbling nitrogen gas for 30 minutes. Iridium chloride (0.38 g, 1.03 mmol) was then added to the solution and the reaction was refluxed under nitrogen for 24 hours. After cooling down to room temperature, the solid was filtered, washed with methanol and dried to give Ir(III) Dimer (1.0 g, 100 % yield) as an orange powder. There is still ligand left but will use without further purification.

Synthesis of Compound 56

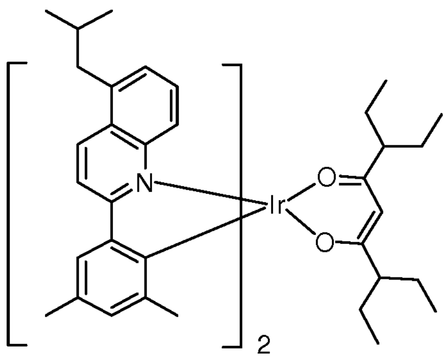
[0116]



[0117] Ir(III) Dimer (1.0 g, 0.52 mmol) and 3,7-diethylnonane-4,6-dione (1.11 g, 5.21 mmol) were diluted in ethoxyethanol (20 mL) and the mixture was degassed by bubbling nitrogen gas. K_2CO_3 (0.72 g, 5.21 mmol) was then added and the reaction was stirred at room temperature overnight. The mixture was diluted with DCM, filtered through a pad of Celite, and washed with DCM. The crude material was purified by column chromatography (silica pre-treated with TEA) using Heptanes/DCM 90/10 solvent system. The product was triturated in methanol and the title compound was afforded as a red powder (0.16 g, 14 % yield).

Device Examples

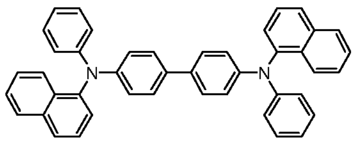
[0118] The inventors have verified the benefits of the inventive compounds disclosed herein by fabricating experimental OLED devices. Device examples were made using Compound 24, Compound 56, and Compound 10 as an emitter material in the emissive layer. A Comparative Device was made using Comparative Compound 1 shown below:



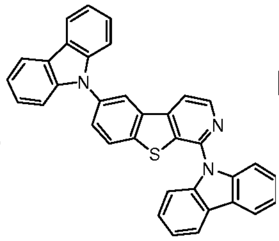
Comparative Compound 1

[0119] All example devices were fabricated by high vacuum (<10^{-7} Torr) thermal evaporation. The anode electrode is 1200 Å of indium tin oxide (ITO). The cathode consisted of 10 Å of LiF followed by 1,000 Å of Al. All devices are encapsulated with a glass lid sealed with an epoxy resin in a nitrogen glove box (<1 ppm of H_2O and O_2) immediately after fabrication, and a moisture getter was incorporated inside the package.

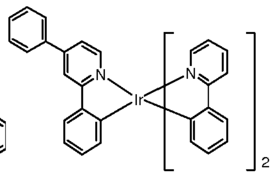
[0120] The organic stack of the device examples consisted of sequentially, from the ITO surface, 100 Å of LG101(purchased from LG chem) as the hole injection layer (HIL); 400 Å of 4,4'-bis[N-(1-naphthyl)-N-phenylamino]biphenyl (NPD) as the hole transporting layer (HTL); 300 Å of an emissive layer (EML) containing Compound H as a host (79%), a stability dopant (SD) (18%), and Compound 24, Compound 56, or Compound 10 as an emitter; 100 Å of Compound H as a blocking layer; and 450 Å of Alq_3 (tris-8-hydroxyquinoline aluminum) as the ETL. The emitter was selected to provide the desired color and the stability dopant (SD) was mixed with the electron-transporting host and the emitter to help transport positive charge in the emissive layer. The Comparative Example was fabricated similarly to the device examples except that Comparative Compound 1 was used as the emitter in the EML. Table 2 shows the composition of the EML in the device, while the device results and data are summarized in Table 3. As used herein, NPD, compound H, SD, and Alq_3 have the following structures:



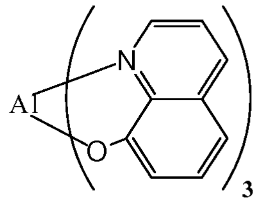
NPD



Compound H



SD



Alq_3

Table 2 Compounds of EML in the devices

Example	Host	Stability dopant	Emitter
Device Example 1	Compound H	SD	Compound 24
Device Example 2			Compound 56
Device Example 3			Compound 10
Comparative example			Comparative compound 1

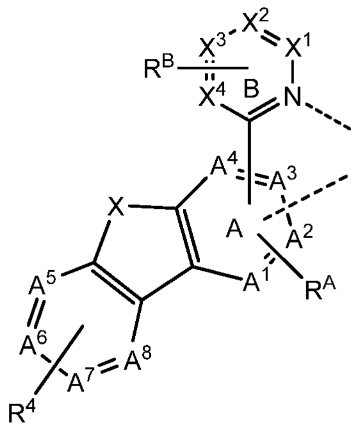
Table 3 Device results

	1931 CIE		λ **max [nm]**	**FWHM [nm]**	**At 80mA/cm^2 Relative LT$_{95\%\ [h]}$**
	X	y			
Device Example 1	0.63	0.37	606	42	3.1
Device Example 2	0.68	0.32	648	54	6.3
Device Example 3	0.60	0.39	614	88	8
Comparative example	0.64	0.36	612	52	1

Table 3 summarizes the performance of the devices. The 1931 CIE values were measured at 10 mA/cm^2. The device operation lifetime measurements were performed at a constant dc current of 80 mA/cm^2 at room temperature with light output monitored as a function of time. The operational lifetimes defined at 95% of the initial luminance ($LT_{95\%}$). The lifetime of the Comparative Example was set to 1 and the lifetimes of device examples are indicated as relative values compared to the Comparative Example (*i.e.,* a value of 2 indicates a $LT_{95\%}$ that is twice that of the Comparative Example). Device Example 1 has a full width at half maximum (FWHM) that is 10 nm narrower than the Comparative Example. Device Example 1 also exhibited a $LT^{95\%}$ at 80mA/cm^2 more than three times longer than the Comparative Device. Device Example 2 exhibits a 42nm red shift of the peak wavelength compared to Device Example 1 and had a $LT_{95\%}$ at 80mA/cm^2 double that of Device Example 1. Device Example 3 exhibits a FWHM 36 nm wider than the Comparative Examiner, but also exhibits a $LT_{95\%}$ at 80mA/cm^2 that is 8 times the $LT_{95\%}$ of the Comparative Example.

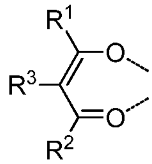
Claims

1. A compound having a formula $M(L_A)_x(L_B)_y(L_C)_z$: wherein ligand L_A is



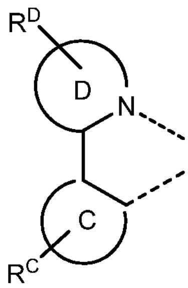
;

wherein ligand L_B is



;

wherein ligand L_C is



;

wherein M is a metal having an atomic number greater than 40;
wherein x is 1, or 2;
wherein y is 0, 1, or 2;
wherein z is 0, 1, or 2;
wherein x+y+z is the oxidation state of the metal M;
wherein X^1, X^2, X^3, X^4, A^1, A^2, A^3, A^4, A^5, A^6, A^7, and A^8 are C or N;
wherein at least one of A^1, A^2, A^3, A^4, A^5, A^6, A^7, and A^8 is N;
wherein ring B is bonded to ring A through a C-C bond;
wherein M is bonded to ring A through a M-C bond;
wherein X is O, S, or Se;
wherein rings C, and D are each independently a 5 or 6-membered carbocyclic or heterocyclic ring;
wherein R^A represents mono, or di-substitution, or no substitution;
wherein R^B represents di, tri, or tetra-substitution;
wherein R^C, R^D, and R^4 each independently represent mono, di, tri, or tetra-substitution, or no substitution;
wherein two adjacent R^B form a six-member aromatic carbocyclic or heterocyclic ring E fused to ring B; wherein, when ring E is heterocyclic, the only heteroatom is nitrogen; wherein ring E can be further substituted by R^E; and wherein R^E represents mono, di, tri, or tetra-substitution, or no substitution;
wherein each of R^A, R^B, R^C, R^D, R^E, R^1, R^2, R^3, and R^4 are independently selected from the group consisting of hydrogen, deuterium, halide, alkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, aryloxy, amino, silyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, and combinations thereof; and

wherein any adjacent substitutents of R^C, and R^D are optionally joined to form a fused ring.

2. The compound of Claim 1, wherein M is Ir.

3. The compound of Claim 1 or 2, wherein X is O.

4. The compound of any one of Claims 1 to 3, wherein the compound has the formula $M(L_A)_2(L_B)$.

5. The compound of any one of Claims 1 to 3, wherein the compound has the formula $M(L_A)(L_C)_2$.

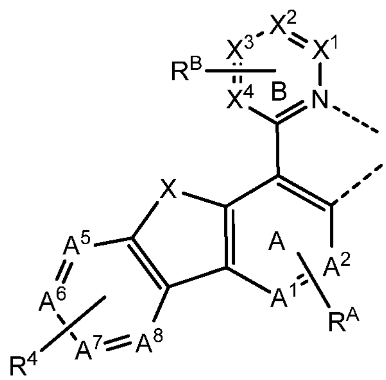
6. The compound of any one of Claims 1 to 5, wherein only one of A^1 to A^8 is N.

7. The compound of any one of Claims 1 to 6, wherein only one of A^5 to A^8 is N.

8. The compound of any one of Claims 1 to 7, wherein X^1, X^2, X^3, and X^4 are C; and ring E is benzene.

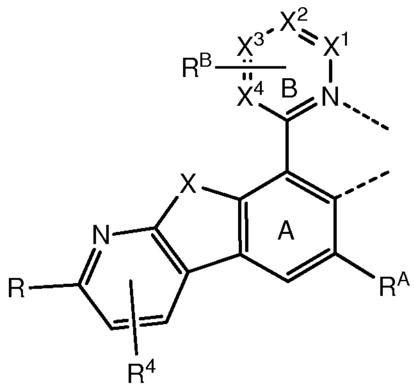
9. The compound of any one of Claims 1 to 7, wherein (a) at least one of X^1, X^2, X^3, and X^4 is N, (b) ring E is heterocylic, or (c) both.

10. The compound of any one of Claims 1 to 9, wherein L_A has the formula:



.

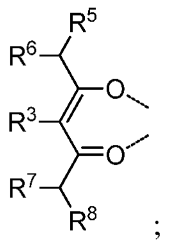
11. The compound of any one of Claims 1 to 10, wherein L_A has the formula:



;

wherein R is selected from the group consisting of alkyl, cycloalkyl, and combinations thereof.

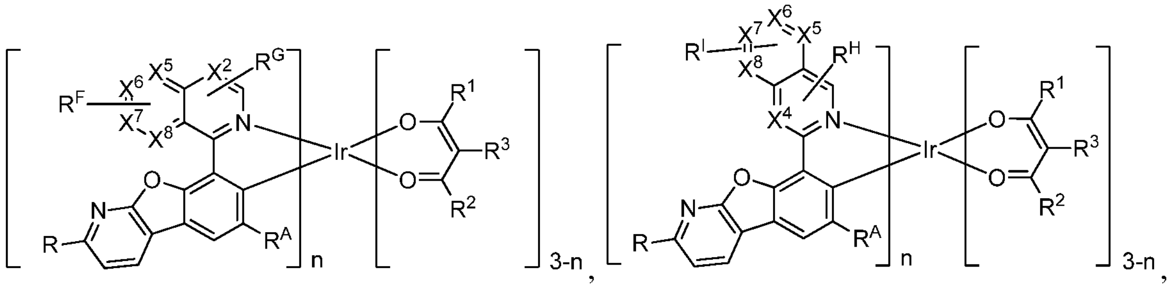
12. The compound of any one of Claims 1 to 4 and 6 to 11, wherein L_B has the formula:



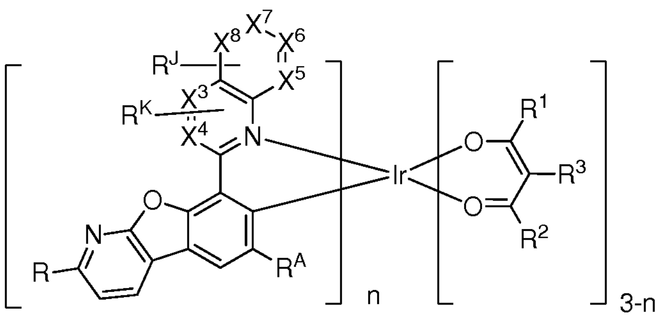
wherein R^5, R^6, R^7, and R^8 are independently selected from group consisting of alkyl, cycloalkyl, aryl, and heteroaryl; wherein at least one of R^5, R^6, R^7, and R^8 has at least two C atoms.

13. The compound of any one of Claims 1 to 3 and 5 to 11, wherein ring C is benzene, and ring D is pyridine.

14. The compound of any one of Claims 1 to 4 and 6 to 12, wherein the compound is selected from the group consisting of:



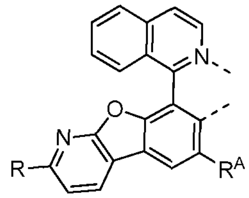
and



wherein each of R^F, R^G, R^H, R^I, R^J, and R^K are independently selected from the group consisting of hydrogen, deuterium, halide, alkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, aryloxy, amino, silyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, and combinations thereof; and wherein X^5, X^6, X^7, and X^8 are C or N.

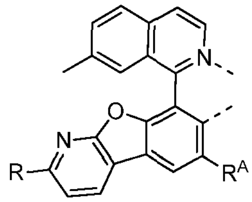
15. The compound of Claim 1, wherein L_A is selected from the group consisting of:

L_{A1} through L_{A13}, each represented by the formula



wherein in L_{A1}, R = H, and R^A = H,
in L_{A2}, R = H, and R^A = CH_3,

L_{A14} through L_{A26}, each represented by the formula



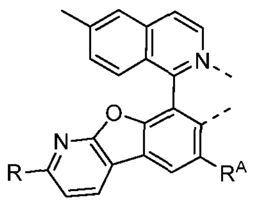
wherein in L_{A14}, R = H, and R^A = H,
in L_{A15}, R = H, and R^A = CH_3,

(continued)

in L_{A3}, R = H, and R^A = CD_3,
in L_{A4}, R = CH_3, and R^A = H,
in L_{A5}, R = CD_3, and R^A = H,
in L_{A6}, R = CH_3, and R^A = CH_3,
in L_{A7}, R = CD_3, and R^A = CD_3,
in L_{A8}, R = Ethyl, and R^A = H,
in L_{A9}, R = Ethyl, and R^A = CH_3,
in L_{A10}, R = Ethyl-*d5*, and R^A = CD_3,
in L_{A11}, R = isopropyl, and R^A = H,
in L_{A12}, R = isopropyl, and R^A = CH_3,
in L_{A13}, R = isopropyl-*d7*, and R^A = CD_3
,

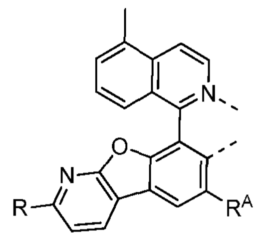
in L_{A16}, R = H, and R^A = CD_3,
in L_{A17}, R = CH_3, and R^A = H,
in L_{A18}, R = CD_3, and R^A = H,
in L_{A19}, R = CH_3, and R^A = CH_3,
in L_{A20}, R = CD_3, and R^A = CD_3,
in L_{A21}, R = Ethyl, and R^A = H,
in L_{A22}, R = Ethyl, and R^A = CH_3,
in L_{A23}, R = Ethyl-*d5*, and R^A = CD_3,
in L_{A24}, R = isopropyl, and R^A = H,
in L_{A25}, R = isopropyl, and R^A = CH_3,
in L_{A26}, R = isopropyl-*d7*, and R^A = CD_3,
,

L_{A27} through L_{A39}, each represented by the formula



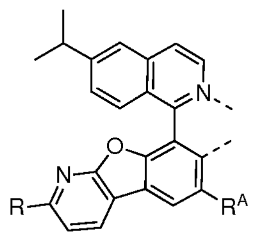
wherein in L_{A27}, R = H, and R^A = H,
in L_{A28}: R = H, and R^A = CH_3,
in L_{A29}: R = H, and R^A = CD_3,
in L_{A30}: R = CH_3, and R^A = H,
in L_{A31}: R = CD_3, and R^A = H,
in L_{A32}: R = CH_3, and R^A = CH_3,
in L_{A33}: R = CD_3, and CD_3,
in L_{A34}: R = Ethyl, and R^A = H,
in L_{A35}: R = Ethyl, and R^A = CH_3,
in L_{A36}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A37}: R = isopropyl, and R^A = H,
in L_{A38}: R = isopropyl, and R^A = CH_3,
in L_{A39}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A40} through L_{A52}, each represented by the formula



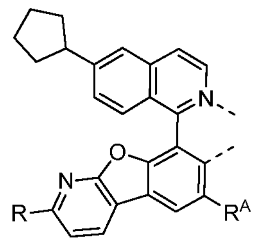
wherein in L_{A40}: R = H, and R^A = H,
in L_{A41}: R = H, and R^A = CH_3,
in L_{A42}: R = H, and R^A = CD_3,
in L_{A43}: R = CH_3, and R^A = H,
in L_{A44}: R = CD_3, and R^A = H,
in L_{A45}: R = CH_3, and R^A = CH_3,
in L_{A46}: R = CD_3, and CD_3,
in L_{A47}: R = Ethyl, and R^A = H,
in L_{A48}: R = Ethyl, and R^A = CH_3,
in L_{A49}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A50}: R = isopropyl, and R^A = H,
in L_{A51}: R = isopropyl, and R^A = CH_3,
in L_{A52}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A53} through L_{A65}, each represented by the formula



wherein in L_{A53}: R = H, and R^A = H,
in L_{A54}: R = H, and R^A = CH_3,
in L_{A55}: R = H, and R^A = CD_3,
in L_{A56}: R = CH_3, and R^A = H,

L_{A66} through L_{A78}, each represented by the formula



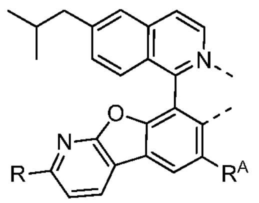
wherein in L_{A66}: R = H, and R^A = H,
in L_{A67}: R = H, and R^A = CH_3,
in L_{A68}: R = H, and R^A = CD_3,
in L_{A69}: R = CH_3, and R^A = H,

(continued)

in L_{A57}: R = CD_3, and R^A = H,
in L_{A58}: R = CH_3, and R^A = CH_3,
in L_{A59}: R = CD_3, and R^A = CD_3,
in L_{A60}: R = Ethyl, and R^A = H,
in L_{A61}: R = Ethyl, and R^A = CH_3,
in L_{A62}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A63}: R = isopropyl, and R^A = H,
in L_{A64}: R = isopropyl, and R^A = CH_3,
in L_{A65}: R = isopropyl-*d7*, and R^A = CD3
,

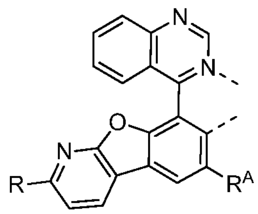
in L_{A70}: R = CD_3, and R^A = H,
in L_{A71}: R = CH_3, and R^A = CH_3,
in L_{A72}: R = CD_3, and R^A = CD_3,
in L_{A73}: R = Ethyl, and R^A = H,
in L_{A74}: R = Ethyl, and R^A = CH_3,
in L_{A75}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A76}: R = isopropyl, and R^A = H,
in L_{A77}: R = isopropyl, and R^A = CH_3,
in L_{A78}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A79} through L_{A91}, each represented by the formula



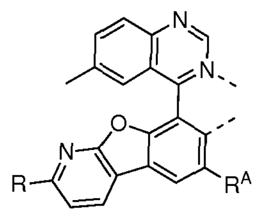
wherein in L_{A79}: R = H, and R^A = H,
n L_{A80}: R = H, and R^A = CH_3,
in L_{A81}: R = H, and R^A = CD_3,
in L_{A82}: R = CH_3, and R^A = H,
in L_{A83}: R = CD_3, and R^A = H,
in L_{A84}: R = CH_3, and R^A = CH_3,
in L_{A85}: R = CD_3, and R^A = CD_3,
in L_{A86}: R = Ethyl, and R^A = H,
in L_{A87}: R = Ethyl, and R^A = CH_3,
in L_{A88}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A89}: R = isopropyl, and R^A = H,
in L_{A90}: R = isopropyl, and R^A = CH_3,
in L_{A91}: R = isopropyl-*d7*, and R^A = CD3
,

L_{A92} through L_{A104}, each represented by the formula



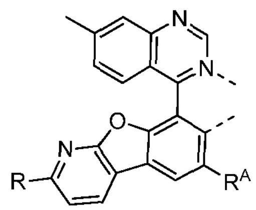
wherein in L_{A92}: R = H, and R^A = H,
in L_{A93}: R = H, and R^A = CH_3,
in L_{A94}: R = H, and R^A = CD_3,
in L_{A95}: R = CH_3, and R^A = H,
in L_{A96}: R = CD_3, and R^A = H,
in L_{A97}: R = CH_3, and R^A = CH_3,
in L_{A98}: R = CD_3, and R^A = CD_3,
in L_{A99}: R = Ethyl, and R^A = H,
in L_{A100}: R = Ethyl, and R^A = CH_3,
in L_{A101}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A102}: R = isopropyl, and R^A = H,
in L_{A103}: R = isopropyl, and R^A = CH_3,
in L_{A104}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A105} through L_{A117}, each represented by the formula



wherein in L_{A105}: R = H, and R^A = H,
in L_{A106}: R = H, and R^A = CH_3,
in L_{A107}: R = H, and R^A = CD_3
in L_{A108}: R = CH_3, and R^A = H,
in L_{A109}: R = CD_3, and R^A = H,
in L_{A110}: R = CH_3, and R^A = CH_3,
in L_{A111}: R = CD_3, and R^A = CD_3,
in L_{A112}: R = Ethyl, and R^A = H,

L_{A118} through L_{A130}, each represented by the formula



wherein in L_{A118}: R = H, and R^A = H,
in L_{A119}: R = H, and R^A = CH_3,
in L_{A120}: R = H, and R^A = CD_3,
in L_{A121}: R = CH_3, and R^A = H,
in L_{A122}: R = CD_3, and R^A = H,
in L_{A123}: R = CH_3, and R^A = CH_3,
in L_{A124}: R = CD_3, and R^A = CD_3
in L_{A125}: R = Ethyl, and R^A = H,

(continued)

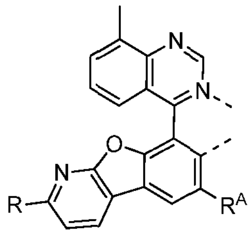
in L_{A113}: R = Ethyl, and $R^A = CH_3$,
in L_{A114}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A115}: R = isopropyl, and R^A = H,
in L_{A116}: R = isopropyl, and $R^A = CH_3$,
in L_{A117}: R = isopropyl-d7, and $R^A = CD_3$

,

in L_{A126}: R = Ethyl, and $R^A = CH_3$,
in L_{A127}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A128}: R = isopropyl, and R^A = H,
in L_{A129}: R = isopropyl, and $R^A = CH_3$,
in L_{A130}: R = isopropyl-*d7*, and $R^A = CD_3$

,

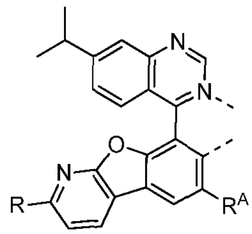
L_{A131} through L_{A143}, each represented by the formula



wherein in L_{A131}: R = H, and R^A = H,
in L_{A132}: R = H, and $R^A = CH_3$,
in L_{A133}: R = H, and $R^A = CD_3$,
in L_{A134}: R = CH_3, and R^A = H,
in L_{A135}: R = CD_3, and R^A = H,
in L_{A136}: R = CH_3, and $R^A = CH_3$,
in L_{A137}: R = CD_3, and $R^A = CD_3$,
in L_{A138}: R = Ethyl, and R^A = H,
in L_{A139}: R = Ethyl, and $R^A = CH_3$,
in L_{A140}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A141}: R = isopropyl, and R^A = H,
in L_{A142}: R = isopropyl, and $R^A = CH_3$,
in L_{A143}: R = isopropyl-*d7*, and $R^A = CD_3$

,

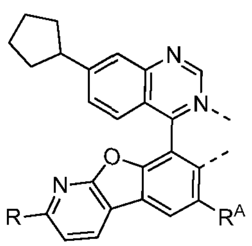
L_{A144} through L_{A156}, each represented by the formula



wherein in L_{A144}: R = H, and R^A = H,
in L_{A145}: R = H, and $R^A = CH_3$,
in L_{A146}: R = H, and $R^A = CD_3$,
in L_{A147}: R = CH_3, and R^A = H,
in L_{A148}: R = CD_3, and R^A = H,
in L_{A149}: R = CH_3, and $R^A = CH_3$,
in L_{A150}: R = CD_3, and $R^A = CD_3$,
in L_{A151}: R = Ethyl, and R^A = H,
in L_{A152}: R = Ethyl, and $R^A = CH_3$,
in L_{A153}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A154}: R = isopropyl, and R^A = H,
in L_{A155}: R = isopropyl, and $R^A = CH_3$,
in L_{A156}: R = isopropyl-*d7*, and $R^A = CD_3$

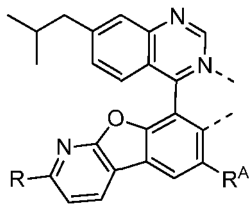
,

L_{A157} through L_{A169}, each represented by the formula



wherein in L_{A157}: R = H, and R^A = H,
in L_{A158}: R = H, and $R^A = CH_3$,
in L_{A159}: R = H, and $R^A = CD_3$,
in L_{A160}: R = CH_3, and R^A = H,
in L_{A161}: R = CD_3, and R^A = H,
in L_{A162}: R = CH_3, and $R^A = CH_3$,
in L_{A163}: R = CD_3, and $R^A = CD_3$,
in L_{A164}: R = Ethyl, and R^A = H,
in L_{A165}: R = Ethyl, and $R^A = CH_3$,
in L_{A166}: R = Ethyl-*d5*, and $R^A = CD_3$,

L_{A170} through L_{A182}, each represented by the formula



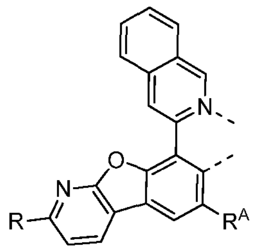
wherein in L_{A170}: R = H, and R^A = H,
in L_{A171}: R = H, and $R^A = CH_3$,
in L_{A172}: R = H, and $R^A = CD_3$.
in L_{A173}: R = CH_3, and R^A = H,
in L_{A174}: R = CD_3, and R^A = H,
in L_{A175}: R = CH_3, and $R^A = CH_3$,
in L_{A176}: R = CD_3, and $R^A = CD_3$,
in L_{A177}: R = Ethyl, and R^A = H,
in L_{A178}: R = Ethyl, and $R^A = CH_3$,
in L_{A179}: R = Ethyl-*d5*, and $R^A = CD_3$,

(continued)

in L_{A167}: R = isopropyl, and R^A = H,
in L_{A168}: R = isopropyl, and R^A = CH_3,
in L_{A169}: R = isopropyl-*d7*, and R^A = CD_3
,

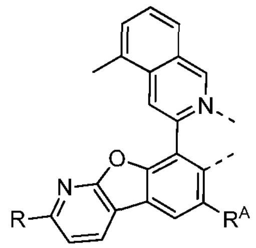
in L_{A180}: R = isopropyl, and R^A = H,
in L_{A181}: R = isopropyl, and R^A = CH_3,
in L_{A182}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A183} through L_{A195}, each represented by the formula



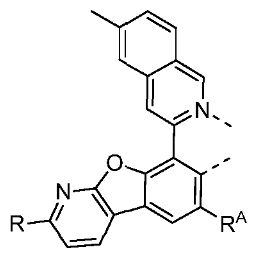
wherein in L_{A183}: R = H, and R^A = H,
in L_{A84}: R = H, and R^A = CH_3,
in L_{A185}: R = H, and R^A = CD_3,
in L_{A186}: R = CH_3, and R^A = H,
in L_{A187}: R = CD_3, and R^A = H,
in L_{A188}: R = CH_3, and R^A = CH_3,
in L_{A189}: R = CD_3, and R^A = CD_3,
in L_{A190}: R = Ethyl, and R^A = H,
in L_{A191}: R = Ethyl, and R^A = CH_3,
in L_{A192}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A193}: R = isopropyl, and R^A = H,
in L_{A194}: R = isopropyl, and R^A = CH_3,
in L_{A195}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A196} through L_{A208}, each represented by the formula



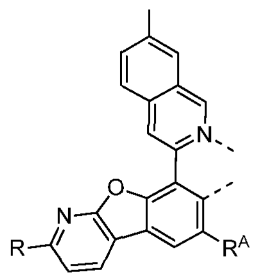
wherein in L_{A196}: R = H, and R^A = H,
in L_{A197} R = H, and R^A = CH_3,
in L_{A198}: R = H, and R^A = CD_3
in L_{A199}: R = CH_3, and R^A = H,
in L_{A200}: R = CD_3, and R^A = H,
in L_{A201}: R = CH_3, and R^A = CH_3,
in L_{A202}: R = CD_3, and R^A = CD_3
in L_{A203}: R = Ethyl, and R^A = H,
in L_{A204}: R = Ethyl, and R^A = CH_3,
in L_{A205}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A206}: R = isopropyl, and R^A = H,
in L_{A207}: R = isopropyl, and R^A = CH_3,
in L_{A208}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A209} through L_{A221}, each represented by the formula



wherein in L_{A209}: R = H, and R^A = H,
in L_{A210}: R = H, and R^A = CH_3,
in L_{A21} R = H, and R^A = CD_3,
in L_{A212}: R = CH_3, and R^A = H,
in L_{A213}: R = CD_3, and R^A = H,
in L_{A214}: R = CH_3, and R^A = CH_3,
in L_{A215}: R = CD_3, and R^A = CD_3,
in L_{A216}: R = Ethyl, and R^A = H,
in L_{A217}: R = Ethyl, and R^A = CH_3,
in L_{A218}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A219}: R = isopropyl, and R^A = H,

L_{A222} through L_{A234}, each represented by the formula



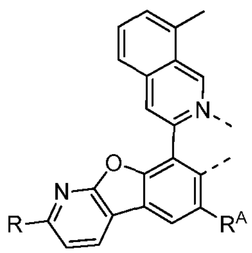
wherein in L_{A222}: R = H, and R^A = H,
in L_{A223}: R = H, and R^A = CH_3,
in L_{A224}: R = H, and R^A = CD_3
in L_{A225}: R = CH_3, and R^A = H,
in L_{A226}: R = CD_3, and R^A = H,
in L_{A227}: R = CH_3, and R^A = CH_3,
in L_{A228}: R = CD_3, and R^A = CD_3
in L_{A229}: R = Ethyl, and R^A = H,
in L_{A230}: R = Ethyl, and R^A = CH_3,
in L_{A231}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A232}: R = isopropyl, and R^A = H,

(continued)

in L_{A220}: R = isopropyl, and $R^A = CH_3$,
in L_{A221}: R = isopropyl-*d7*, and $R^A = CD_3$
,

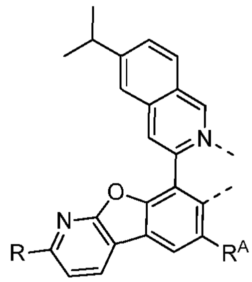
in L_{A233}: R = isopropyl, and $R^A = CH_3$,
in L_{A234}: R = isopropyl-*d7*, and $R^A = CD_3$
,

L_{A235} through L_{A247}, each represented by the formula



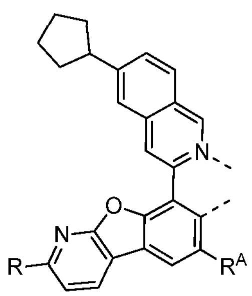
wherein in L_{A235}: R = H, and R^A = H,
in L_{A236}: R = H, and $R^A = CH_3$,
in L_{A237}: R = H, and $R^A = CD_3$,
in L_{A238}: R = CH_3, and R^A = H,
in L_{A239}: R = CD_3, and R^A = H,
in L_{A240}: R = CH_3, and $R^A = CH_3$,
in L_{A241}: R = CD_3, and $R^A = CD_3$
in L_{A242}: R = Ethyl, and R^A = H,
in L_{A243}: R = Ethyl, and $R^A = CH_3$,
in L_{A244}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A245}: R = isopropyl, and R^A = H,
in L_{A246}: R = isopropyl, and $R^A = CH_3$,
in L_{A247} R = isopropyl-*d7*, and $R^A = CD_3$
,

L_{A248} through L_{A260}, each represented by the formula



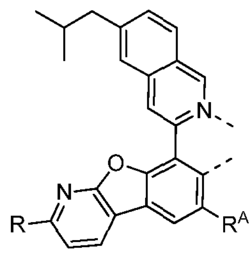
wherein in L_{A248}: R = H, and R^A = H,
in L_{A249}: R = H, and $R^A = CH_3$,
in L_{A250}: R = H, and $R^A = CD_3$,
in L_{A251}: R = CH_3, and R^A = H,
in L_{A252}: R = CD_3, and R^A = H,
in L_{A253}: R = CH_3, and $R^A = CH_3$,
in L_{A254}: R = CD_3, and $R^A = CD_3$,
in L_{A255}: R = Ethyl, and R^A = H,
in L_{A256}: R = Ethyl, and $R^A = CH_3$,
in L_{A257}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A258}: R = isopropyl, and R^A = H,
in L_{A259}: R = isopropyl, and $R^A = CH_3$,
in L_{A260}: R = isopropyl-*d7*, and $R^A = CD_3$
,

L_{A261} through L_{A273}, each represented by the formula



wherein in L_{A261}: R = H, and R^A = H,
in L_{A262}: R = H, and $R^A = CH_3$,
in L_{A263}: R = H, and $R^A = CD_3$,
in L_{A264}: R = CH_3, and R^A = H,
in L_{A265}: R = CD_3, and R^A = H,
in L_{A266}: R = CH_3, and $R^A = CH_3$,
in L_{A267}: R = CD_3, and $R^A = CD_3$,
in L_{A268}: R = Ethyl, and R^A = H,
in L_{A269}: R = Ethyl, and $R^A = CH_3$,
in L_{A270}: R = Ethyl-*d5*, and $R^A = CD_3$,

L_{A274} through L_{A286}, each represented by the formula



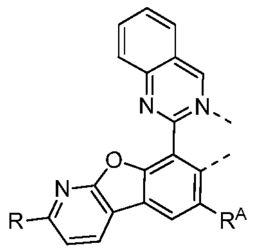
wherein in L_{A274}: R = H, and R^A = H,
in L_{A275}: R = H, and $R^A = CH_3$,
in L_{A276}: R = H, and $R^A = CD_3$,
in L_{A277}: R = CH_3, and R^A = H,
in L_{A278}: R = CD_3, and R^A = H,
in L_{A279}: R = CH_3, and $R^A = CH_3$,
in L_{A280}: R = CD_3, and $R^A = CD_3$,
in L_{A281}: R = Ethyl, and R^A = H,
in L_{A282}: R = Ethyl, and $R^A = CH_3$,
in L_{A283}: R = Ethyl-*d5*, and $R^A = CD_3$,

(continued)

in L_{A271}: R = isopropyl, and R^A = H,
in L_{A272}: R = isopropyl, and R^A = CH_3,
in L_{A273}: R = isopropyl-*d7*, and R^A = CD_3
,

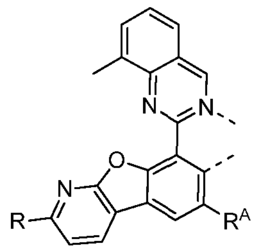
in L_{A284}: R = isopropyl, and R^A = H,
in L_{A285}: R = isopropyl, and R^A = CH_3,
in L_{A286}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A287} through L_{A299}, each represented by the formula



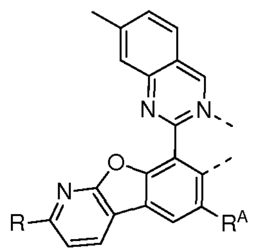
wherein in L_{A287}: R = H, and R^A = H,
in L_{A288}: R = H, and R^A = CH_3,
in L_{A289}: R = H, and R^A = CD_3
in L_{A290}: R CH_3, and R^A = H,
in L_{A291}: R = CD_3, and R^A = H,
in L_{A292}: R = CH_3, and R^A = CH_3,
in L_{A293}: R = CD_3, and R^A = CD_3,
in L_{A294}: R = Ethyl, and R^A = H,
in L_{A295}: R = Ethyl, and R^A = CH_3,
in L_{A296}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A297}: R = isopropyl, and R^A = H,
in L_{A298}: R = isopropyl, and R^A = CH_3,
in L_{A299}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A300} through L_{A312}, each represented by the formula



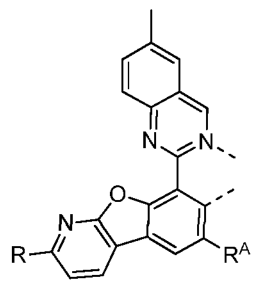
wherein in L_{A300}: R = H, and R^A = H,
in L_{A301}: R = H, and R^A = CH_3,
in L_{A302}: R = H, and R^A = CD_3,
in L_{A303}: R CH_3, and R^A = H,
in L_{A304}: R = CD_3, and R^A = H,
in L_{A305}: R = CH_3, and R^A = CH_3,
in L_{A306}: R = CD_3, and R^A = CD_3
in L_{A307}: R = Ethyl, and R^A = H,
in L_{A308}: R = Ethyl, and R^A = CH_3,
in L_{A309}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A310}: R = isopropyl, and R^A = H,
in L_{A31} R = isopropyl, and R^A = CH_3,
in L_{A312}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A313} through L_{A325}, each represented by the formula



wherein in L_{A313}: R = H, and R^A = H,
in L_{A314}: R = H, and R^A = CH_3,
in L_{A315}: R = H, and R^A = CD_3
in L_{A316}: R = CH_3, and R^A = H,
in L_{A317}: R = CD_3, and R^A = H,
in L_{A318}: R = CH_3, and R^A = CH_3,
in L_{A319}: R = CD_3, and R^A = CD_3,
in L_{A320}: R = Ethyl, and R^A = H,
in L_{A321}: R = Ethyl, and R^A = CH_3,
in L_{A322}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A323}: R = isopropyl, and R^A = H,

