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(54) **ORGANIC ELECTROLUMINESCENT MATERIALS AND DEVICES**

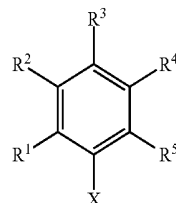
(57) **ABSTRACT**

A compound having the structure of Formula 1,

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Formula 1

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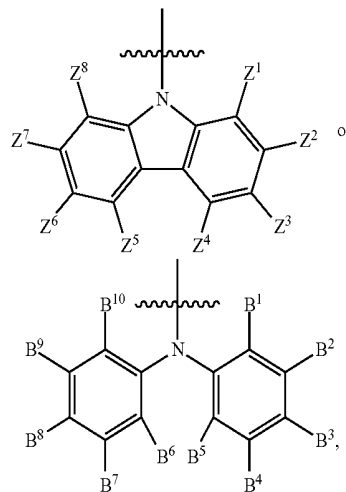
as well as, a first device and a formulation including the same are disclosed. In the structure of Formula 1:

R⁵ is

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Related U.S. Application Data

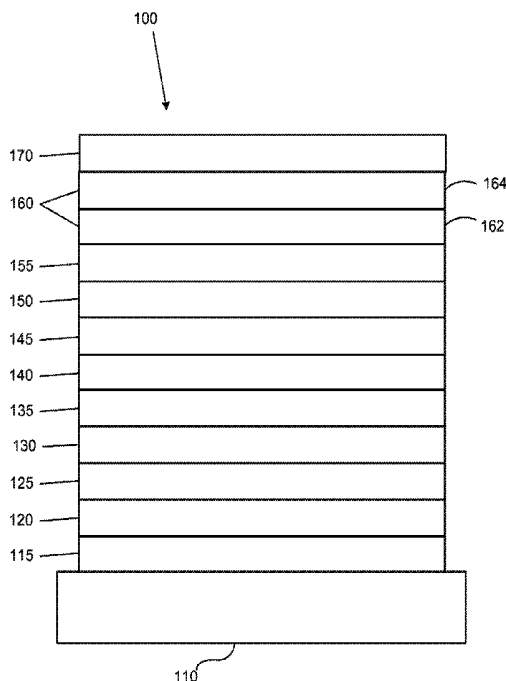
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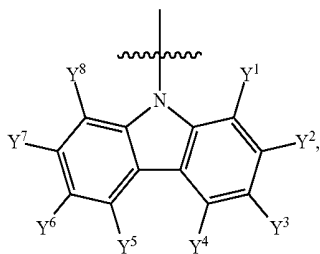
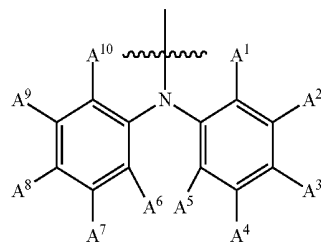
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and

(a) at least one of R¹-R⁴ isor (b) R¹ is

In addition, R¹, R², R³, R⁴, A¹, A², A³, A⁴, A⁵, A⁶, A⁷, A⁸, A⁹, A¹⁰, B¹, B², B³, B⁴, B⁵, B⁶, B⁷, B⁸, B⁹, B¹⁰, Y¹, Y², Y³, Y⁴, Y⁵, Y⁶, Y⁷, Y⁸, Z¹, Z², Z³, Z⁴, Z⁵, Z⁶, Z⁷, and Z⁸, are each independently selected from a variety of substituents, where adjacent A, B, Y, and Z groups are, optionally, joined to form a fused ring structure. Finally, X includes an acceptor group selected from $-C_mF_{2m+1}$, $-Si_mF_{2m+1}$, $-NCO$, $-NCS$, $-OCN$, $-SCN$, $-OC_mF_{2m+1}$, and $-SC_mF_{2m+1}$.

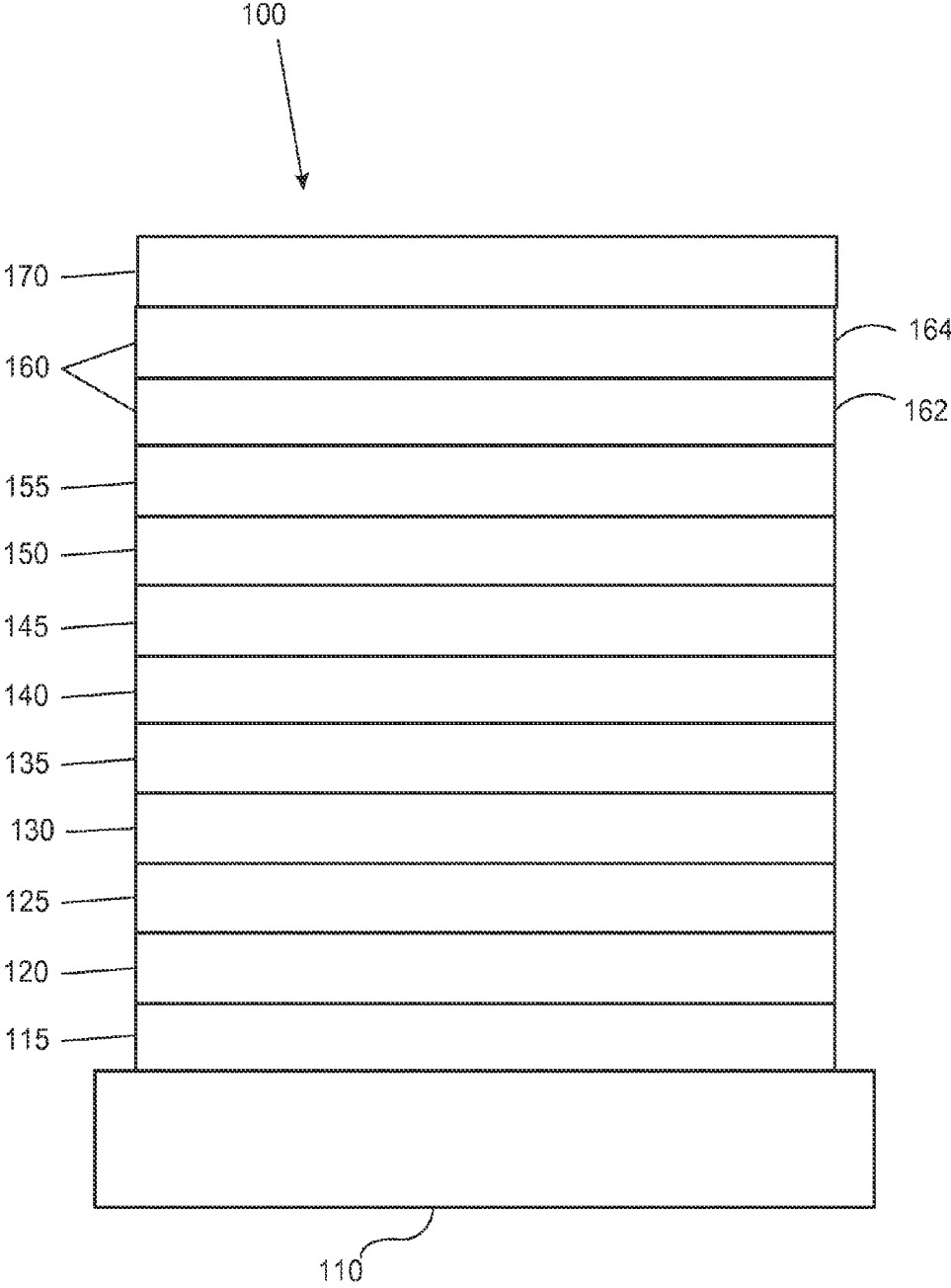


FIGURE 1

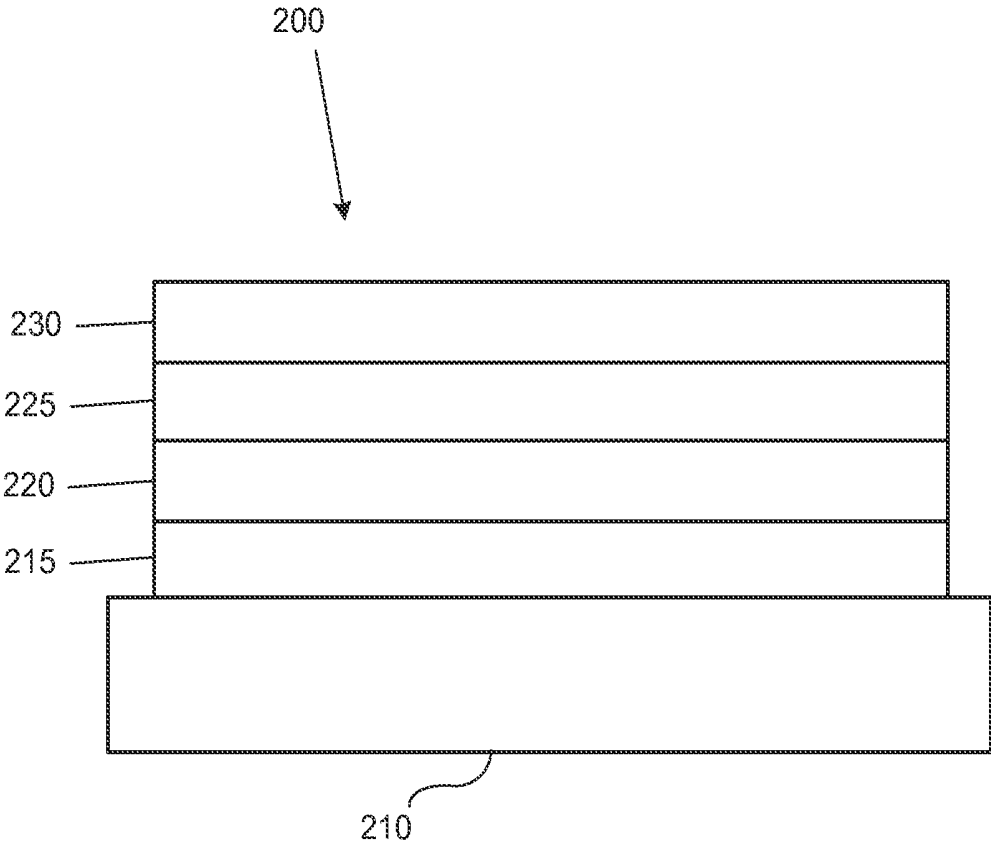
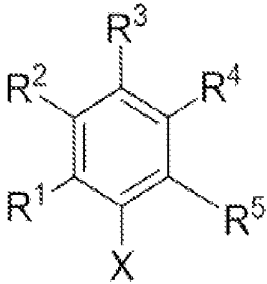
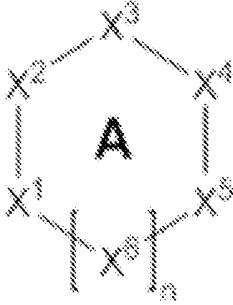


FIGURE 2



Formula 1



Formula 2

Figure 3

ORGANIC ELECTROLUMINESCENT MATERIALS AND DEVICES

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Application Ser. No. 61/904,098, filed Nov. 13, 2013, the entire content of which is incorporated herein by reference.