L_{A326} through L_{A338}, each represented by the formula



wherein in L_{A326}: R = H, and R^A = H,
in L_{A327}: R = H, and R^A = CH_3,
in L_{A328}: R = H, and R^A = CD_3,
in L_{A329}: R = CH_3, and R^A = H,
in L_{A330}: R = CD_3, and R^A = H,
in L_{A331}: R = CH_3, and R^A = CH_3,
in L_{A332}: R = CD_3, and R^A = CD_3,
in L_{A333}: R = Ethyl, and R^A = H,
in L_{A334}: R = Ethyl, and R^A = CH_3,
in L_{A335}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A336}: R = isopropyl, and R^A = H,

(continued)

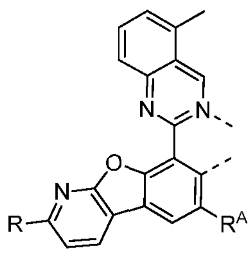
in L_{A324}: R = isopropyl, and R^A = CH_3,
in L_{A325}: R = isopropyl-*d7*, and R^A = CD_3

,

in L_{A337}: R = isopropyl, and R^A = CH_3,
in L_{A338}: R = isopropyl-*d7*, and R^A = CD_3

,

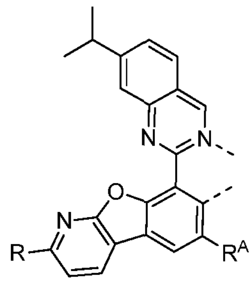
L_{A339} through L_{A351}, each represented by the formula



wherein in L_{A339}: R = H, and R^A = H,
in L_{A340}: R = H, and R^A = CH_3,
in L_{A341}: R = H, and R^A = CD_3,
in L_{A342}: R = CH_3, and R^A = H,
in L_{A343}: R = CD_3, and R^A = H,
in L_{A344}: R = CH_3, and R^A = CH_3,
in L_{A345}: R = CD_3, and R^A = CD_3,
in L_{A346}: R = Ethyl, and R^A = H,
in L_{A347}: R = Ethyl, and R^A = CH_3,
in L_{A348}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A349}: R = isopropyl, and R^A = H,
in L_{A350}: R = isopropyl, and R^A = CH_3,
in L_{A351}: R = isopropyl-*d7*, and R^A = CD3

,

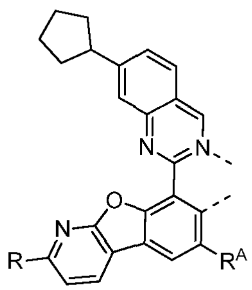
L_{A352} through L_{A364}, each represented by the formula



wherein in L_{A352}: R = H, and R^A = H,
in L_{A353}: R = H, and R^A = CH_3,
in L_{A354}: R = H, and R^A = CD_3,
in L_{A355}: R = CH_3, and R^A = H,
in L_{A356}: R = CD_3, and R^A = H,
in L_{A357}: R = CH_3, and R^A = CH_3,
in L_{A358}: R = CD_3, and R^A = CD_3,
in L_{A359}: R = Ethyl, and R^A = H,
in L_{A360}: R = Ethyl, and R^A = CH_3,
in L_{A361}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A362}: R = isopropyl, and R^A = H,
in L_{A363}: R = isopropyl, and R^A = CH_3,
in L_{A364}: R = isopropyl-*d7*, and R^A = CD_3

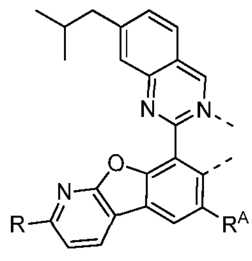
,

L_{A365} through L_{A377}, each represented by the formula



wherein in L_{A365}: R = H, and R^A = H,
in L_{A366}: R = H, and R^A = CH_3,
in L_{A367}: R = H, and R^A = CD_3,
in L_{A368}: R = CH_3, and R^A = H,
in L_{A369}: R = CD_3, and R^A = H,
in L_{A370}: R = CH_3, and R^A = CH_3,
in L_{A371}: R = CD_3, and R^A = CD_3
in L_{A372}: R = Ethyl, and R^A = H,
in L_{A373}: R = Ethyl, and R^A = CH_3,
in L_{A374}: R = Ethyl-*d5*, and R^A = CD_3,

L_{A378} through L_{A390}, each represented by the formula



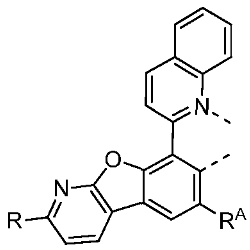
wherein in L_{A378}: R = H, and R^A = H,
in L_{A379}: R = H, and R^A = CH_3,
in L_{A380}: R = H, and R^A = CD_3,
in L_{A381}: R = CH_3, and R^A = H,
in L_{A382}: R = CD_3, and R^A = H,
in L_{A383}: R = CH_3, and R^A = CH_3,
in L_{A384}: R = CD_3, and R^A = CD_3
in L_{A385}: R = Ethyl, and R^A = H,
in L_{A386}: R = Ethyl, and R^A = CH_3,
in L_{A387}: R = Ethyl-*d5*, and R^A = CD_3,

(continued)

in L_{A375}: R = isopropyl, and R^A = H,
in L_{A376}: R = isopropyl, and R^A = CH_3,
in L_{A377}: R = isopropyl-*d7*, and R^A = CD_3
,

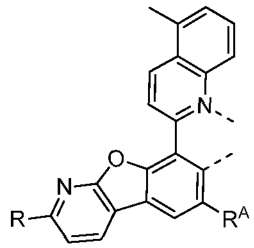
in L_{A388}: R = isopropyl, and R^A = H,
in L_{A389}: R = isopropyl, and R^A = CH_3,
in L_{A390}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A391} through L_{A403}, each represented by the formula



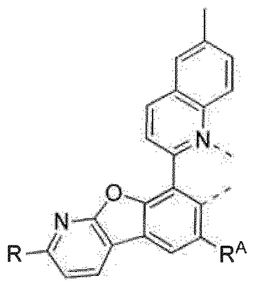
wherein in L_{A391}: R = H, and R^A = H,
in L_{A392} R = H, and R^A = CH_3,
in L_{A393}: R = H, and R^A = CD_3,
in L_{A394}: R = CH_3, and R^A = H,
in L_{A395}: R = CD_3, and R^A = H,
in L_{A396}: R = CH_3, and R^A = CH_3,
in L_{A397}: R = CD_3, and R^A = CD_3,
in L_{A398}: R = Ethyl, and R^A = H,
in L_{A399}: R = Ethyl, and R^A = CH_3,
in L_{A400}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A401}: R = isopropyl, and R^A = H,
in L_{A402}: R = isopropyl, and R^A = CH_3,
in L_{A403}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A404} through L_{A416}, each represented by the formula



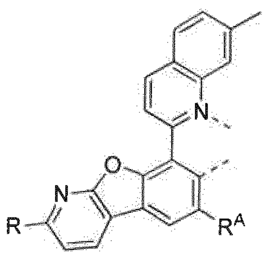
wherein in L_{A404}: R = H, and R^A = H,
in L_{A405}: R = H, and R^A = CH_3,
in L_{A406}: R = H, and R^A = CD_3
in L_{A407}: R = CH_3, and R^A = H,
in L_{A408}: R = CD_3, and R^A = H,
in L_{A409}: R = CH_3, and R^A = CH_3,
in L_{A410}: R = CD_3, and R^A = CD_3
in L_{A411}: R = Ethyl, and R^A = H,
in L_{A412}: R = Ethyl, and R^A = CH_3,
in L_{A413}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A414}: R = isopropyl, and R^A = H,
in L_{A415}: R = isopropyl, and R^A = CH_3,
in L_{A416}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A417} through L_{A429}, each represented by the formula



wherein in L_{A417}: R = H, and R^A = H,
in L_{A418}: R = H, and R^A = CH_3,
in L_{A419}: R = H, and R^A = CD_3,
in L_{A420}: R = CH_3, and R^A = H,
in L_{A421}: R = CD_3, and R^A = H,
in L_{A422}: R = CH_3, and R^A = CH_3,
in L_{A423}: R = CD_3, and R^A = CD_3,
in L_{A424}: R = Ethyl, and R^A = H,
in L_{A425}: R = Ethyl, and R^A = CH_3,
in L_{A426}: R = Ethyl-*d5*, and R^A = CD_3,

L_{A430} through L_{A442}, each represented by the formula



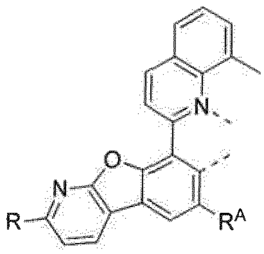
wherein in L_{A430}: R = H, and R^A = H,
in L_{A431}: R = H, and R^A = CH_3,
in L_{A432}: R = H, and R^A = CD_3,
in L_{A433}: R = CH_3, and R^A = H,
in L_{A434}: R = CD_3, and R^A = H,
in L_{A435}: R = CH_3, and R^A = CH_3,
in L_{A436}: R = CD_3, and R^A = CD_3,
in L_{A437}: R = Ethyl, and R^A = H,
in L_{A438}: R = Ethyl, and R^A = CH_3,
in L_{A439}: R = Ethyl-*d5*, and R^A = CD_3,

(continued)

in L_{A427}: R = isopropyl, and R^A = H,
in L_{A428}: R = isopropyl, and R^A = CH_3,
in L_{A429}: R = isopropyl-*d7*, and R^A = CD_3
,

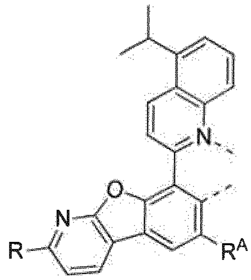
in L_{A440}: R = isopropyl, and R^A = H,
in L_{A441}: R = isopropyl, and R^A = CH_3,
in L_{A442}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A443} through L_{A455}, each represented by the formula



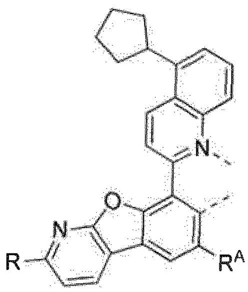
wherein in L_{A443}: R = H, and R^A = H,
in L_{A444}: R = H, and R^A = CH_3
in L_{A445}: R = H, and R^A = CD_3,
in L_{A446}: R = CH_3, and R^A = H,
in L_{A447}: R = CD_3, and R^A = H,
in L_{A448}: R = CH_3, and R^A = CH_3,
in L_{A449}: R = CD_3, and R^A = CD_3,
in L_{A450}: R = Ethyl, and R^A = H,
in L_{A451}: R = Ethyl, and R^A = CH_3,
in L_{A452}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A453}: R = isopropyl, and R^A = H,
in L_{A454}: R = isopropyl, and R^A = CH_3,
in L_{A455}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A456} through L_{A468}, each represented by the formula



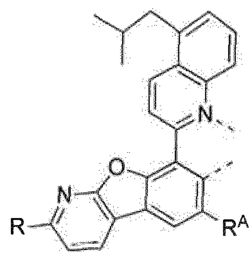
wherein in L_{A456}: R = H, and R^A = H,
in L_{A457}: R = H, and R^A = CH_3,
in L_{A458}: R = H, and R^A = CD_3,
in L_{A459}: R = CH_3, and R^A = H,
in L_{A460}: R = CD_3, and R^A = H,
in L_{A461}: R = CH_3, and R^A = CH_3,
in L_{A462}: R = CD_3, and R^A = CD_3,
in L_{A463}: R = Ethyl, and R^A = H,
in L_{A464}: R = Ethyl, and R^A = CH_3,
in L_{A465}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A466}: R = isopropyl, and R^A = H,
in L_{A467}: R = isopropyl, and R^A = CH_3,
in L_{A468}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A469} through L_{A481}, each represented by the formula



wherein in L_{A469}: R = H, and R^A = H,
in L_{A470}: R = H, and R^A = CH_3,
in L_{A471}: R = H, and R^A = CD_3,
in L_{A472}: R = CH_3, and R^A = H,
in L_{A473}: R = CD_3, and R^A = H,
in L_{A474}: R = CH_3, and R^A = CH_3,
in L_{A475}: R = CD_3, and R^A = CD_3,
in L_{A476}: R = Ethyl, and R^A = H,
in L_{A477}: R = Ethyl, and R^A = CH_3,

L_{A482} through L_{A494}, each represented by the formula



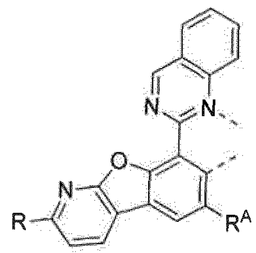
wherein in L_{A482}: R = H, and R^A = H,
in L_{A483}: R = H, and R^A = CH_3,
in L_{A484}: R = H, and R^A = CD_3,
in L_{A485}: R = CH_3, and R^A = H,
in L_{A486}: R = CD_3, and R^A = H,
in L_{A487}: R = CH_3, and R^A = CH_3,
in L_{A488}: R = CD_3, and R^A = CD_3
in L_{A489}: R = Ethyl, and R^A = H,
in L_{A490}: R = Ethyl, and R^A = CH_3,

(continued)

in L_{A478}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A479}: R = isopropyl, and R^A = H,
in L_{A480}: R = isopropyl, and R^A = CH_3,
in L_{A481}: R = isopropyl-*d7*, and R^A = CD_3
,

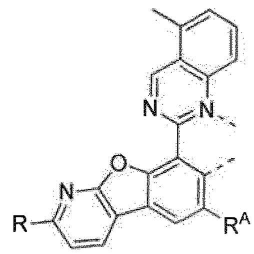
in L_{A491}: R = Ethyl-*d5*, and R^A CD_3,
in L_{A492}: R = isopropyl, and R^A = H,
in L_{A493}: R = isopropyl, and R^A = CH_3,
in L_{A494}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A495} through L_{A507}, each represented by the formula



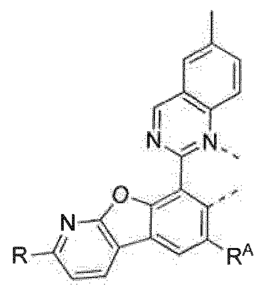
wherein in L_{A495}: R = H, and R^A = H,
in L_{A496}: R = H, and R^A = CH_3,
in L_{A497}: R = H, and R^A = CD_3,
in L_{A498}: R = CH_3, and R^A = H,
in L_{A499}: R = CD_3, and R^A = H,
in L_{A500}: R = CH_3, and R^A = CH_3,
in L_{A501}: R = CD_3, and R^A = CD_3,
in L_{A502}: R = Ethyl, and R^A = H,
in L_{A503}: R = Ethyl, and R^A = CH_3,
in L_{A504}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A505}: R = isopropyl, and R^A = H,
in L_{A506}: R = isopropyl, and R^A = CH_3,
in L_{A507}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A508} through L_{A520}, each represented by the formula



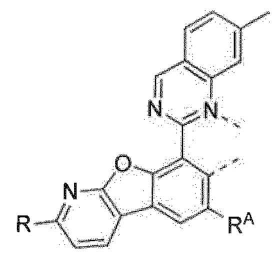
wherein in L_{A508}: R = H, and R^A = H,
in L_{A509}: R = H, and R^A = CH_3,
in L_{A510}: R = H, and R^A = CD_3,
in L_{A511}: R = CH_3, and R^A = H,
in L_{A512}: R = CD_3, and R^A = H,
in L_{A513}: R = CH_3, and R^A = CH_3,
in L_{A514}: R = CD_3, and R^A = CD_3,
in L_{A515}: R = Ethyl, and R^A = H,
in L_{A516}: R = Ethyl, and R^A = CH_3,
in L_{A517}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A518}: R = isopropyl, and R^A = H,
in L_{A519}: R = isopropyl, and R^A = CH_3,
in L_{A520}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A521} through L_{A533}, each represented by the formula



wherein in L_{A521}: R = H, and R^A = H,
in L_{A522}: R = H, and R^A = CH_3,
in L_{A523}: R = H, and R^A = CD_3,
in L_{A524}: R = CH_3, and R^A = H,
in L_{A525}: R = CD_3, and R^A = H,
in L_{A526}: R = CH_3, and R^A = CH_3,
in L_{A527}: R = CD_3, and R^A = CD_3,
in L_{A528}: R = Ethyl, and R^A = H,
in L_{A529}: R = Ethyl, and R^A = CH_3,

L_{A534} through L_{A546}, each represented by the formula



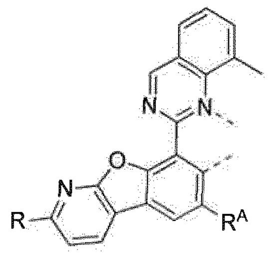
wherein in L_{A534}: R = H, and R^A = H,
in L_{A535}: R = H, and R^A = CH_3,
in L_{A536}: R = H, and R^A = CD_3,
in L_{A537}: R = CH_3, and R^A = H,
in L_{A538}: R = CD_3, and R^A = H,
in L_{A539}: R = CH_3, and R^A = CH_3,
in L_{A540}: R = CD_3, and R^A = CD_3,
in L_{A541}: R = Ethyl, and R^A = H,
in L_{A542}: R = Ethyl, and R^A = CH_3,

(continued)

in L_{A530}: R = Ethyl-*d5*, and $R^A = CD_3$
in L_{A531}: R = isopropyl, and R^A = H,
in L_{A532}: R = isopropyl, and $R^A = CH_3$,
in L_{A533}: R = isopropyl-*d7*, and $R^A = CD_3$
,

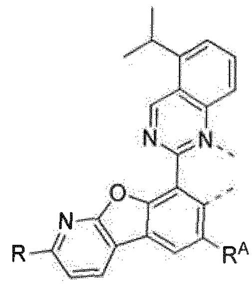
in L_{A543}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A544}: R = isopropyl, and R^A = H,
in L_{A545}: R = isopropyl, and $R^A = CH_3$,
in L_{A546}: R = isopropyl-*d7*, and $R^A = CD_3$
,

L_{A547} through L_{A559}, each represented by the formula



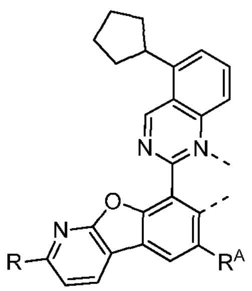
wherein in L_{A547}: R = H, and R^A = H,
in L_{A546}: R = H, and $R^A = CH_3$,
in L_{A549}: R = H, and $R^A = CD_3$,
in L_{A550}: R = CH_3, and R^A = H,
in L_{A551}: R = CD_3, and R^A = H,
in L_{A552}: R = CH_3, and $R^A = CH_3$,
in L_{A553}: R = CD_3, and $R^A = CD_3$
in L_{A554}: R = Ethyl, and R^A = H,
in L_{A555}: R = Ethyl, and $R^A = CH_3$,
in L_{A556}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A557}: R = isopropyl, and R^A = H,
in L_{A558}: R = isopropyl, and $R^A = CH_3$,
in L_{A559}: R = isopropyl-*d7*, and $R^A = CD_3$
,

L_{A560} through L_{A572}, each represented by the formula



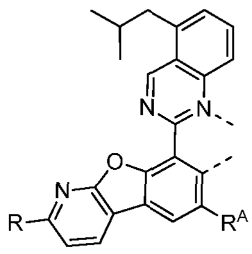
wherein in L_{A560}: R = H, and R^A = H,
in L_{A561}: R = H, and $R^A = CH_3$,
in L_{A562}: R = H, and $R^A = CD_3$,
in L_{A563}: R = CH_3, and R^A = H,
in L_{A564}: R = CD_3, and R^A = H,
in L_{A565}: R = CH_3, and $R^A = CH_3$,
in L_{A566}: R = CD_3, and $R^A = CD_3$,
in L_{A567}: R = Ethyl, and R^A = H,
in L_{A568}: R = Ethyl, and $R^A = CH_3$,
in L_{A569}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A570}: R = isopropyl, and R^A = H,
in L_{A571}: R = isopropyl, and $R^A = CH_3$,
in L_{A572}: R = isopropyl-*d7*, and $R^A = CD_3$
,

L_{A573} through L_{A585}, each represented by the formula



wherein in L_{A573}: R = H, and R^A = H,
in L_{A574}: R = H, and $R^A = CH_3$,
in L_{A575}: R = H, and $R^A = CD_3$
in L_{A576}: R = CH_3, and R^A = H,
in L_{A577}: R = CD_3, and R^A = H,
in L_{A578}: R = CH_3, and $R^A = CH_3$,
in L_{A579}: R = CD_3, and $R^A = CD_3$,
in L_{A580}: R = Ethyl, and R^A = H,

L_{A586} through L_{A598}, each represented by the formula



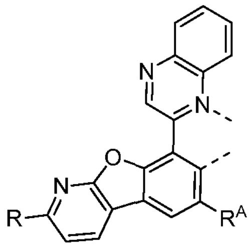
wherein in L_{A586}: R = H, and R^A = H,
in L_{A587}: R = H, and $R^A = CH_3$,
in L_{A588}: R = H, and $R^A = CD_3$,
in L_{A589}: R = CH_3, and R^A = H,
in L_{A590}: R = CD_3, and R^A = H,
in L_{A591}: R = CH_3, and $R^A = CH_3$,
in L_{A592}: R = CD_3, and $R^A = CD_3$,
in L_{A593}: R = Ethyl, and R^A = H,

(continued)

in L_{A581}: R = Ethyl, and R^A = CH_3,
in L_{A582}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A583}: R = isopropyl, and R^A = H,
in L_{A584}: R = isopropyl, and R^A = CH_3,
in L_{A585}: R = isopropyl-*d7*, and R^A = CD_3
,

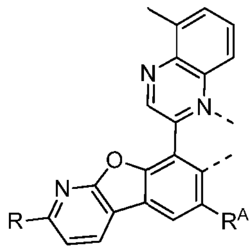
in L_{A594}: R = Ethyl, and R^A = CH_3,
in L_{A595}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A596}: R = isopropyl, and R^A = H,
in L_{A597}: R = isopropyl, and R^A = CH_3,
in L_{A598}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A599} through L_{A611}, each represented by the formula



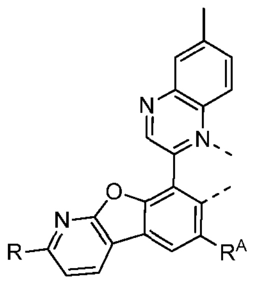
wherein in L_{A599}: R = H, and R^A = H,
in L_{A600}: R = H, and R^A = CH_3,
in L_{A601}: R = H, and R^A = CD_3,
in L_{A602}: R = CH_3, and R^A = H,
in L_{A603}: R = CD_3, and R^A = H,
in L_{A604}: R = CH_3, and R^A = CH_3,
in L_{A605}: R = CD_3, and R^A = CD_3,
in L_{A606}: R = Ethyl, and R^A = H,
in L_{A607}: R = Ethyl, and R^A = CH_3,
in L_{A608}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A609}: R = isopropyl, and R^A = H,
in L_{A610}: R = isopropyl, and R^A = CH_3,
in L_{A611}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A612} through L_{A624}, each represented by the formula



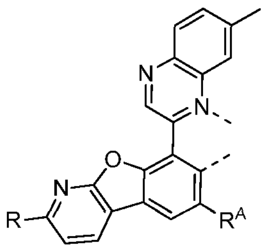
wherein in L_{A612}: R = H, and R^A = H,
in L_{A613}: R = H, and R^A = CH_3,
in L_{A614}: R = H, and R^A = CD_3,
in L_{A415}: R = CH_3, and R^A = H,
in L_{A616}: R = CD_3, and R^A = H,
in L_{A617}: R = CH_3, and R^A = CH_3,
in L_{A618}: R = CD_3, and R^A = CD_3,
in L_{A619}: R = Ethyl, and R^A = H,
in L_{A620}: R = Ethyl, and R^A = CH_3,
in L_{A621}: R = Ethyl-*d5*, and R^A = CD_3,
in L_{A622}: R = isopropyl, and R^A = H,
in L_{A623}: R = isopropyl, and R^A = CH_3,
in L_{A624}: R = isopropyl-*d7*, and R^A = CD_3
,

L_{A625} through L_{A637}, each represented by the formula



wherein in L_{A625}: R = H, and R^A = H,
in L_{A626}: R = H, and R^A = CH_3,
in L_{A627}: R = H, and R^A = CD_3,
in L_{A628}: R = CH_3, and R^A = H,
in L_{A629}: R = CD_3, and R^A = H,
in L_{A630}: R = CH_3, and R^A = CH_3,
in L_{A631}: R = CD_3, and R^A = CD_3,
in L_{A632}: R = Ethyl, and R^A = H,
in L_{A633}: R = Ethyl, and R^A = CH_3,

L_{A638} through L_{A650}, each represented by the formula



wherein in L_{A638}: R = H, and R^A = H,
in L_{A639}: R = H, and R^A = CH_3,
in L_{A640}: R = H, and R^A = CD_3
in L_{A641}: R = CH_3, and R^A = H,
in L_{A642}: R = CD_3, and R^A = H,
in L_{A643}: R = CH_3, and R^A = CH_3,
in L_{A644}: R = CD_3, and R^A = CD_3
in L_{A645}: R = Ethyl, and R^A = H,
in L_{A646}: R = Ethyl, and R^A = CH_3,

(continued)

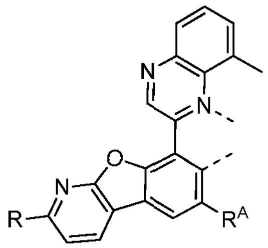
in $L_{A634:}$ R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A635}: R = isopropyl, and R^A = H,
in L_{A636}: R = isopropyl, and $R^A = CH_3$,
in L_{A637}: R = isopropyl-*d7*, and $R^A = CD_3$

,

in L_{A647}: R Ethyl-*d5*, and $R^A = CD_3$,
in L_{A648}: R = isopropyl, and R^A = H,
in L_{A649}: R = isopropyl, and $R^A = CH_3$,
in L_{A650}: R = isopropyl-*d7*, and $R^A = CD_3$

,

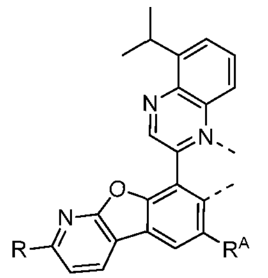
L_{A651} through L_{A663}, each represented by the formula



wherein in L_{A651}: R = H, and R^A = H,
in L_{A652}: R = H, and $R^A = CH_{3,}$
in L_{A653}: R = H, and $R^A = CD_{3,}$
in L_{A654}: R = CH_3, and R^A = H,
in L_{A655}: R = CD_3, and R^A = H,
in L_{A656}: R = CH_3, and $R^A = CH_3$,
in L_{A657}: R = CD_3, and $R^A = CD_3$,
in L_{A658}: R = Ethyl, and R^A = H,
in L_{A659}: R = Ethyl, and $R^A = CH_{3,}$
in L_{A660}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A661}: R = isopropyl, and R^A = H,
in L_{A662}: R = isopropyl, and $R^A = CH_3$,
in L_{A663}: R = isopropyl-*d7*, and $R^A = C_{D3}$

,

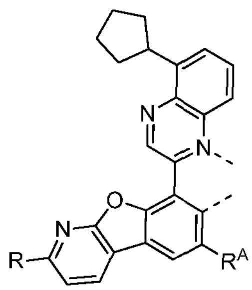
L_{A664} through L_{A676}, each represented by the formula



wherein in L_{A664}: R = H, and R^A = H,
in L_{A665}: R = H, and $R^A = CH_3$,
in L_{A666}: R = H, and $R^A = CD_3$,
in L_{A667}: R = CH_3, and R^A = H,
in L_{A668}: R = CD_3, and R^A = H,
in L_{A669}: R = CH_3, and $R^A = CH_3$,
in L_{A670}: R = CD_3, and $R^A = CD_3$,
in L_{A671}: R = Ethyl, and R^A = H,
in L_{A672}: R = Ethyl, and $R^A = CH_3$,
in L_{A673}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A674}: R = isopropyl, and R^A = H,
in L_{A675}: R = isopropyl, and $R^A = CH_3$,
in L_{A676}: R = isopropyl-*d7*, and $R^A = CD_3$

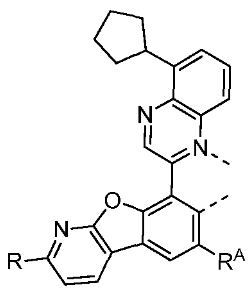
,

L_{A677} through L_{A689}, each represented by the formula



wherein in L_{A677}: R = H, and R^A = H,
in L_{A678}: R = H, and $R^A = CH_3$,
in L_{A679}: R = H, and $R^A = CD_3$,
in L_{A680}: R = CH_3, and R^A = H,
in L_{A681}: R = CD_3, and R^A = H,
in L_{A682}: R = CH_3, and $R^A = CH_3$,
in L_{A683}: R = CD_3, and $R^A = CD_3$,
in L_{A684}: R = Ethyl, and R^A = H,
in L_{A685}: R = Ethyl, and $R^A = CH_3$,

L_{A690} through L_{A702}, each represented by the formula



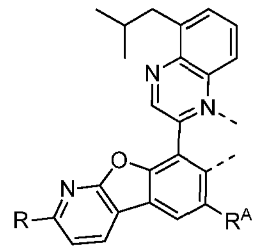
wherein in L_{A690}: R = H, and R^A = H,
in L_{A691}: R = H, and $R^A = CH_3$,
in L_{A692}: R = H, and $R^A = CD_3$,
in L_{A693}: R = CH_3, and R^A = H,
in L_{A694}: R = CD_3, and R^A = H,
in L_{A695}: R = CH_3, and $R^A = CH_3$,
in L_{A696}: R = CD_3, and $R^A = CD_3$
in L_{A697}: R = Ethyl, and R^A = H,
in L_{A698}: R = Ethyl, and $R^A = CH_3$,

(continued)

in L_{A686}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A687}: R = isopropyl, and R^A = H,
in L_{A688}: R = isopropyl, and $R^A = CH_3$,
in L_{A689}: R = isopropyl-*d7*, and $R^A = CD_3$,
in L_{A699}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A700}: R = isopropyl, and R^A = H,
in L_{A701}: R = isopropyl, and $R^A = CH_3$,
in L_{A702}: R = isopropyl-*d7*, and $R^A = CD_3$,

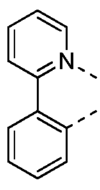
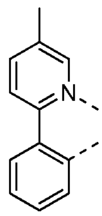
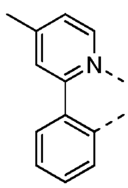
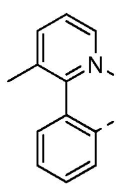
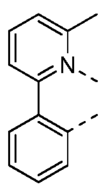
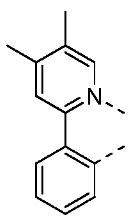
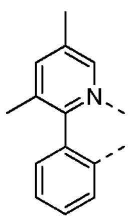
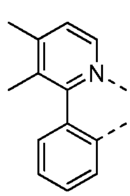
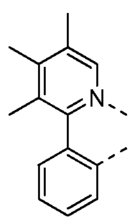
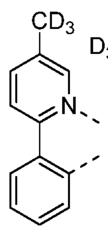
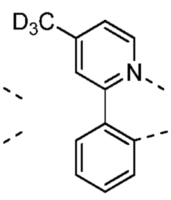
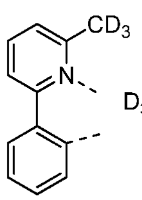
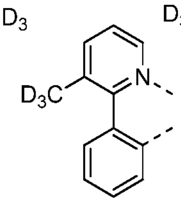
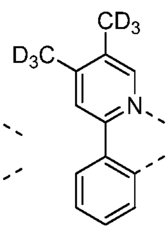
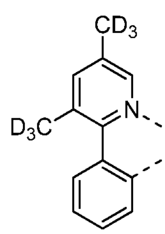
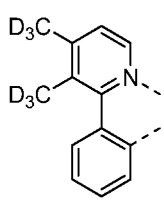
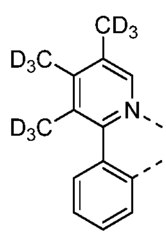
and

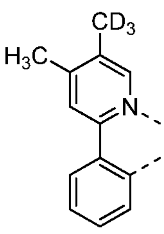
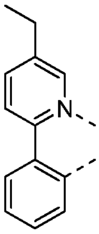
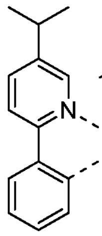
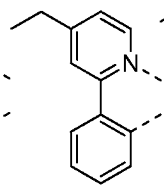
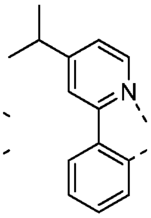
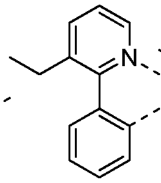
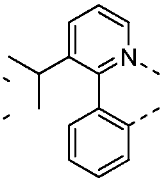
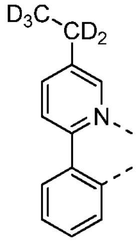
L_{A703} through L_{A715}, each represented by the formula

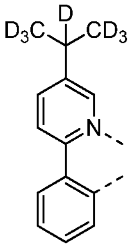
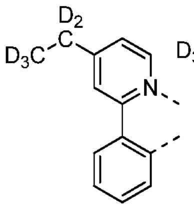
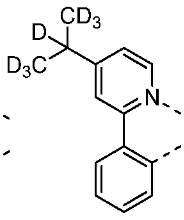
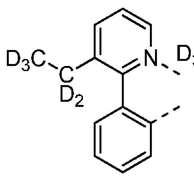
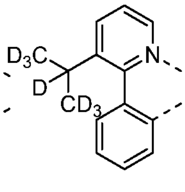
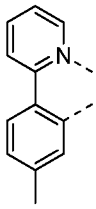
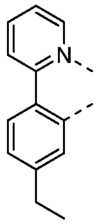


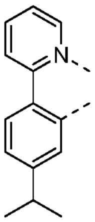
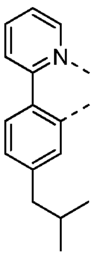
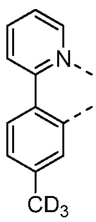
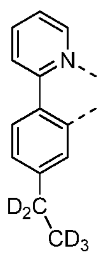
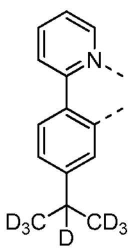
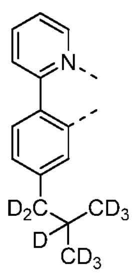
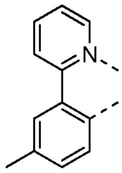
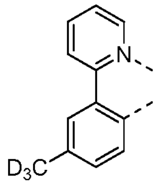
wherein in L_{A703}: R = H, and R^A = H,
in L_{A704}: R = H, and $R^A = CH_3$,
in L_{A705} : R = H, and $R^A = CD_3$,
in L_{A706}: R = CH_3, and R^A = H,
in L_{A707}: R = CD_3, and R^A = H,
in L_{A708}: R = CH_3, and $R^A = CH_3$,
in L_{A709}: R = CD_3, and $R^A = CD_3$,
in L_{A710}: R = Ethyl, and R^A = H,
in L_{A711} : R = Ethyl, and $R^A = CH_3$,
in L_{A712}: R = Ethyl-*d5*, and $R^A = CD_3$,
in L_{A713}: R = isopropyl, and R^A = H,
in L_{A714}: R = isopropyl, and $R^A = CH_3$,
in L_{A715}: R = isopropyl-*d7*, and $R^A = CD_3$.

16. The compound of Claim 1 or 15, wherein L_C is selected from the group consisting of:

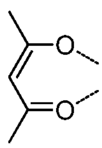
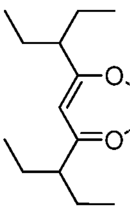
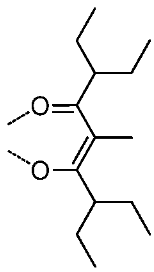
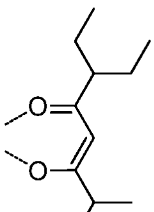
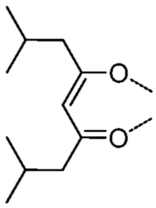
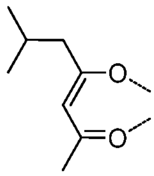
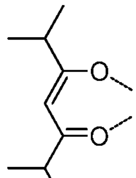
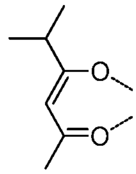

L_{C1} ,

L_{C2} ,

L_{C3} ,

L_{C4} ,

L_{C5} ,

L_{C6} ,

L_{C7} ,

L_{C8} ,

L_{C9} ,

L_{C10} ,

L_{C11} ,

L_{C12} ,

L_{C13} ,

L_{C14} ,

L_{C15} ,

L_{C16} ,

L_{C17} ,

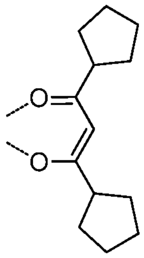
 L_{C18} ,  L_{C19} ,  L_{C20} ,  L_{C21} ,  L_{C22} ,  L_{C23} ,  L_{C24} ,  L_{C25} ,

 L_{C26} ,  L_{C27} ,  L_{C28} ,  L_{C29} ,  L_{C30} ,  L_{C31} ,  L_{C32} ,

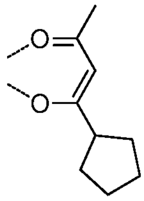
 L_{C33} ,  L_{C34} ,  L_{C35} ,  L_{C36} ,  L_{C37} ,  L_{C38} ,  L_{C39} , and  L_{C40} .