PARTIES TO A JOINT RESEARCH AGREEMENT

[0002] 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

[0003] The present invention relates to compounds for use as emitters and devices, such as organic light emitting diodes, including the same.

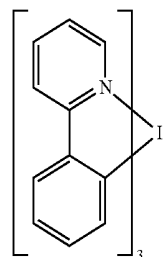
BACKGROUND

[0004] 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.

[0005] 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, and 5,707,745, which are incorporated herein by reference in their entirety.

[0006] 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.

[0007] One example of a green emissive molecule is tris(2-phenylpyridine) iridium, denoted Ir(ppy)₃, which has the following structure:



[0008] In this, and later figures herein, we depict the dative bond from nitrogen to metal (here, Ir) as a straight line.

[0009] 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.

[0010] 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.

[0011] 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.

[0012] 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.

[0013] 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

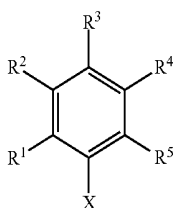
energy level of the same material. A “higher” HOMO or LUMO energy level appears closer to the top of such a diagram than a “lower” HOMO or LUMO energy level.

[0014] 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.

[0015] More details on OLEDs, and the definitions described above, can be found in U.S. Pat. No. 7,279,704, which is incorporated herein by reference in its entirety.

SUMMARY OF THE INVENTION

[0016] According to an embodiment, a compound comprising a structure according to Formula 1:

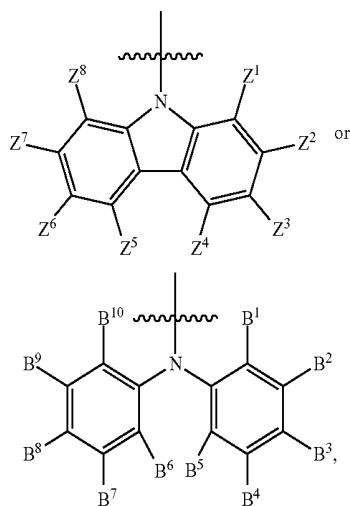


Formula 1

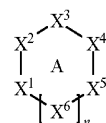
is described.

In the structure according to Formula 1:

[0017] R^5 is

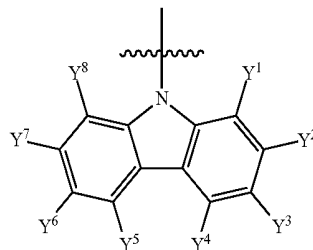


Formula 2



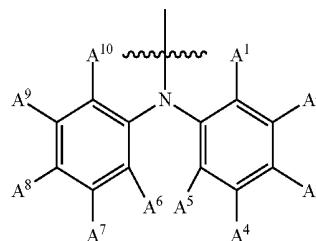
and

[0018] (a) at least one of R^1 - R^4 is



or (b) R^1 is

[0019]



[0020] where $R^1, R^2, R^3, R^4, A^1, A^2, A^3, A^4, A^5, A^6, A^7, A^8, A^9, A^{10}, B^1, B^2, B^3, B^4, B^5, B^6, B^7, B^8, B^9, B^{10}, Y^1, Y^2, Y^3, Y^4, Y^5, Y^6, Y^7, Y^8, Z^1, Z^2, Z^3, Z^4, Z^5, Z^6, Z^7,$ and Z^8 , are each independently selected from the group consisting of hydrogen, deuterium, halide, alkyl, haloalkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, thioalkoxy, aryloxy, thioaryloxy, amino, arylamino, diarylamino, carbazolyl, silyl, halosilyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, $-C_mF_{2m+1}$, $-Si_mF_{2m+1}$, $-NCO$, $-NCS$, $-OCN$, $-SCN$, $-OC_mF_{2m+1}$, $-SC_mF_{2m+1}$, and combinations thereof;

[0021] adjacent A, B, Y, and Z groups are, optionally, joined to form a fused ring structure; and

[0022] X comprises an acceptor group selected from the group consisting of $-C_mF_{2m+1}$, $-Si_mF_{2m+1}$, $-NCO$, $-NCS$, $-OCN$, $-SCN$, $-OC_mF_{2m+1}$, and $-SC_mF_{2m+1}$.

[0023] According to another embodiment, a first device is also provided. The first device can include a first organic light emitting device that includes an anode; a cathode; and an emissive layer disposed between the anode and the cathode. The emissive layer can include a first emitting compound comprising a structure according to Formula 2:

In the compound of Formula 2,

[0024] ring A is an aromatic or heteroaromatic ring;

[0025] n is 0 or 1;

[0026] when n is 0, X^1 , X^2 , X^3 , X^4 , and X^5 are independently selected from the group consisting of CR, N, NR, O, S, and Se, and at least one of X^1 to X^5 is CR; when n is 1, X^1 , X^2 , X^3 , X^4 , X^5 , and X^6 are independently selected from the group consisting of CR and N, and at least one of X^1 to X^6 is CR;

[0027] each R is independently selected from the group consisting of hydrogen, deuterium, halide, alkyl, haloalkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, thioalkoxy, aryloxy, thioaryloxy, amino, arylamino, diarylamino, carbazolyl, silyl, halosilyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, $-C_mF_{2m+1}$, $-Si_mF_{2m+1}$, $-NCO$, $-NCS$, $-OCN$, $-SCN$, $-OC_mF_{2m+1}$, $-SC_mF_{2m+1}$, and combinations thereof;

[0028] adjacent R groups are, optionally, joined to form a fused ring structure;

[0029] $m \geq 1$;

[0030] at least one R group comprises a donor group with at least one electron-donating nitrogen; and

[0031] at least one R group comprises an acceptor group selected from the group consisting of $-F$, $-C_mF_{2m+1}$, $-Si_mF_{2m+1}$, $-NCO$, $-NCS$, $-OCN$, $-SCN$, $-OC_mF_{2m+1}$, and $-SC_mF_{2m+1}$.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] FIG. 1 shows an organic light emitting device.

[0033] FIG. 2 shows an inverted organic light emitting device that does not have a separate electron transport layer.

[0034] FIG. 3 shows Formulas 1 and 2 as disclosed herein.

DETAILED DESCRIPTION

[0035] 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.

[0036] 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, which is incorporated by reference in its entirety. Fluorescent emission generally occurs in a time frame of less than 10 nanoseconds.

[0037] 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"), which are incorporated by reference in their entireties. Phosphorescence is described in more detail in U.S. Pat. No. 7,279,704 at cols. 5-6, which are incorporated by reference.

[0038] 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 U.S. Pat. No. 7,279,704 at cols. 6-10, which are incorporated by reference.

[0039] 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, which is incorporated by reference in its entirety. 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, which is incorporated by reference in its entirety. Examples of emissive and host materials are disclosed in U.S. Pat. No. 6,303,238 to Thompson et al., which is incorporated by reference in its entirety. 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, which is incorporated by reference in its entirety. U.S. Pat. Nos. 5,703,436 and 5,707,745, which are incorporated by reference in their entireties, 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, which are incorporated by reference in their entireties. Examples of injection layers are provided in U.S. Patent Application Publication No. 2004/0174116, which is incorporated by reference in its entirety. A description of protective layers may be found in U.S. Patent Application Publication No. 2004/0174116, which is incorporated by reference in its entirety.

[0040] 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.

[0041] The simple layered structure illustrated in FIGS. 1 and 2 is provided by way of non-limiting 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 under-

stood 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.

[0042] 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., which is incorporated by reference in its entirety. 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., which are incorporated by reference in their entireties.

[0043] 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, which are incorporated by reference in their entireties, organic vapor phase deposition (OVPD), such as described in U.S. Pat. No. 6,337,102 to Forrest et al., which is incorporated by reference in its entirety, and deposition by organic vapor jet printing (OVJP), such as described in U.S. Pat. No. 7,431,968, which is incorporated by reference in its entirety. 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, which are incorporated by reference in their entireties, 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 processability 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.

[0044] 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, which are herein incorporated by reference in their entireties. 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.

[0045] 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.

[0046] 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.

[0047] The term “halo” or “halogen” as used herein includes fluorine, chlorine, bromine, and iodine.

[0048] 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.

[0049] 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.

[0050] 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.

[0051] The term “alkynyl” as used herein contemplates both straight and branched chain alkyne radicals. Preferred alkynyl groups are those containing two to fifteen carbon atoms. Additionally, the alkynyl group may be optionally substituted.

[0052] 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.

[0053] The term “heterocyclic group” as used herein contemplates aromatic and non-aromatic cyclic radicals. Hetero-aromatic 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.

[0054] 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.

[0055] The term “heteroaryl” as used herein contemplates single-ring hetero-aromatic groups that may include from one to three heteroatoms, 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.

[0056] 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.

[0057] As used herein, “substituted” indicates that a substituent other than H is bonded to the relevant position, such as carbon. Thus, for example, where R¹ is mono-substituted, then one R¹ must be other than H. Similarly, where R¹ is di-substituted, then two of R¹ must be other than H. Similarly, where R¹ is unsubstituted, R¹ is hydrogen for all available positions.

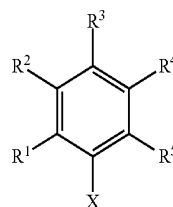
[0058] The “aza” designation in the fragments described herein, i.e. aza-dibenzofuran, aza-dibenzothiophene, etc. means that one or more of the C—H groups in the respective fragment can be replaced by a nitrogen atom, for example, and without any limitation, azatriphenylene encompasses both dibenzo[f,h]quinoxaline 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.

[0059] 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. phenyl, phenylene, naphthyl, dibenzofuryl) or as if it were the whole molecule (e.g. benzene, naphthalene, dibenzofuran). As used herein, these different ways of designating a substituent or attached fragment are considered to be equivalent.

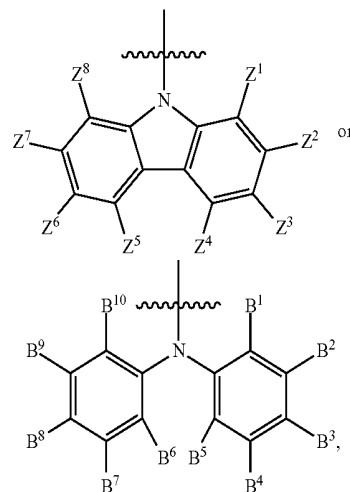
[0060] A compound comprising a structure according to Formula 1

Formula 1



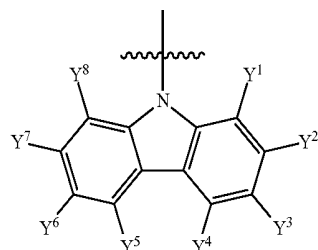
is described. In the structure according to Formula 1:

[0061] R⁵ is

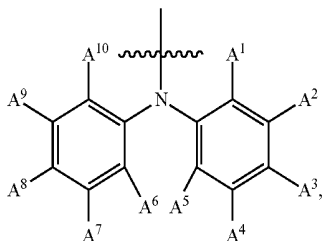


and

[0062] (a) at least one of R¹-R⁴ is



or (b) is



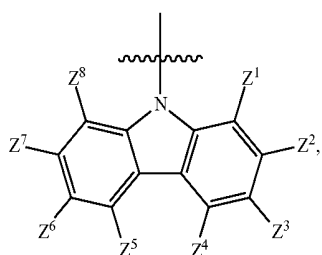
[0063] $R^1, R^2, R^3, R^4, A^1, A^2, A^3, A^4, A^5, A^6, A^7, A^8, A^9, A^{10}, B^1, B^2, B^3, B^4, B^5, B^6, B^7, B^8, B^9, B^{10}, Y^1, Y^2, Y^3, Y^4, Y^5, Y^6, Y^7, Y^8, Z^1, Z^2, Z^3, Z^4, Z^5, Z^6, Z^7,$ and $Z^8,$ are each independently selected from the group consisting of hydrogen, deuterium, halide, alkyl, haloalkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, thioalkoxy, aryloxy, thioaryloxy, amino, arylamino, diarylamino, carbazolyl, silyl, halosilyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, $-C_mF_{2m+1}, -Si_mF_{2m+1}, -NCO, -NCS, -OCN, -SCN, -OC_mF_{2m+1}, -SC_mF_{2m+1},$ and combinations thereof;

[0064] adjacent A, B, Y, and Z groups are, optionally, joined to form a fused ring structure; and

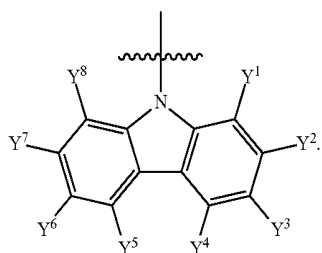
[0065] X comprises an acceptor group selected from the group consisting of $-C_mF_{2m+1}, -Si_mF_{2m+1}, -NCO, -NCS, -OCN, -SCN, -OC_mF_{2m+1},$ and $-SC_mF_{2m+1}.$

[0066] In some embodiments, A^5 & A^6 are not joined to form a fused ring, while A^5 & A^6 are joined to form a fused ring in other embodiments. In some embodiments, B^5 & B^6 are not joined to form a fused ring, while B^5 & B^6 are joined to form a fused ring in other embodiments.

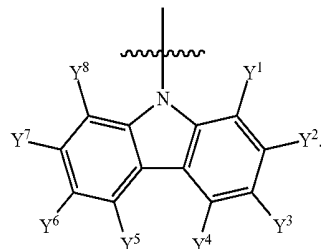
[0067] In some embodiments, R^5 is



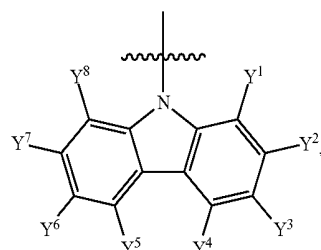
and at least one of R^1 - R^4 is



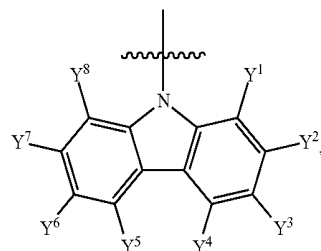
In some embodiments, at least two of R^1 - R^4 are



In some embodiments, at least three of R^1 - R^4 are



while all four of R^1 - R^4 are



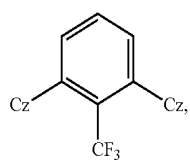
in other embodiments.

[0068] In some embodiments, at least one of R^1 - R^4 comprises an acceptor group selected from the group consisting of $-C_mF_{2m+1}, -Si_mF_{2m+1}, -NCO, -NCS, -OCN, -SCN, -OC_mF_{2m+1},$ and $-SC_mF_{2m+1}.$ In some embodiments, at least two of R^1 - R^4 comprise an acceptor group selected from the group consisting of $-C_mF_{2m+1}, -Si_mF_{2m+1}, -NCO, -NCS, -OCN, -SCN, -OC_mF_{2m+1},$ and $-SC_mF_{2m+1}.$ In some embodiments, at least three of R^1 - R^4 comprise an acceptor group selected from the group consisting of $-C_mF_{2m+1}, -Si_mF_{2m+1}, -NCO, -NCS, -OCN, -SCN, -OC_mF_{2m+1},$ and $-SC_mF_{2m+1}.$

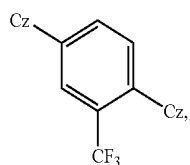
[0069] In some embodiments, at least one of R^1 - R^4 is an electron withdrawing group with a Hammett value (σ_{para}) of at least 0.05. In some embodiments, at least two of R^1 - R^4 are electron withdrawing groups with a Hammett value (σ_{para}) of at least 0.05. In some embodiments, at least three of R^1 - R^4 are electron withdrawing groups with a Hammett value (σ_{para}) of at least 0.05.

[0070] In some embodiments, the compound is selected from the group consisting of:

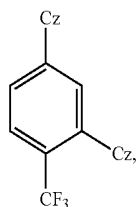
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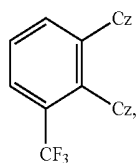
Compound 1



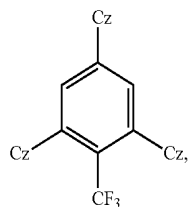
Compound 2



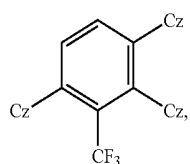
Compound 3



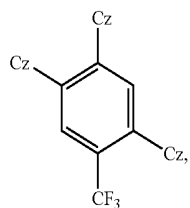
Compound 4



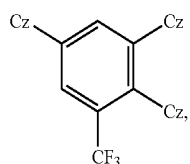
Compound 6



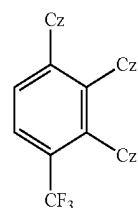
Compound 7



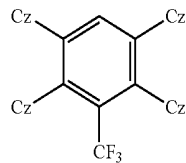
Compound 8



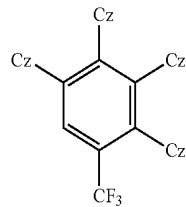
Compound 9



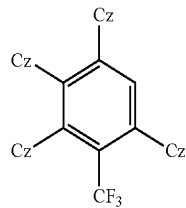
Compound 10



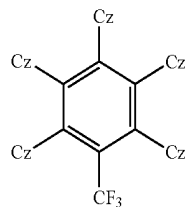
Compound 11



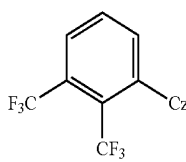
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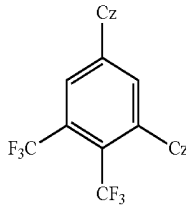
Compound 13



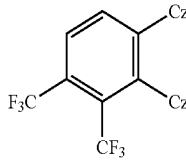
Compound 14



Compound 15

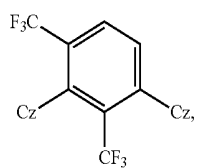


Compound 29

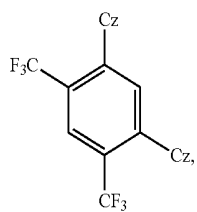


Compound 30

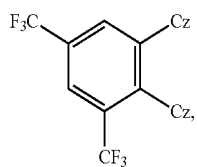
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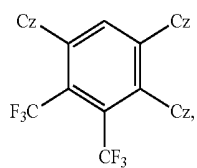
Compound 31



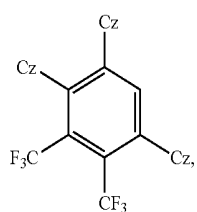
Compound 32



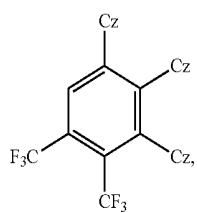
Compound 33



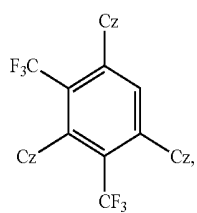
Compound 34



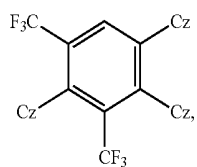
Compound 35



Compound 36

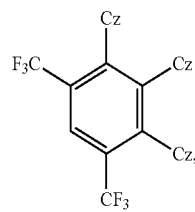


Compound 37

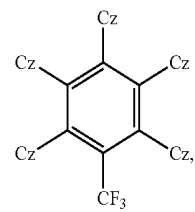


Compound 38

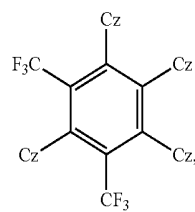
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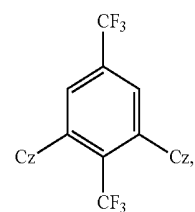
Compound 39



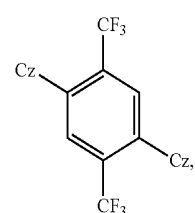
Compound 40



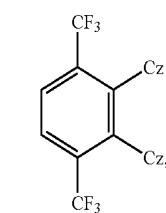
Compound 41



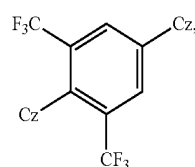
Compound 42



Compound 43

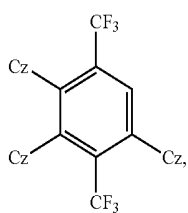


Compound 44

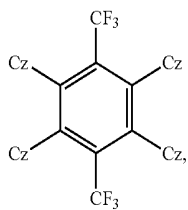


Compound 45

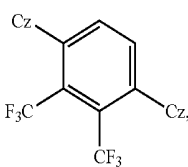
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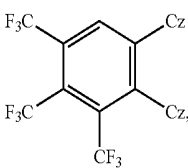
Compound 46