17. The compound of Claim 1 or 15, wherein L_B is selected from the group consisting of:

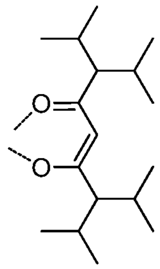
 L_{B42} ,  L_{B43} ,  L_{B44} ,  L_{B45} ,  L_{B46} ,  L_{B47} ,  L_{B48} ,  L_{B49} ,



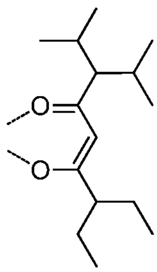
, L_{B50}



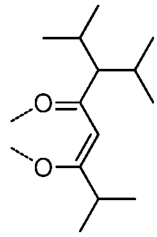
, L_{B51}



, L_{B52}

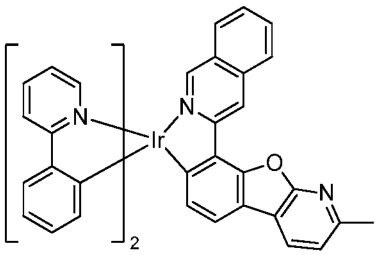


, L_{B53}

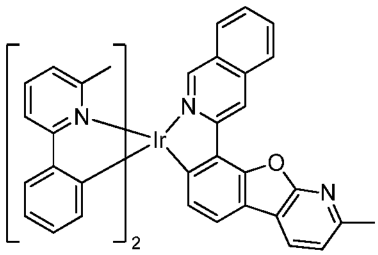


, and L_{B54} .

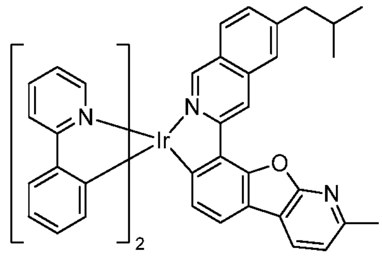
18. The compound of Claim 1, wherein the compound is selected from the group consisting of:



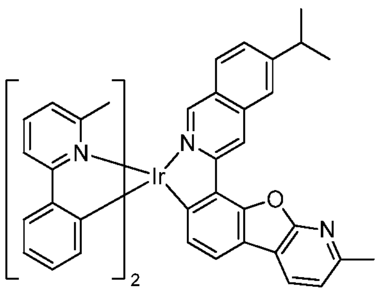
Compound 1 ,



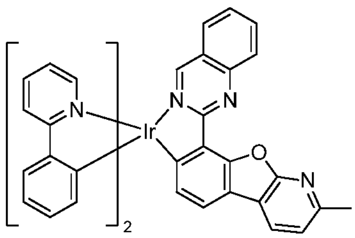
Compound 2 ,



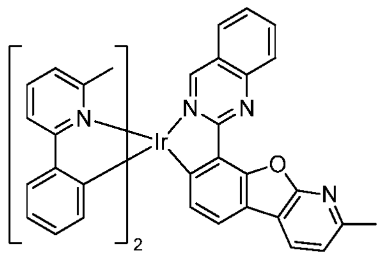
Compound 3 ,



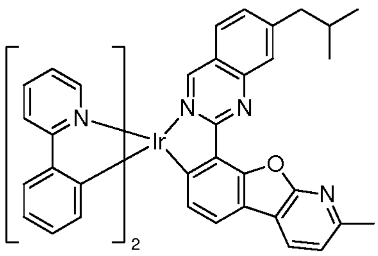
Compound 4 ,



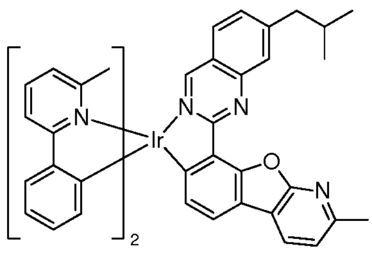
Compound 5 ,



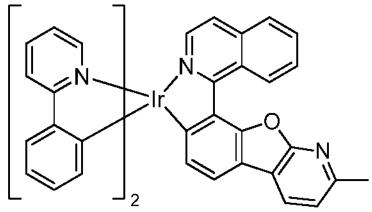
Compound 6 ,



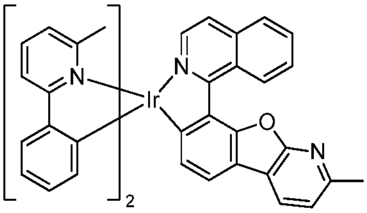
Compound 7 ,

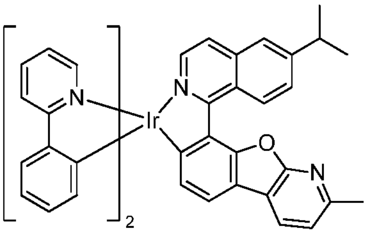


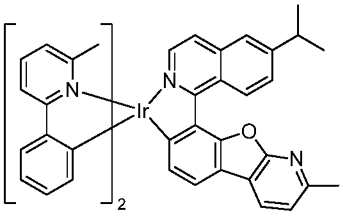
Compound 8 ,

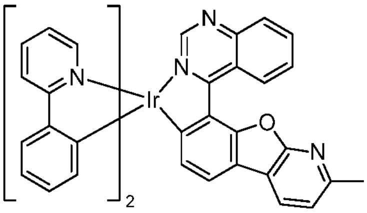


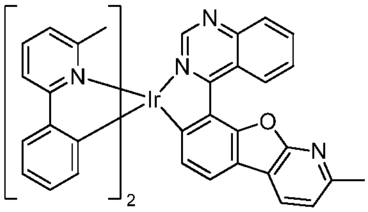
Compound 9 ,

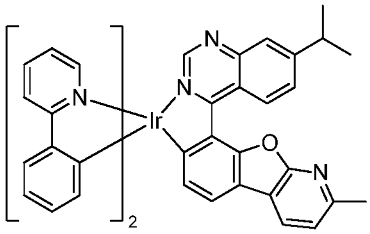

Compound 10,

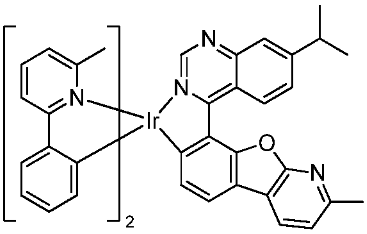

Compound 11,

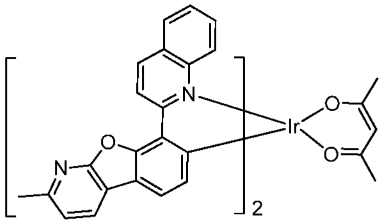

Compound 12,

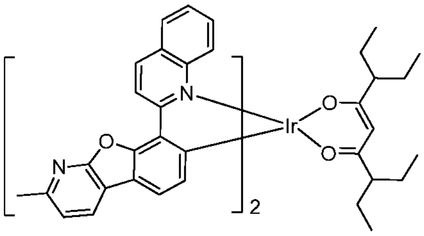

Compound 13,

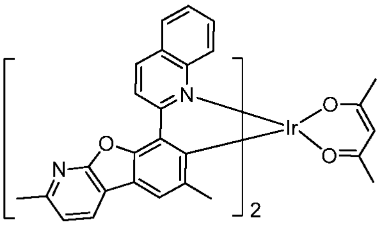

Compound 14,


Compound 15,


Compound 16,


Compound 17,


Compound 18,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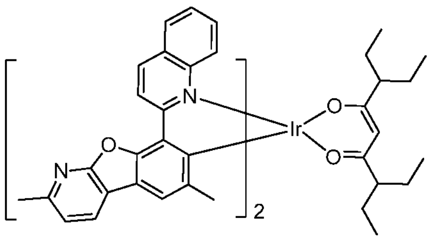
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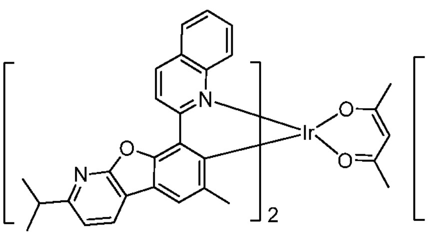
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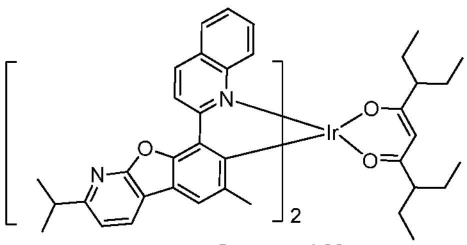
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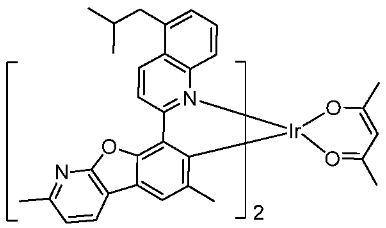
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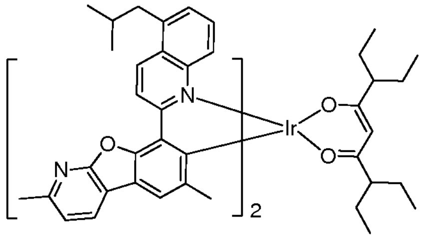
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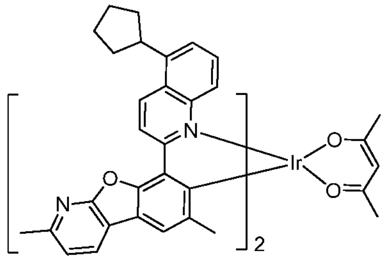
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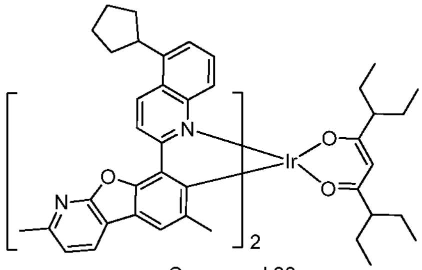
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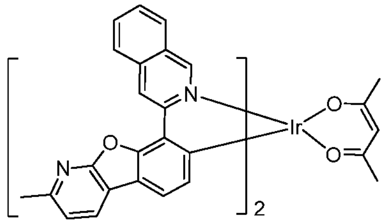
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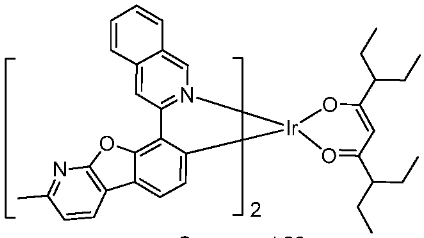
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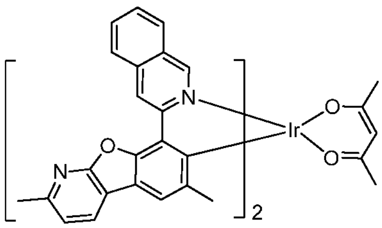
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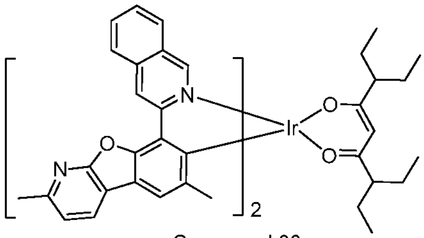
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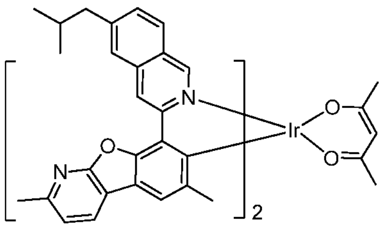
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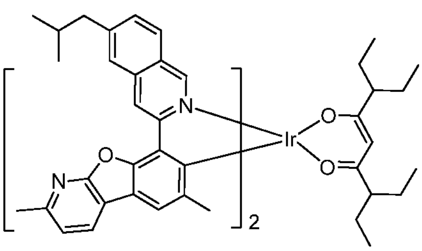
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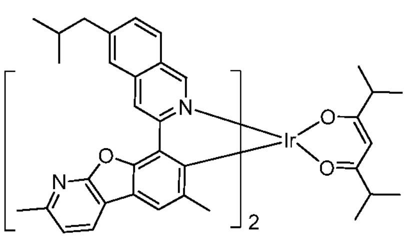
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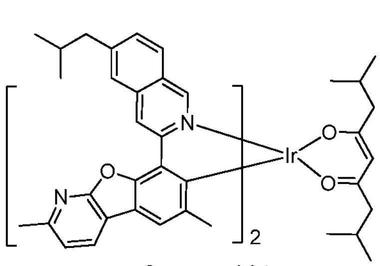
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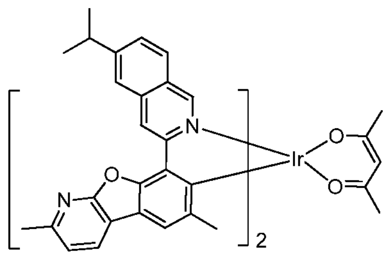
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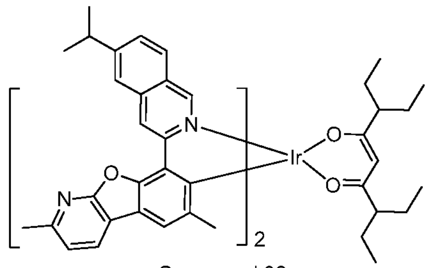
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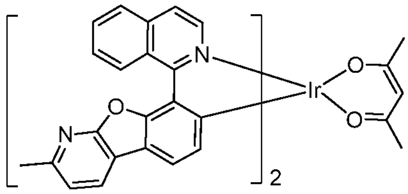
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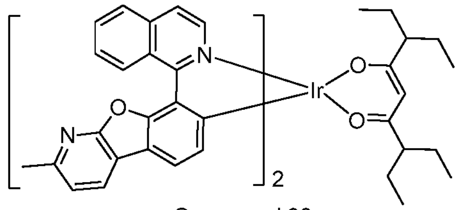
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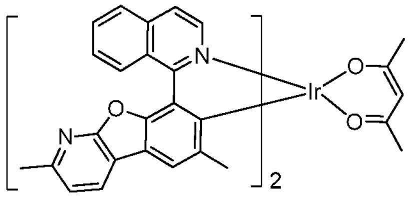
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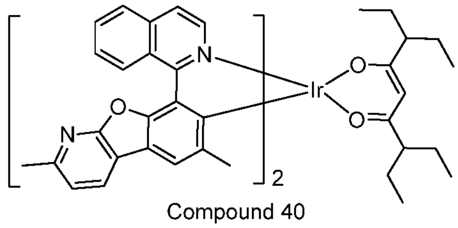
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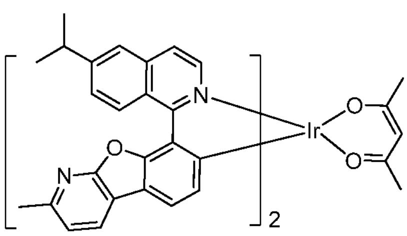
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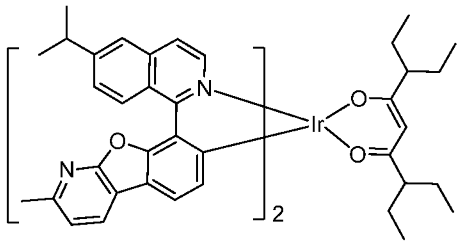
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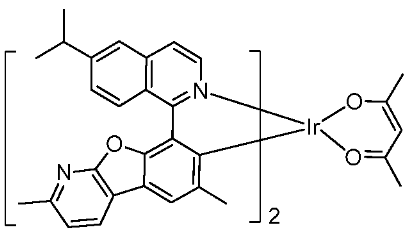
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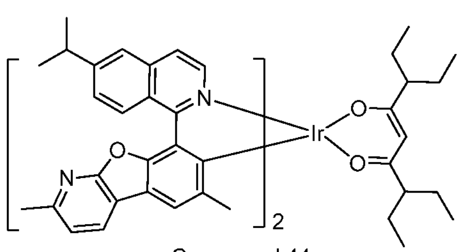
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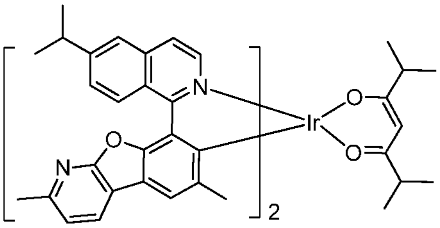

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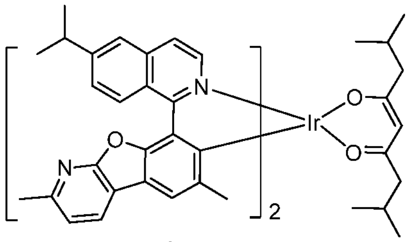

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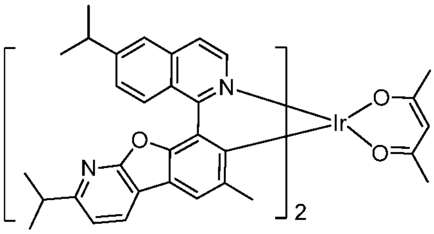

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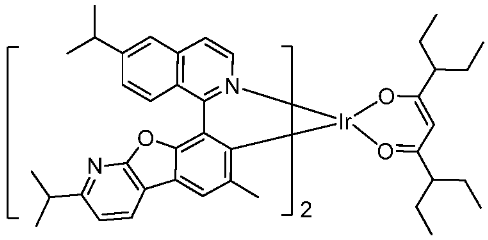

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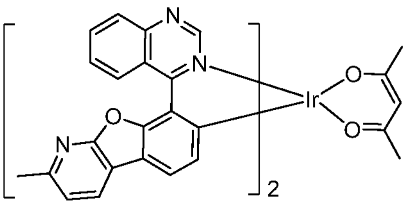

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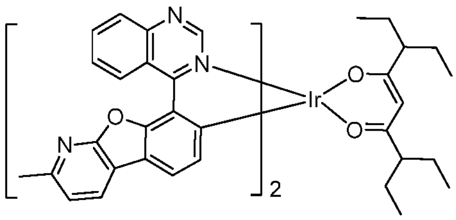

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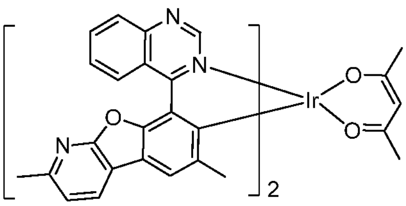

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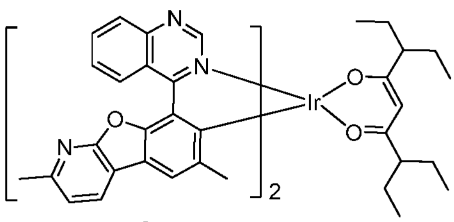

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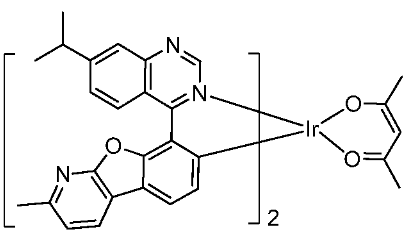

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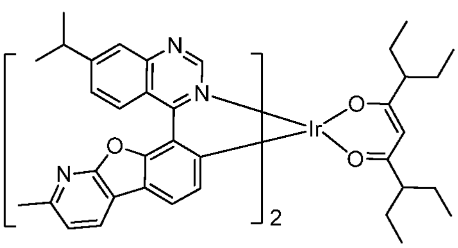

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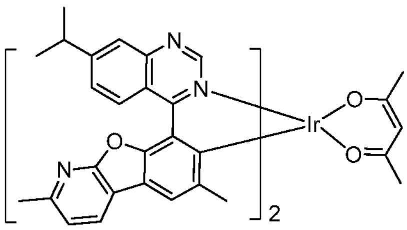

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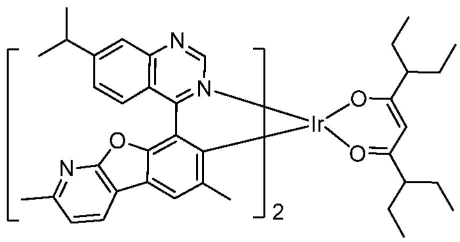

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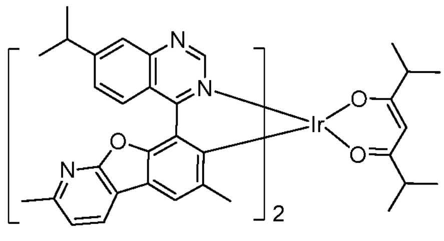

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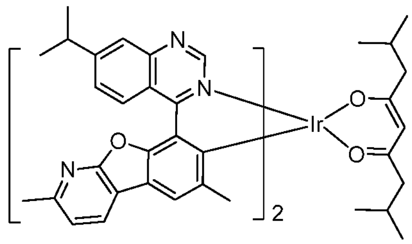

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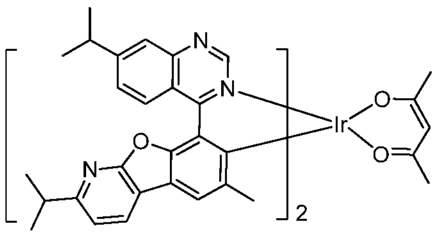
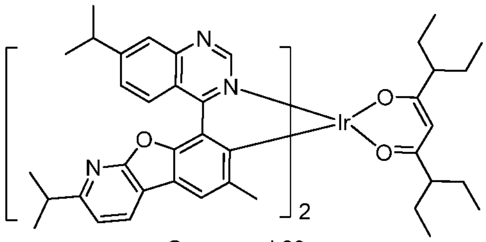


Compound 59 , and



Compound 60 .

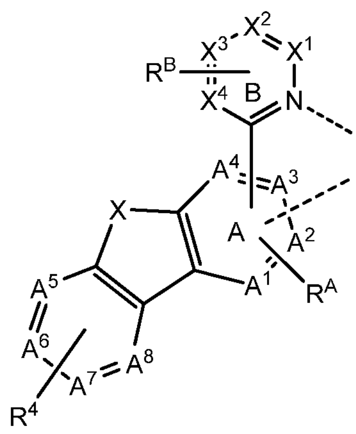
19. A first device comprising a first organic light emitting device, the first organic light emitting device comprising:

an anode;
a cathode; and
an organic layer, disposed between the anode and the cathode, comprising a compound as defined in any one of claims 1 to 18.

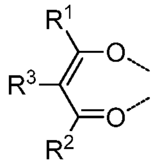
20. A formulation comprising a compound as defined in any one of claims 1 to 19.

Patentansprüche

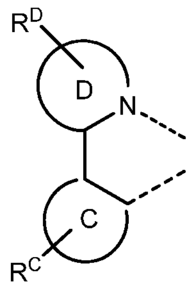
1. Eine Verbindung mit einer Formel $M(L_A)x(L_B)y(L_C)z$: wobei Ligand L_A



ist; wobei Ligand L_B



ist; wobei Ligand Lc



ist;

wobei M ein Metall mit einer Atomzahl größer als 40 ist;
wobei x 1 oder 2 ist;
wobei y 0, 1 oder 2 ist;
wobei z 0, 1 oder 2 ist;
wobei x+y+z die Oxidationsstufe des Metalls M ist;
wobei X^1,X^2, X^3, X^4, A^1, A^2, A^3, A^4, A^5, A^6, A^7 und A^8 C oder N sind;
wobei mindestens eines von A^1, A^2, A^3, A^4, A^5, A^6, A^7 und A^8 N ist;
wobei Ring B an Ring A durch eine C-C-Bindung gebunden ist;
wobei M an Ring A durch eine M-C-Bindung gebunden ist;
wobei X O, S oder Se ist;
wobei Ringe C und D jeweils unabhängig ein 5- oder 6-gliedriger carbozyklischer oder heterozyklischer Ring sind;
wobei R^A für mono- oder di-Substitution oder keine Substitution steht;
wobei R^B für di-, tri-, oder tetra-Substitution steht;
wobei R^C, R^D und R^4 jeweils unabhängig für mono-, di-, tri- oder tetra-Substitution oder keine Substitution steht;
wobei zwei benachbarte R^B einen sechsgliedrigen aromatischen carbozyklischen oder heterozyklischen Ring E fusioniert an Ring B bilden; wobei, wenn Ring E ein Heterozyklus ist, ist das einzige Heteroatom Stickstoff; wobei Ring E weiter durch R^E substituiert sein kann; und wobei R^E für mono-, di-, tri oder tetra-Substitution oder keine Substitution steht;
wobei jedes von R^A, R^B, R^C, R^D, R^E, R^1, R^2, R^3 und R^4 unabhängig ausgewählt sind aus der Gruppe bestehend aus Wasserstoff, Deuterium, Halid, Alkyl, Cycloalkyl, Heteroalkyl, Arylalkyl, Alkoxy, Aryloxy, Amino, Silyl, Alkenyl,

Cycloalkenyl, Heteroalkenyl, Alkinyl, Aryl, Heteroaryl, Acyl, Carbonyl, Carbonsäuren, Ester, Nitril, Isonitril, Sulfanyl, Sulfinyl, Sulfonyl, Phosphino und Kombinationen daraus; und
wobei beliebige benachbarte Substitutenten von R^C und R^D optional verbunden sind um einen Ring zu bilden.

2. Die Verbindung nach Anspruch 1, wobei M gleich Ir ist.

3. Die Verbindung nach Anspruch 1 oder 2, wobei X gleich O ist.

4. Die Verbindung nach einem der Ansprüche 1 bis 3, wobei die Verbindung die Formel $M(L_A)_2(L_B)$ hat.

5. Die Verbindung nach einem der Ansprüche 1 bis 3, wobei die Verbindung die Formel $M(L_A)(L_C)_2$ hat.

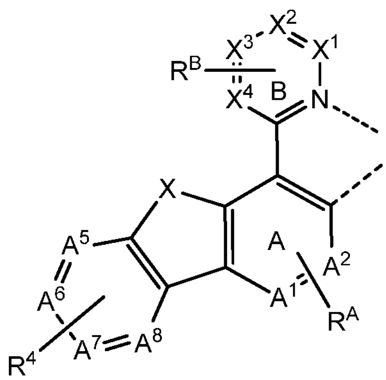
6. Die Verbindung nach einem der Ansprüche 1 bis 5, wobei nur eines von A^1 bis A^8 N ist.

7. Die Verbindung nach einem der Ansprüche 1 bis 6, wobei nur eines von A^5 bis A^8 N ist.

8. Die Verbindung nach einem der Ansprüche 1 bis 7, wobei X^1, X^2, X^3 und X^4 C sind; und Ring E Benzol ist.

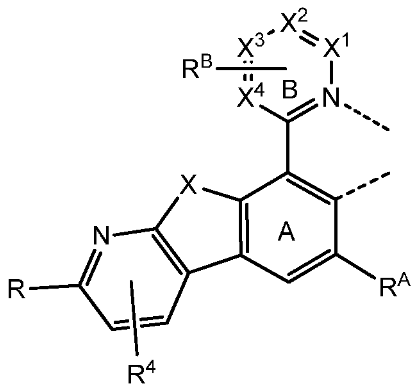
9. Die Verbindung nach einem der Ansprüche 1 bis 7, wobei (a) mindestens eines von X^1, X^2, X^3 und X^4 N ist, (b) Ring E heterozyklisch ist, oder (c) beides.

10. Die Verbindung nach einem der Ansprüche 1 bis 9, wobei L_A die Formel hat:



.

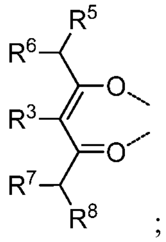
11. Die Verbindung nach einem der Ansprüche 1 bis 10, wobei L_A die Formel hat:



;

wobei R ausgewählt ist aus der Gruppe bestehend aus Alkyl, Cycloalkyl und Kombinationen davon.

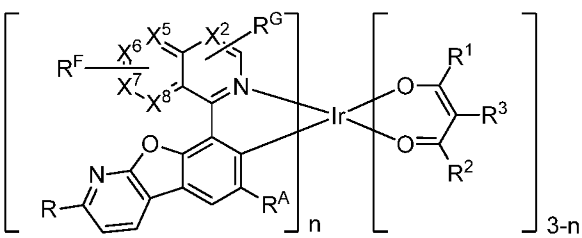
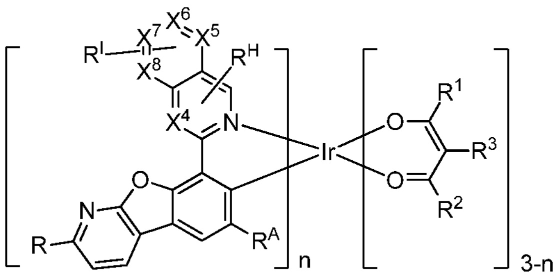
12. Die Verbindung nach einem der Ansprüche 1 bis 4 und 6 bis 11, wobei L_B die Formel hat:



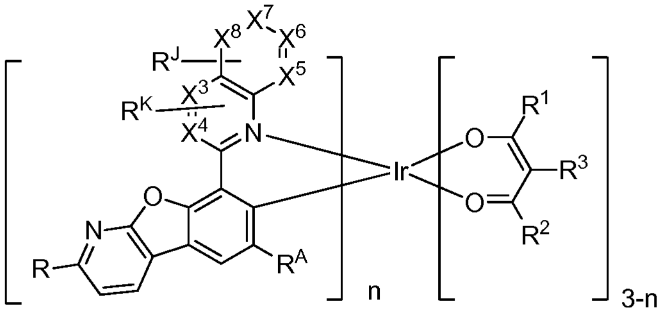
wobei R^5, R^6, R^7 und R^8 unabhängig voneinander ausgewählt sind aus der Gruppe bestehend aus Alkyl, Cycloalkyl, Aryl und Heteroaryl;
wobei mindestens eines von R^5, R^6, R^7 und R^8 mindestens zwei C-Atome hat.

13. Die Verbindung nach einem der Ansprüche 1 bis 3 und 5 bis 11, wobei Ring C Benzol ist und Ring D Pyridin ist.

14. Die Verbindung nach einem der Ansprüche 1 bis 4 und 6 bis 12, wobei die Verbindung ausgewählt ist aus der Gruppe bestehend aus:

,
,

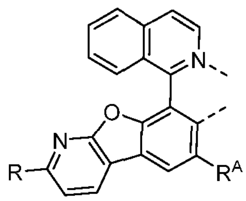
und



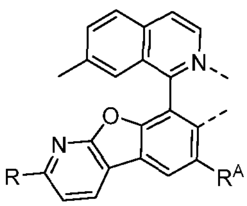
wobei jedes von R^F, R^G, R^H, R^I, R^J und R^K unabhängig ausgewählt ist aus der Gruppe bestehend aus Wasserstoff, Deuterium, Halid, Alkyl, Cycloalkyl, Heteroalkyl, Arylalkyl, Alkoxy, Aryloxy, Amino, Silyl, Alkenyl, Cycloalkenyl, Heteroalkenyl, Alkinyl, Aryl, Heteroaryl, Acyl, Carbonyl, Carbonsäuren, Ester, Nitril, Isonitril, Sulfanyl, Sulfinyl, Sulfonyl, Phosphino und Kombinationen davon; und wobei X^5, X^6, X^7 und X^8 C oder N sind.

15. Die Verbindung nach Anspruch 1, wobei L_A ausgewählt ist aus der Gruppe bestehend aus:

L_{A1} bis L_{A13}, jeweils dargestellt durch die Formel



L_{A14} bis L_{A26}, jeweils dargestellt durch die Formel

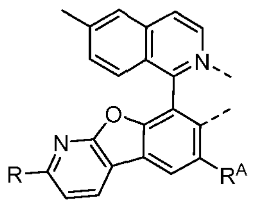


(fortgesetzt)

wobei in L_{A1}, R = H, und R^A = H,
in L_{A2}, R = H, und R^A = CH_3,
in L_{A3}, R = H, und R^A = CD_3,
in L_{A4}, R = CH_3, und R^A = H,
in L_{A5}, R = CD_3, und R^A = H,
in L_{A6}, R = CH_3, und R^A = CH_3,
in L_{A7}, R = CD_3, und R^A = CD_3,
in L_{A8}, R = Ethyl, und R^A = H,
in L_{A9}, R = Ethyl, und R^A = CH_3,
in L_{A10}, R = Ethyl-*d5*, und R^A = CD_3,
in L_{A11}, R = Isopropyl, und R^A = H,
in L_{A12}, R = Isopropyl, und R^A = CH_3,
in L_{A13}, R = Isopropyl-*d7*, und R^A = CD_3
,

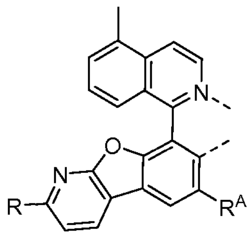
wobei in L_{A14}, R = H, und R^A = H,
in L_{A15}, R = H, und R^A = CH_3,
in L_{A16}, R = H, und R^A = CD_3,
in L_{A17}, R = CH_3, und R^A = H,
in L_{A18}, R = CD_3, und R^A = H,
in L_{A19}, R = CH_3, und R^A = CH_3,
in L_{A20}, R = CD_3, und R^A = CD_3,
in L_{A21}, R = Ethyl, und R^A = H,
in L_{A22}, R = Ethyl, und R^A = CH_3,
in L_{A23}, R = Ethyl-*d5*, und R^A = CD_3,
in L_{A24}, R = Isopropyl, und R^A = H,
in L_{A25}, R = Isopropyl, und R^A = CH_3,
in L_{A26}, R = Isopropyl-*d7*, und R^A = CD_3,
,

L_{A27} bis L_{A39}, jeweils dargestellt durch die Formel



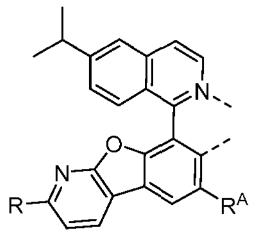
wobei in L_{A27}, R = H, und R^A = H,
in L_{A28}: R = H, und R^A = CH_3,
in L_{A29}: R = H, und R^A = CD_3,
in L_{A30}: R = CH_3, und R^A = H,
in L_{A31}: R = CD_3, und R^A = H,
in L_{A32}: R = CH_3, und R^A = CH_3,
in L_{A33}: R = CD_3, und R^A = CD_3,
in L_{A34}: R = Ethyl, und R^A = H,
in L_{A35}: R = Ethyl, und R^A = CH_3.
in L_{A36}: R = Ethyl-d5, und R^A = CD_3,
in L_{A37}: R = Isopropyl, und R^A = H,
in L_{A38}: R = Isopropyl, und R^A = CH_3,
in L_{A39}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A40} bis L_{A52}, jeweils dargestellt durch die Formel



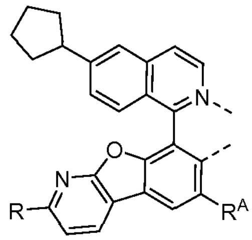
wobei in L_{A40}: R = H, und R^A = H,
in L_{A41}: R = H, und R^A = CH_3,
in L_{A42}: R = H, und R^A = CD_3,
in L_{A43}: R = CH_3, und R^A = H,
in L_{A44}: R = CD_3, und R^A = H,
in L_{A45}: R = CH_3, und R^A = CH_3,
in L_{A46}: R = CD_3, und R^A = CD_3,
in L_{A47}: R = Ethyl, und R^A = H,
in L_{A48}: R = Ethyl, und R^A = CH_3,
in L_{A49}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A50}: R = Isopropyl, und R^A = H,
in L_{A51}: R = Isopropyl, und R^A = CH_3,
in L_{A52}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A53} bis L_{A65}, jeweils dargestellt durch die Formel



wobei in L_{A53}: R = H, und R^A = H,
in L_{A54}: R = H, und R^A = CH_3,

L_{A66} bis L_{A78}, jeweils dargestellt durch die Formel



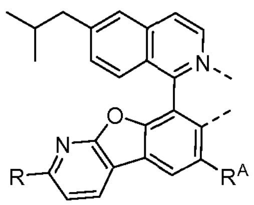
wobei in L_{A66}: R = H, und R^A = H,
in L_{A67}: R = H, und R^A = CH_3,

(fortgesetzt)

in L_{A55}: R = H, und R^A = CD_3,
in L_{A56}: R = CH_3, und R^A = H,
in L_{A57}: R = CD_3, und R^A = H,
in L_{A58}: R = CH_3, und R^A = CH_3,
in L_{A59}: R = CD_3, und R^A = CD_3,
in L_{A60}: R = Ethyl, und R^A = H,
in L_{A61}: R = Ethyl, und R^A = CH_3,
in L_{A62}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A63}: R = Isopropyl, und R^A = H,
in L_{A64}: R = Isopropyl, und R^A = CH_3,
in L_{A65}: R = Isopropyl-*d7*, und R^A = CD_3 ,

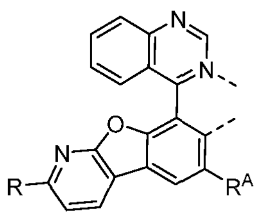
in L_{A68}: R = H, und R^A = CD_3,
in L_{A69}: R = CH_3, und R^A = H,
in L_{A70}: R = CD_3, und R^A = H,
in L_{A71}: R = CH_3, und R^A = CH_3,
in L_{A72}: R = CD_3, und R^A = CD_3,
in L_{A73}: R = Ethyl, und R^A = H,
in L_{A74}: R = Ethyl, und R^A = CH_3,
in L_{A75}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A76}: R = Isopropyl, und R^A = H,
in L_{A77}: R = Isopropyl, und R^A = CH_3,
in L_{A78}: R = Isopropyl-*d7*, und R^A = CD_3 ,

L_{A79} bis L_{A91}, jeweils dargestellt durch die Formel



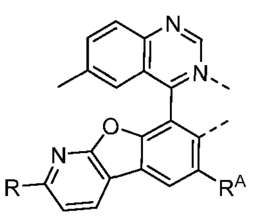
wobei in L_{A79}: R = H, und R^A = H,
in L_{A80}: R = H, und R^A = CH_3,
in L_{A81}: R = H, und R^A = CD_3,
in L_{A82}: R = CH_3, und R^A = H,
in L_{A83}: R = CD_3, und R^A = H,
in L_{A84}: R = CH_3, und R^A = CH_3,
in L_{A85}: R = CD_3, und R^A = CD_3,
in L_{A86}: R = Ethyl, und R^A = H,
in L_{A87}: R = Ethyl, und R^A = CH_3,
in L_{A88}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A89}: R = Isopropyl, und R^A = H,
in L_{A90}: R = Isopropyl, und R^A = CH_3,
in L_{A91}: R = Isopropyl-*d7*, und R^A = CD_3 ,

L_{A92} bis L_{A104}, jeweils dargestellt durch die Formel



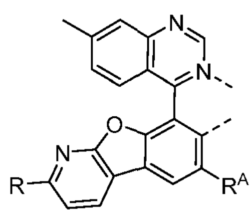
wobei in L_{A92}: R = H, und R^A = H,
in L_{A93}: R = H, and R^A = CH_3,
in L_{A94}: R = H, and R^A = CD_3,
in L_{A95}: R = CH_3, und R^A = H,
in L_{A96}: R = CD_3, und R^A = H,
in L_{A97}: R = CH_3, und R^A = CH_3,
in L_{A98}: R = CD_3, und R^A = CD_3,
in L_{A99}: R = Ethyl, und R^A = H,
in L_{A100}: R = Ethyl, und R^A = CH_3,
in L_{A101}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A102}: R = Isopropyl, und R^A = H,
in L_{A103}: R = Isopropyl, und R^A = CH_3,
in L_{A104}: R = Isopropyl-*d7*, und R^A = CD_3 ,