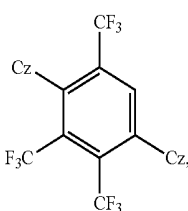
Compound 47



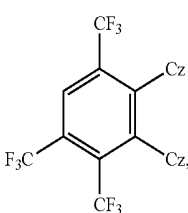
Compound 48



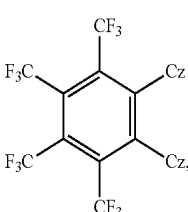
Compound 49



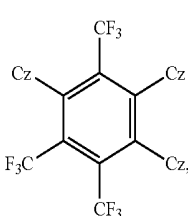
Compound 50



Compound 51

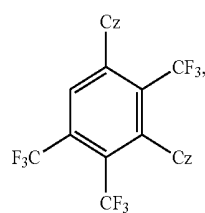


Compound 52

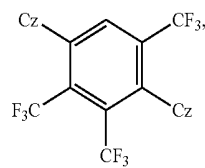


Compound 53

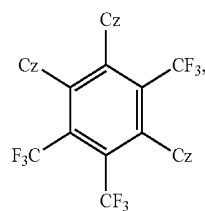
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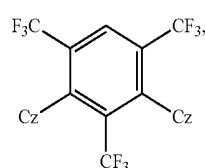
Compound 54



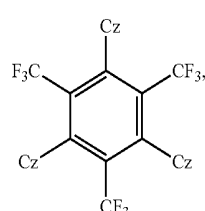
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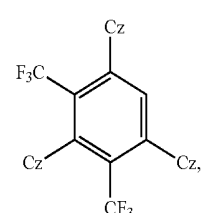
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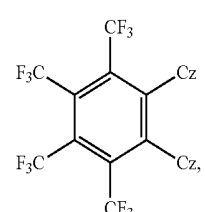
Compound 57



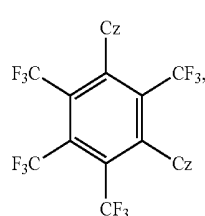
Compound 58



Compound 59

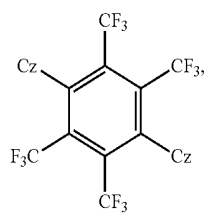


Compound 60

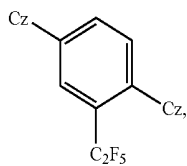


Compound 61

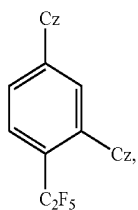
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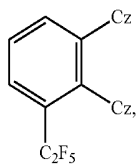
Compound 62



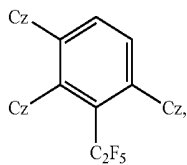
Compound 63



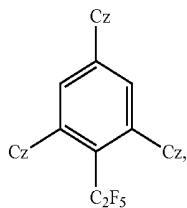
Compound 64



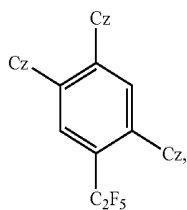
Compound 65



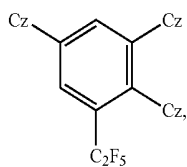
Compound 66



Compound 67

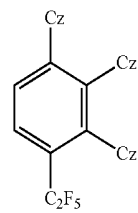


Compound 69

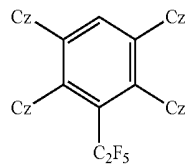


Compound 70

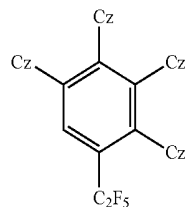
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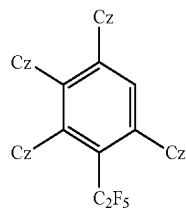
Compound 71



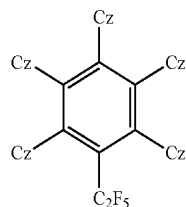
Compound 72



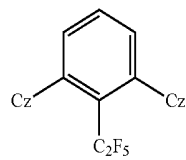
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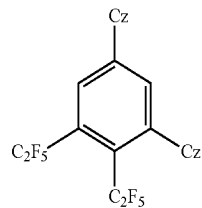
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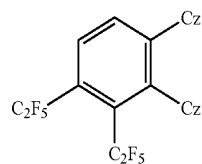
Compound 75



Compound 76

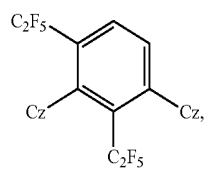


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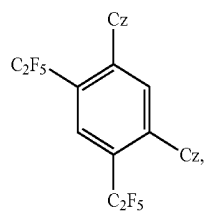


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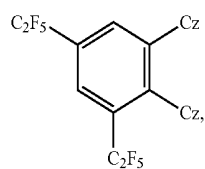
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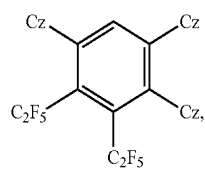
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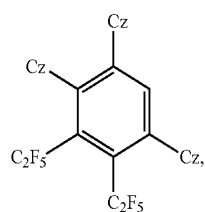
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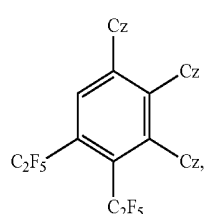
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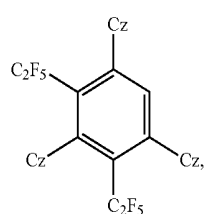
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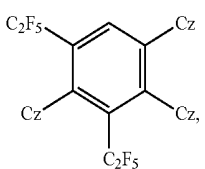
Compound 97



Compound 98

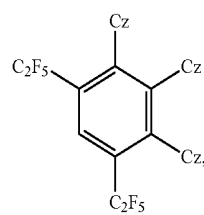


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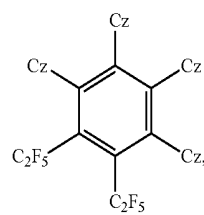


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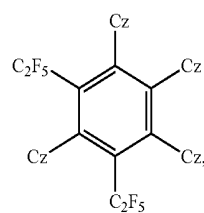
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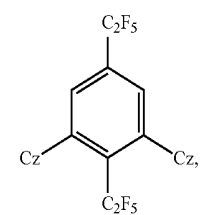
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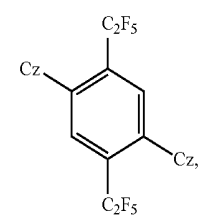
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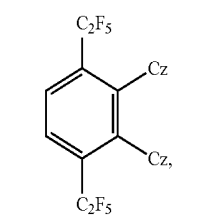
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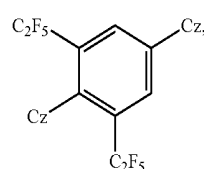
Compound 104



Compound 105

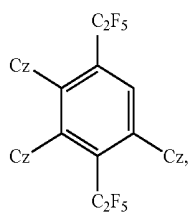


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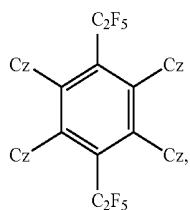


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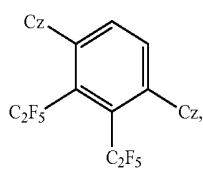
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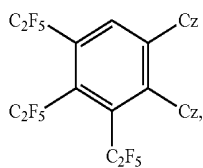
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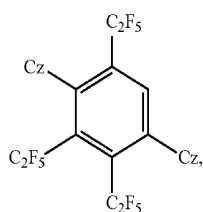
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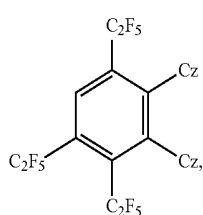
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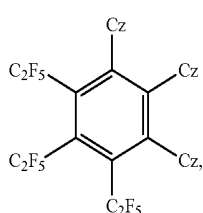
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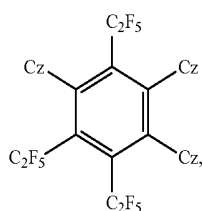
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Compound 113

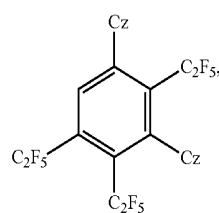


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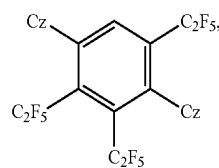


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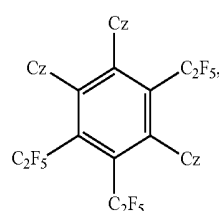
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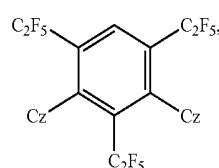
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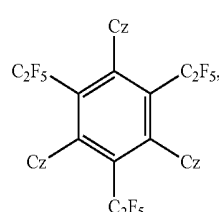
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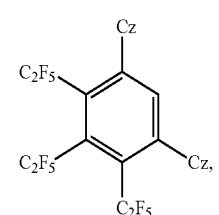
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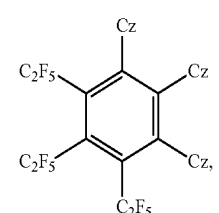
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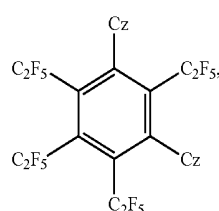
Compound 120



Compound 121

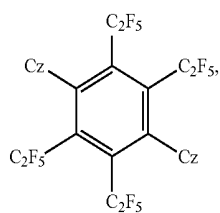


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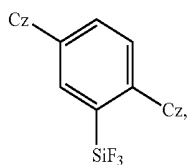


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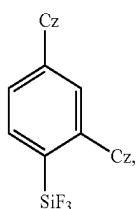
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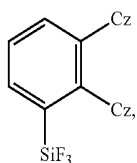
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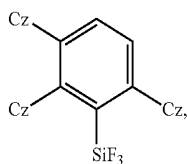
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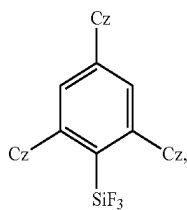
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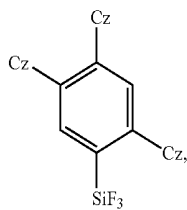
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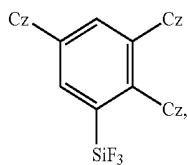
Compound 128



Compound 129

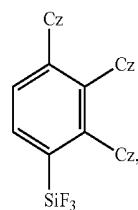


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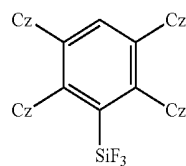


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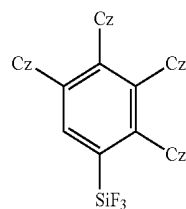
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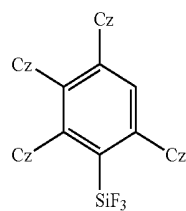
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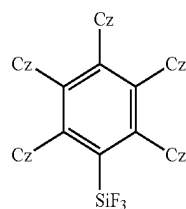
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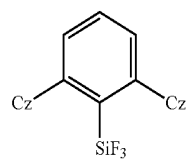
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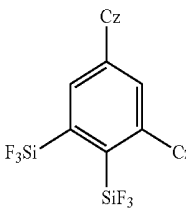
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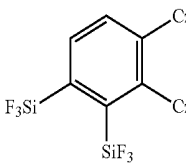
Compound 137



Compound 138

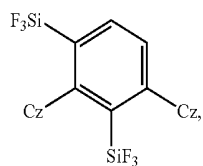


Compound 153

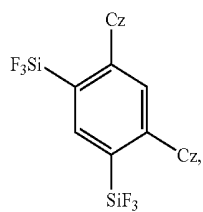


Compound 154

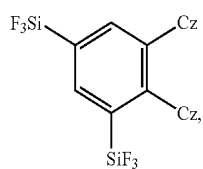
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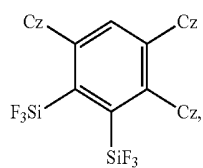
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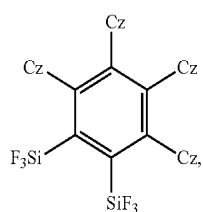
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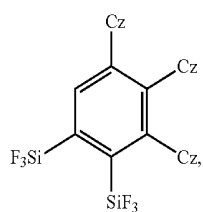
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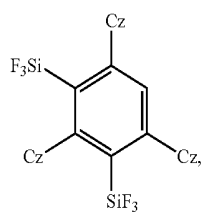
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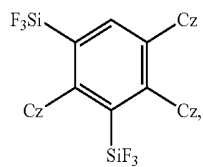
Compound 159



Compound 160

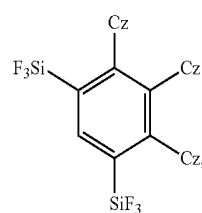


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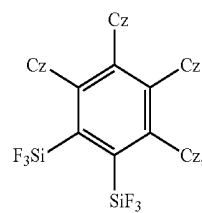


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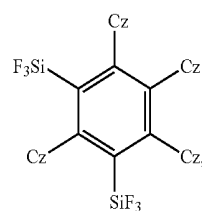
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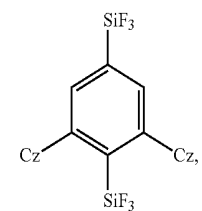
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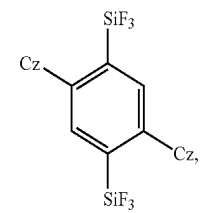
Compound 164



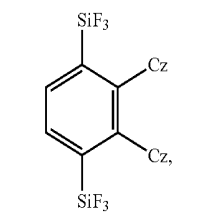
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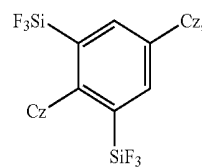
Compound 166



Compound 167

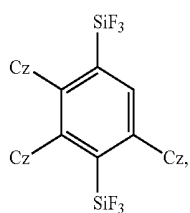


Compound 168

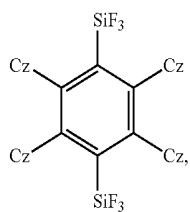


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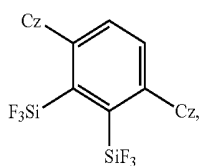
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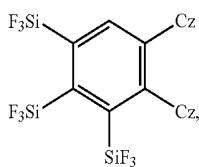
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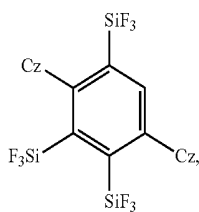
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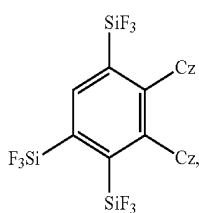
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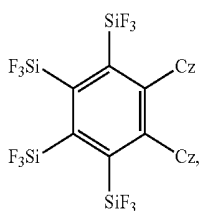
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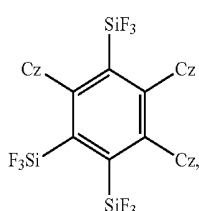
Compound 174



Compound 175

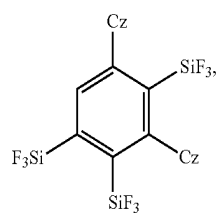


Compound 176

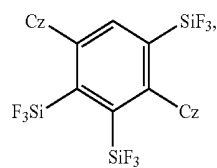


Compound 177

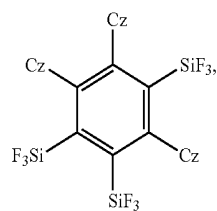
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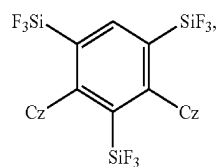
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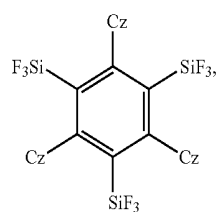
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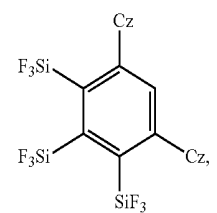
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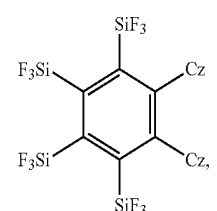
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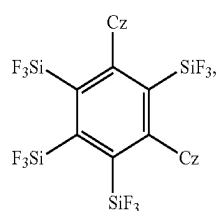
Compound 182



Compound 183

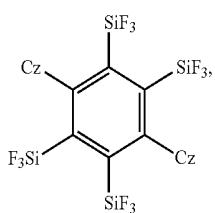


Compound 184

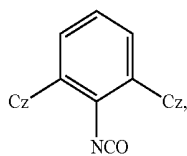


Compound 185

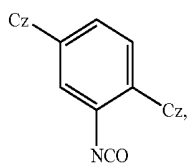
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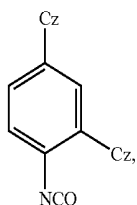
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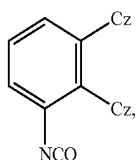
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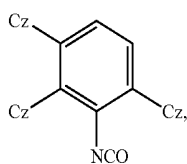
Compound 188



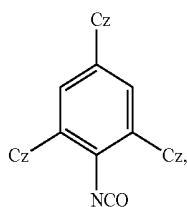
Compound 189



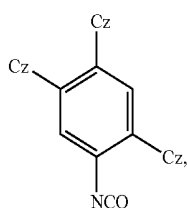
Compound 190



Compound 191

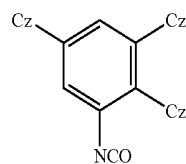


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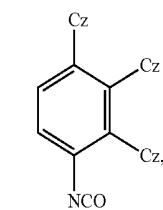


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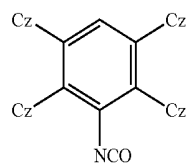
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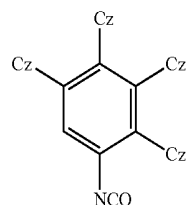
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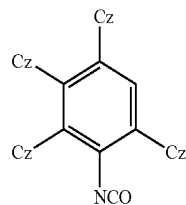
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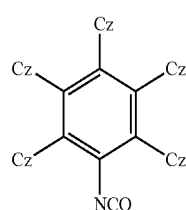
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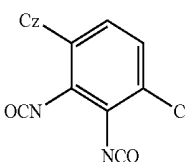
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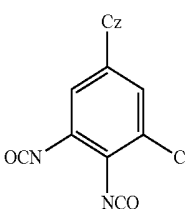
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Compound 200

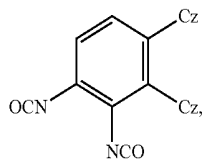


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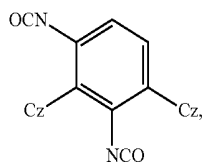


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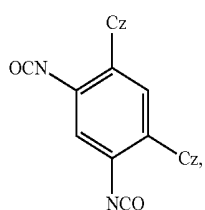
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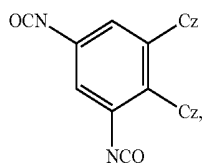
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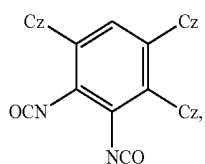
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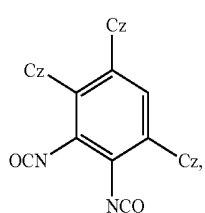
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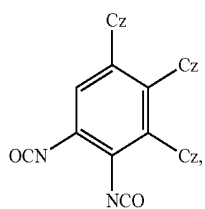
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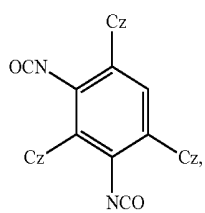
Compound 221



Compound 222

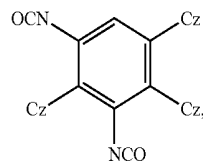


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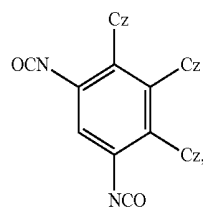


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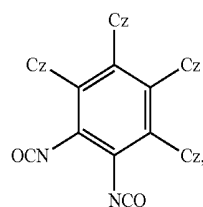
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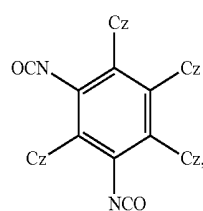
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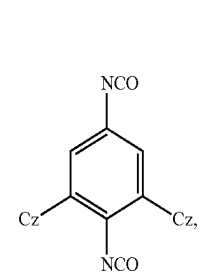
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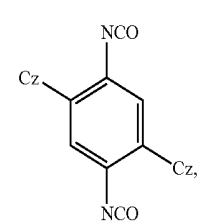
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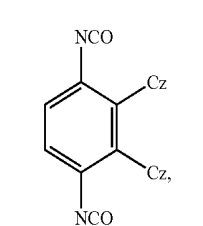
Compound 228