L_{A105} bis L_{A117}, jeweils dargestellt durch die Formel



wobei in L_{A105}: R = H, und R^A = H,
in L_{A106}: R = H, und R^A = CH_3,
in L_{A107}: R = H, und R^A = CD_3,
in L_{A108}: R = CH_3, und R^A = H,
in L_{A109}: R = CD_3, und R^A = H,
in L_{A110}: R = CH_3, und R^A = CH_3,

L_{A118} bis L_{A130}, jeweils dargestellt durch die Formel



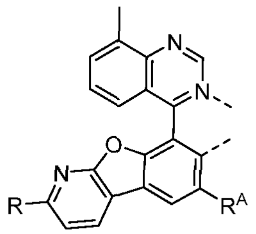
wobei in L_{A118}: R = H, und R^A = H,
in L_{A119}: R = H, und R^A = CH_3,
in L_{A120}: R = H, und R^A = CD_3,
in L_{A121}: R = CH_3, und R^A = H,
in L_{A122}: R = CD_3, und R^A = H,
in L_{A123}: R = CH_3, und R^A = CH_3,

(fortgesetzt)

in L_{A111}: R = CD_3, und R^A = CD_3,
in L_{A112}: R = Ethyl, und R^A = H,
in L_{A113}: R = Ethyl, und R^A = CH_3,
in L_{A114}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A115}: R = Isopropyl, und R^A = H,
in L_{A116}: R = Isopropyl, und R^A = CH_3,
in L_{A117}: R = Isopropyl-*d7*, und R^A = CD_3
,

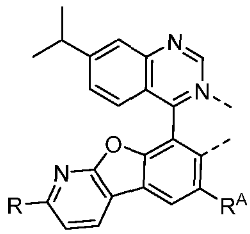
in L_{A124}: R = CD_3, und R^A = CD_3,
in L_{A125}: R = Ethyl, und R^A = H,
in L_{A126}: R = Ethyl, und R^A = CH_3,
in L_{A127}: R = Ethyl-*d5*, und R^A = CD_3.
in L_{A128}: R = Isopropyl, und R^A = H,
in L_{A129}: R = Isopropyl, und R^A = CH_3,
in L_{A130}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A131} bis L_{A143}, jeweils dargestellt durch die Formel



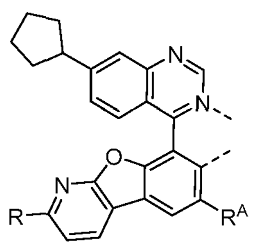
wobei in L_{A131}: R = H, und R^A = H,
in L_{A132}: R = H, und R^A = CH_3,
in L_{A133}: R = H, und R^A = CD_3,
in L_{A134}: R = CH_3, und R^A = H,
in L_{A135}: R = CD_3, und R^A = H,
in L_{A136}: R = CH_3, und R^A = CH_3,
in L_{A137}: R = CD_3, und R^A = C_{D3}
in L_{A138}: R = Ethyl, und R^A = H,
in L_{A139}: R = Ethyl, und R^A = CH_3,
in L_{A140}: R = Ethyl-*d5*, und R^A = CD3,
in L_{A141}: R = Isopropyl, und R^A = H,
in L_{A142}: R = Isopropyl, und R^A = CH_3,
in L_{A143}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A144} bis L_{A156}, jeweils dargestellt durch die Formel



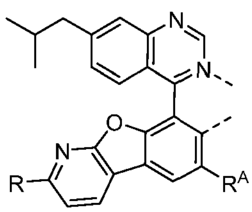
wobei in L_{A144}: R = H, und R^A = H,
in L_{A145}: R = H, und R^A = CH_3,
in L_{A146}: R = H, und R^A = CD_3,
in L_{A147}: R = CH_3, und R^A = H,
in L_{A148}: R = CD_3, und R^A = H,
in L_{A149}: R = CH_3, und R^A = CH_3,
in L_{A150}: R = CD_3, und R^A = C_{D3}
in L_{A151}: R = Ethyl, und R^A = H,
in L_{A152}: R = Ethyl, und R^A = CH_3,
in L_{A153}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A154}: R = Isopropyl, und R^A = H,
in L_{A155}: R = Isopropyl, und R^A = CH_3,
in L_{A156}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A157} bis L_{A169}, jeweils dargestellt durch die Formel



wobei in L_{A157}: R = H, und R^A = H,
in L_{A158}: R = H, und R^A CH_3,
in L_{A159}: R = H, und R^A = CD_3,
in L_{A160}: R = CH_3, und R^A = H,
in L_{A161}: R = CD_3, und R^A = H,
in L_{A162}: R = CH_3, und R^A = CH_3,
in L_{A163}: R = CD_3, und R^A = CD_3,
in L_{A164}: R = Ethyl, und R^A = H,

L_{A170} bis $L_{A182,}$ jeweils dargestellt durch die Formel



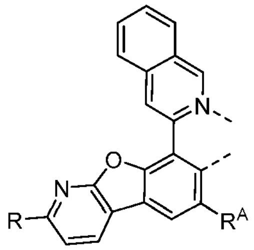
wobei in L_{A170}: R = H, und R^A = H,
in L_{A171}: R = H, und R^A= CH_3,
in L_{A172}: R = H, und R^A = CD_3,
in L_{A173}: R = CH_3, und R^A = H,
in L_{A174}: R = CD_3, und R^A = H,
in L_{A175}: R = CH_3, und R^A = CH_3,
in L_{A176}: R = CD_3, und R^A = CD_3,
in L_{A177}: R = Ethyl, und R^A = H,

(fortgesetzt)

in L_{A165}: R = Ethyl, und $R^A = CH_3$,
in L_{A166}: R = Ethyl-*d5*, und $R^A = CD_3$,
in L_{A167}: R = Isopropyl, und R^A = H,
in L_{A168}: R = Isopropyl, und $R^A = CH_3$,
in L_{A169}: R = Isopropyl-*d7*, und $R^A = CD_3$
,

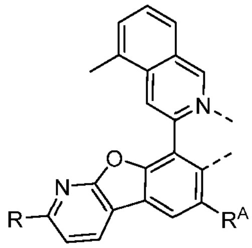
in L_{A178}: R = Ethyl, und $R^A = CH_3$,
in L_{A179}: R = Ethyl-*d5*, und $R^A = CD_3$.
in L_{A180}: R = Isopropyl, und R^A = H,
in L_{A181}: R = Isopropyl, und $R^A = CH_3$,
in L_{A182}: R = Isopropyl-*d7*, und $R^A = CD_3$
,

L_{A183} bis L_{A195}, jeweils dargestellt durch die Formel



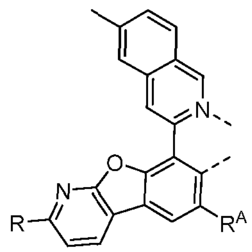
wobei in L_{A183}: R = H, und R^A = H,
in L_{A84}: R = H, und $R^A = CH_3$,
in L_{A185}: R = H, und $R^A = CD_3$,
in L_{A186}: R = CH_3, und R^A = H,
in L_{A187}: R = CD_3, und R^A = H,
in L_{A188}: R = CH_3, und $R^A = CH_3$,
in L_{A189}: R = CD_3, und $R^A = CD_3$,
in L_{A190}: R = Ethyl, und R^A = H,
in L_{A191}: R = Ethyl, und $R^A = CH_3$,
in L_{A192}: R = Ethyl-*d5*, und $R^A = CD_3$,
in L_{A193}: R = Isopropyl, und R^A = H,
in L_{A194}: R = Isopropyl, und $R^A = CH_3$,
in L_{A195}: R = Isopropyl-*d7*, und $R^A = CD_3$
,

L_{A196} bis L_{A208}, jeweils dargestellt durch die Formel



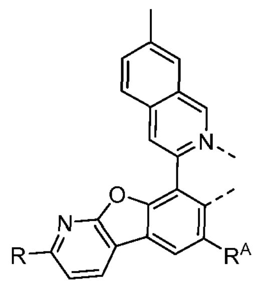
wobei in L_{A196}: R = H, und R^A = H,
in L_{A197}: R = H, und $R^A = CH_3$,
in L_{A198}: R = H, und $R^A = CD_3$,
in L_{A199}: R = CH_3, und R^A = H,
in L_{A200}: R = CD_3, und R^A = H,
in L_{A201}: R = CH_3, und $R^A = CH_3$,
in L_{A202}: R = CD_3, und $R^A = CD_3$,
in L_{A203}: R = Ethyl, und R^A = H,
in L_{A204}: R = Ethyl, und $R^A = CH_3$,
in L_{A205}: R = Ethyl-*d5*, und $R^A = CD_3$,
in L_{A206}: R = Isopropyl, und R^A = H,
in L_{A207}: R = Isopropyl, und $R^A = CH_3$,
in L_{A208}: R = Isopropyl-*d7*, und $R^A = CD_3$
,

L_{A209} bis L_{A221}, jeweils dargestellt durch die Formel



wobei in L_{A209}: R = H, und R^A = H,
in L_{A210}: R = H, und $R^A = CH_3$,
in L_{A211}: R = H, und $R^A = CD_3$,
in L_{A212}: R = CH_3, und R^A = H,
in L_{A213}: R = CD_3, und R^A = H,
in L_{A214}: R = CH_3, und $R^A = CH_3$,
in L_{A215}: R = CD_3, und $R^A = CD_3$,
in L_{A216}: R = Ethyl, und R^A = H,

L_{A222} bis L_{A234}. jeweils dargestellt durch die Formel



wobei in L_{A222}: R = H, und R^A = H,
in L_{A223}: R = H, und $R^A = CH_3$,
in L_{A224}: R = H, und $R^A = CD_3$,
in L_{A225}: R = CH_3, und R^A = H,
in L_{A226}: R = CD_3, und R^A = H,
in L_{A227}: R = CH_3, und $R^A = CH_3$,
in L_{A228}: R = CD_3, und $R^A = CD_3$,
in L_{A229}: R = Ethyl, und R^A = H,

(fortgesetzt)

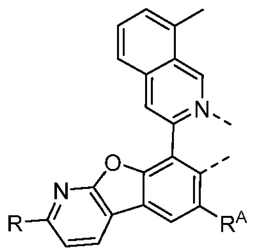
in L_{A217}: R = Ethyl, und R^A = CH_3,
in L_{A218}: R = Ethyl-*d5*, und R^A = CD_3.
in L_{A219}: R = Isopropyl, und R^A = H,
in L_{A220}: R = Isopropyl, und R^A = CH_3,
in L_{A221}: R = Isopropyl-*d7*, und R^A = CD_3

,

in L_{A230}: R = Ethyl, und R^A = CH_3,
in L_{A231}: R = Ethyl-*d5*, und R^A = CD_3.
in L_{A232}: R = Isopropyl, und R^A = H,
in L_{A233}: R = Isopropyl, und R^A = CH_3,
in L_{A234}: R = Isopropyl-*d7*, und R^A = CD_3

,

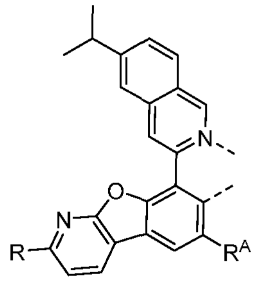
L_{A235} bis L_{A247}, jeweils dargestellt durch die Formel



wobei in L_{A235}: R = H, und R^A = H,
in L_{A236}: R = H, und R^A = CH_3,
in L_{A237}: R = H, und R^A = CD_3
in L_{A238}: R = CH_3, und R^A = H,
in L_{A239}: R = CD_3, und R^A = H,
in L_{A240}: R = CH_3, und R^A = CH_3,
in L_{A241}: R = CD_3, und R^A = CD_3,
in L_{A242}: R = Ethyl, und R^A = H,
in L_{A243}: R = Ethyl, und R^A = CH_3,
in L_{A244}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A245}: R = Isopropyl, und R^A = H,
in L_{A246}: R = Isopropyl, und R^A = CH_3,
in L_{A247}: R = Isopropyl-*d7*, und R^A = CD_3

,

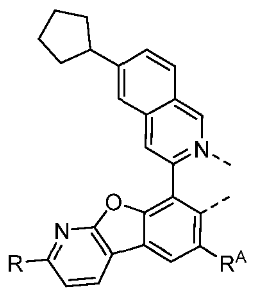
L_{A248} bis L_{A260}, jeweils dargestellt durch die Formel



wobei in L_{A248}: R = H, und R^A = H,
in L_{A249}: R = H, und R^A = CH_3,
in L_{A250}: R = H, und R^A = CD_3,
in L_{A251}: R = CH_3, und R^A = H,
in L_{A252}: R = CD_3, und R^A = H,
in L_{A253}: R = CH_3, und R^A = CH_3,
in L_{A254}: R = CD_3, und R^A = CD_3,
in L_{A255}: R = Ethyl, und R^A = H,
in L_{A256}: R = Ethyl, und R^A = CH_3,
in L_{A257}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A258}: R = Isopropyl, und R^A = H,
in L_{A259}: R = Isopropyl, und R^A = CH_3,
in L_{A260}: R = Isopropyl-*d7*, und R^A = CD_3

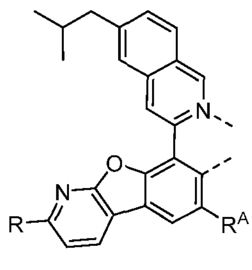
,

L_{A261} bis L_{A273}, jeweils dargestellt durch die Formel



wobei in L_{A261}: R = H, und R^A = H,
in L_{A262}: R = H, und R^A = CH_3,
in L_{A263}: R = H, und R^A = CD_3,
in L_{A264}: R = CH_3, und R^A = H,
in L_{A265}: R = CD_3, und R^A = H,
in L_{A266}: R = CH_3, und R^A = CH_3,
in L_{A267}: R = CD_3, und R^A = CD_3

L_{A274} bis L_{A286}, jeweils dargestellt durch die Formel



wobei in L_{A274}: R = H, und R^A = H,
in L_{A275}: R = H, und R^A = CH_3,
in L_{A276}: R = H, und R^A = CD_3
in L_{A277}: R = CH_3, und R^A = H,
in L_{A278}: R = CD_3, und R^A = H,
in L_{A279}: R = CH_3, und R^A = CH_3,
in L_{A280}: R = CD_3, und R^A = CD_3

(fortgesetzt)

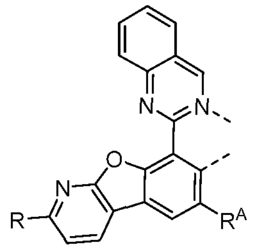
in L_{A268}: R = Ethyl, und R^A = H,
in L_{A269}: R = Ethyl, und R^A = CH_3,
in L_{A270}: R = Ethyl-d5, und R^A = CD_3,
in L_{A271}: R Isopropyl, und R^A = H,
in L_{A272}: R = Isopropyl, und R^A = CH_3,
in L_{A273}: R = Isopropyl-*d7*, und R^A = CD_3

,

in L_{A281}: R = Ethyl, und R^A = H,
in L_{A282}: R = Ethyl, und R^A = CH_3,
in L_{A283}: R = Ethyl-d5, und R^A = CD_3,
in L_{A284}: R = Isopropyl, und R^A = H,
in L_{A285}: R = Isopropyl, und R^A = CH_3,
in L_{A286}: R = Isopropyl-*d7*, und R^A = CD_3

,

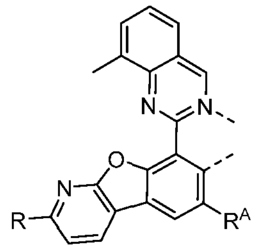
L_{A287} bis L_{A299}, jeweils dargestellt durch die Formel



wobei in L_{A287}: R = H, und R^A = H,
in L_{A288}: R = H, und R^A = CH_3,
in L_{A289}: R = H, und R^A = CD_3,
in L_{A290}: R = CH_3, und R^A = H,
in L_{A291}: R = CD_3, und R^A = H,
in L_{A292}: R = CH_3, und R^A = CH_3
in L_{A293}: R = CD_3, und R^A = CD_3,
in L_{A294}: R = Ethyl, und R^A = H,
in L_{A295}: R = Ethyl, und R^A = CH_3,
in L_{A296}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A297}: R = Isopropyl, und R^A = H,
in L_{A298}: R = Isopropyl, und R^A = CH_3,
in L_{A299}: R = Isopropyl-*d7*, und R^A = CD_3

,

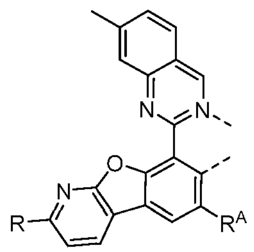
L_{A300} bis L_{A312}, jeweils dargestellt durch die Formel



wobei in L_{A300}: R = H, und R^A = H,
in L_{A301}: R = H, und R^A = CH_3,
in L_{A302}: R = H, und R^A = CD_3,
in L_{A303}: R = CH_3, und R^A = H,
in L_{A304}: R = CD_3, und R^A = H,
in L_{A305}: R = CH_3, und R^A = CH_3,
in L_{A306}: R = CD_3, und R^A = CD_3,
in L_{A307}: R = Ethyl, und R^A = H,
in L_{A308}: R = Ethyl, und R^A = CH_3,
in L_{A309}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A310}: R = Isopropyl, und R^A = H,
in L_{A311}: R = Isopropyl, und R^A = CH_3,
in L_{A312}: R = Isopropyl-*d7*, und R^A = CD_3

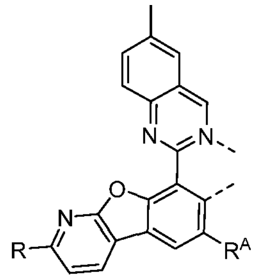
,

L_{A313} bis L_{A325}, jeweils dargestellt durch die Formel



wobei in L_{A313}: R = H, und R^A = H,
in L_{A314}: R = H, und R^A = CH_3,
in L_{A315}: R = H, und R^A = CD_3
in L_{A316}: R = CH_3, und R^A = H,
in L_{A317}: R = CD_3, und R^A = H,
in L_{A318}: R = CH_3, und R^A = CH_3
in L_{A319}: R = CD_3, und R^A = CD_3
in L_{A320}: R = Ethyl, und R^A = H,

L_{A326} bis L_{A338}, jeweils dargestellt durch die Formel



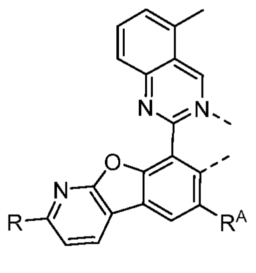
wobei in L_{A326}: R = H, und R^A = H,
in L_{A327}: R = H, und R^A = CH_3,
in L_{A328}: R = H, und R^A = CD_3
in L_{A329}: R = CH_3, und R^A = H,
in L_{A330}: R = CD_3, und R^A = H,
in L_{A331}: R = CH_3, und R^A = CH_3,
in L_{A332}: R = CD_3, und R^A = CD_3
in L_{A333}: R = Ethyl, und R^A = H,

(fortgesetzt)

in L_{A321}: R = Ethyl, und $R^A = CH_3$,
in L_{A322}: R = Ethyl-*d5*, und $R^A = CD_3$,
in L_{A323}: R = Isopropyl, und R^A = H,
in L_{A324}: R = Isopropyl, und $R^A = CH_3$,
in L_{A325}: R = Isopropyl-*d7*, und $R^A = CD_3$
,

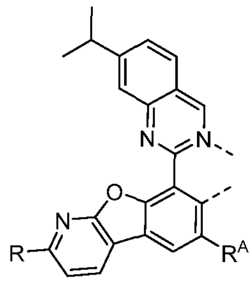
in L_{A334}: R = Ethyl, und $R^A = CH_3$,
in L_{A335}: R = Ethyl-*d5*, und $R^A = CD_3$,
in L_{A336}: R = Isopropyl, und R^A = H,
in L_{A337}: R = Isopropyl, und $R^A = CH_3$,
in L_{A338}: R = Isopropyl-*d7*, und $R^A = CD_3$
,

L_{A339} bis L_{A351}, jeweils dargestellt durch die Formel



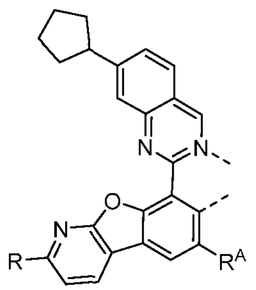
wobei in L_{A339}: R = H, und R^A = H,
in L_{A340}: R = H, und $R^A = CH_3$,
in L_{A341}: R=H, und $R^A = CD_3$.
in L_{A342}: R = CH_3, und R^A = H,
in L_{A343}: R = CD_3, und R^A = H,
in L_{A344}: R = CH_3, und $R^A = CH_3$
in L_{A345}: R = CD_3, und $R^A = CD_3$,
in L_{A346}: R = Ethyl, und R^A = H,
in L_{A347}: R = Ethyl, und $R^A = CH_3$,
in L_{A348}: R = Ethyl-*d5*, und $R^A = CD_3$,
in L_{A349}: R = Isopropyl, und R^A = H,
in L_{A350}: R = Isopropyl, und $R^A = CH_3$,
in L_{A351}: R = Isopropyl-*d7*, und $R^A = CD_3$
,

L_{A352} bis L_{A364}, jeweils dargestellt durch die Formel



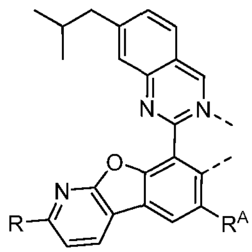
wobei in L_{A352}: R = H, und R^A = H,
in L_{A353}: R = H, und $R^A = CH_3$,
in L_{A354}: R = H, und $R^A = CD_3$,
in L_{A355}: R = CH_3, und R^A = H,
in L_{A356}: R = CD_3, und R^A = H,
in L_{A357}: R = CH_3, und $R^A = CH_3$,
in L_{A358}: R = CD_3, und $R^A = CD_3$
in L_{A359}: R = Ethyl, und R^A = H,
in L_{A360}: R = Ethyl, und $R^A = CH_3$,
in L_{A361}: R = Ethyl-*d5*, und $R^A = CD_3$,
in L_{A362}: R = Isopropyl, und R^A = H,
in L_{A363}: R = Isopropyl, und $R^A = CH_3$,
in L_{A364}: R = Isopropyl-*d7*, und $R^A = CD_3$
,

L_{A365} bis L_{A377}, jeweils dargestellt durch die Formel



wobei in L_{A365}: R = H, und R^A = H,
in L_{A366}: R = H, und $R^A = CH_3$,
in L_{A367}: R = H, und $R^A = CD_3$,
in L_{A368}: R = CH_3, und R^A = H,
in L_{A369}: R = CD_3, und R^A = H,
in L_{A370}: R = CH_3, und $R^A = CH_3$,
in L_{A371}: R = CD_3, und $R^A = CD_3$,

L_{A378} bis L_{A390}, jeweils dargestellt durch die Formel



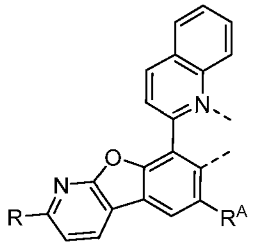
wobei in L_{A378}: R = H, und R^A = H,
in L_{A379}: R = H, und $R^A = CH_3$,
in L_{A380}: R = H, und $R^A = CD_3$,
in L_{A381}: R = CH_3, und R^A = H,
in L_{A382}: R = CD_3, und R^A = H,
in L_{A383}: R = CH_3, und $R^A = CH_3$,
in L_{A384}: R = CD_3, und $R^A = CD_3$

(fortgesetzt)

in L_{A372}: R = Ethyl, und R^A = H,
in L_{A373}: R = Ethyl, und R^A = CH_3,
in L_{A374}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A375}: R = Isopropyl, und R^A = H,
in L_{A376}: R = Isopropyl, und R^A = CH_3,
in L_{A377}: R = Isopropyl-*d7*, und R^A = CD_3
,

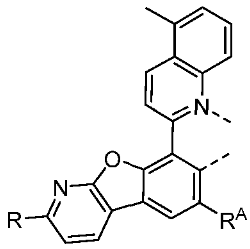
in L_{A385}: R = Ethyl, und R^A = H,
in L_{A386}: R = Ethyl, und R^A = CH_3,
in L_{A387}: R = Ethyl-*d5*, und R^A = CD_3
in L_{A388}: R = Isopropyl, und R^A = H,
in L_{A389}: R = Isopropyl, und R^A = CH_3,
in L_{A390}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A391} bis L_{A403}, jeweils dargestellt durch die Formel



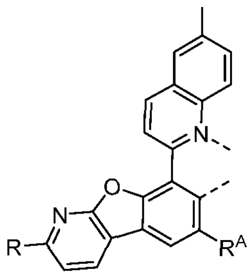
wobei in L_{A391}: R = H, und R^A = H,
in L_{A392}: R = H, und R^A = CH_3,
in L_{A393}: R = H, und R^A = CD_3
in L_{A394}: R = CH_3, und R^A = H,
in L_{A395}: R = CD_3, und R^A = H,
in L_{A396}: R = CH_3, und R^A = CH_3,
in L_{A397}: R = CD_3, und R^A = CD_3,
in L_{A398}: R = Ethyl, und R^A = H,
in L_{A399}: R = Ethyl, und R^A = CH_3,
in L_{A400}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A401}: R = Isopropyl, und R^A = H,
in L_{A402}: R = Isopropyl, und R^A = CH_3,
in L_{A403}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A404} bis L_{A416}, jeweils dargestellt durch die Formel



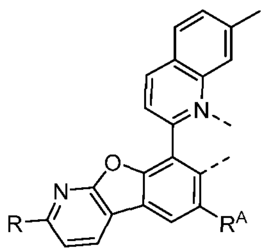
wobei in L_{A404}: R = H, und R^A = H,
in L_{A405}: R = H, und R^A = CH_3,
in L_{A406}: R = H, und R^A = CD_3,
in L_{A407}: R = CH_3, und R^A = H,
in L_{A408}: R = CD_3, und R^A = H,
in L_{A409}: R = CH_3, und R^A = CH_3,
in L_{A410}: R = CD_3, und R^A = CD_3,
in L_{A411}: R = Ethyl, und R^A = H,
in L_{A412}: R = Ethyl, und R^A = CH_3,
in L_{A413}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A414}: R = Isopropyl, und R^A = H,
in L_{A415}: R = Isopropyl, und R^A = CH_3,
in L_{A416}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A417} bis L_{A429}, jeweils dargestellt durch die Formel



wobei in L_{A417}: R = H, und R^A = H,
in L_{A418}: R = H, und R^A = CH_3,
in L_{A419}: R = H, und R^A = CD_3,
in L_{A420}: R = CH_3, und R^A = H,
in L_{A421}: R = CD_3, und R^A = H,
in L_{A422}: R = CH_3, und R^A = CH_3,
in L_{A423}: R = CD_3, und R^A = CD_3
in L_{A424}: R = Ethyl, und R^A = H,

L_{A430} bis L_{A442}, jeweils dargestellt durch die Formel



wobei in L_{A430}: R = H, und R^A = H,
in L_{A431}: R = H, und R^A = CH_3,
in L_{A432}: R = H, und R^A = CD_3,
in L_{A433}: R = CH_3, und R^A = H,
in L_{A434}: R = CD_3, und R^A = H,
in L_{A435}: R = CH_3, und R^A = CH_3,
in L_{A436}: R = CD_3, und R^A = CD_3,
in L_{A437}: R = Ethyl, und R^A = H,

(fortgesetzt)

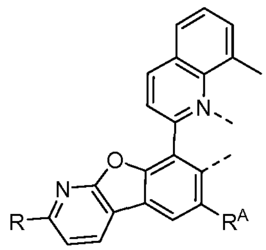
in L_{A425}: R = Ethyl, und R^A = CH_3,
in L_{A426}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A427}: R = Isopropyl, und R^A = H,
in P_{A428}: R = Isopropyl, und R^A = CH_3,
in L_{A429}: R = Isopropyl-*d7*, und R^A = CD_3

,

in L_{A438}: R = Ethyl, und R^A = CH_3,
in L_{A439}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A440}: R = Isopropyl, und R^A = H,
in L_{A441}: R = Isopropyl, und R^A = CH_3,
in L_{A442}: R = Isopropyl-*d7*, und R^A = CD_3

,

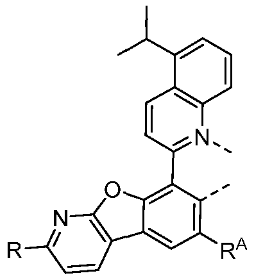
L_{A443} bis L_{A455}, jeweils dargestellt durch die Formel



wobei in L_{A443}: R = H, und R^A = H,
in L_{A444}: R = H, und R^A = CH_3,
in L_{A445}: R = H, und R^A = CD_3,
in L_{A446}: R = CH_3, und R^A = H,
in L_{A447}: R = CD_3, und R^A = H,
in L_{A448}: R = CH_3, und R^A = CH_3,
in L_{A449}: R = CD_3, und R^A = CD_3,
in L_{A450}: R = Ethyl, und R^A = H,
in L_{A451}: R = Ethyl, und R^A = CH_3,
in L_{A452}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A453}: R = Isopropyl, und R^A = H,
in L_{A454}: R = Isopropyl, und R^A = CH_3,
in L_{A455}: R = Isopropyl-*d7*, und R^A = CD_3

,

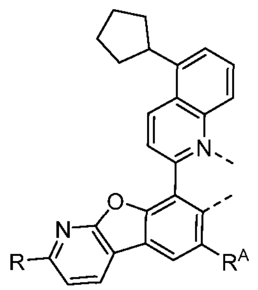
L_{A456} bis L_{A468}, jeweils dargestellt durch die Formel



wobei in L_{A456}: R = H, und R^A = H,
in L_{A457}: R = H, und R^A = CH_3,
in L_{A458}: R = H, und R^A = CD_3
in L_{A459}: R = CH_3, und R^A = H,
in L_{A460}: R = CD_3, und R^A = H,
in L_{A461}: R = CH_3, und R^A = CH_3,
in L_{A462}: R = CD_3, und R^A = CD_3
in L_{A463}: R = Ethyl, und R^A = H,
in L_{A464}: R = Ethyl, und R^A = CH_3,
in L_{A465}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A466}: R = Isopropyl, und R^A = H,
in L_{A467}: R = Isopropyl, und R^A = CH_3,
in L_{A468}: R = Isopropyl-*d7*, und R^A = CD_3

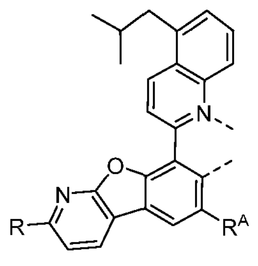
,

L_{A469} bis L_{A481}, jeweils dargestellt durch die Formel



wobei in L_{A469}: R = H, und R^A = H,
in L_{A470}: R = H, und R^A = CH_3,
in L_{A471}: R = H, und R^A = CD_3,
in L_{A472}: R = CH_3, und R^A = H,
in L_{A473}: R = CD_3, und R^A = H,
in L_{A474}: R = CH_3, und R^A = CH_3,
in L_{A475}: R = CD_3, und R^A = CD_3,

L_{A482} bis L_{A494}, jeweils dargestellt durch die Formel



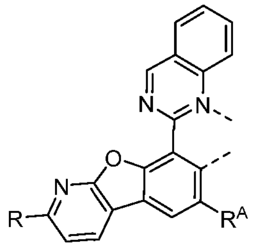
wobei in L_{A482}: R = H, und R^A = H,
in L_{A483}: R = H, und R^A = CH_3,
in L_{A484}: R = H, und R^A = CD_3,
in L_{A485}: R = CH_3, und R^A = H,
in L_{A486}: R = CD_3, und R^A = H,
in L_{A487}: R = CH_3, und R^A = CH_3,
in L_{A488}: R = CD_3, und R^A = CD_3,

(fortgesetzt)

in L_{A476}: R = Ethyl, und R^A = H,
in L_{A477}: R = Ethyl, und R^A = CH_3,
in L_{A478}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A479}: R = Isopropyl, und R^A = H,
in L_{A480}: R = Isopropyl, und R^A = CH_3,
in L_{A481}: R = Isopropyl-*d7*, und R^A = CD_3
,

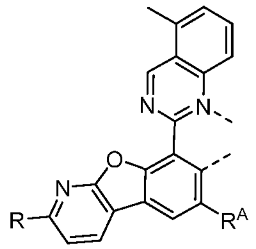
in L_{A489}: R = Ethyl, und R^A = H,
in L_{A490}: R = Ethyl, und R^A = CH_3,
in L_{A491}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A492}: R = Isopropyl, und R^A = H,
in L_{A493}: R = Isopropyl, und R^A = CH_3,
in L_{A494}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A495} bis L_{A507}, jeweils dargestellt durch die Formel



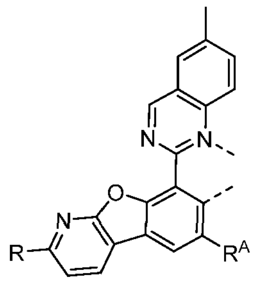
wobei in L_{A495}: R = H, und R^A = H,
in L_{A496}: R = H, und R^A = CH_3,
in L_{A497}: R = H, und R^A = CD_3,
in L_{A498}: R = CH_3, und R^A = H,
in L_{A499}: R = CD_3, und R^A = H,
in L_{A500}: R = CH_3, und R^A = CH_3,
in L_{A501}: R = CD_3, und R^A = CD_3,
in L_{A502}: R = Ethyl, und R^A = H,
in L_{A503}: R = Ethyl, und R^A = CH_3,
in L_{A504}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A505}: R = Isopropyl, und R^A = H,
in L_{A506}: R = Isopropyl, und R^A = CH_3,
in L_{A507}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A508} bis L_{A520}, jeweils dargestellt durch die Formel



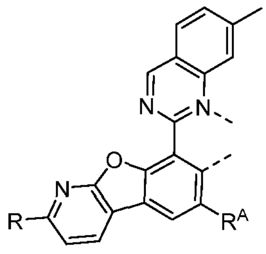
wobei in L_{A508}: R = H, und R^A = H,
in L_{A509}: R = H, und R^A = CH_3,
in L_{A510}: R = H, und R^A = CD_3,
in L_{A511}: R = CH_3, und R^A = H,
in L_{A512}: R = CD_3, und R^A = H,
in L_{A513}: R = CH_3, und R^A = CH_3,
in L_{A514}: R = CD_3, und R^A = CD_3,
in L_{A515}: R = Ethyl, und R^A = H,
in L_{A516}: R = Ethyl, und R^A = CH_3,
in L_{A517}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A518}: R = Isopropyl, und R^A = H,
in L_{A519}: R = Isopropyl, und R^A = CH_3,
in L_{A520}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A521} bis L_{A533}, jeweils dargestellt durch die Formel



wobei in L_{A521}: R = H, und R^A = H,
in L_{A522}: R = H, und R^A = CH_3,
in L_{A523}: R = H, und R^A = CD_3,
in L_{A524}: R = CH_3, und R^A = H,
in L_{A525}: R = CD_3, und R^A = H,
in L_{A526}: R = CH_3, und R^A = CH_3,
in L_{A527}: R = CD_3, und R^A = CD_3,

L_{A534} bis L_{A546}, jeweils dargestellt durch die Formel



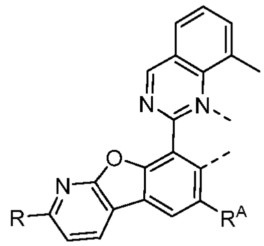
wobei in L_{A534}: R = H, und R^A = H,
in L_{A535}: R = H, und R^A = CH_3,
in L_{A536}: R = H, und R^A = CD_3,
in L_{A537}: R = CH_3, und R^A = H,
in L_{A538}: R = CD_3, und R^A = H,
in L_{A539}: R = CH_3, und R^A = CH_3,
in L_{A540}: R = CD_3, und R^A = CD_3,

(fortgesetzt)

in L_{A528}: R = Ethyl, und R^A = H,
in L_{A529}: R = Ethyl, und R^A = CH_3,
in L_{A530}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A531}: R = Isopropyl, und R^A = H,
in L_{A532}: R = Isopropyl, und R^A = CH_3,
in L_{A533}: R = Isopropyl-*d7*, und R^A = CD_3
,

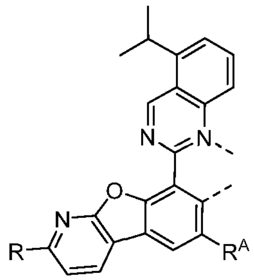
in L_{A541}: R = Ethyl, und R^A = H,
in L_{A542}: R = Ethyl, und R^A = CH_3,
in L_{A543}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A544}: R = Isopropyl, und R^A = H,
in L_{A545}: R = Isopropyl, und R^A = CH_3,
in L_{A546}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A547} bis L_{A559}, jeweils dargestellt durch die Formel



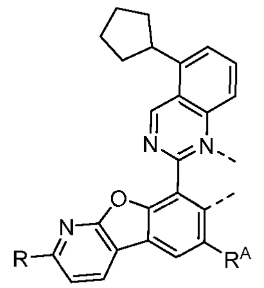
wobei in L_{A547}: R = H, und R^A = H,
in L_{A548}: R = H, und R^A = CH_3,
in L_{A549}: R = H, und R^A = CD_3,
in L_{A550}: R = CH_3, und R^A = H,
in L_{A551}: R = CD_3, und R^A = H,
in L_{A552}: R = CH_3, und R^A = CH_3,
in L_{A553}: R = CD_3, und R^A = CD_3,
in L_{A554}: R = Ethyl, und R^A = H,
in L_{A555}: R = Ethyl, und R^A = CH_3,
in L_{A556}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A557}: R = Isopropyl, und R^A = H,
in L_{A558}: R = Isopropyl, und R^A = CH_3,
in L_{A559}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A560} bis L_{A572}, jeweils dargestellt durch die Formel



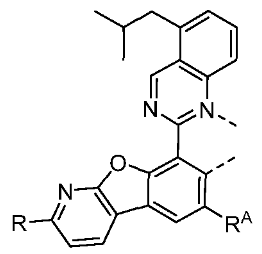
wobei in L_{A560}: R = H, und R^A = H,
in L_{A561}: R = H, und R^A = CH_3,
in L_{A562}: R = H, und R^A = CD_3,
in L_{A563}: R = CH_3, und R^A = H,
in L_{A564}: R = CD_3, und R^A = H,
in L_{A565}: R = CH_3, und R^A = CH_3,
in L_{A566}: R = CD_3, und R^A = CD_3,
in L_{A567}: R = Ethyl, und R^A = H,
in L_{A568}: R = Ethyl, und R^A = CH_3,
in L_{A569}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A570}: R = Isopropyl, und R^A = H,
in L_{A571}: R = Isopropyl, und R^A = CH_3,
in L_{A572}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A573} bis L_{A585}, jeweils dargestellt durch die Formel



wobei in L_{A573}: R = H, und R^A = H,
in $L_{A574:}$ R = H, und R^A = CH_3,
in L_{A575}: R = H, und R^A = CD_3,
in L_{A576}: R = CH_3, und R^A = H,
in L_{A577}: R = CD_3, und R^A = H,
in L_{A578}: R = CH_3, und R^A = CH_3,
in L_{A579}: R = CD_3, und R^A = CD_3,

L_{A586} bis L_{A598}, jeweils dargestellt durch die Formel



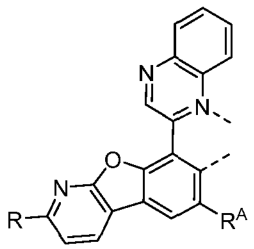
wobei in L_{A586}: R = H, und R^A = H,
in L_{A587}: R = H, und R^A = CH_3,
in L_{A588}: R = H, und R^A = CD_3,
in L_{A589}: R = CH_3, und R^A = H,
in L_{A590}: R = CD_3, und R^A = H,
in L_{A591}: R = CH_3, und R^A = CH_3,
in L_{A592}: R = CD_3, und R^A = CD_3,

(fortgesetzt)

in L_{A580}: R = Ethyl, und R^A = H,
in L_{A581}: R = Ethyl, und R^A = CH_3,
in L_{A582}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A583}: R = Isopropyl, und R^A = H,
in L_{A584}: R = Isopropyl, und R^A = CH_3,
in L_{A585}: R = Isopropyl-*d7*, und R^A = CD_3
,

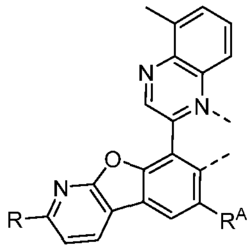
in L_{A593}: R = Ethyl, und R^A = H,
in L_{A594}: R = Ethyl, und R^A = CH_3,
in L_{A595}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A596}: R = Isopropyl, und R^A = H,
in L_{A597}: R = Isopropyl, und R^A = CH_3,
in L_{A598}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A599} bis L_{A611}, jeweils dargestellt durch die Formel



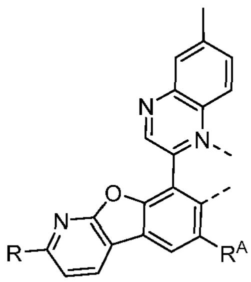
wobei in L_{A599}: R = H, und R^A = H,
in L_{A600}: R = H, und R^A = CH_3,
in L_{A601}: R = H, und R^A = CD_3,
in L_{A602}: R = CH_3, und R^A = H,
in L_{A603}: R = CD_3, und R^A = H,
in L_{A604}: R = CH_3, und R^A = CH_3,
in L_{A605}: R = CD_3, und R^A = CD_3,
in L_{A606}: R = Ethyl, und R^A = H,
in L_{A607}: R = Ethyl, und R^A = CH_3,
in L_{A608}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A609}: R = Isopropyl, und R^A = H,
in L_{A610}: R = Isopropyl, und R^A = CH_3,
in L_{A611}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A612} bis L_{A624}, jeweils dargestellt durch die Formel



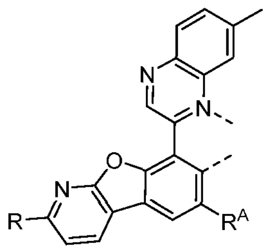
wobei in L_{A612}: R = H, und R^A = H,
in L_{A613}: R = H, und R^A = CH_3,
in L_{A614}: R = H, und R^A = CD_3,
in L_{A615}: R = CH_3, und R^A = H,
in L_{A616}: R = CD_3, und R^A = H,
in L_{A617}: R = CH_3, und R^A = CH_3,
in L_{A618}: R = CD_3, und R^A = CD_3,
in L_{A619}: R = Ethyl, und R^A = H,
in L_{A620}: R = Ethyl, und R^A = CH_3,
in L_{A621}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A622}: R = Isopropyl, und R^A = H,
in L_{A623}: R = Isopropyl, und R^A = CH_3,
in L_{A624}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A625} bis L_{A637}, jeweils dargestellt durch die Formel



wobei in L_{A625}: R = H, und R^A = H,
in L_{A626}: R = H, und R^A = CH_3,
in L_{A627}: R = H, und R^A = CD_3
in L_{A628}: R = CH_3, und R^A = H,
in L_{A629}: R = CD_3, und R^A = H,
in L_{A630}: R = CH_3, und R^A = CH_3,
in L_{A631}: R = CD_3, und R^A = CD_3,
in L_{A632}: R = Ethyl, und R^A = H,

L_{A638} bis L_{A650}, jeweils dargestellt durch die Formel



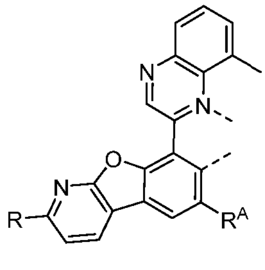
wobei in L_{A638}: R = H, und R^A = H,
in L_{A639}: R = H, und R^A = CH_3,
in L_{A640}: R = H, und R^A = CD_3
in L_{A641}: R = CH_3, und R^A = H,
in L_{A642}: R = CD_3, und R^A = H,
in L_{A643}: R = CH_3, und R^A = CH_3,
in L_{A644}: R = CD_3, und R^A = CD_3,
in L_{A645}: R = Ethyl, und R^A = H,

(fortgesetzt)

in L_{A633}: R = Ethyl, und R^A = CH_3,
in L_{A634}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A635}: R = Isopropyl, und R^A = H,
in L_{A636}: R = Isopropyl, und R^A = CH_3,
in L_{A637}: R = Isopropyl-*d7*, und R^A = CD_3
,

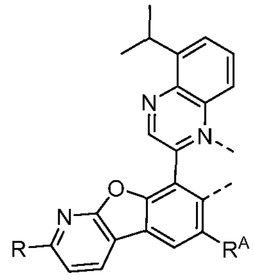
in L_{A646}: R = Ethyl, und R^A = CH_3,
in L_{A647}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A648}: R = Isopropyl, und R^A = H,
in L_{A649}: R = Isopropyl, und R^A = CH_3,
in L_{A650}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A651} bis L_{A663}, jeweils dargestellt durch die Formel



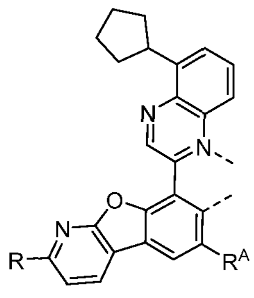
wobei in L_{A651}: R = H, und R^A = H,
in L_{A652}: R = H, und R^A = CH_3,
in L_{A653}: R = H, und R^A = CD_3,
in L_{A654}: R = CH_3, und R^A = H,
in L_{A655}: R = CD_3, und R^A = H,
in L_{A656}: R = CH_3, und R^A = CH_3,
in L_{A657}: R = CD_3, und R^A = CD_3,
in L_{A658}: R = Ethyl, und R^A = H,
in L_{A659}: R = Ethyl, und R^A = CH_3,
in L_{A660}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A661}: R = Isopropyl, und R^A = H,
in L_{A662}: R = Isopropyl, und R^A = CH_3,
in L_{A663}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A664} bis L_{A676}, jeweils dargestellt durch die Formel



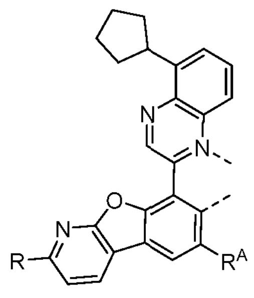
wobei in L_{A664}: R = H, und R^A = H,
in L_{A665}: R = H, und R^A = CH_3,
in L_{A666}: R = H, und R^A = CD_3,
in L_{A667}: R = CH_3, und R^A = H,
in L_{A668}: R = CD_3, und R^A = H,
in L_{A669}: R = CH_3, und R^A = CH_3,
in L_{A670}: R = CD_3, und R^A = CD_3
in L_{A671}: R = Ethyl, und R^A = H,
in L_{A672}: R = Ethyl, und R^A = CH_3,
in L_{A673}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A674}: R = Isopropyl, und R^A = H,
in L_{A675}: R = Isopropyl, und R^A = CH_3,
in L_{A676}: R = Isopropyl-*d7*, und R^A = CD_3
,

L_{A677} bis L_{A689}, jeweils dargestellt durch die Formel



wobei in L_{A677}: R = H, und R^A = H,
in L_{A678}: R = H, und R^A = CH_3,
in L_{A679}: R = H, und R^A = CD_3,
in L_{A680}: R = CH_3, und R^A = H,
in L_{A681}: R = CD_3, und R^A = H,
in L_{A682}: R = CH_3, und R^A = CH_3,
in L_{A683}: R = CD_3, und R^A = CD_3,

L_{A690} bis L_{A702}, jeweils dargestellt durch die Formel



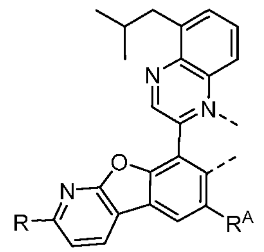
wobei in L_{A690}: R = H, und R^A = H,
in L_{A691}: R = H, und R^A = CH_3,
in L_{A692}: R = H, und R^A = CD_3,
in L_{A693}: R = CH_3, und R^A = H,
in L_{A694}: R = CD_3, und R^A = H,
in L_{A695}: R = CH_3, und R^A = CH_3,
in L_{A696}: R = CD_3, und R^A = CD_3,

(fortgesetzt)

in L_{A684}: R = Ethyl, und R^A = H,
in L_{A685}: R = Ethyl, und R^A = CH_3,
in L_{A686}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A687}: R = Isopropyl, und R^A = H,
in L_{A688}: R = Isopropyl, und R^A = CH_3,
in L_{A689}: R = Isopropyl-*d7*, und R^A = CD_3,
in L_{A697}: R = Ethyl, und R^A = H,
in L_{A698}: R = Ethyl, und R^A = CH_3,
in L_{A699}: R = Ethyl-*d5*, und R^A = CD_3
in L_{A700}: R = Isopropyl, und R^A = H,
in L_{A701}: R = Isopropyl, und R^A = CH_3,
in L_{A702}: R = Isopropyl-*d7*, und R^A = CD_3,

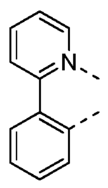
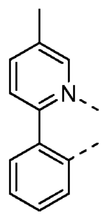
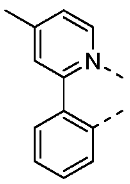
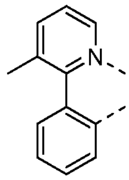
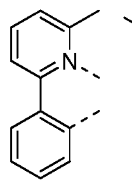
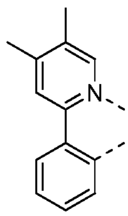
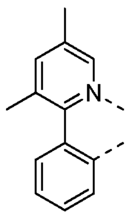
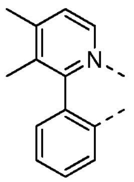
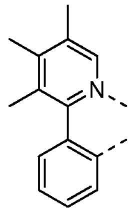
und

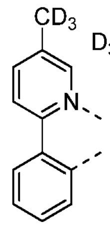
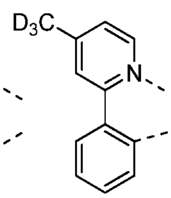
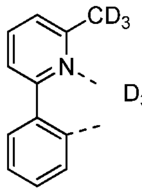
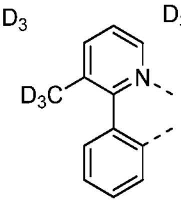
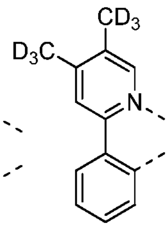
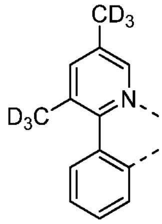
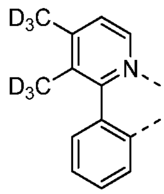
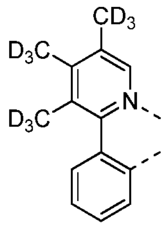
L_{A703} bis L_{A715}, jeweils dargestellt durch die Formel

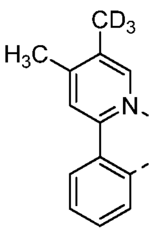
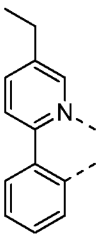
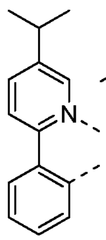


wobei in L_{A703}: R = H, und R^A = H,
in L_{A704}: R = H, und R^A = CH_3,
in L_{A705}: R = H, und R^A = CD_3,
in L_{A706}: R = CH_3, und R^A = H,
in L_{A707}: R = CD_3, und R^A = H,
in L_{A708}: R = CH_3, und R^A = CH_3,
in L_{A709}: R = CD_3, und R^A = CD_3,
in L_{A710}: R = Ethyl, und R^A = H,
in L_{A711}: R = Ethyl, und R^A = CH_3,
in L_{A712}: R = Ethyl-*d5*, und R^A = CD_3,
in L_{A713}: R = Isopropyl, und R^A = H,
in L_{A714}: R = Isopropyl, und R^A = CH_3,
in L_{A715}: R = Isopropyl-*d7*, und R^A = CD_3.

16. Die Verbindung nach Anspruch 1 oder 15, wobei L_C ausgewählt ist aus der Gruppe bestehend aus:


L_{C1} ,

L_{C2} ,

L_{C3} ,

L_{C4} ,

L_{C5} ,

L_{C6} ,

L_{C7} ,

L_{C8} ,

L_{C9} ,


L_{C10},

L_{C11},

L_{C12},

L_{C13},

L_{C14},

L_{C15},

L_{C16},

L_{C17},


L_{C18},

L_{C19},

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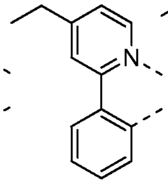
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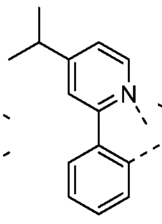
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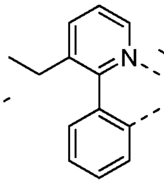
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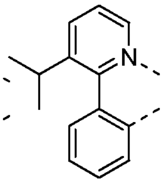
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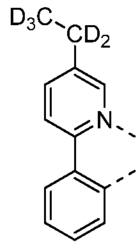
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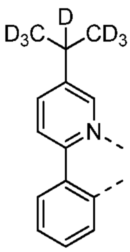
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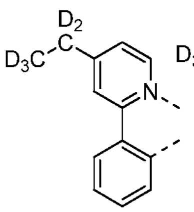
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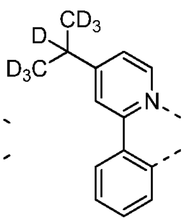
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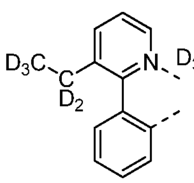
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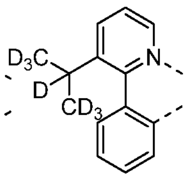
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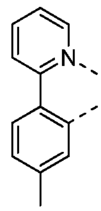
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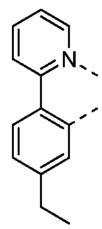
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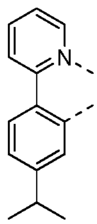
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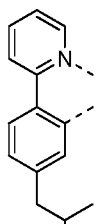
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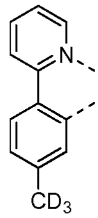
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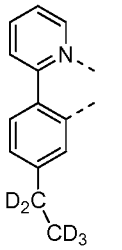
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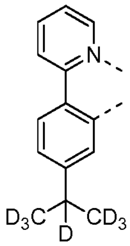
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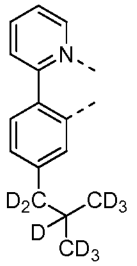
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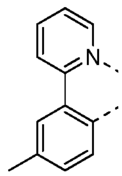
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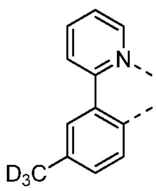
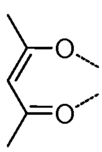
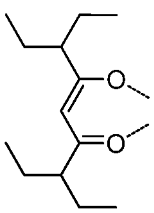
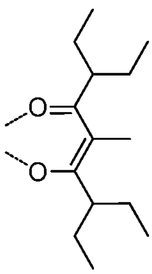
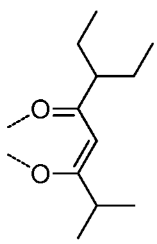
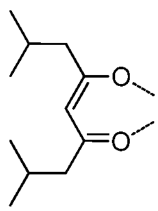
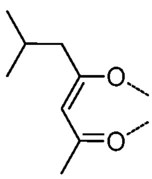
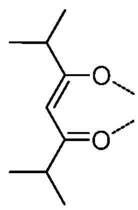
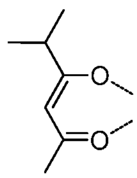
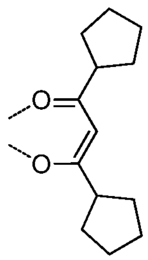

L_{C40}.

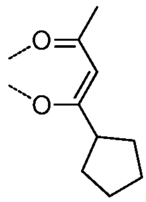
17. Die Verbindung nach Anspruch 1 oder 15, wobei L_B ausgewählt ist aus der Gruppe bestehend aus:


L_{B42},

L_{B43},

L_{B44},

L_{B45},

L_{B46},

L_{B47},

L_{B48},

L_{B49},

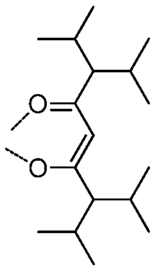
,



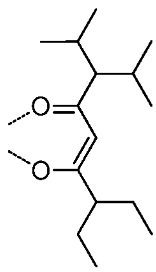
L_{B50} ,



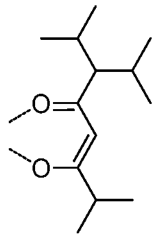
L_{B51} ,



L_{B52} ,

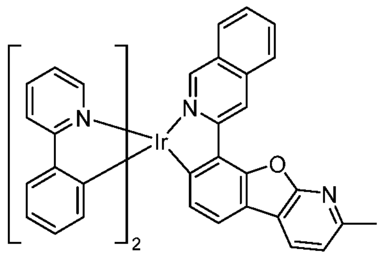


L_{B53} und

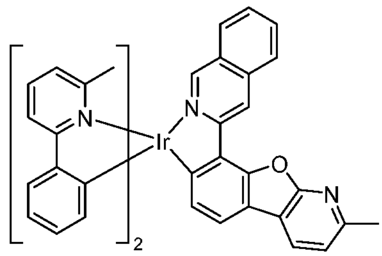


L_{B54} .

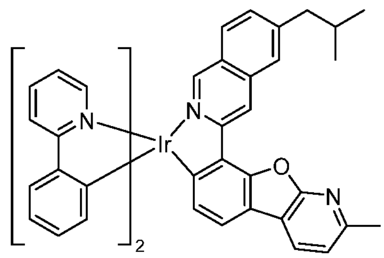
18. Die Verbindung nach Anspruch 1, wobei die Verbindung ausgewählt ist aus der Gruppe bestehend aus:



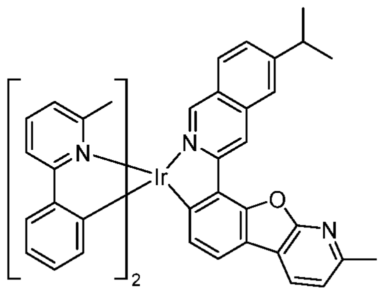
Verbindung 1 ,



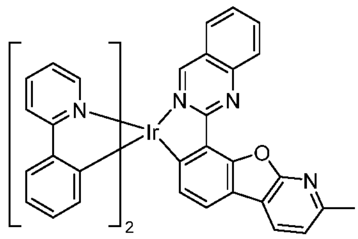
Verbindung 2 ,



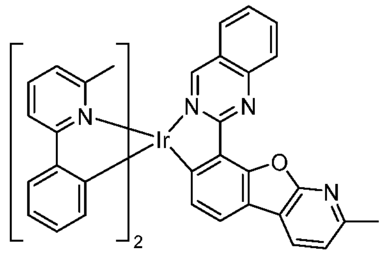
Verbindung 3 ,



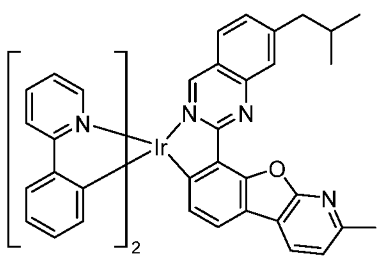
Verbindung 4 ,



Verbindung 5 ,



Verbindung 6 ,



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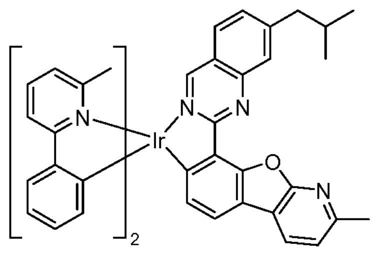

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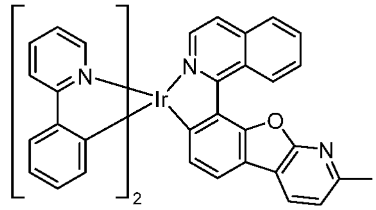
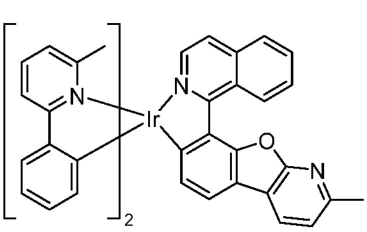
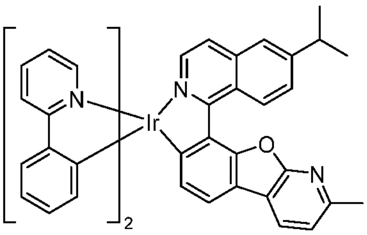
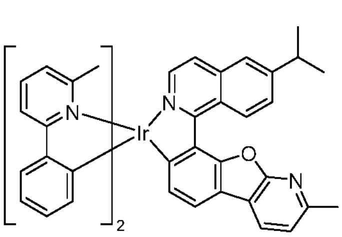


Verbindung 9 ,


Verbindung 10 ,


Verbindung 11 ,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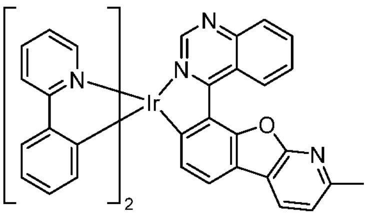
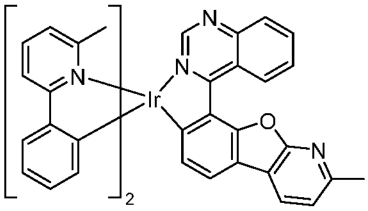

Verbindung 13 ,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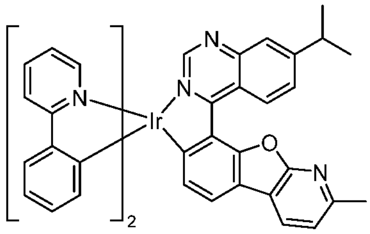
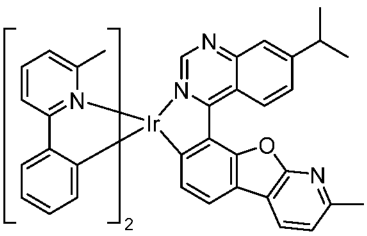

Verbindung 15 ,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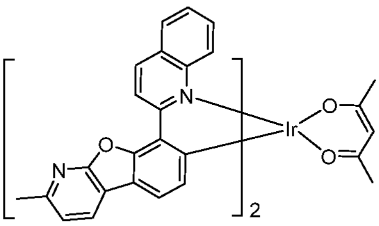
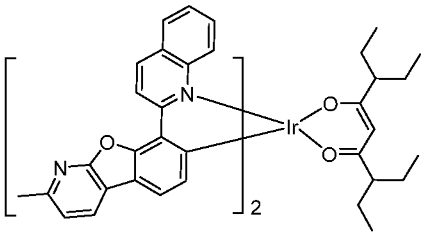

Verbindung 17 ,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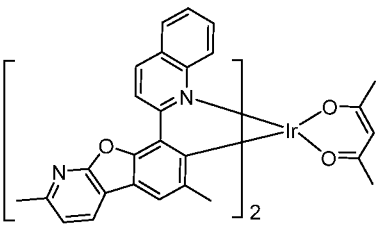
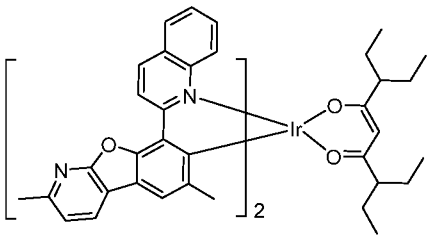
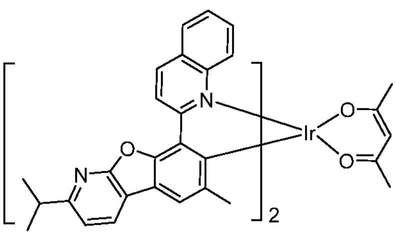

Verbindung 19 ,


Verbindung 20 ,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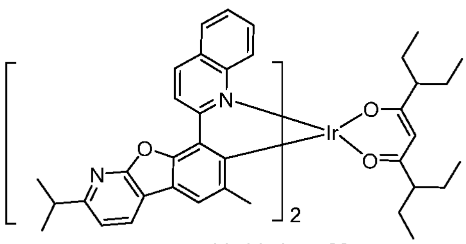
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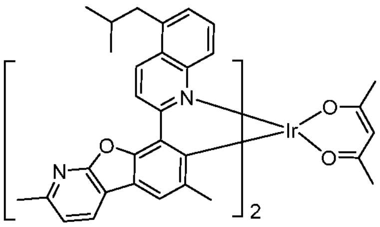
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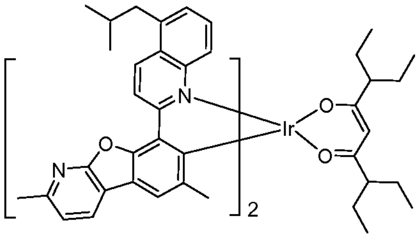
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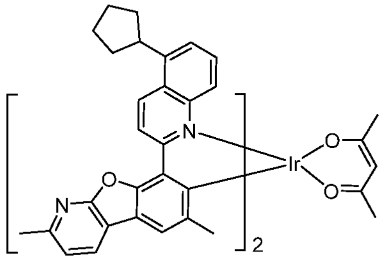
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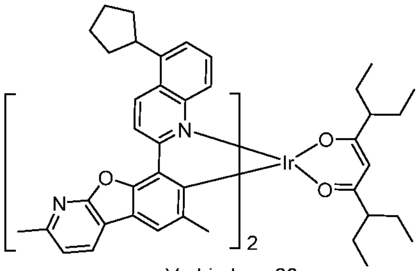
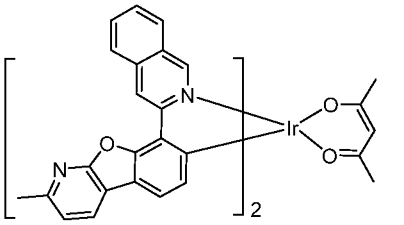

Verbindung 26 ,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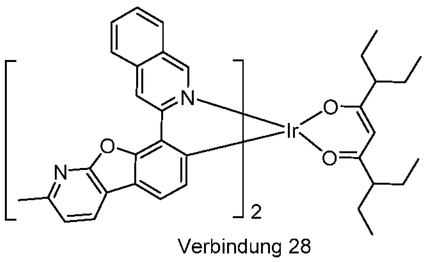
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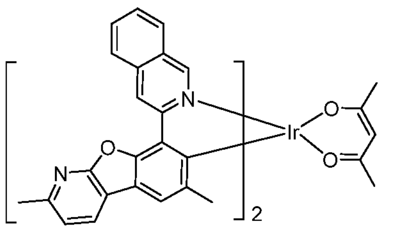
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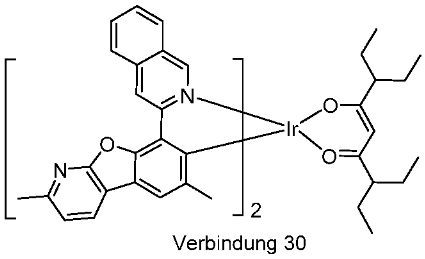
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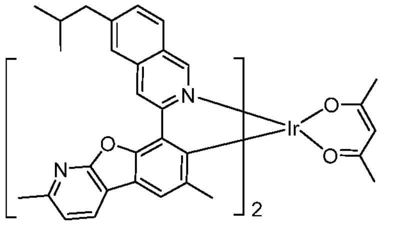
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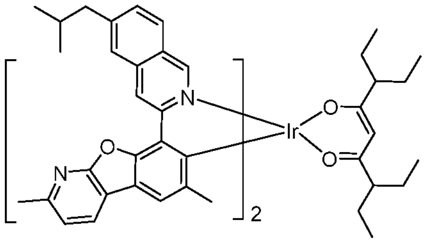
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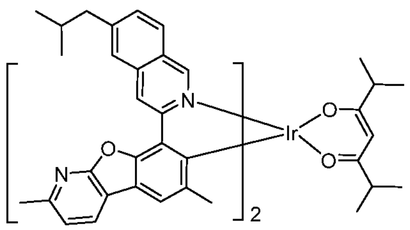
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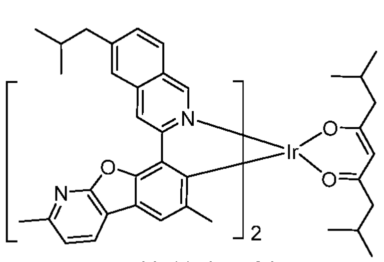
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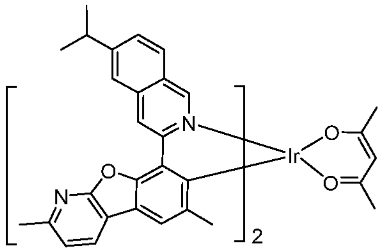
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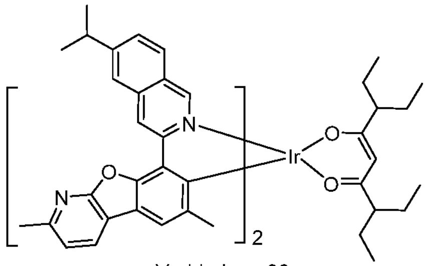
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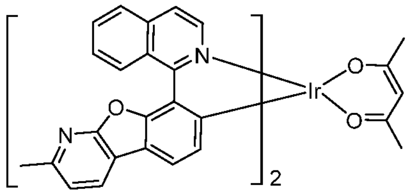
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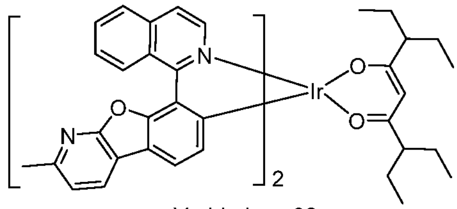
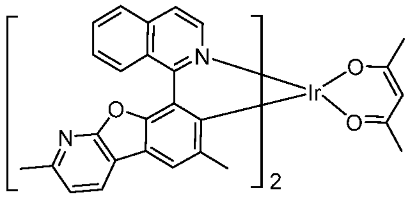

Verbindung 38,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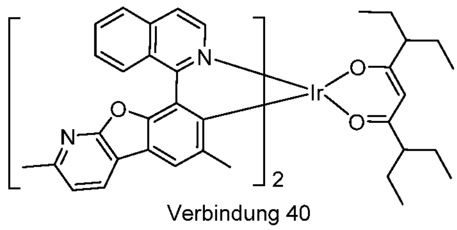
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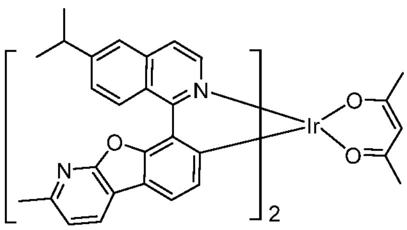
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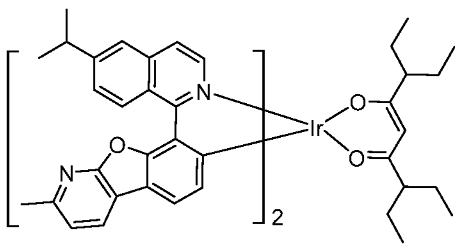
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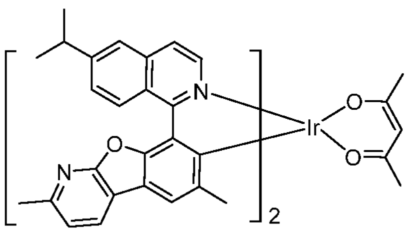
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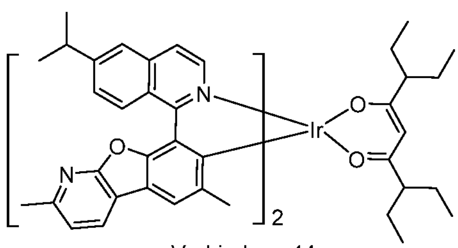
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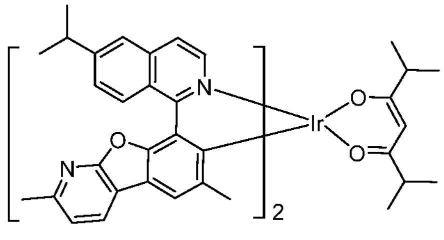

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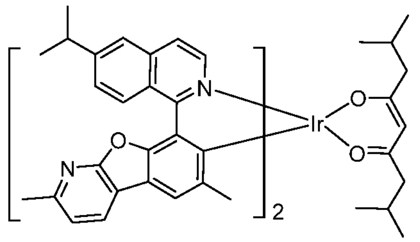

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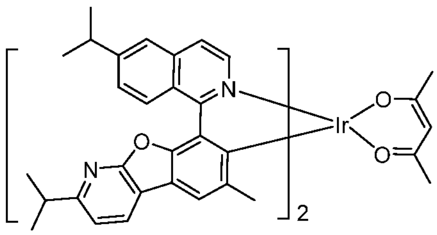
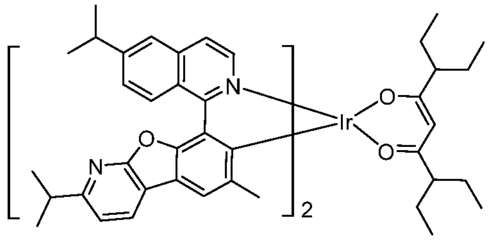


Verbindung 47,



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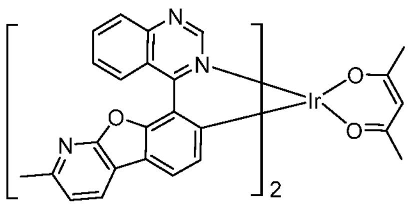

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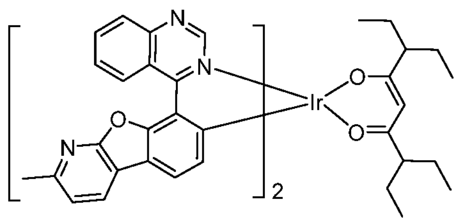
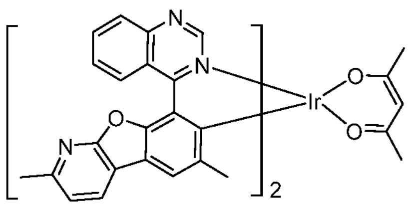


Verbindung 50,



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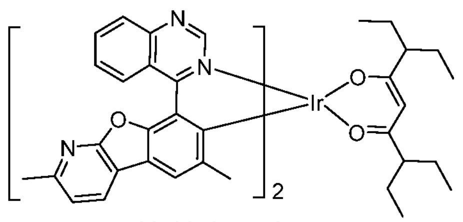

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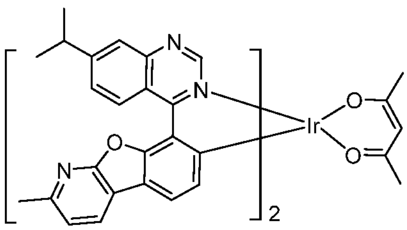
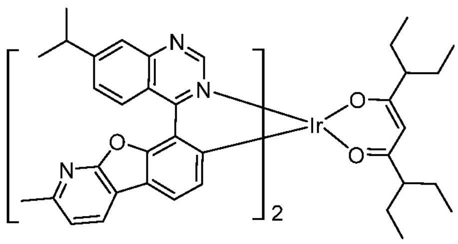


Verbindung 53,



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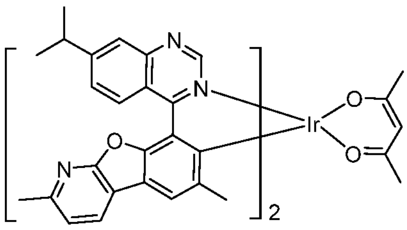

Verbindung 55

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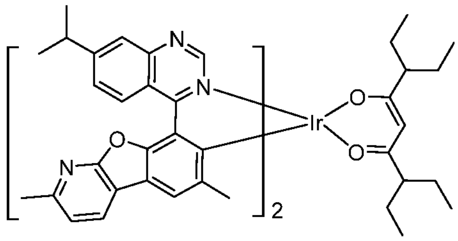

Verbindung 56

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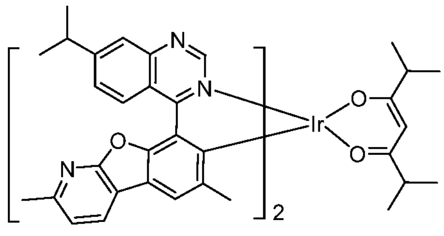

Verbindung 57

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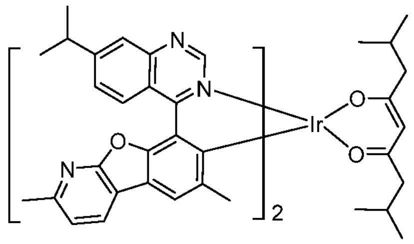

Verbindung 58

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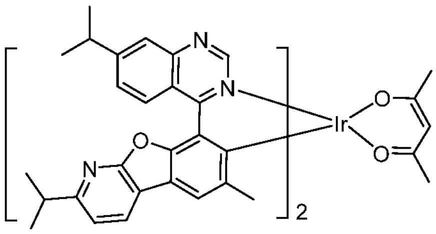
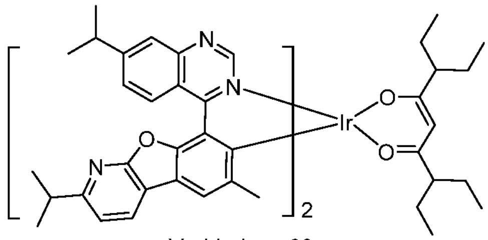


Verbindung 59

und



Verbindung 60

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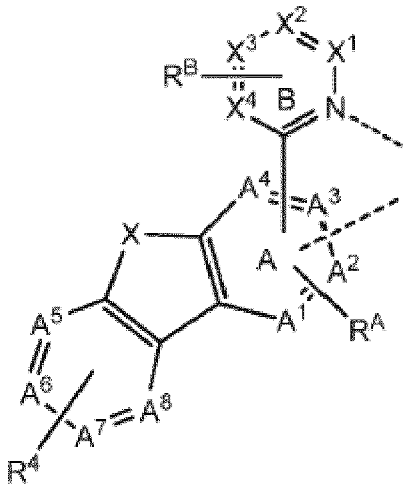
19. Eine erste Vorrichtung umfassend eine erste organische Licht-emittierende Vorrichtung, wobei die erste organische Licht-emittierende Vorrichtung umfasst:

eine Anode;
a Kathode; und
eine organische Schicht angeordnet zwischen der Anode und der Kathode, umfassend eine Verbindung wie in einem der Ansprüche 1 bis 18 definiert.