Compound 229

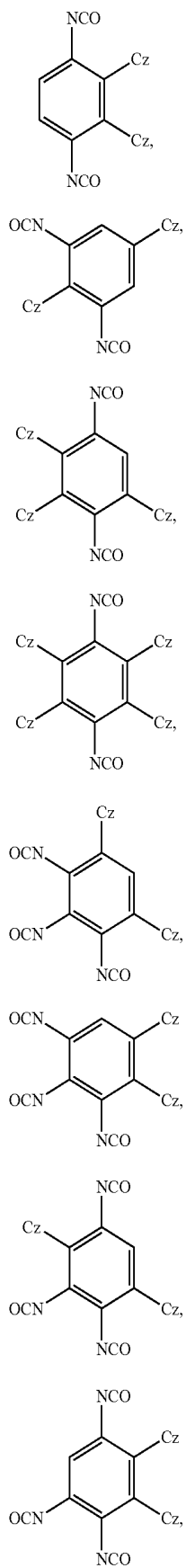


Compound 230



Compound 231

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Compound 231

Compound 232

Compound 233

Compound 234

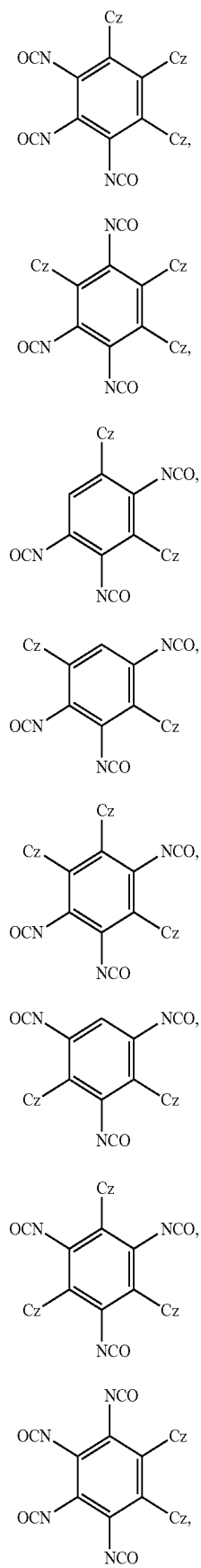
Compound 235

Compound 236

Compound 237

Compound 238

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Compound 239

Compound 240

Compound 241

Compound 242

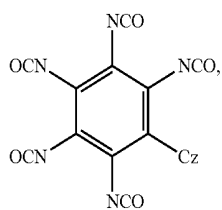
Compound 243

Compound 244

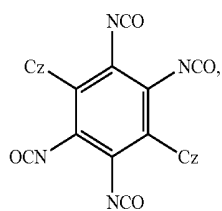
Compound 245

Compound 246

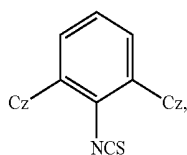
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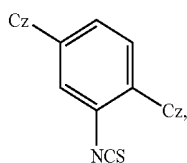
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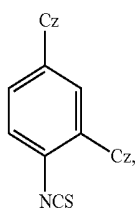
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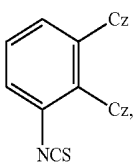
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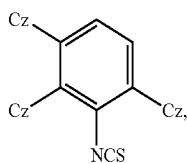
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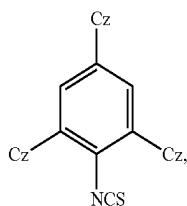
Compound 251



Compound 252

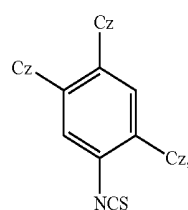


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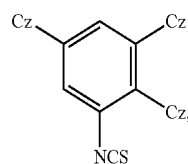


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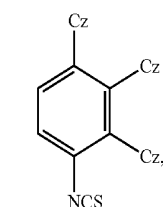
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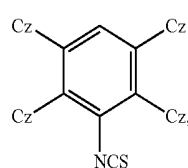
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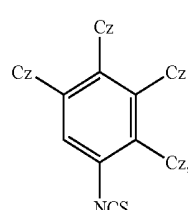
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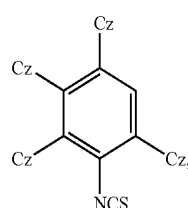
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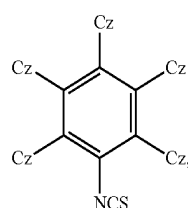
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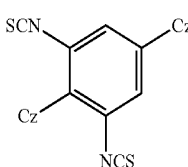
Compound 260



Compound 261

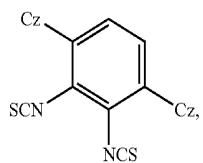


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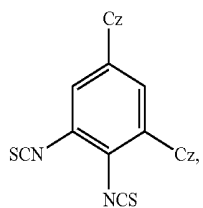


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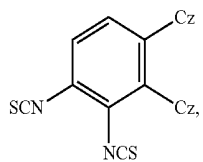
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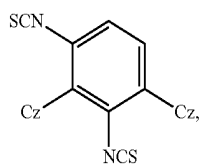
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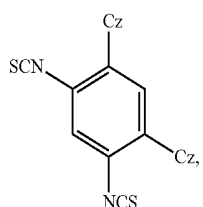
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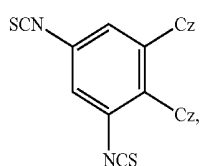
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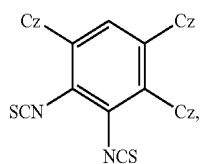
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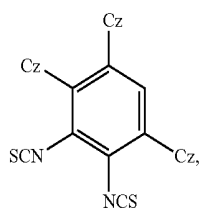
Compound 282



Compound 283

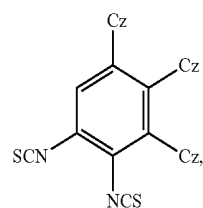


Compound 284

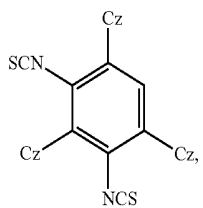


Compound 285

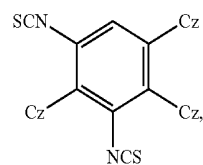
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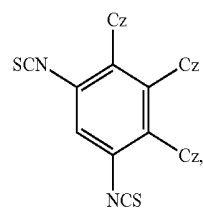
Compound 286



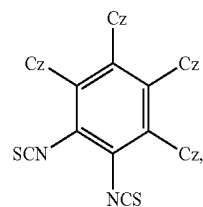
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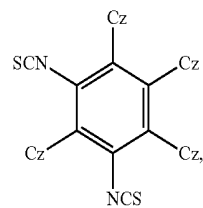
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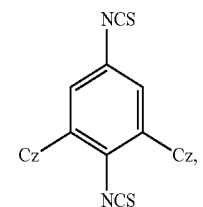
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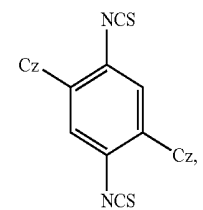
Compound 290



Compound 291

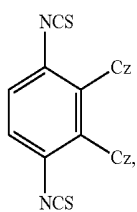


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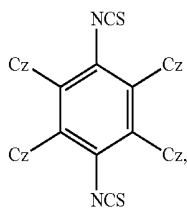


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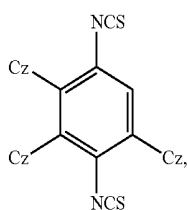
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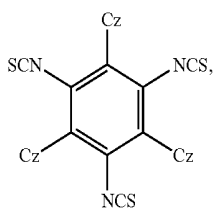
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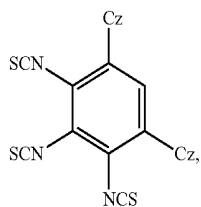
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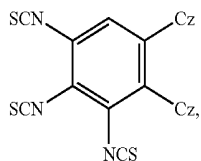
Compound 296



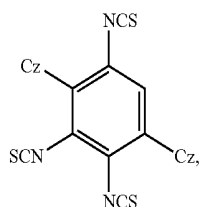
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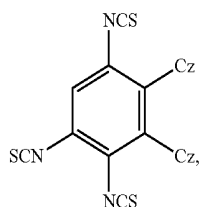
Compound 298



Compound 299

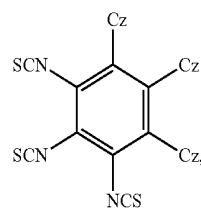


Compound 300

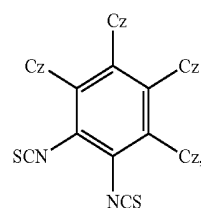


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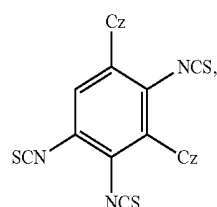
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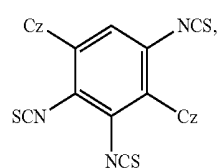
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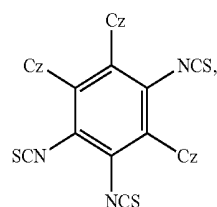
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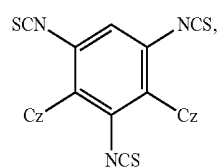
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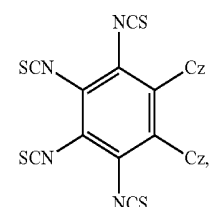
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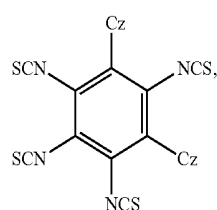
Compound 306



Compound 307

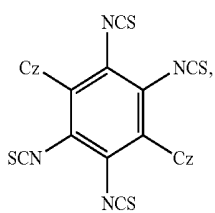


Compound 308

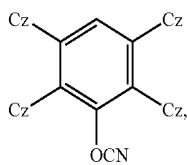


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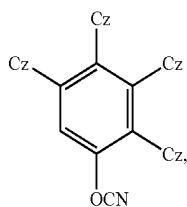
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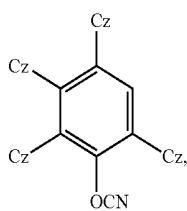
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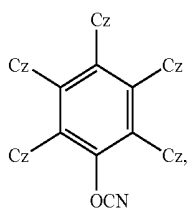
Compound 311



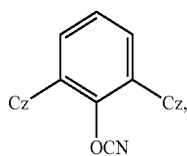
Compound 312



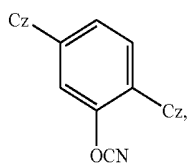
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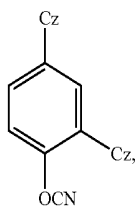
Compound 314



Compound 329

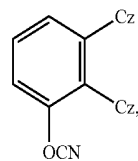


Compound 330

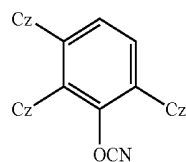


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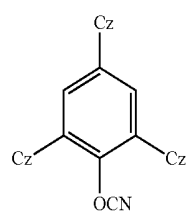
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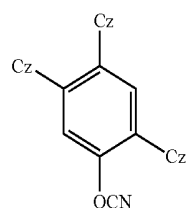
Compound 332



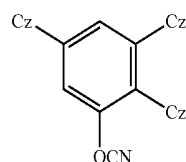
Compound 333



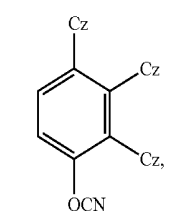
Compound 334



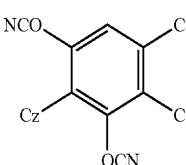
Compound 336



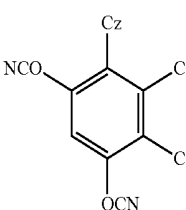
Compound 337



Compound 338

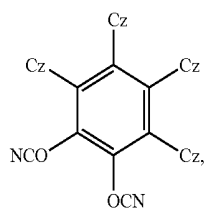


Compound 339

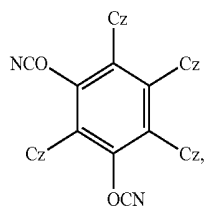


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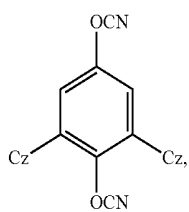
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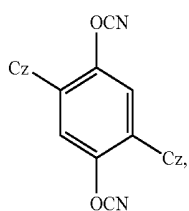
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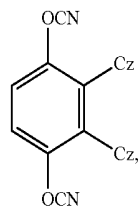
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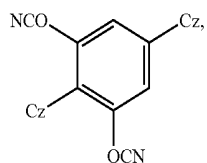
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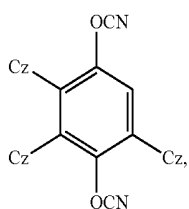
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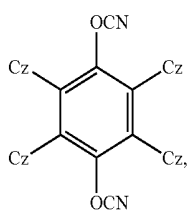
Compound 345



Compound 346

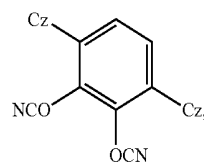


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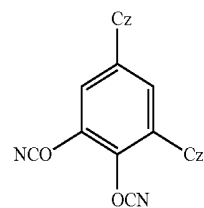


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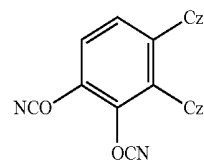
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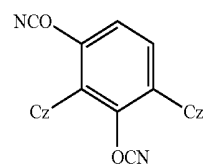
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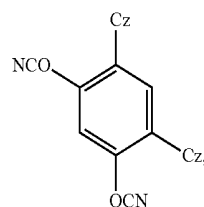
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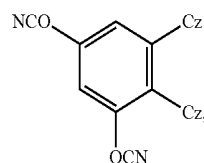
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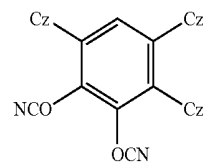
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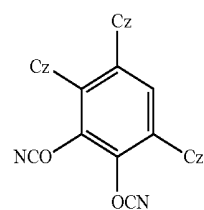
Compound 353



Compound 354

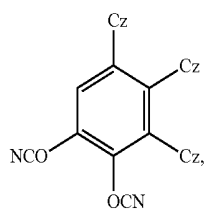


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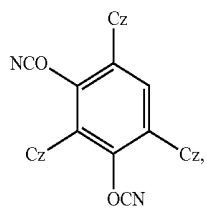


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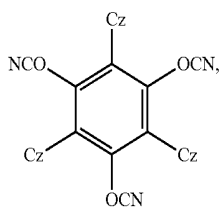
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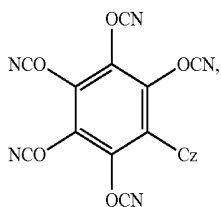
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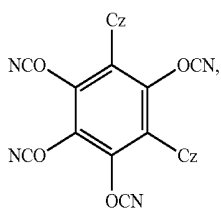
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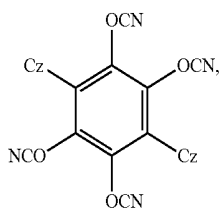
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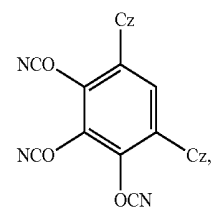
Compound 360



Compound 361

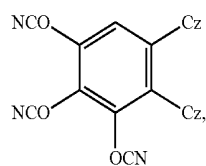


Compound 362

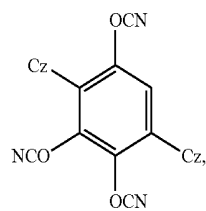


Compound 363

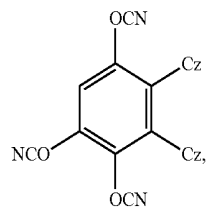
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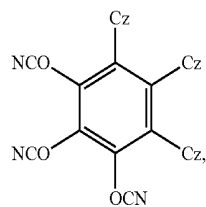
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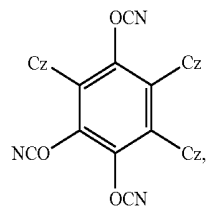
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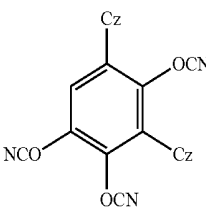
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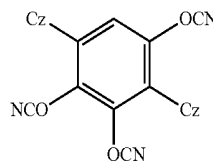
Compound 367



Compound 368

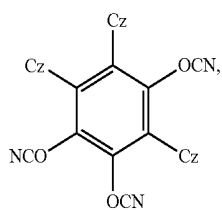


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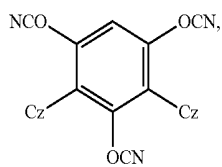


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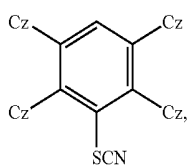
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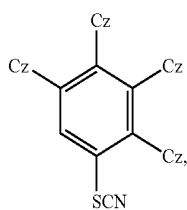
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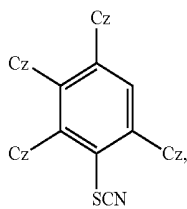
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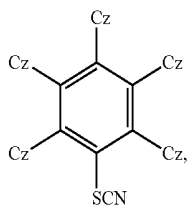
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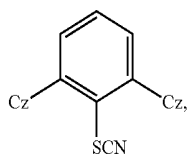
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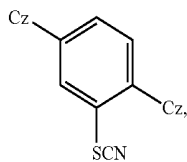
Compound 375



Compound 376

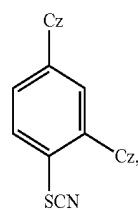


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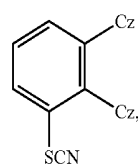


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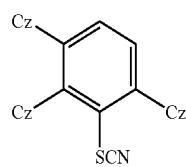
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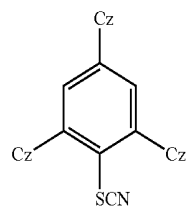
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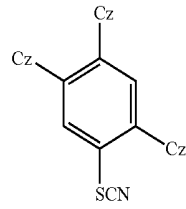
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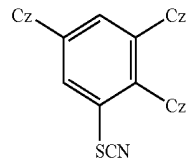
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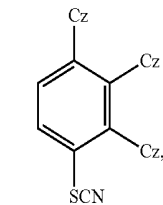
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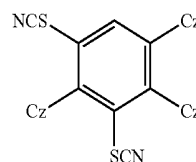
Compound 398



Compound 399

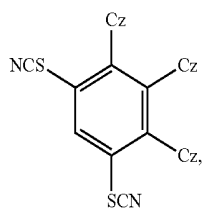


Compound 400

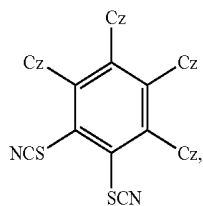


Compound 401

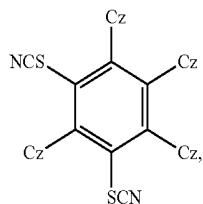
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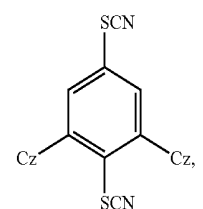
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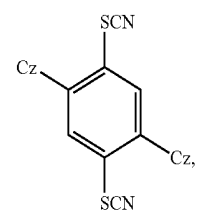
Compound 403



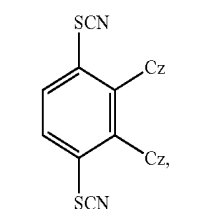
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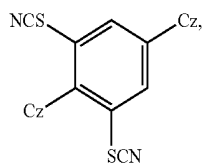
Compound 405



Compound 406

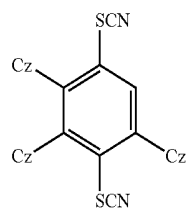


Compound 407

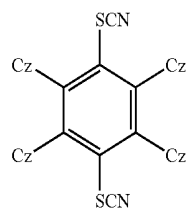


Compound 408

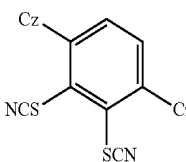
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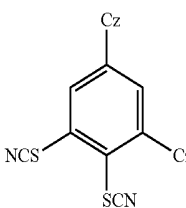
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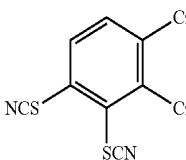
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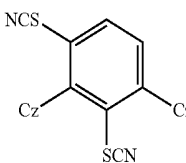
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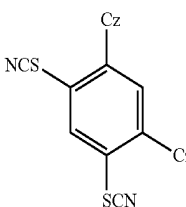
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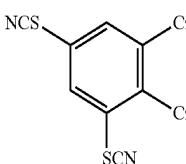
Compound 413