20. Eine Formulierung umfassend eine Verbindung wie in einem der Ansprüche 1 bis 19 definiert.

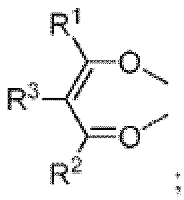
Revendications

1. Un composé étant représenté par une formule $M(L_A)_X(L_B)_y(L_c)_Z$: où le ligand L_A est



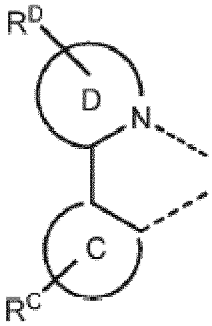
;

où le ligand L_B est



;

où le ligand Le est



;

où M est un métal ayant un numéro atomique supérieur à 40 ;
où x est 1 ou 2 ;
où y est 0, 1 ou 2 ;
où z est 0, 1 ou 2 ;
où x+y+z est l'état d'oxydation du métal M ;
où X^1, X^2, X^3, X^4, A^1, A^2, A^3, A^4, A^5, A^6, A^7, et A^8 sont C ou N ;
où au moins un de A^1, A^2, A^3, A^4, A^5, A^6, A^7, et A^8 est N ;
où le cycle B est lié au cycle A via une liaison C-C ;
où M est lié au cycle A via une liaison M-C ;
où X est O, S, ou Se ;
où les cycles C et D sont chacun indépendamment un cycle carbocyclique ou hétérocyclique à 5 ou 6 chaînons ;
où R^A représente une mono ou di substitution, ou pas de substitution ;
où R^B représente une di, tri, ou tétra substitution ;
où R^C, R^D, et R^4 représentent chacun indépendamment une mono, di, tri ou tétra substitution, ou pas de substitution ;
où deux R^B adjacents forment un cycle E carbocyclique ou hétérocyclique aromatique à six chaînons fusionné au cycle B ; où, lorsque le cycle E est hétérocyclique, le seul hétéroatome est azote ; où le cycle E peut en outre être substitué par R^E ; et où R^E représente une mono, di, tri, ou tétra substitution, ou pas de substitution ;

où R^A, R^B, R^C, R^D, R^E, R^1, R^2, R^3, et R^4 sont chacun indépendamment sélectionnés parmi le groupe constitué d'hydrogène, deutérium, halogénure, alkyle, cycloalkyle, hétéroalkyle, arylalkyle, alkoxy, aryloxy, amino, silyle, alcényle, cycloalcényle, hétéroalcényle, alcynyle, aryle, hétéroaryle, acyle, carbonyle, acides carboxyliques, ester, nitrile, isonitrile, sulfanyle, sulfinyle, sulfonyle, phosphino, et de combinaisons de ceux-ci ; et
où tous substituants adjacents de R^C et R^D sont éventuellement liés pour former un cycle fusionné.

2. Le composé selon la revendication 1, où M est Ir.

3. Le composé selon la revendication 1 ou 2, où X est O.

4. Le composé selon l'une quelconque des revendications 1 à 3, où le composé est représenté par la formule $M(L_A)_2(L_B)$.

5. Le composé selon l'une quelconque des revendications 1 à 3, où le composé est représenté par la formule $M(L_A)(L_C)_2$.

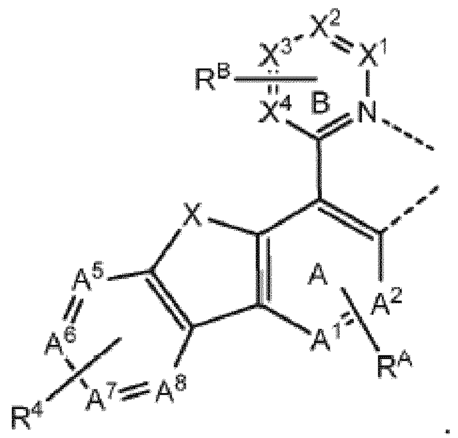
6. Le composé selon l'une quelconque des revendications 1 à 5, où un seul de A^1 à A^8 est N.

7. Le composé selon l'une quelconque des revendications 1 à 6, où un seul de A^5 à A^8 est N.

8. Le composé selon l'une quelconque des revendications 1 à 7, où X^1, X^2, X^3, et X^4 sont C ; et E est benzène.

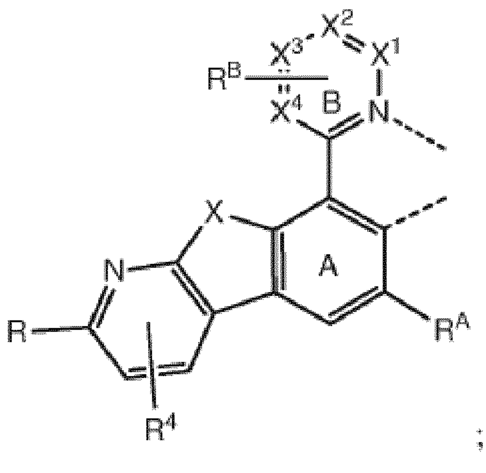
9. Le composé selon l'une quelconque des revendications 1 à 7, où (a) au moins un de X^1, X^2, X^3, et X^4 est N, (b) le cycle E est hétérocylique, ou (c) les deux.

10. Le composé selon l'une quelconque des revendications 1 à 9, où L_A est représenté par la formule :



.

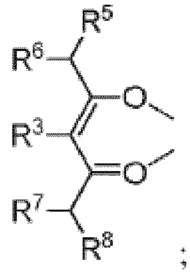
11. Le composé selon l'une quelconque des revendications 1 à 10, où L_A est représenté par la formule :



;

où R est sélectionné parmi le groupe constitué d'alkyle, cycloalkyle, et de combinaisons de ceux-ci.

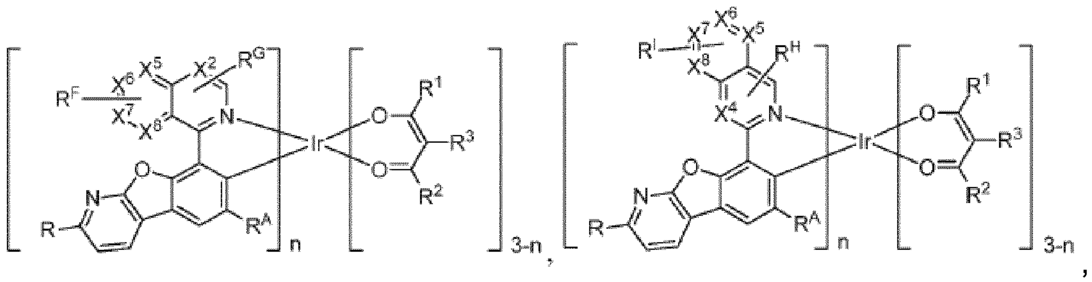
12. Le composé selon l'une quelconque des revendications 1 à 4 et 6 à 11, où L_B est représenté par la formule :



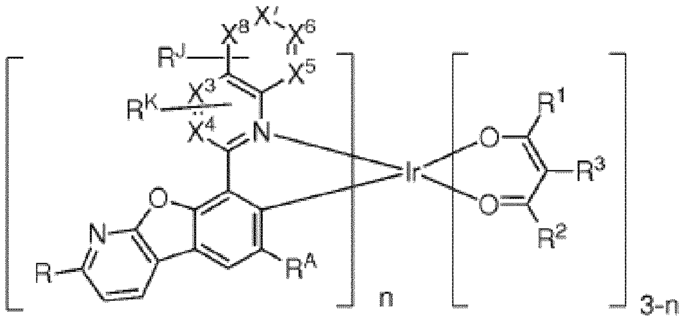
où R^5, R^6, R^7 et R^8 sont indépendamment sélectionnés parmi le groupe constitué d'alkyle, cycloalkyle, aryle et hétéroaryle ;
où au moins un de R^5, R^6, R^7, et R^8 comprend au moins deux atomes de carbone ;

13. Le composé selon l'une quelconque des 1 à 3 et 5 à 11, où le cycle C est benzène, et le cycle D est pyridine.

14. Le composé selon l'une quelconque des revendications 1 à 4 et 6 à 12, où le composé est sélectionné parmi le groupe constitué de :



et

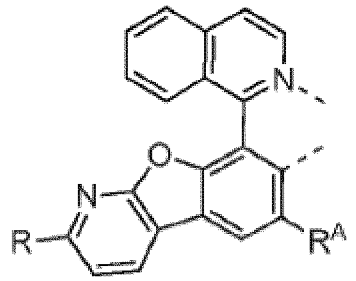


où R^F, R^G, R^H, R^I, R^J, et R^K sont chacun indépendamment sélectionnés parmi le groupe constitué d'hydrogène, deutérium, halogénure, alkyle, cycloalkyle, hétéroalkyle, arylalkyle, alkoxy, aryloxy, amino, silyle, alcényle, cycloalcényle, hétéroalcényle, alcynyle, aryle, hétéroaryle, acyle, carbonyle, acides carboxyliques, ester, nitrile, isonitrile, sulfanyle, sulfinyle, sulfonyle, phosphino, et de combinaisons de ceux-ci ; et où X^5, X^6, X^7, et X^8 sont C ou N.

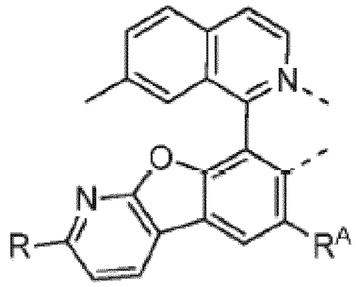
15. Le composé selon la revendication 1, où L_A est sélectionné parmi le groupe constitué de :

L_{A1} à L_{A13}, représenté chacun par la formule L_{A14} à L_{A26}, représenté chacun par la formule

(suite)

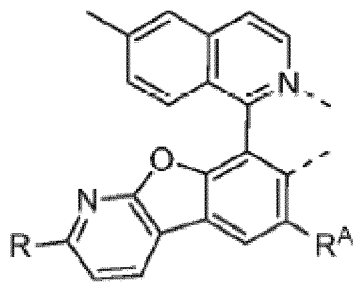


où dans L_{A1}, R = H, et R^A = H,
dans L_{A2}, R = H, et $R^A = CH_3$,
dans L_{A3}, R = H, et $R^A = CD_3$,
dans L_{A4}, R = CH_3, et R^A = H,
dans L_{A5}, R = CD_3, et R^A = H,
dans L_{A6}, R = CH_3, et $R^A = CH_3$,
dans L_{A7}, R = CD_3, et $R^A = CD_3$,
dans L_{A8}, R = Éthyle, et R^A = H,
dans L_{A9}, R = Éthyle, et $R^A = CH_3$,
dans L_{A10}, R = Éthyle-*d5*, et $R^A = CD_3$,
dans L_{A11}, R = isopropyle, et R^A = H,
dans L_{A12}, R = isopropyle, et $R^A = CH_3$,
dans L_{A13}, R = isopropyle-*d7*, et $R^A = CD_3$



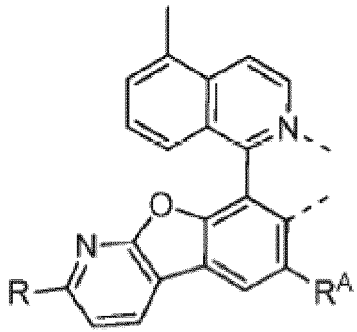
où dans L_{A14}, R = H, et R^A = H,
dans L_{A15}, R = H, et $R^A = CH_3$,
dans L_{A16}, R = H, et $R^A = CD_3$,
dans L_{A17}, R = CH_3, et R^A = H,
dans L_{A18}, R = CD_3, et R^A = H,
dans L_{A19}, R = CH_3, et $R^A = CH_3$,
dans L_{A20}, R = CD_3, et $R^A = CD_3$,
dans L_{A21}, R = Éthyle, et R^A = H,
dans L_{A22}, R = Éthyle, et $R^A = CH_3$,
dans L_{A23}, R = Éthyle-*d5*, et $R^A = CD_3$,
dans L_{A24}, R = isopropyle, et R^A = H,
dans L_{A25}, R = isopropyle, et $R^A = CH_3$,
dans L_{A26}, R = isopropyle-*d7*, et $R^A = CD_3$

L_{A27} à L_{A39}, représenté chacun par la formule



où dans L_{A27}: R = H, et R^A = H,
dans L_{A28} : R = H, et $R^A = CH_3$,
dans L_{A29} : R = H, et $R^A = CD_3$,
dans L_{A30} : R = CH_3, et R^A = H,
dans L_{A31} : R = CD_3, et R^A = H,
dans L_{A32} : R = CH_3, et $R^A = CH_3$,
dans L_{A33} : R = CD_3, et $R^A = CD_3$,
dans L_{A34} : R = Éthyle, et R^A = H,
dans L_{A35} : R = Éthyle, et $R^A = CH_3$,
dans L_{A36} : R = Éthyle-*d5*, et $R^A = CD_3$,
dans L_{A37} : R = isopropyle, et R^A = H,
dans L_{A38} : R = isopropyle, et $R^A = CH_3$,
dans L_{A39} : R = isopropyle-*d7*, et $R^A = CD_3$

L_{A40} à L_{A52}, représenté chacun par la formule

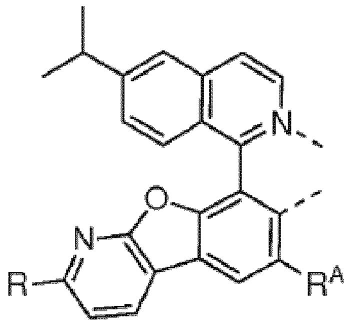


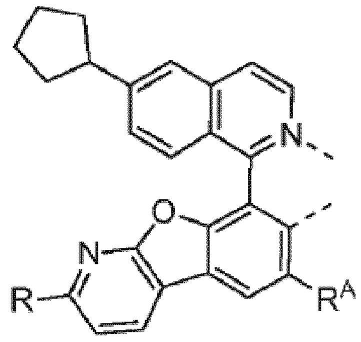
où dans L_{A40} : R = H, et R^A = H,
dans L_{A41} : R = H, et $R^A = CH_3$,
dans L_{A42} : R = H, et $R^A = CD_3$,
dans L_{A43} : R = CH_3, et R^A = H,
dans L_{A44} : R = CD_3, et R^A = H,
dans L_{A45} : R = CH_3, et $R^A = CH_3$,
dans L_{A46} : R = CD_3, et $R^A = CD_3$,
dans L_{A47} : R = Éthyle, et R^A = H,
dans L_{A48} : R = Éthyle, et $R^A = CH_3$,
dans L_{A49} : R = Éthyle-*d5*, et $R^A = CD_3$,
dans L_{A50} : R = isopropyle, et R^A = H,
dans L_{A51} : R = isopropyle, et $R^A = CH_3$,
dans L_{A52} : R = isopropyle-*d7*, et $R^A = CD_3$

L_{A53} à L_{A65}, représenté chacun par la formule

L_{A66} à L_{A78}, représenté chacun par la formule

(suite)

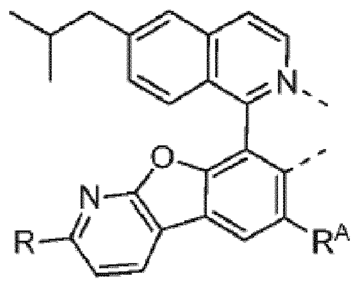




où dans L_{A53} : R = H, et R^A = H,
dans L_{A54} : R = H, et R^A = CH_3,
dans L_{A55} : R = H, et R^A = CD_3,
dans L_{A56} : R = CH_3, et R^A = H,
dans L_{A57} : R = CD_3, et R^A = H,
dans L_{A58} : R = CH_3, et R^A = CH_3,
dans L_{A59} : R = CD_3, et R^A = CD_3,
dans L_{A60} : R = Éthyle, et R^A = H,
dans L_{A61} : R = Éthyle, et R^A = CH_3,
dans L_{A62} : R = Éthyle-*d5*, et R^A = CD_3,
dans L_{A63} : R = isopropyle, et R^A = H,
dans L_{A64} : R = isopropyle, et R^A = CH_3,
dans L_{A65} : R = isopropyle-*d7*, et R^A = CD_3

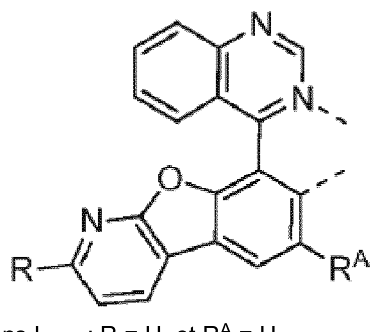
où dans L_{A66}: R = H, et R^A = H,
dans L_{A67} : R = H, et R^A = CH_3,
dans L_{A68} : R = H, et R^A = CD_3,
dans L_{A69} : R = CH_3, et R^A = H,
dans L_{A70} : R = CD_3, et R^A = H,
dans L_{A71} : R = CH_3, et R^A = CH_3,
dans L_{A72} : R = CD_3, et R^A = CD_3,
dans L_{A73} : R = Éthyle, et R^A = H,
dans L_{A74} : R = Éthyle, et R^A = CH_3,
dans L_{A75} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A76} : R = isopropyle, et R^A = H,
dans L_{A77} : R = isopropyle, et R^A = CH_3,
dans L_{A78} : R = isopropyle-*d7*, et R^A = CD_3

L_{A79} à L_{A91}, représenté chacun par la formule



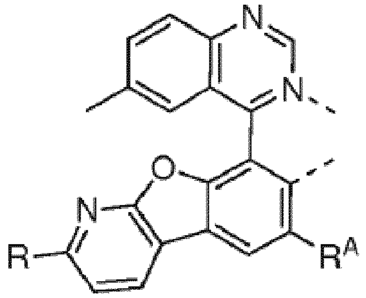
où dans L_{A79} : R = H, et R^A = H,
dans L_{A80} : R = H, et R^A = CH_3,
dans L_{A81} : R = H, et R^A = CD_3,
dans L_{A82} : R = CH_3, et R^A = H,
dans L_{A83} : R = CD_3, et R^A = H,
dans L_{A84} : R = CH_3, et R^A = CH_3,
dans L_{A85} : R = CD_3, et R^A = CD_3,
dans L_{A86} : R = Éthyle, et R^A = H,
dans L_{A87} : R = Éthyle, et R^A = CH_3,
dans L_{A88} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A89} : R = isopropyle, et R^A = H,
dans L_{A90} : R = isopropyle, et R^A = CH_3,
dans L_{A91} : R = isopropyle-*d7*, et R^A = CD_3

L_{A92} à L_{A104}, représenté chacun par la formule



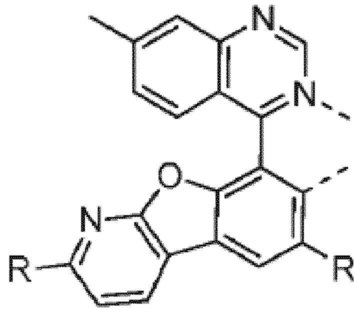
où dans L_{A92} : R = H, et R^A = H,
dans L_{A93} : R = H, et R^A = CH_3,
dans L_{A94} : R = H, et R^A = CD_3,
dans L_{A95} : R = CH_3, et R^A = H,
dans L_{A96} : R = CD_3, et R^A = H,
dans L_{A97} : R = CH_3, et R^A = CH_3,
dans L_{A98} : R = CD_3, et R^A = CD_3,
dans L_{A99} : R = Éthyle, et R^A = H,
dans L_{A100} R = Éthyle, et R^A = CH_3,
dans L_{A101} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A102} : R = isopropyle, et R^A = H,
dans L_{A103} : R = isopropyle, et R^A = CH_3,
dans L_{A104} : R = isopropyle-*d7*, et R^A = CD_3

L_{A105} à L_{A117}, représenté chacun par la formule



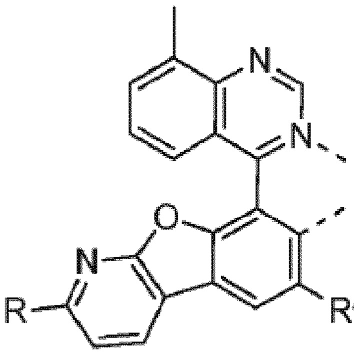
où dans L_{A105} : R = H, et R^A = H,
dans L_{A106} R = H, et R^A = CH_3,
dans L_{A107} : R = H, et R^A = CD_3,
dans L_{A108} : R = CH_3, et R^A = H,
dans L_{A109} : R = CD_3, et R^A = H,
dans L_{A110} : R = CH_3, et R^A = CH_3,
dans L_{A111} : R = CD_3, et R^A = CD_3,
dans L_{A112} : R = Éthyle, et R^A = H,
dans L_{A113} : R = Éthyle, et R^A = CH_3,
dans L_{A114} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A115} : R = isopropyle, et R^A = H,
dans L_{A116} : R = isopropyle, et R^A = CH_3,
dans L_{A117} : R = isopropyle-*d7*, et R^A = CD_3

L_{A118} à L_{A130}, représenté chacun par la formule



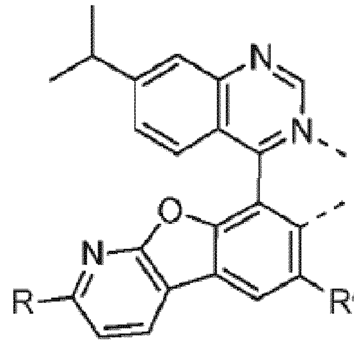
où dans L_{A118} : R = H, et R^A = H,
dans L_{A119} : R = H, et R^A = CH_3,
dans L_{A120} : R = H, et R^A = CD_3,
dans L_{A121} : R = CH_3, et R^A = H,
dans L_{A122} : R = CD_3, et R^A = H,
dans L_{A123} : R = CH_3, et R^A = CH_3,
dans L_{A124} : R = CD_3, et R^A = CD_3,
dans L_{A125} : R = Éthyle, et R^A = H,
dans L_{A126} : R = Éthyle, et R^A = CH_3,
dans L_{A127} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A128} : R = isopropyle, et R^A = H,
dans L_{A129} : R = isopropyle, et R^A = CH_3,
dans L_{A130} : R = isopropyle-*d7*, et R^A = CD_3

L_{A131} à L_{A143}, représenté chacun par la formule



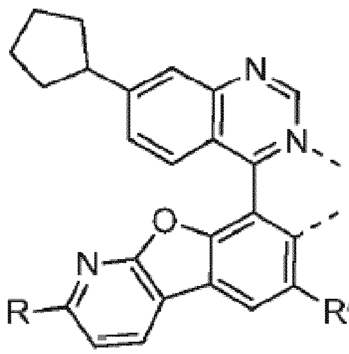
où dans L_{A131} : R = H, et R^A = H,
dans L_{A132} : R = H, et R^A = CH_3,
dans L_{A133} : R = H, et R^A = CD_3,
dans L_{A134} : R = CH_3, et R^A = H,
dans L_{A135} : R = CD_3, et R^A = H,
dans L_{A136} : R = CH_3, et R^A = CH_3,
dans L_{A137} : R = CD_3, et R^A = CD_3,
dans L_{A138} : R = Éthyle, et R^A = H,
dans L_{A139} : R = Éthyle, et R^A = CH_3,
dans L_{A140} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A141} : R = isopropyle, et R^A = H,
dans L_{A142} : R = isopropyle, et R^A = CH_3,
dans L_{A143} : R = isopropyle-*d7*, et R^A = CD_3

L_{A144} à L_{A156}, représenté chacun par la formule



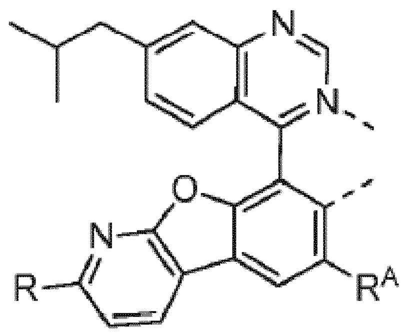
où dans L_{A144} : R = H, et R^A = H,
dans L_{A145} : R = H, et R^A = CH_3,
dans L_{A146} : R = H, et R^A = CD_3,
dans L_{A147} : R = CH_3, et R^A = H,
dans L_{A148} : R = CD_3, et R^A = H,
dans L_{A149} : R = CH_3, et R^A = CH_3,
dans L_{A150} : R = CD_3, et R^A = CD_3,
dans L_{A151} : R = Éthyle, et R^A = H,
dans L_{A152} : R = Éthyle, et R^A = CH_3,
dans L_{A153} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A154} : R = isopropyle, et R^A = H,
dans L_{A155} : R = isopropyle, et R^A = CH_3,
dans L_{A156} : R = isopropyle-*d7*, et R^A = CD_3

L_{A157} à L_{A169}, représenté chacun par la formule



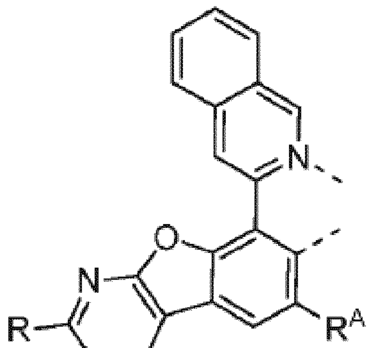
où dans L_{A157} : R = H, et R^A = H,
dans L_{A158} : R = H, et R^A = CH_3,
dans L_{A159} : R = H, et R^A = CD_3,
dans L_{A160} : R = CH_3, et R^A = H,
dans L_{A161} : R = CD_3, et R^A = H,
dans L_{A162} : R = CH_3, et R^A = CH_3,
dans L_{A163} : R = CD_3, et R^A = CD_3,
dans L_{A164} : R = Éthyle, et R^A = H,
dans L_{A165} : R = Éthyle, et R^A = CH_3,
dans L_{A166} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A167} : R = isopropyle, et R^A = H,
dans L_{A168} : R = isopropyle, et R^A = CH_3,
dans L_{A169} : R = isopropyle-*d7*, et R^A = CD_3

L_{A170} à L_{A182}, représenté chacun par la formule



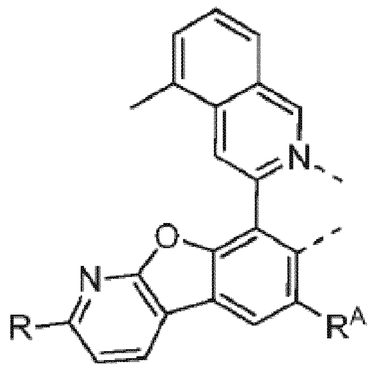
où dans L_{A170} : R = H, et R^A = H,
dans L_{A171} : R = H, et R^A = CH_3,
dans L_{A172} : R = H, et R^A = CD_3,
dans L_{A173} : R = CH_3, et R^A = H,
dans L_{A174} : R = CD_3, et R^A = H,
dans L_{A175} : R = CH_3, et R^A = CH_3,
dans L_{A176} : R = CD_3, et R^A = CD_3,
dans L_{A177} : R = Éthyle, et R^A = H,
dans L_{A178} : R = Éthyle, et R^A = CH_3,
dans L_{A179} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A180} : R = isopropyle, et R^A = H,
dans L_{A181} : R = isopropyle, et R^A = CH_3,
dans L_{A182} : R = isopropyle-*d7*, et R^A = CD_3

L_{A183} à L_{A195}, représenté chacun par la formule



où dans L_{A183}: R = H, et R^A = H,
dans L_{A184} : R = H, et R^A = CH_3,
dans L_{A185} : R = H, et R^A = CD_3,
dans L_{A186} : R = CH_3, et R^A = H,
dans L_{A187} : R = CD_3, et R^A = H,
dans L_{A188} : R = CH_3, et R^A = CH_3,
dans L_{A189} : R = CD_3, et R^A = CD_3,
dans L_{A190} : R = Éthyle, et R^A = H,
dans L_{A191} : R = Éthyle, et R^A = CH_3,
dans L_{A192} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A193} : R = isopropyle, et R^A = H,
dans L_{A194} : R = isopropyle, et R^A = CH_3,

L_{A196} à L_{A208}, représenté chacun par la formule



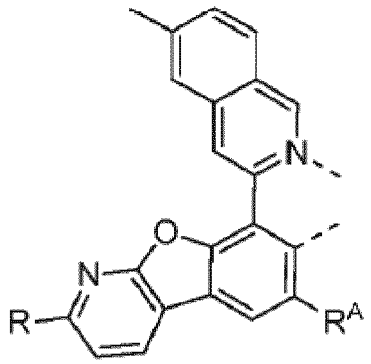
où dans L_{A196} : R = H, et R^A = H,
dans L_{A197} : R = H, et R^A = CH_3,
dans L_{A198} : R = H, et R^A = CD_3,
dans L_{A199} : R = CH_3, et R^A = H,
dans L_{A200} : R = CD_3, et R^A = H,
dans L_{A201} : R = CH_3, et R^A = CH_3,
dans L_{A202} : R = CD_3, et R^A = CD_3,
dans L_{A203} : R = Éthyle, et R^A = H,
dans L_{A204} : R = Éthyle, et R^A = CH_3,
dans L_{A205} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A206} : R = isopropyle, et R^A = H,
dans L_{A207} : R = isopropyle, et R^A = CH_3,

(suite)

dans L_{A195} : R = isopropyle-*d7*, et $R^A = CD_3$

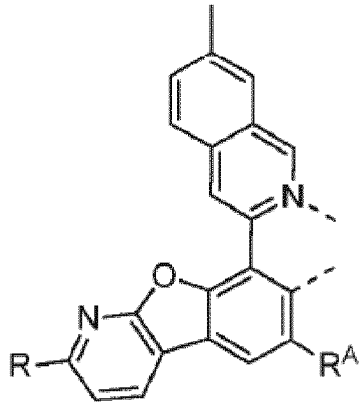
dans L_{A208} : R = isopropyle-*d7*, et $R^A = CD_3$

L_{A209} à L_{A221}, représenté chacun par la formule



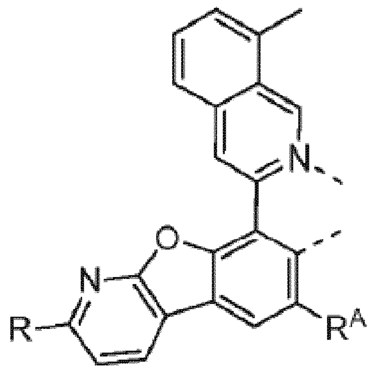
où dans L_{A209} : R = H, et R^A = H,
dans L_{A210} : R = H, et $R^A = CH_3$,
dans L_{A211} : R = H, et $R^A = CD_3$,
dans L_{A212} : R = CH_3, et R^A = H,
dans L_{A213} : R = CD_3, et R^A = H,
dans L_{A214} : R = CH_3, et $R^A = CH_3$,
dans L_{A215} : R = CD_3, et $R^A = CD_3$,
dans L_{A216} : R = Éthyle, et R^A = H,
dans L_{A217} : R = Éthyle, et $R^A = CH_3$,
dans L_{A218} : R = Éthyle-*d5*, and $R^A = CD_3$,
dans L_{A219} : R = isopropyle, et R^A = H,
dans L_{A220} : R = isopropyle, et $R^A = CH_3$,
dans L_{A221} : R = isopropyle-*d7*, et $R^A = CD_3$

L_{A222} à L_{A234}, représenté chacun par la formule



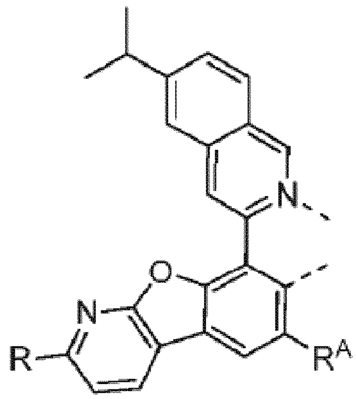
où dans L_{A222} : R = H, et R^A = H,
dans L_{A223} : R = H, et $R^A = CH_3$,
dans L_{A224} : R = H, et $R^A = CD_3$,
dans L_{A225} : R = CH_3, et R^A = H,
dans L_{A226} : R = CD_3, et R^A = H,
dans L_{A227} : R = CH_3, et $R^A = CH_3$,
dans L_{A228} : R = CD_3, et $R^A = CD_3$,
dans L_{A229} : R = Éthyle, et R^A = H,
dans L_{A230} : R = Éthyle, et $R^A = CH_3$,
dans L_{A231} : R = Éthyle-*d5*, and $R^A = CD_3$,
dans L_{A232} : R = isopropyle, et R^A = H,
dans L_{A233} : R = isopropyle, et $R^A = CH_3$,
dans L_{A234} : R = isopropyle-*d7*, et $R^A = CD_3$

L_{A235} à L_{A247}, représenté chacun par la formule



où dans L_{A235} : R = H, et R^A = H,
dans L_{A236} : R = H, et $R^A = CH_3$,
dans L_{A237} : R = H, et $R^A = CD_3$,
dans L_{A238} : R = CH_3, et R^A = H,
dans L_{A239} : R = CD_3, et R^A = H,
dans L_{A240} : R = CH_3, et $R^A = CH_3$,
dans L_{A241} : R = CD_3, et $R^A = CD_3$,

L_{A248} à L_{A260}, représenté chacun par la formule



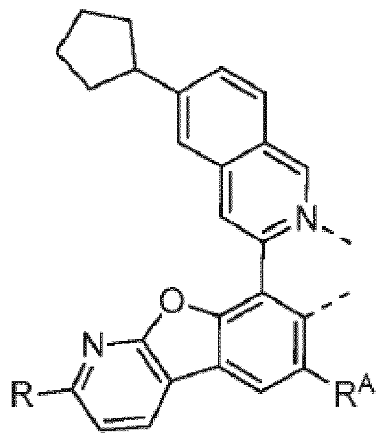
où dans L_{A248} : R = H, et R^A = H,
dans L_{A249} : R = H, et $R^A = CH_3$,
dans L_{A250} : R = H, et $R^A = CD_3$,
dans L_{A251} : R = CH_3, et R^A = H,
dans L_{A252} : R = CD_3, et R^A = H,
dans L_{A253} : R = CH_3, et $R^A = CH_3$,
dans L_{A254} : R = CD_3, et $R^A = CD_3$,

(suite)

dans L_{A242} : R = Éthyle, et R^A = H,
dans L_{A243} : R = Éthyle, et R^A = CH_3,
dans L_{A244} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A245} : R = isopropyle, et R^A = H,
dans L_{A246} : R = isopropyle, et R^A = CH_3,
dans L_{A247} : R = isopropyle-*d7*, et R^A = CD_3

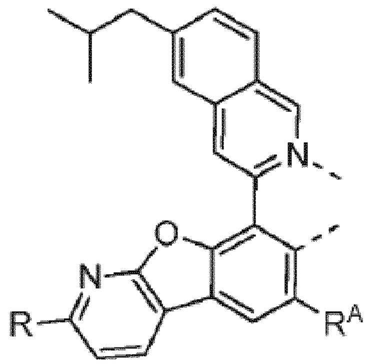
dans L_{A255} : R = Éthyle, et R^A = H,
dans L_{A256} : R = Éthyle, et R^A = CH_3,
dans L_{A257} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A258} : R = isopropyle, et R^A = H,
dans L_{A259} : R = isopropyle, et R^A = CH_3,
dans L_{A260} : R = isopropyle-*d7*, et R^A = CD_3

L_{A261} à L_{A273}, représenté chacun par la formule



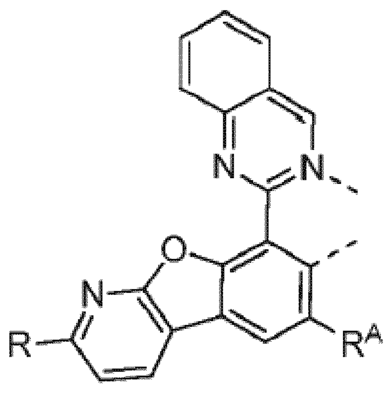
où dans L_{A261} : R = H, et R^A = H,
dans L_{A262} R = H, et R^A = CH_3,
dans L_{A263} : R = H, et R^A = CD_3,
dans L_{A264} : R = CH_3, et R^A = H,
dans L_{A265} : R = CD_3, et R^A = H,
dans L_{A266} : R = CH_3, et R^A = CH_3,
dans L_{A267} : R = CD_3, et R^A = CD_3,
dans L_{A268} : R = Éthyle, et R^A = H,
dans L_{A269} : R = Éthyle, et R^A = CH_3,
dans L_{A270} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A271} : R = isopropyle, et R^A = H,
dans L_{A272} : R = isopropyle, et R^A = CH_3,
dans L_{A273} : R = isopropyle-*d7*, et R^A = CD_3

L_{A274} à L_{A286}, représenté chacun par la formule



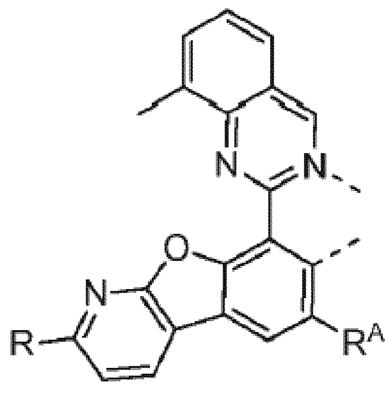
où dans L_{A274} : R = H, et R^A = H,
dans L_{A275} : R = H, et R^A = CH_3,
dans L_{A276} : R = H, et R^A = CD_3,
dans L_{A277} : R = CH_3, et R^A = H,
dans L_{A278} : R = CD_3, et R^A = H,
dans L_{A279} : R = CH_3, et R^A = CH_3,
dans L_{A280} : R = CD_3, et R^A = CD_3,
dans L_{A281} : R = Éthyle, et R^A = H,
dans L_{A282} : R = Éthyle, et R^A = CH_3,
dans L_{A283} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A284} : R = isopropyle, et R^A = H,
dans L_{A285} : R = isopropyle, et R^A = CH_3,
dans L_{A286} : R = isopropyle-*d7*, et R^A = CD_3

L_{A287} à L_{A299}, représenté chacun par la formule



où dans L_{A287} : R = H, et R^A = H,

L_{A300} à L_{A312}, représenté chacun par la formule



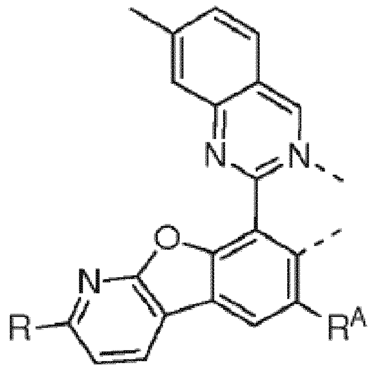
où dans L_{A300} : R = H, et R^A = H,

(suite)

dans L_{A288} R = H, et $R^A = CH_3$,
dans L_{A289} : R = H, et $R^A = CD_3$,
dans L_{A290} : R = CH_3, et R^A = H,
dans L_{A291} : R = CD_3, et R^A = H,
dans L_{A292} : R = CH_3, et $R^A = CH_3$,
dans L_{A293} : R = CD_3, et $R^A = CD_3$,
dans L_{A294} : R = Éthyle, et R^A = H,
dans L_{A295} : R = Éthyle, et $R^A = CH_3$,
dans L_{A296} : R = Éthyle-*d5*, and $R^A = CD_3$,
dans L_{A297} : R = isopropyle, et R^A = H,
dans L_{A298} : R = isopropyle, et $R^A = CH_3$,
dans L_{A299} : R = isopropyle-*d7*, et $R^A = CD_3$

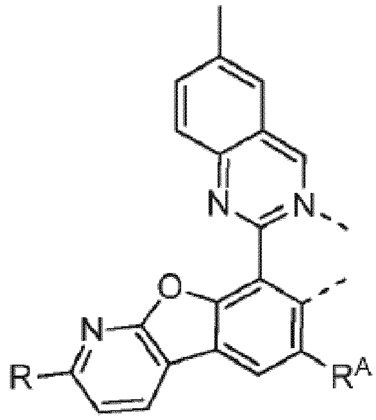
dans L_{A301} : R = H, et $R^A = CH_3$,
dans L_{A302} : R = H, et $R^A = CD_3$,
dans L_{A303} : R = CH_3, et R^A = H,
dans L_{A304} : R = CD_3, et R^A = H,
dans L_{A305} : R = CH_3, et $R^A = CH_3$,
dans L_{A306} : R = CD_3, et $R^A = CD_3$,
dans L_{A307} : R = Éthyle, et R^A = H,
dans L_{A308} : R = Éthyle, et $R^A = CH_3$,
dans L_{A309} : R = Éthyle-*d5*, and $R^A = CD_3$,
dans L_{A310} : R = isopropyle, et R^A = H,
dans L_{A311} : R = isopropyle, et $R^A = CH_3$,
dans L_{A312} : R = isopropyle-*d7*, et $R^A = CD_3$

L_{A313} à L_{A325}, représenté chacun par la formule



où dans L_{A313} : R = H, et R^A = H,
dans L_{A314} : R = H, et $R^A = CH_3$,
dans L_{A315} : R = H, et $R^A = CD_3$,
dans L_{A316} : R = CH_3, et R^A = H,
dans L_{A317} : R = CD_3, et R^A = H,
dans L_{A318} : R = CH_3, et $R^A = CH_3$,
dans L_{A319} : R = CD_3, et $R^A = CD_3$,
dans L_{A320} : R = Éthyle, et R^A = H,
dans L_{A321} : R = Éthyle, et $R^A = CH_3$,
dans L_{A322} : R = Éthyle-*d5*, and $R^A = CD_3$,
dans L_{A323} : R = isopropyle, et R^A = H,
dans L_{A324} : R = isopropyle, et $R^A = CH_3$,
dans L_{A325} : R = isopropyle-*d7*, et $R^A = CD_3$

L_{A326} à L_{A338}, représenté chacun par la formule

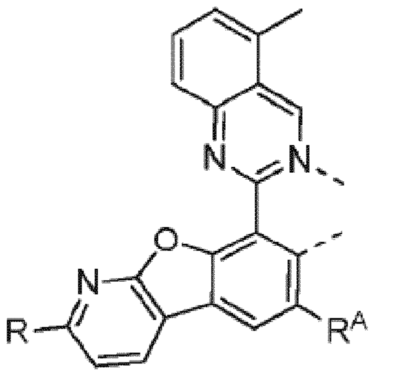


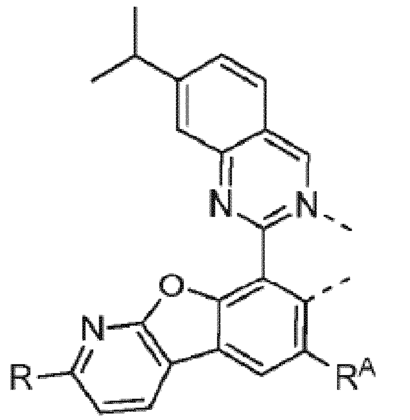
où dans L_{A326} : R = H, et R^A = H,
dans L_{A327} : R = H, et $R^A = CH_3$,
dans L_{A328} : R = H, et $R^A = CD_3$,
dans L_{A329} : R = CH_3, et R^A = H,
dans L_{A330} : R = CD_3, et R^A = H,
dans L_{A331} : R = CH_3, et $R^A = CH_3$,
dans L_{A332} : R = CD_3, et $R^A = CD_3$,
dans L_{A333} : R = Éthyle, et R^A = H,
dans L_{A334} : R = Éthyle, et $R^A = CH_3$,
dans L_{A335} : R = Éthyle-*d5*, and $R^A = CD_3$,
dans L_{A336} : R = isopropyle, et R^A = H,
dans L_{A337} : R = isopropyle, et $R^A = CH_3$,
dans L_{A338} : R = isopropyle-*d7*, et $R^A = CD_3$

L_{A339} à L_{A351}, représenté chacun par la formule

L_{A352} à L_{A364}, représenté chacun par la formule

(suite)

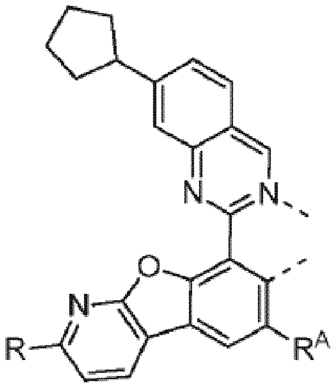




où dans L_{A339} : R = H, et R^A = H,
dans L_{A340} : R = H, et R^A = CH_3,
dans L_{A341} : R = H, et R^A = CD_3,
dans L_{A342} : R = CH_3, et R^A = H,
dans L_{A343} : R = CD_3, et R^A = H,
dans L_{A344} : R = CH_3, et R^A = CH_3,
dans L_{A345} : R = CD_3, et R^A = CD_3,
dans L_{A346} : R = Éthyle, et R^A = H,
dans L_{A347} : R = Éthyle, et R^A = CH_3,
dans L_{A348} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A349} : R = isopropyle, et R^A = H,
dans L_{A350} : R = isopropyle, et R^A = CH_3,
dans L_{A351} : R = isopropyle-*d7*, et R^A = CD_3

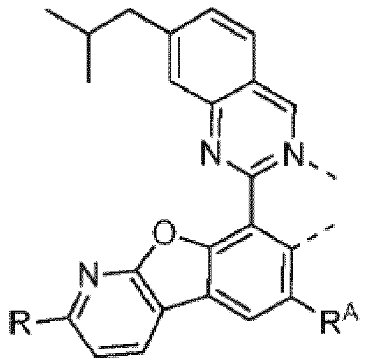
où dans L_{A352} : R = H, et R^A = H,
dans L_{A353} : R = H, et R^A = CH_3,
dans L_{A354} : R = H, et R^A = CD_3,
dans L_{A355} : R = CH_3, et R^A = H,
dans L_{A356} : R = CD_3, et R^A = H,
dans L_{A357} : R = CH_3, et R^A = CH_3,
dans L_{A358} : R = CD_3, et R^A = CD_3,
dans L_{A359} : R = Éthyle, et R^A = H,
dans L_{A360} : R = Éthyle, et R^A = CH_3,
dans L_{A361} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A362} : R = isopropyle, et R^A = H,
dans L_{A363} : R = isopropyle, et R^A = CH_3,
dans L_{A364} : R = isopropyle-*d7*, et R^A = CD_3

L_{A365} à L_{A377}, représenté chacun par la formule



où dans L_{A365} : R = H, et R^A = H,
dans L_{A366} R = H, et R^A = CH_3,
dans L_{A367} : R = H, et R^A = CD_3,
dans L_{A368} : R = CH_3, et R^A = H,
dans L_{A369} : R = CD_3, et R^A = H,
dans L_{A370} : R = CH_3, et R^A = CH_3,
dans L_{A371} : R = CD_3, et R^A = CD_3,
dans L_{A372} : R = Éthyle, et R^A = H,
dans L_{A373} : R = Éthyle, et R^A = CH_3,
dans L_{A374} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A375} : R = isopropyle, et R^A = H,

L_{A378} à L_{A390}, représenté chacun par la formule



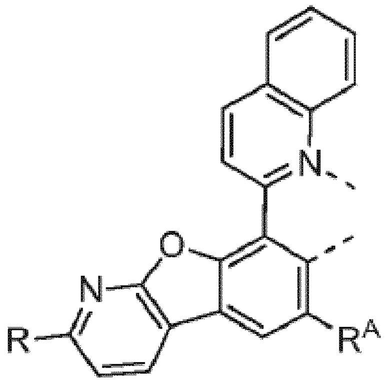
où dans L_{A378} : R = H, et R^A = H,
dans L_{A379} : R = H, et R^A = CH_3,
dans L_{A380} : R = H, et R^A = CD_3,
dans L_{A381} : R = CH_3, et R^A = H,
dans L_{A382} : R = CD_3, et R^A = H,
dans L_{A383} : R = CH_3, et R^A = CH_3,
dans L_{A384} : R = CD_3, et R^A = CD_3,
dans L_{A385} : R = Éthyle, et R^A = H,
dans L_{A386} : R = Éthyle, et R^A = CH_3,
dans L_{A387} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A388} : R = isopropyle, et R^A = H,

(suite)

dans L_{A376} : R = isopropyle, et $R^A = CH_3$,
dans L_{A377} : R = isopropyle-*d7*, et $R^A = CD_3$

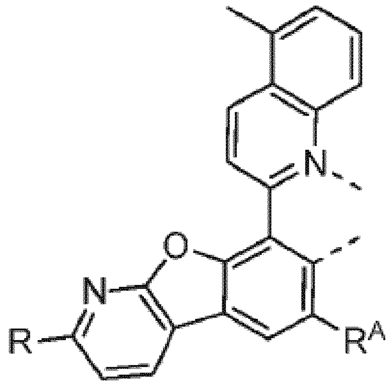
dans L_{A389} : R = isopropyle, et $R^A = CH_3$,
dans L_{A390} : R = isopropyle-*d7*, et $R^A = CD_3$

L_{A391} à L_{A403}, représenté chacun par la formule



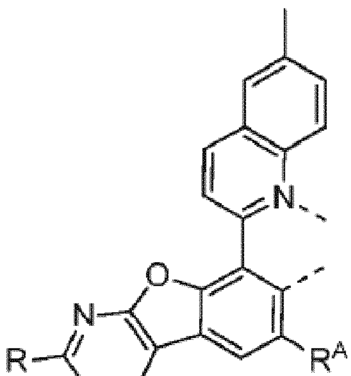
où dans L_{A391} : R = H, et R^A = H,
dans L_{A392} : R = H, et $R^A = CH_3$,
dans L_{A393} : R = H, et $R^A = CD_3$,
dans L_{A394} : R = CH_3, et R^A = H,
dans L_{A395} : R = CD_3, et R^A = H,
dans L_{A396} : R = CH_3, et $R^A = CH_3$,
dans L_{A397} : R = CD_3, et $R^A = CD_3$,
dans L_{A398} : R = Éthyle, et R^A = H,
dans L_{A399} : R = Éthyle, et $R^A = CH_3$,
dans L_{A400} : R = Éthyle-*d5*, and $R^A = CD_3$,
dans L_{A401} : R = isopropyle, et R^A = H,
dans L_{A402} : R = isopropyle, et $R^A = CH_3$,
dans L_{A403} : R = isopropyle-*d7*, et $R^A = CD_3$

L_{A404} à L_{A146}, représenté chacun par la formule



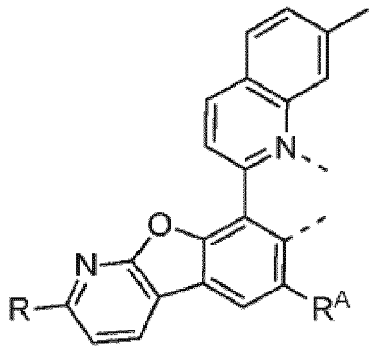
où dans L_{A404} : R = H, et R^A = H,
dans L_{A405} : R = H, et $R^A = CH_3$,
dans L_{A406} : R = H, et $R^A = CD_3$,
dans L_{A407} : R = CH_3, et R^A = H,
dans L_{A408} : R = CD_3, et R^A = H,
dans L_{A409} : R = CH_3, et $R^A = CH_3$,
dans L_{A410} : R = CD_3, et $R^A = CD_3$,
dans L_{A411} R = Éthyle, et R^A = H,
dans L_{A412} : R = Éthyle, et $R^A = CH_3$,
dans L_{A413} : R = Éthyle-*d5*, and $R^A = CD_3$,
dans L_{A414} : R = isopropyle, et R^A = H,
dans L_{A415} : R = isopropyle, et $R^A = CH_3$,
dans L_{A416} : R = isopropyle-*d7*, et $R^A = CD_3$

L_{A417} à L_{A429}, représenté chacun par la formule



où dans L_{A417} : R = H, et R^A = H,
dans L_{A418} : R = H, et $R^A = CH_3$,
dans L_{A419} : R = H, et $R^A = CD_3$,
dans L_{A420} : R = CH_3, et R^A = H,
dans L_{A421} : R = CD_3, et R^A = H,
dans L_{A422} : R = CH_3, et $R^A = CH_3$,

L_{A430} à L_{A442}, représenté chacun par la formule



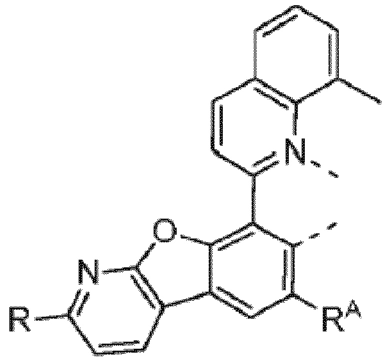
où dans L_{A430} : R = H, et R^A = H,
dans L_{A431} : R = H, et $R^A = CH_3$,
dans L_{A432} : R = H, et $R^A = CD_3$,
dans L_{A433} : R = CH_3, et R^A = H,
dans L_{A434} : R = CD_3, et R^A = H,
dans L_{A435} : R = CH_3, et $R^A = CH_3$,

(suite)

dans L_{A423} : R = CD_3, et R^A = CD_3,
dans L_{A424} : R = Éthyle, et R^A = H,
dans L_{A425} : R = Éthyle, et R^A = CH_3,
dans L_{A426} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A427} : R = isopropyle, et R^A = H,
dans L_{A428} : R = isopropyle, et R^A = CH_3,
dans L_{A429} : R = isopropyle-*d7*, et R^A = CD_3

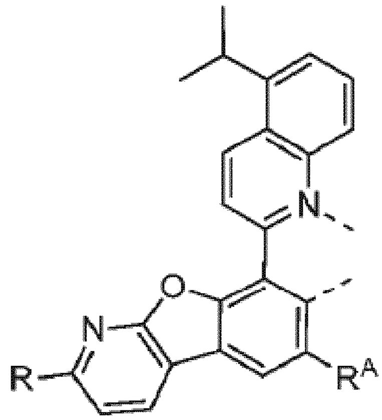
dans L_{A436} : R = CD_3, et R^A = CD_3,
dans L_{A437} : R = Éthyle, et R^A = H,
dans L_{A438} : R = Éthyle, et R^A = CH_3,
dans L_{A439} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A440} : R = isopropyle, et R^A = H,
dans L_{A441} : R = isopropyle, et R^A = CH_3,
dans L_{A442} : R = isopropyle-*d7*, et R^A = CD_3

L_{A443} à L_{A455}, représenté chacun par la formule



où dans L_{A443} : R=H, et R^A=H,
dans L_{A444} : R = H, et R^A = CH_3,
dans L_{A445} : R = H, et R^A = CD_3,
dans L_{A446} : R = CH_3, et R^A = H,
dans L_{A447} : R = CD_3, et R^A = H,
dans L_{A448} : R = CH_3, et R^A = CH_3,
dans L_{A449} : R = CD_3, et R^A = CD_3,
dans L_{A450} : R = Éthyle, et R^A = H,
dans L_{A451} : R = Éthyle, et R^A = CH_3,
dans L_{A452} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A453} : R = isopropyle, et R^A = H,
dans L_{A454} : R = isopropyle, et R^A = CH_3,
dans L_{A455} : R = isopropyle-*d7*, et R^A = CD_3

L_{A456} à L_{A468}, représenté chacun par la formule

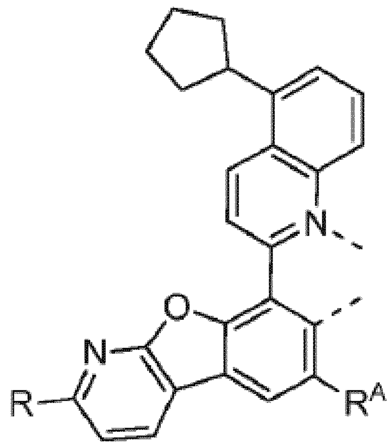


où dans L_{A456} : R = H, et R^A = H,
dans L_{A457} : R = H, et R^A = CH_3,
dans L_{A458} : R = H, et R^A = CD_3,
dans L_{A459} : R = CH_3, et R^A = H,
dans L_{A460} : R = CD_3, et R^A = H,
dans L_{A461} : R = CH_3, et R^A = CH_3,
dans L_{A462} : R = CD_3, et R^A = CD_3,
dans L_{A463} : R = Éthyle, et R^A = H,
dans L_{A464} : R = Éthyle, et R^A = CH_3,
dans L_{A465} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A466} : R = isopropyle, et R^A = H,
dans L_{A467} : R = isopropyle, et R^A = CH_3,
dans L_{A468} : R = isopropyle-*d7*, et R^A = CD_3

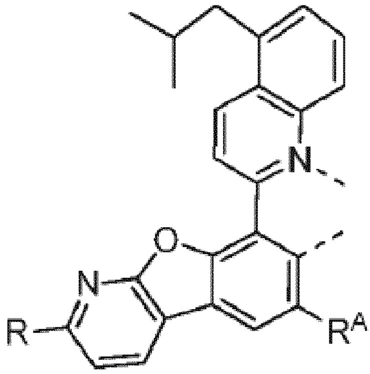
L_{A469} à L_{A481}, représenté chacun par la formule

L_{A482} à L_{A494}, représenté chacun par la formule

(suite)

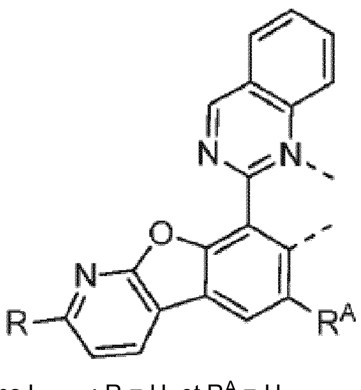


où dans L_{A469} : R = H, et R^A = H,
dans L_{A470} : R = H, et R^A = CH_3,
dans L_{A471} : R = H, et R^A = CD_3,
dans L_{A472} : R = CH_3, et R^A = H,
dans L_{A473} : R = CD_3, et R^A = H,
dans L_{A474} : R = CH_3, et R^A = CH_3,
dans L_{A475} : R = CD_3, et R^A = CD_3,
dans L_{A476} : R = Éthyle, et R^A = H,
dans L_{A477} : R = Éthyle, et R^A = CH_3,
dans L_{A478} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A479} : R = isopropyle, et R^A = H,
dans L_{A480} : R = isopropyle, et R^A = CH_3,
dans L_{A481} : R = isopropyle-*d7*, et R^A = CD_3



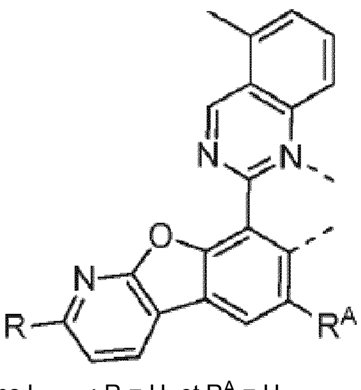
où dans L_{A482} : R = H, et R^A = H,
dans L_{A483} : R = H, et R^A = CH_3,
dans L_{A484} : R = H, et R^A = CD_3,
dans L_{A485} : R = CH_3, et R^A = H,
dans L_{A486} : R = CD_3, et R^A = H,
dans L_{A487} : R = CH_3, et R^A = CH_3,
dans L_{A488} : R = CD_3, et R^A = CD_3,
dans L_{A489} : R = Éthyle, et R^A = H,
dans L_{A490} : R = Éthyle, et R^A = CH_3,
dans L_{A491} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A492} : R = isopropyle, et R^A = H,
dans L_{A493} : R = isopropyle, et R^A = CH_3,
dans L_{A494} : R = isopropyle-*d7*, et R^A = CD_3

L_{A495} à L_{A507}, représenté chacun par la formule



où dans L_{A495} : R = H, et R^A = H,
dans L_{A496} : R = H, et R^A = CH_3,
dans L_{A497} : R = H, et R^A = CD_3,
dans L_{A498} : R = CH_3, et R^A = H,
dans L_{A499} : R = CD_3, et R^A = H,
dans L_{A500} : R = CH_3, et R^A = CH_3,
dans L_{A501} : R = CD_3, et R^A = CD_3,
dans L_{A502} : R = Éthyle, et R^A = H,
dans L_{A503} : R = Éthyle, et R^A = CH_3,
dans L_{A504} : R = Éthyle-*d5*, and R^A = CD_3,
dans L_{A505} : R = isopropyle, et R^A = H,

L_{A508} à L_{A520}, représenté chacun par la formule



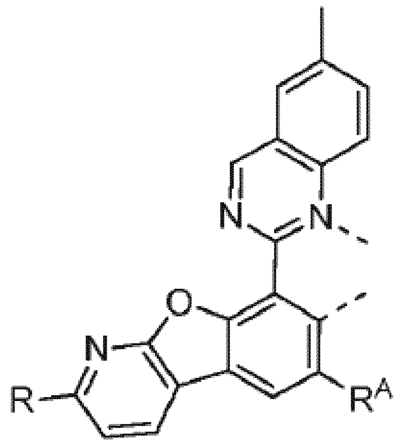
où dans L_{A508} : R = H, et R^A = H,
dans L_{A509} : R = H, et R^A = CH_3,
dans L_{A510} : R = H, et R^A = CD_3,
dans L_{A511} : R = CH_3, et R^A = H,
dans L_{A512} : R = CD_3, et R^A = H,
dans L_{A513} : R = CH_3, et R^A = CH_3,
dans L_{A514} : R = CD_3, et R^A = CD_3,
dans L_{A515} : R = Éthyle, et R^A = H,
dans L_{A516} : R = Éthyle, et R^A = CH_3,
dans L_{A517} : R = Éthyle-*d5*, et R^A = CD_3,
dans L_{A518} : R = isopropyle, et R^A = H,

(suite)

dans L_{A506} : R = isopropyle, et $R^A = CH_3$,
dans L_{A507} : R = isopropyle-*d7*, et $R^A = CD_3$

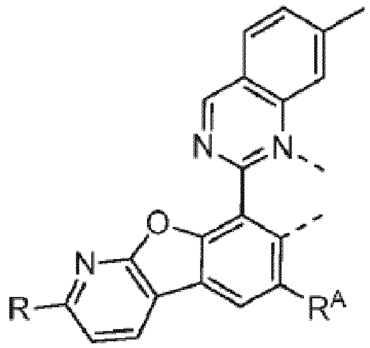
dans L_{A519} : R = isopropyle, et $R^A = CH_3$,
dans L_{A520} : R = isopropyle-*d7*, et $R^A = CD_3$

L_{A521} à L_{A533}, représenté chacun par la formule



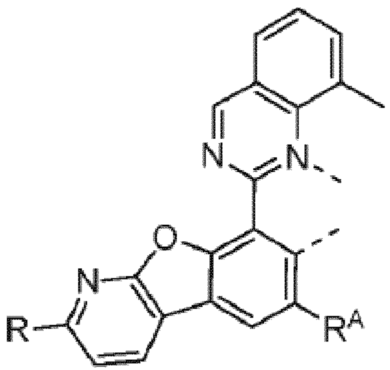
où dans L_{A521} : R = H, et R^A = H,
dans L_{A522} : R = H, et $R^A = CH_3$,
dans L_{A523} : R = H, et $R^A = CD_3$,
dans L_{A524} : R = CH_3, et R^A = H,
dans L_{A525} : R = CD_3, et R^A = H,
dans L_{A526} : R = CH_3, et $R^A = CH_3$,
dans L_{A527} : R = CD_3, et $R^A = CD_3$,
dans L_{A528} : R = Éthyle, et R^A = H,
dans L_{A529} : R = Éthyle, et $R^A = CH_3$,
dans L_{A530} : R = Éthyle-*d5*, et $R^A = CD_3$,
dans L_{A531} : R = isopropyle, et R^A = H,
dans L_{A532} : R = isopropyle, et $R^A = CH_3$,
dans L_{A533} : R = isopropyle-*d7*, et $R^A = CD_3$

L_{A534} à L_{A546}, représenté chacun par la formule



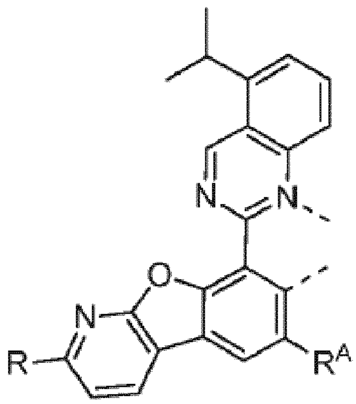
où dans L_{A534} : R = H, et R^A = H,
dans L_{A535} : R = H, et $R^A = CH_3$,
dans L_{A536} : R = H, et $R^A = CD_3$,
dans L_{A537} : R = CH_3, et R^A = H,
dans L_{A538} : R = CD_3, et R^A = H,
dans L_{A539} : R = CH_3, et $R^A = CH_3$,
dans L_{A540} : R = CD_3, et $R^A = CD_3$,
dans L_{A541} : R = Éthyle, et R^A = H,
dans L_{A542} : R = Éthyle, et $R^A = CH_3$,
dans L_{A543} : R = Éthyle-*d5*, et $R^A = CD_3$,
dans L_{A544} : R = isopropyle, et R^A = H,
dans L_{A545} : R = isopropyle, et $R^A = CH_3$,
dans L_{A546} : R = isopropyle-*d7*, et $R^A = CD_3$

L_{A547} à L_{A559}, représenté chacun par la formule



où dans L_{A547} : R = H, et R^A = H,
dans L_{A548} : R = H, et $R^A = CH_3$,
dans L_{A549} : R = H, et $R^A = CD_3$,
dans L_{A550} : R = CH_3, et R^A = H,

L_{A560} à L_{A572}, représenté chacun par la formule



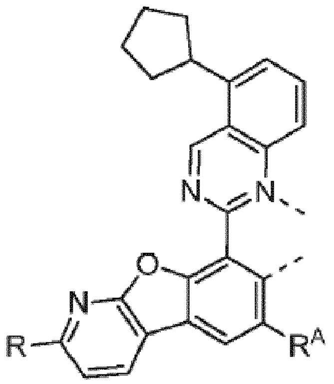
où dans L_{A560}: R = H, et R^A = H,
dans L_{A561} : R = H, et $R^A = CH_3$,
dans L_{A562} : R = H, et $R^A = CD_3$,
dans L_{A563} : R = CH_3, et R^A = H,

(suite)

dans L_{A551} : R = CD_3, et R^A = H,
dans L_{A552} : R = CH_3, et R^A = CH_3,
dans L_{A553} : R = CD_3, et R^A = CD_3,
dans L_{A554} : R = Éthyle, et R^A = H,
dans L_{A555} : R = Éthyle, et R^A = CH_3,
dans L_{A556} : R = Éthyle-*d5*, et R^A = CD_3,
dans L_{A557} : R = isopropyle, et R^A = H,
dans L_{A558} : R = isopropyle, et R^A = CH_3,
dans L_{A559} : R = isopropyle-*d7*, et R^A = CD_3

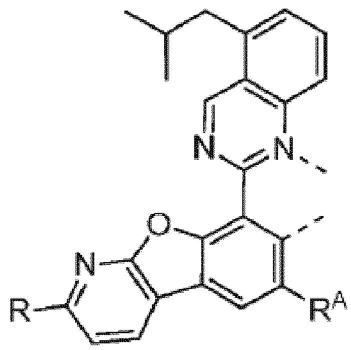
dans L_{A564} : R = CD_3, et R^A = H,
dans L_{A565} : R = CH_3, et R^A = CH_3,
dans L_{A566} : R = CD_3, et R^A = CD_3,
dans L_{A567} : R = Éthyle, et R^A = H,
dans L_{A568} : R = Éthyle, et R^A = CH_3,
dans L_{A569} : R = Éthyle-*d5*, et R^A = CD_3,
dans L_{A570} : R = isopropyle, et R^A = H,
dans L_{A571} : R = isopropyle, et R^A = CH_3,
dans L_{A572} : R = isopropyle-*d7*, et R^A = CD_3

L_{A573} à L_{A585}, représenté chacun par la formule



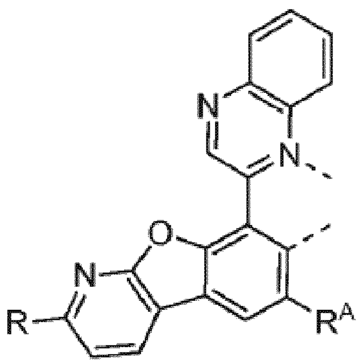
où dans L_{A573} : R = H, et R^A = H,
dans L_{A574} : R = H, et R^A = CH_3,
dans L_{A575} : R = H, et R^A = CD_3,
dans L_{A576} : R = CH_3, et R^A = H,
dans L_{A577} : R = CD_3, et R^A = H,
dans L_{A578} : R = CH_3, et R^A = CH_3,
dans L_{A579} : R = CD_3, et R^A = CD_3,
dans L_{A580} : R = Éthyle, et R^A = H,
dans L_{A581} : R = Éthyle, et R^A = CH_3,
dans L_{A582} : R = Éthyle-*d5*, et R^A = CD_3,
dans L_{A583} : R = isopropyle, et R^A = H,
dans L_{A584} : R = isopropyle, et R^A = CH_3,
dans L_{A585} : R = isopropyle-*d7*, et R^A = CD_3

L_{A586} à L_{A598}, représenté chacun par la formule

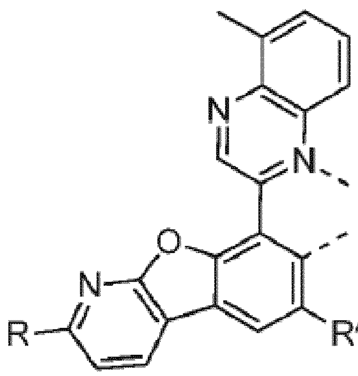


où dans L_{A586} : R = H, et R^A = H,
dans L_{A587} : R = H, et R^A = CH_3,
dans L_{A588} : R = H, et R^A = CD_3,
dans L_{A589} : R = CH_3, et R^A = H,
dans L_{A590} : R = CD_3, et R^A = H,
dans L_{A591} : R = CH_3, et R^A = CH_3,
dans L_{A592} : R = CD_3, et R^A = CD_3,
dans L_{A593} : R = Éthyle, et R^A = H,
dans L_{A594} : R = Éthyle, et R^A = CH_3,
dans L_{A595} : R = Éthyle-*d5*, et R^A = CD_3,
dans L_{A596} : R = isopropyle, et R^A = H,
dans L_{A597} : R = isopropyle, et R^A = CH_3,
dans L_{A598} : R = isopropyle-*d7*, et R^A = CD_3

L_{A599} à L_{A611}, représenté chacun par la formule



L_{A612} à L_{A624}, représenté chacun par la formule

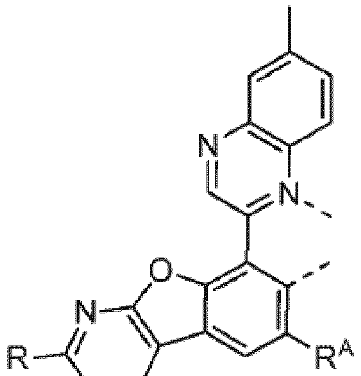


(suite)

où dans L_{A599} : R = H, et R^A = H,
dans L_{A600} : R = H, et R^A = CH_3,
dans L_{A601} : R = H, et R^A = CD_3,
dans L_{A602} : R = CH_3, et R^A = H,
dans L_{A603} : R = CD_3, et R^A = H,
dans L_{A604} : R = CH_3, et R^A = CH_3,
dans L_{A605} : R = CD_3, et R^A = CD_3,
dans L_{A606} : R = Éthyle, et R^A = H,
dans L_{A607} : R = Éthyle, et R^A = CH_3,
dans L_{A608} : R = Éthyle-*d5*, et R^A = CD_3,
dans L_{A609} : R = isopropyle, et R^A = H,
dans L_{A610} : R = isopropyle, et R^A = CH_3,
dans L_{A611} : R = isopropyle-*d7*, et R^A = CD_3

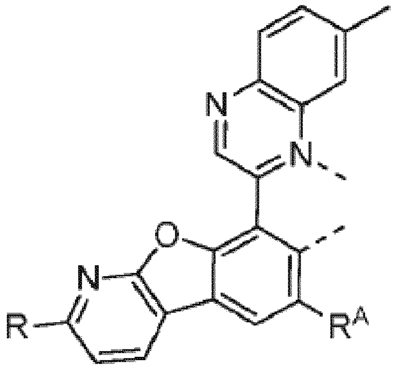
où dans L_{A612} : R = H, et R^A = H,
dans L_{A613} : R = H, et R^A = CH_3,
dans L_{A614} : R = H, et R^A = CD_3,
dans L_{A615} : R = CH_3, et R^A = H,
dans L_{A616} : R = CD_3, et R^A = H,
dans L_{A617} : R = CH_3, et R^A = CH_3,
dans L_{A618} : R = CD_3, et R^A = CD_3,
dans L_{A619} : R = Éthyle, et R^A = H,
dans L_{A620} : R = Éthyle, et R^A = CH_3,
dans L_{A621} : R = Éthyle-*d5*, et R^A = CD_3,
dans L_{A622} : R = isopropyle, et R^A = H,
dans L_{A623} : R = isopropyle, et R^A = CH_3,
dans L_{A624} : R = isopropyle-*d7*, et R^A = CD_3

L_{A625} à L_{A637}, représenté chacun par la formule



où dans L_{A625} : R = H, et R^A = H,
dans L_{A626} : R = H, et R^A = CH_3,
dans L_{A627} : R = H, et R^A = CD_3,
dans L_{A628} : R = CH_3, et R^A = H,
dans L_{A629} : R = CD_3, et R^A = H,
dans L_{A630} : R = CH_3, et R^A = CH_3,
dans L_{A631} : R = CD_3, et R^A = CD_3,
dans L_{A632} : R = Éthyle, et R^A = H,
dans L_{A633} : R = Éthyle, et R^A = CH_3,
dans L_{A634} : R = Éthyle-*d5*, et R^A = CD_3,
dans L_{A635} : R = isopropyle, et R^A = H,
dans L_{A636} : R = isopropyle, et R^A = CH_3,
dans L_{A637} : R = isopropyle-*d7*, et R^A = CD_3

L_{A638} à L_{A650}, représenté chacun par la formule

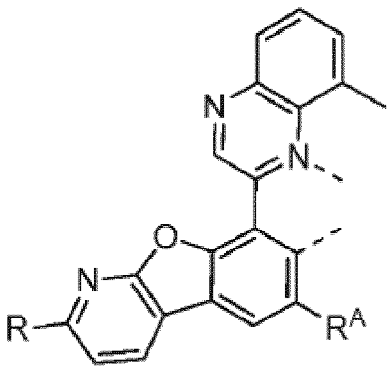


où dans L_{A638} : R = H, et R^A = H,
dans L_{A639} : R = H, et R^A = CH_3,
dans L_{A640} R = H, et R^A = CD_3,
dans L_{A641} : R = CH_3, et R^A = H,
dans L_{A642} : R = CD_3, et R^A = H,
dans L_{A643} : R = CH_3, et R^A = CH_3,
dans L_{A644} : R = CD_3, et R^A = CD_3,
dans L_{A645} : R = Éthyle, et R^A = H,
dans L_{A646} : R = Éthyle, et R^A = CH_3,
dans L_{A647} : R = Éthyle-*d5*, et R^A = CD_3,
dans L_{A648} : R = isopropyle, et R^A = H,
dans L_{A649} : R = isopropyle, et R^A = CH_3,
dans L_{A650} : R = isopropyle-*d7*, et R^A = CD_3

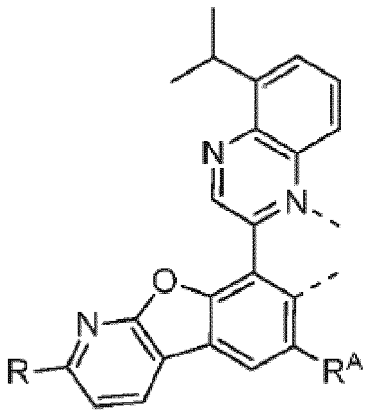
L_{A651} à L_{A663}, représenté chacun par la formule

L_{A664} à L_{A676}, représenté chacun par la formule

(suite)

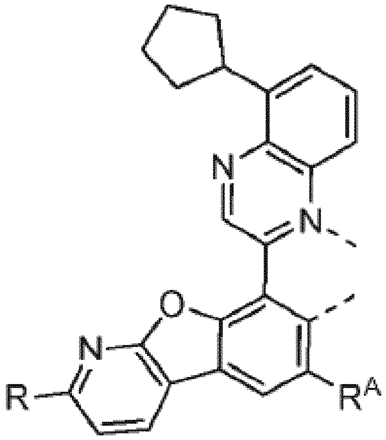


où dans L_{A651} : R = H, et R^A = H,
dans L_{A652} : R = H, et $R^A = CH_3$,
dans L_{A653} : R = H, et $R^A = CD_3$,
dans L_{A654} : R = CH_3, et R^A = H,
dans L_{A655} : R = CD_3, et R^A = H,
dans L_{A656} : R = CH_3, et $R^A = CH_3$,
dans L_{A657} : R = CD_3, et $R^A = CD_3$,
dans L_{A658} : R = Éthyle, et R^A = H,
dans L_{A659} : R = Éthyle, et $R^A = CH_3$,
dans L_{A660} : R = Éthyle-*d5*, et $R^A = CD_3$,
dans L_{A661} : R = isopropyle, et R^A = H,
dans L_{A662} : R = isopropyle, et $R^A = CH_3$,
dans L_{A663} : R = isopropyle-*d7*, et $R^A = CD_3$



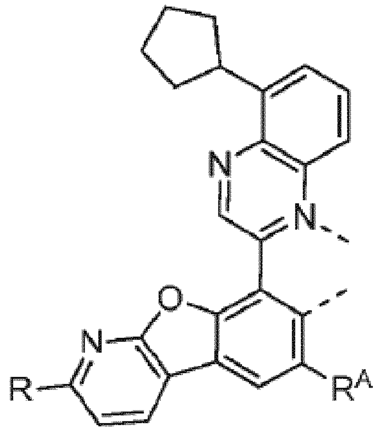
où dans L_{A664}: R = H, et R^A = H,
dans L_{A665} : R = H, et $R^A = CH_3$,
dans L_{A666} : R = H, et $R^A = CD_3$,
dans L_{A667} : R = CH_3, et R^A = H,
dans L_{A668} : R = CD_3, et R^A = H,
dans L_{A669} : R = CH_3, et $R^A = CH_3$,
dans L_{A670} : R = CD_3, et $R^A = CD_3$,
dans L_{A671} : R = Éthyle, et R^A = H,
dans L_{A672} : R = Éthyle, et $R^A = CH_3$,
dans L_{A673} : R = Éthyle-*d5*, et $R^A = CD_3$,
dans L_{A674} : R = isopropyle, et R^A = H,
dans L_{A675} : R = isopropyle, et $R^A = CH_3$,
dans L_{A676} : R = isopropyle-*d7*, et $R^A = CD_3$

L_{A677} à L_{A689}, représenté chacun par la formule



où dans L_{A677} : R = H, et R^A = H,
dans L_{A678} : R = H, et $R^A = CH_3$,
dans L_{A679} : R = H, et $R^A = CD_3$,
dans L_{A680} : R = CH_3, et R^A = H,
dans L_{A681} : R = CD_3, et R^A = H,
dans L_{A682} : R = CH_3, et $R^A = CH_3$,
dans L_{A683} : R = CD_3, et $R^A = CD_3$,
dans L_{A684} : R = Éthyle, et R^A = H,

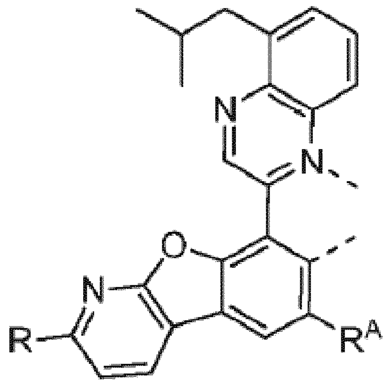
L_{A690} à L_{A702}, représenté chacun par la formule



où dans L_{A690} : R = H, et R^A = H,
dans L_{A691} : R = H, et $R^A = CH_3$,
dans L_{A692} : R = H, et $R^A = CD_3$,
dans L_{A693} : R = CH_3, et R^A = H,
dans L_{A694} : R = CD_3, et R^A = H,
dans L_{A695} : R = CH_3, et $R^A = CH_3$,
dans L_{A696} : R = CD_3, et $R^A = CD_3$,
dans L_{A697} : R = Éthyle, et R^A = H,

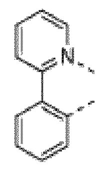
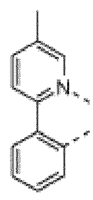
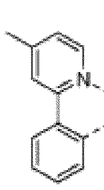
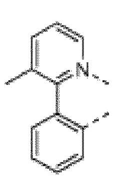
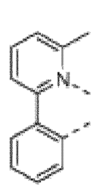
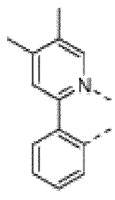
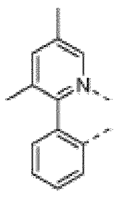
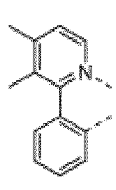
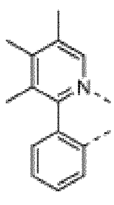
(suite)

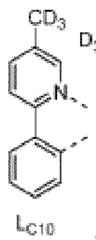
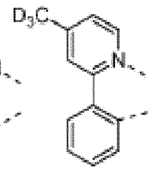
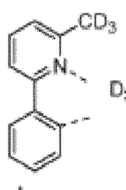
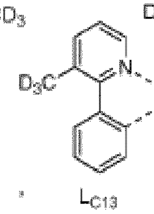
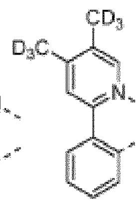
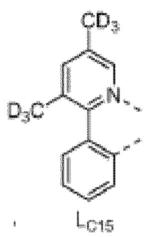
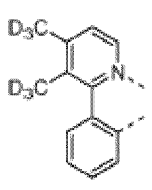
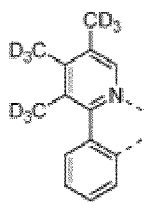
dans L_{A685} : R = Éthyle, et $R^A = CH_3$,
dans L_{A686} : R = Éthyle-*d5*, et $R^A = CD_3$,
dans L_{A687} : R = isopropyle, et R^A = H,
dans L_{A688} : R = isopropyle, et $R^A = CH_3$,
dans L_{A689} : R = isopropyle-*d7*, et $R^A = CD_3$
dans L_{A698} : R = Éthyle, et $R^A = CH_3$,
dans L_{A699} : R = Éthyle-*d5*, et $R^A = CD_3$,
dans L_{A700} R = isopropyle, et R^A = H,
dans L_{A701} : R = isopropyle, et $R^A = CH_3$,
dans L_{A702} : R = isopropyle-*d7*, et $R^A = CD_3$
, et
L_{A703} à L_{A715}, représenté chacun par la formule

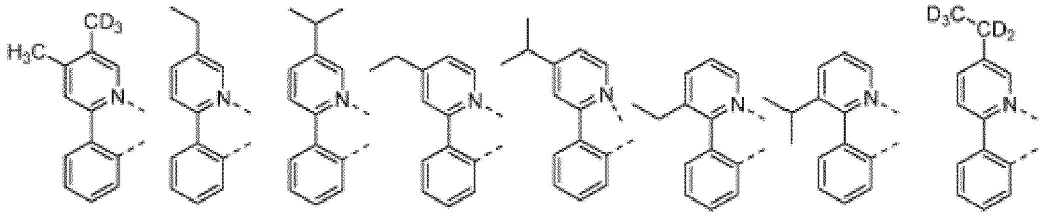


où dans L_{A703} : R = H, et R^A = H,
dans L_{A704} : R = H, et $R^A = CH_3$,
dans L_{A705} : R = H, et $R^A = CD_3$,
dans L_{A706} : R = CH_3, et R^A = H,
dans L_{A707} : R = CD_3, et R^A = H,
dans L_{A708} : R = CH_3, et $R^A = CH_3$,
dans L_{A709} : R = CD_3, et $R^A = CD_3$,
dans L_{A710} : R = Éthyle, et R^A = H,
dans L_{A711} : R = Éthyle, et $R^A = CH_3$,
dans L_{A712} : R = Éthyle-*d*5, et $R^A = CD_3$,
dans L_{A713} : R = isopropyle, et R^A = H,
dans L_{A714} : R = isopropyle, et $R^A = CH_3$,
dans L_{A715} : R = isopropyle-*d*7, et $R^A = CD_3$

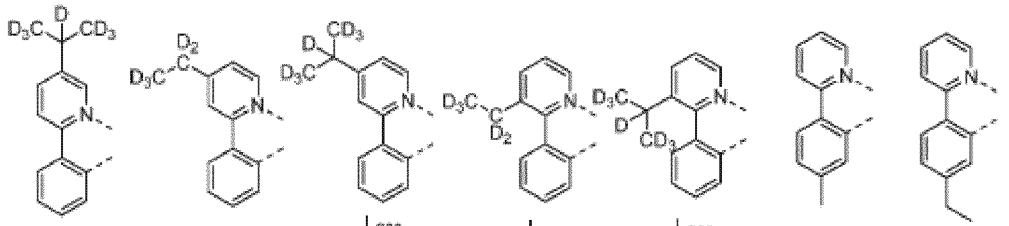
16. Le composé selon la revendication 1 ou 15, où L_c est sélectionné parmi le groupe constitué de :

 L_{C1} ,  L_{C2} ,  L_{C3} ,  L_{C4} ,  L_{C5} ,  L_{C6} ,  L_{C7} ,  L_{C8} ,  L_{C9} ,

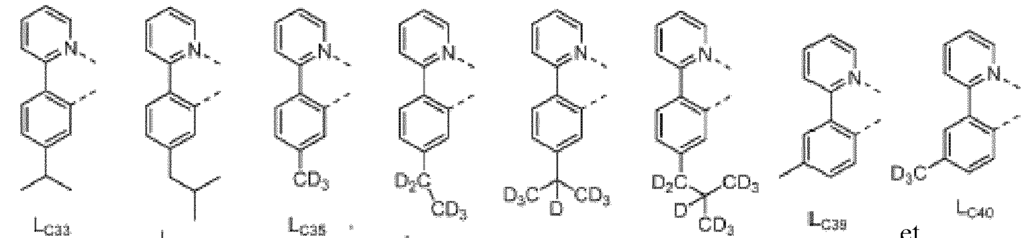
 L_{C10} ,  L_{C11} ,  L_{C12} ,  L_{C13} ,  L_{C14} ,  L_{C15} ,  L_{C16} ,  L_{C17} ,



L_{C18} , L_{C19} , L_{C20} , L_{C21} , L_{C22} , L_{C23} , L_{C24} , L_{C25} ,

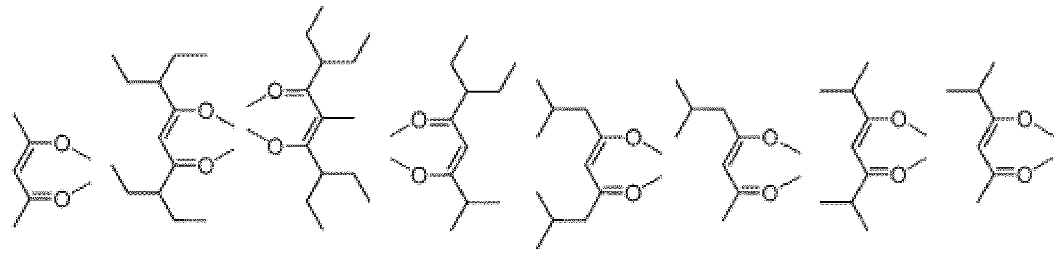


L_{C26} , L_{C27} , L_{C28} , L_{C29} , L_{C30} , L_{C31} , L_{C32} ,

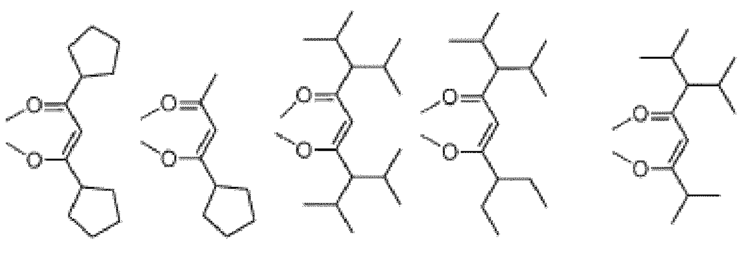


L_{C33} , L_{C34} , L_{C35} , L_{C36} , L_{C37} , L_{C38} , L_{C39} et L_{C40} .

17. Le composé selon la revendication 1 ou 15, où L_B est sélectionné parmi le groupe constitué de :

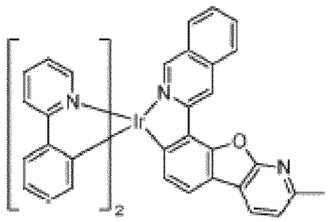


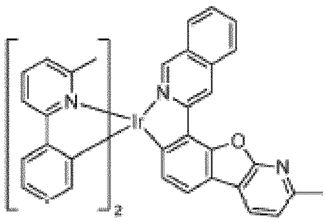
L_{B42} , L_{B43} , L_{B44} , L_{B45} , L_{B46} , L_{B47} , L_{B48} , L_{B49}



, L_{B50} , L_{B51} , L_{B52} , L_{B53} , et L_{B54} .

18. Le composé selon la revendication 1, où le composé est sélectionné parmi le groupe constitué de :


Composé 1,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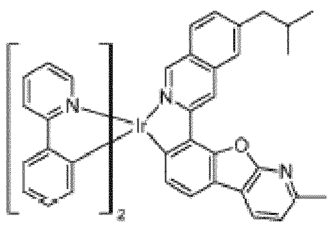
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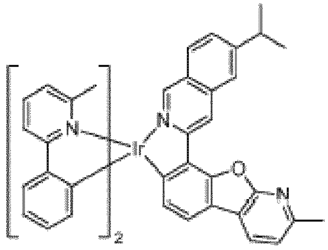
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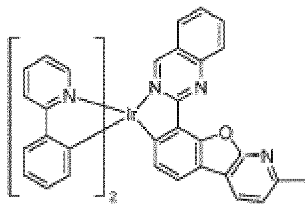
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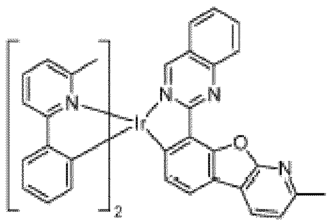
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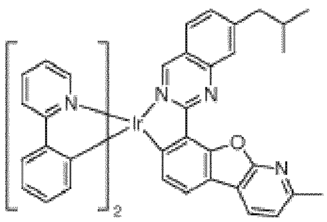
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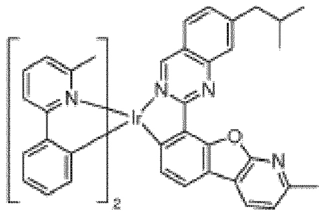
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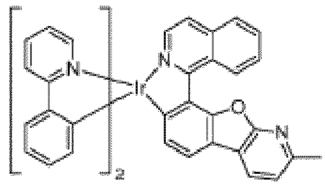
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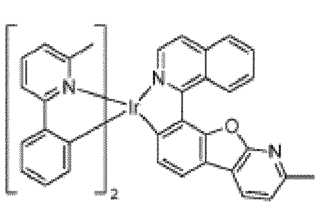
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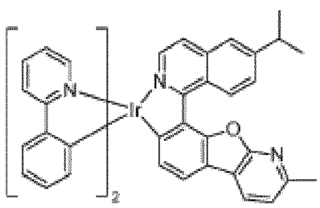
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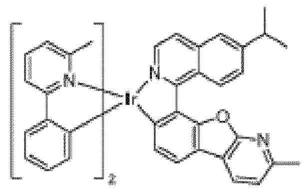
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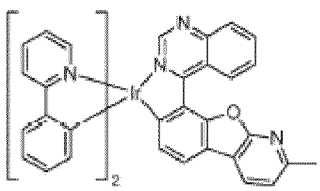
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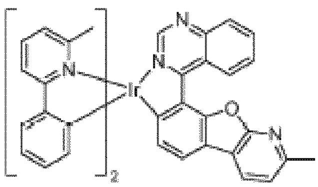
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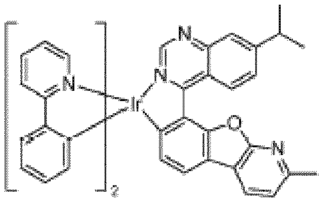
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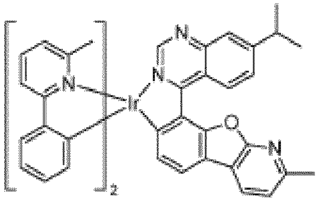
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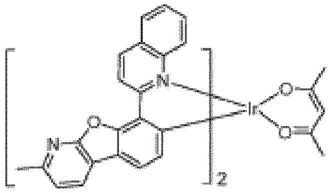
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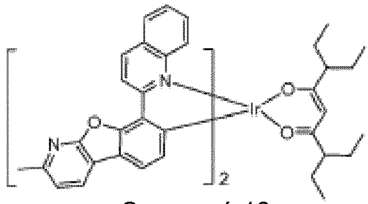
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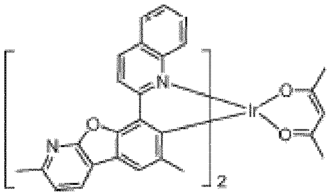
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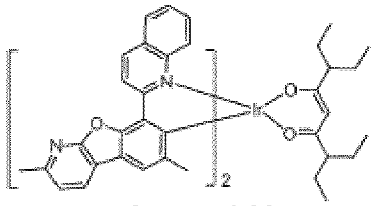
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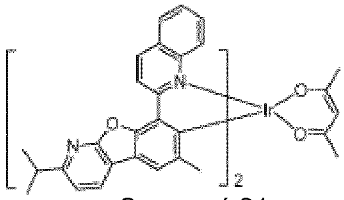
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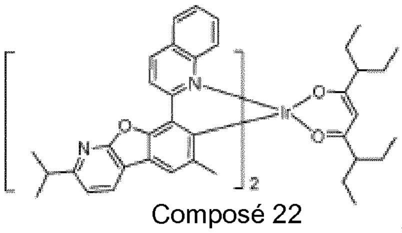
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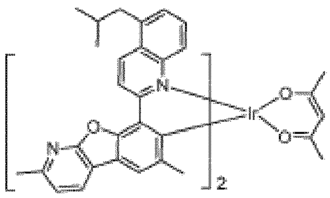
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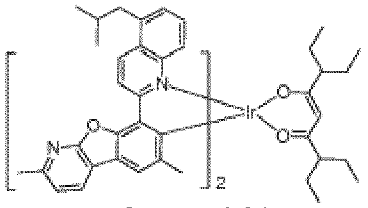
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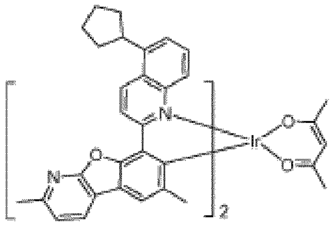
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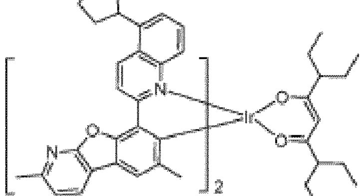
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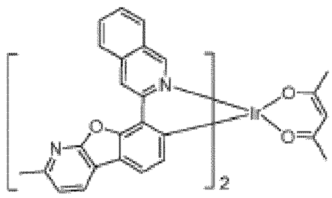
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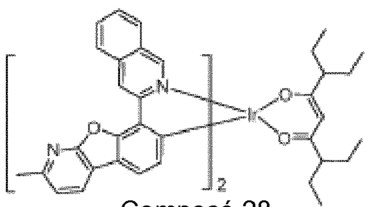
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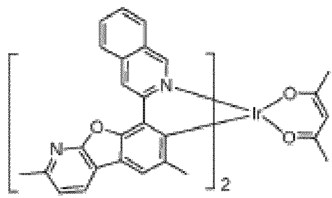
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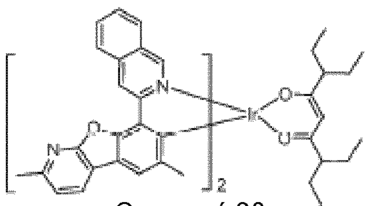
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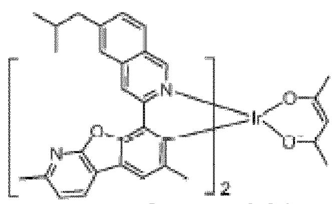
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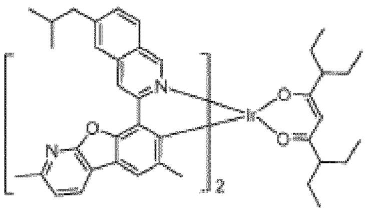
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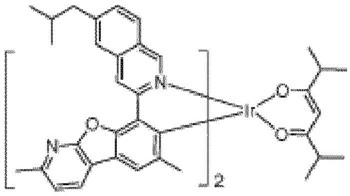
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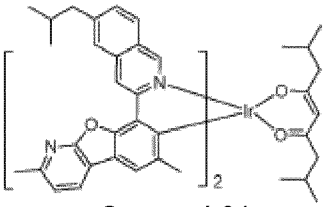
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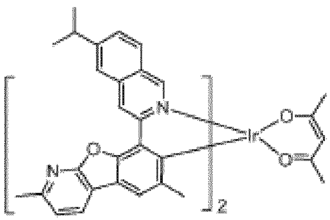
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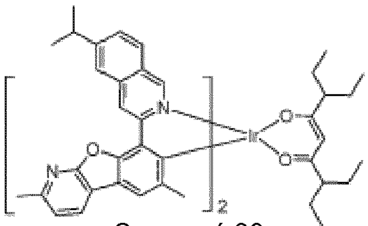
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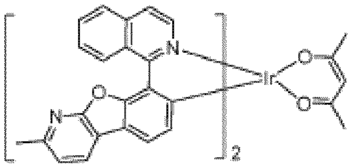
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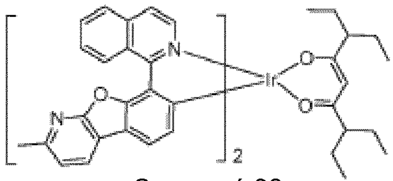
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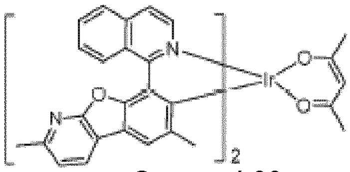
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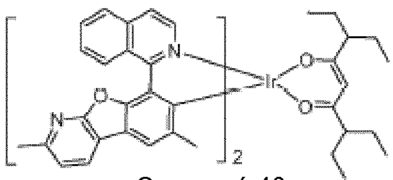
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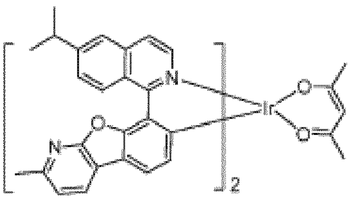
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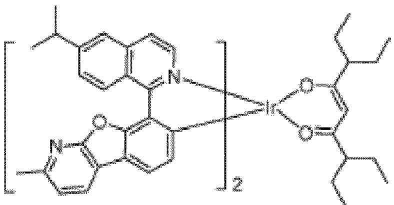
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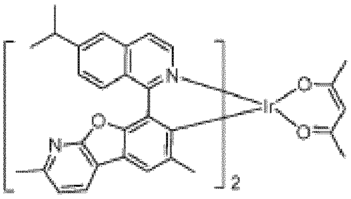
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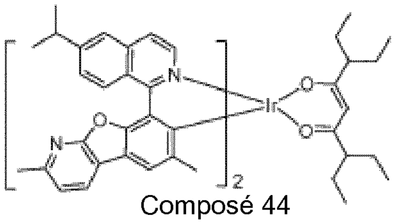
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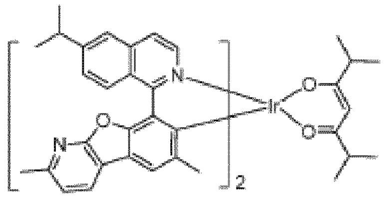
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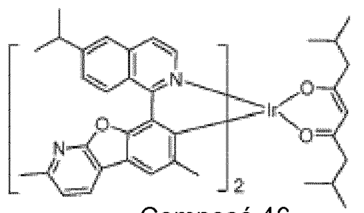
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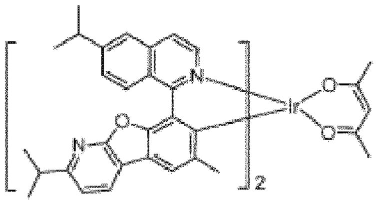
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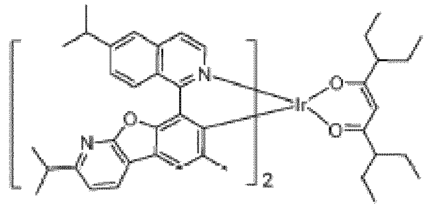
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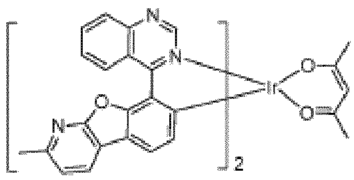
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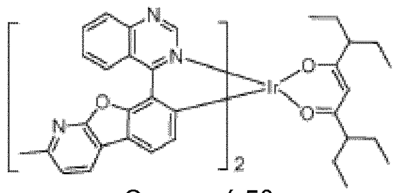
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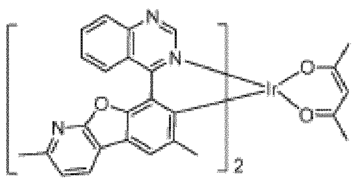
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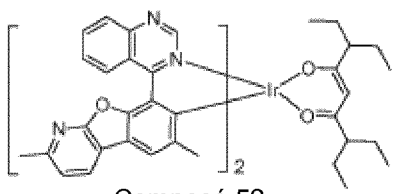
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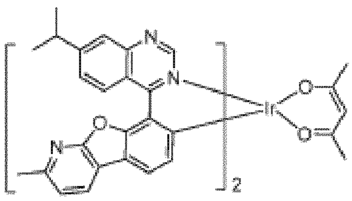
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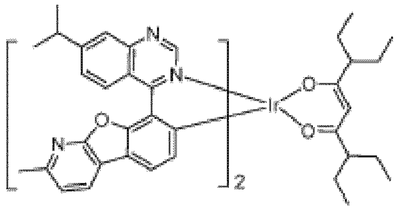
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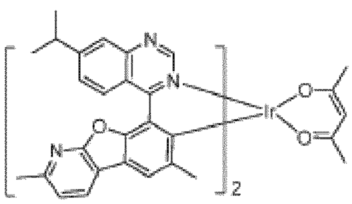
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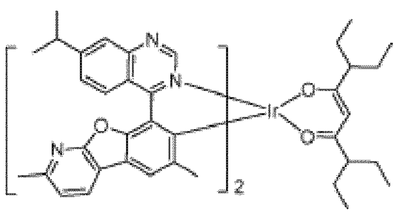
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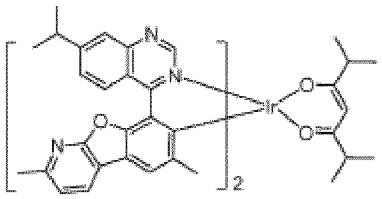

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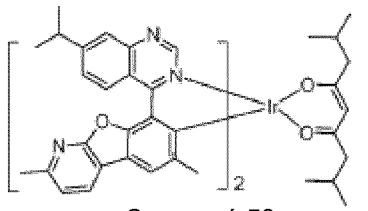

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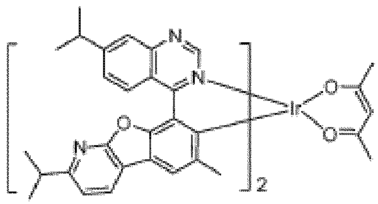

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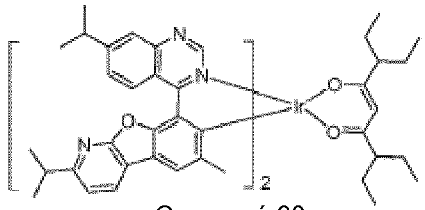


Composé 60 .

19. Un premier dispositif comprenant un premier dispositif électroluminescent organique, le premier dispositif électroluminescent organique comprenant :

une anode ;
une cathode ; et
une couche organique, située entre l'anode et la cathode, comprenant un composé tel que défini selon l'une quelconque des revendications 1 à 18.

20. Une formulation comprenant un composé tel que défini selon l'une quelconque des revendications 1 à 19.

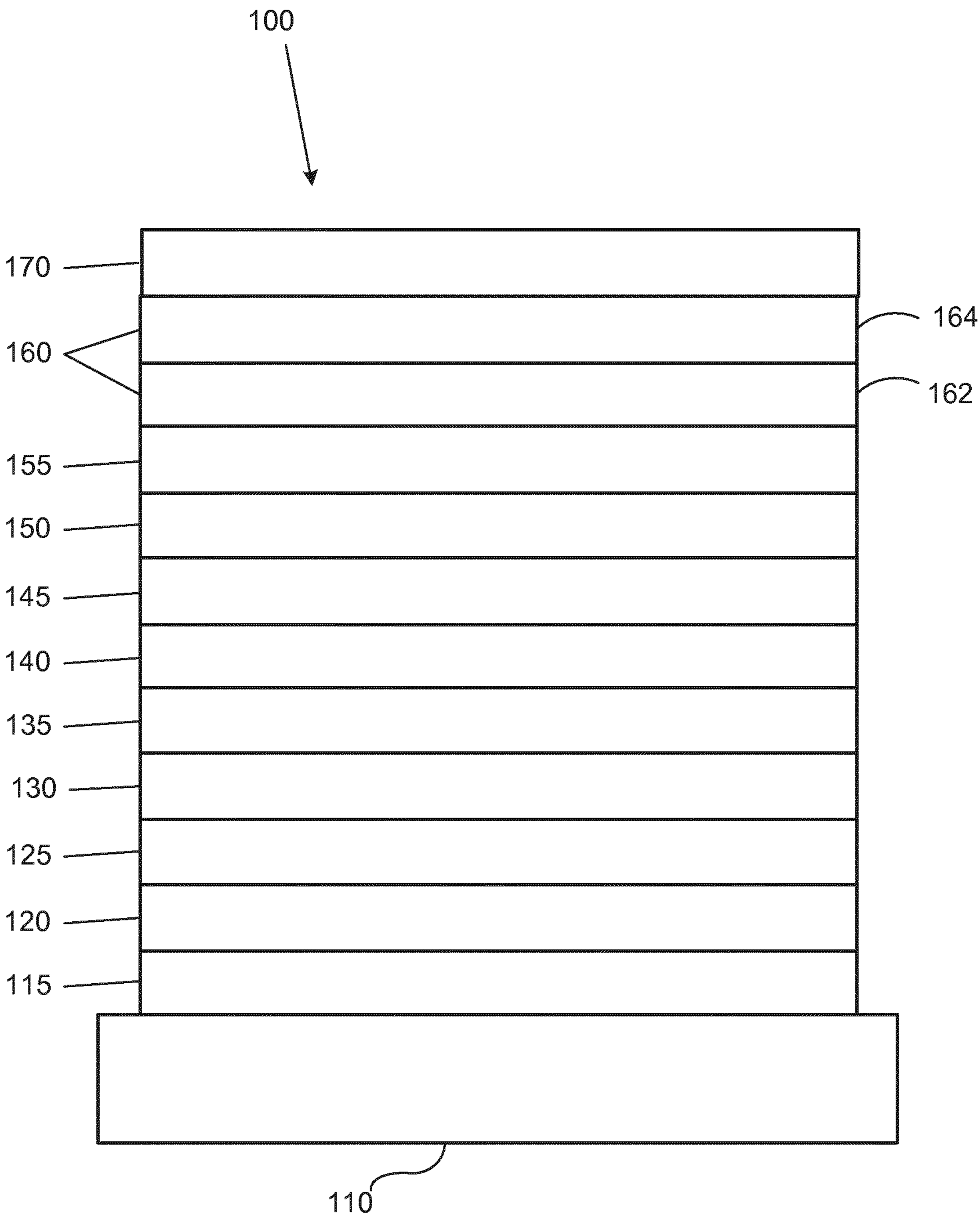


FIGURE 1

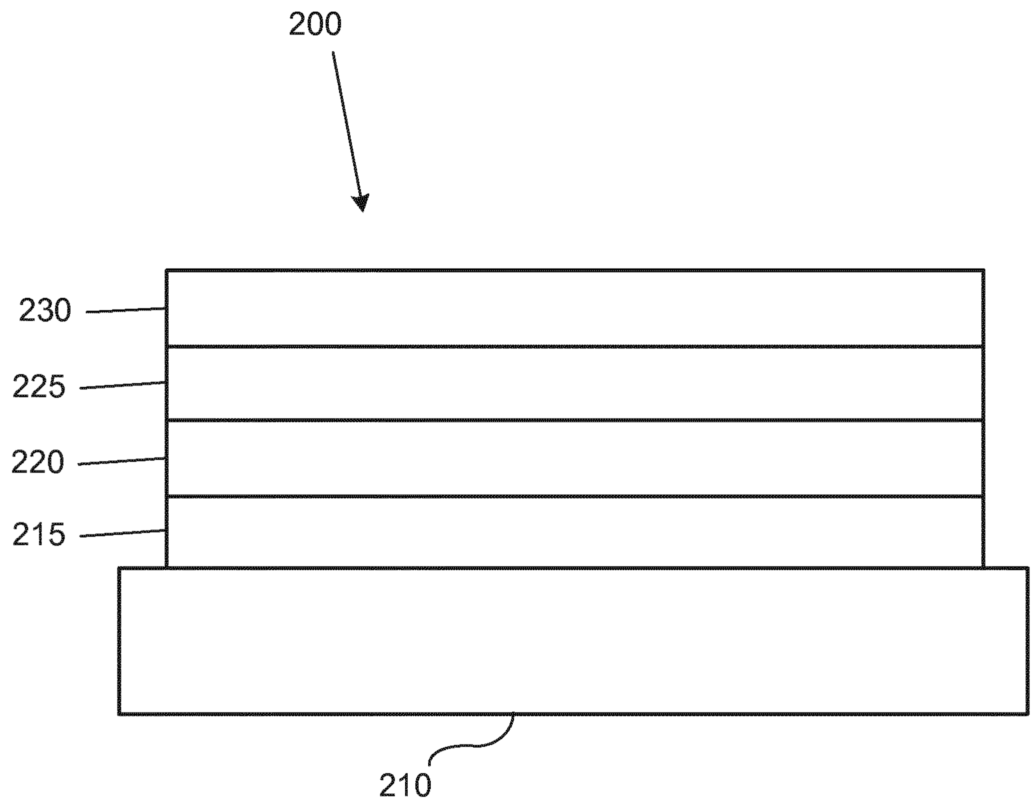
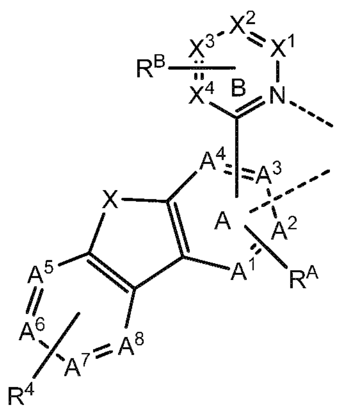
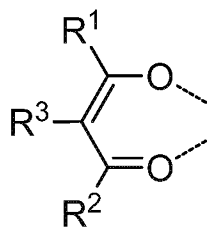


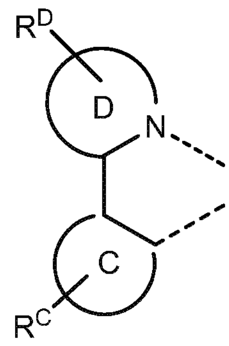
FIGURE 2



Ligand L_A



Ligand L_B



Ligand L_C

FIGURE 3

REFERENCES CITED IN THE DESCRIPTION

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摘要(译)

具有根据式M（L A）x（L B）y（L C）z的结构的化合物：其中配体LA是配体L B是；配体LC是并且公开了包含这些化合物的装置和制剂。式M（L A）x（L B）y（L C）z中：M为原子数大于40的金属。 x是1或2; x + y + z是金属M的氧化态； X 1 -X 4和A 1 -A 8为C或N； A 1 -A 8中的至少一个是N； X是O，S或Se;两个相邻的R B形成与环B稠合的六元芳族环E；其中环E可以被R E取代；每个RA -RE和R 1 -R 4独立地选自氢，氘，卤化物，烷基，环烷基，杂烷基，芳烷基，烷氧基，芳氧基，氨基，甲硅烷基，烯基，环烯基，杂烯基，炔基，芳基，杂芳基，酰基，羰基，羧酸，酯，腈，异腈，硫烷基，亚磺酰基，磺酰基，膦基及其组合。