Compound 414

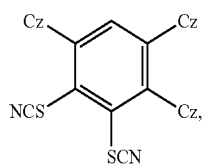


Compound 415

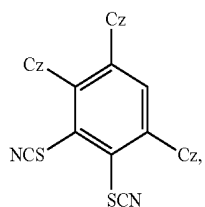


Compound 416

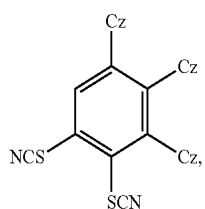
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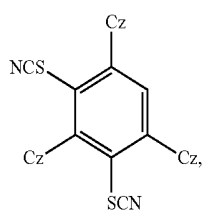
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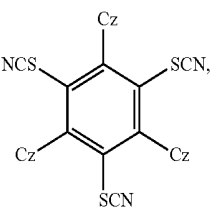
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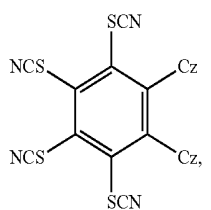
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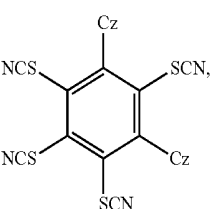
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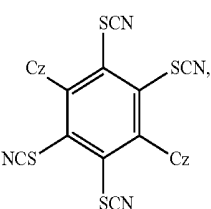
Compound 421



Compound 422

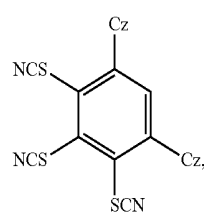


Compound 423

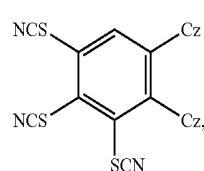


Compound 424

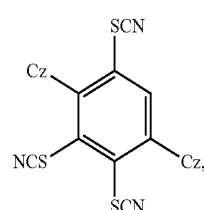
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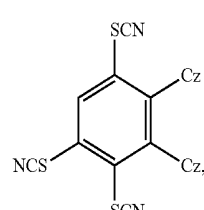
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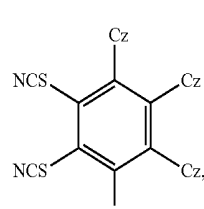
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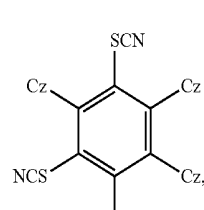
Compound 427



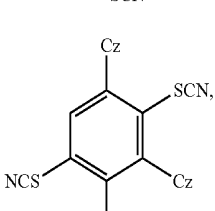
Compound 428



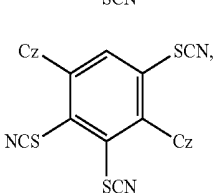
Compound 429



Compound 430

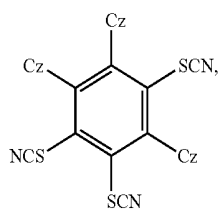


Compound 431

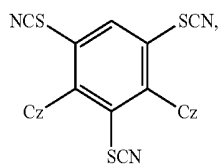


Compound 432

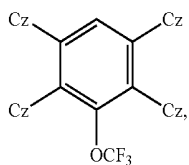
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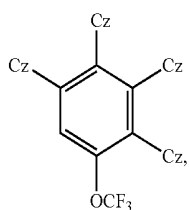
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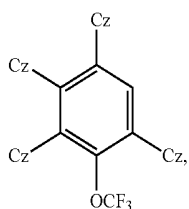
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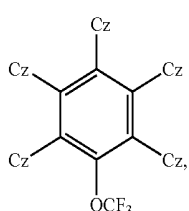
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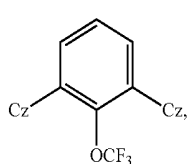
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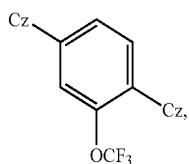
Compound 437



Compound 438

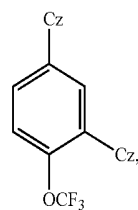


Compound 453

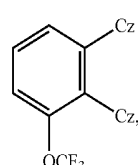


Compound 454

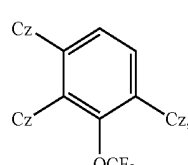
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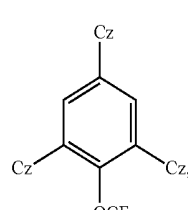
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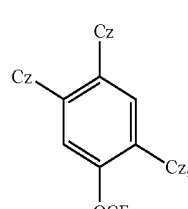
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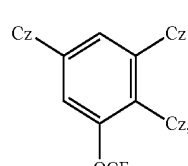
Compound 457



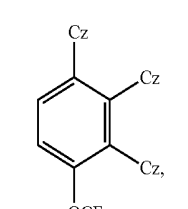
Compound 458



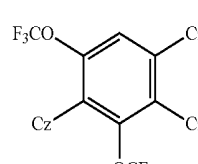
Compound 460



Compound 461

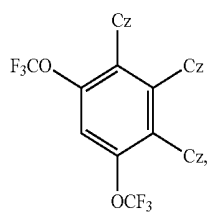


Compound 462

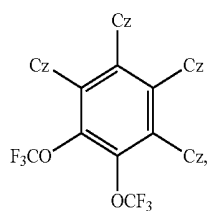


Compound 463

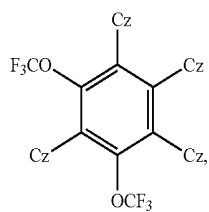
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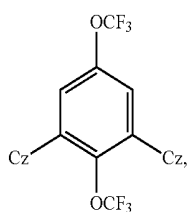
Compound 464



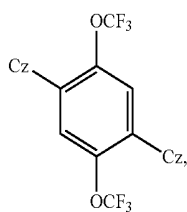
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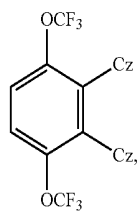
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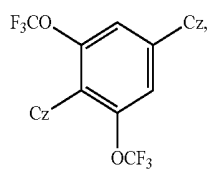
Compound 467



Compound 468

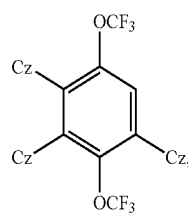


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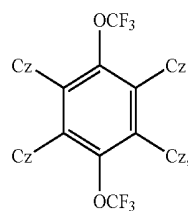


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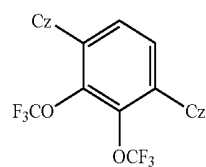
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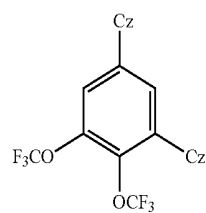
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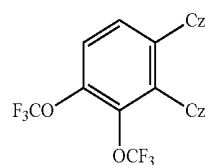
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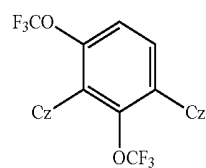
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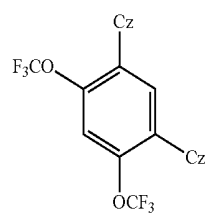
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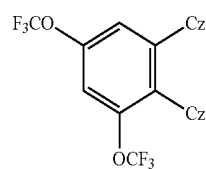
Compound 475



Compound 476

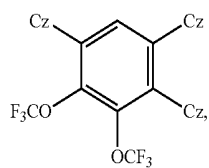


Compound 477

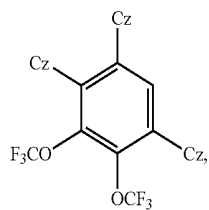


Compound 478

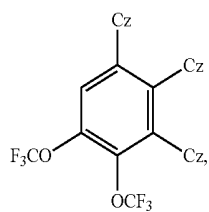
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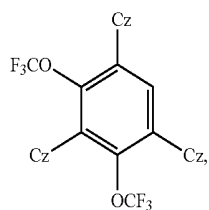
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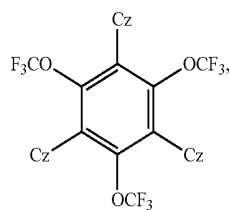
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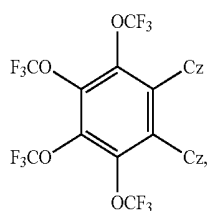
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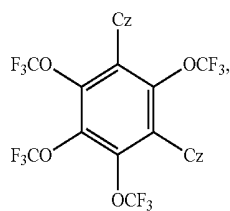
Compound 482



Compound 483

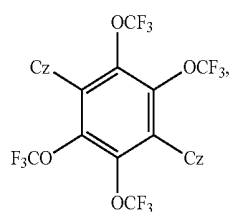


Compound 484

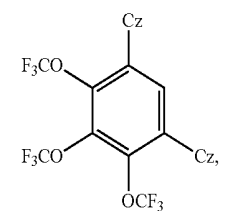


Compound 485

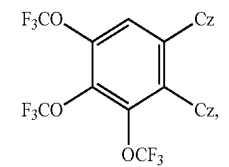
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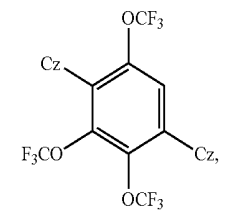
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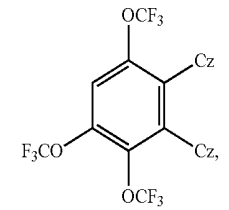
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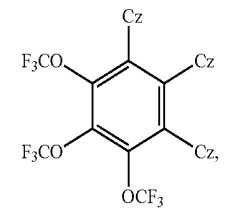
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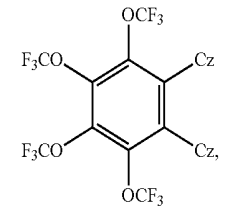
Compound 489



Compound 490

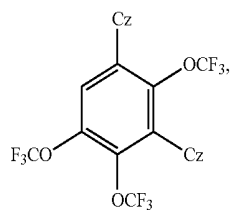


Compound 491

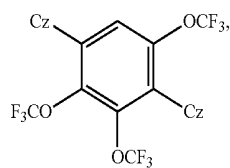


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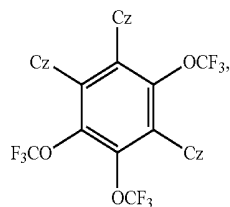
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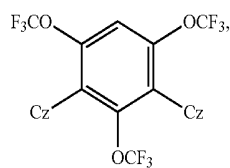
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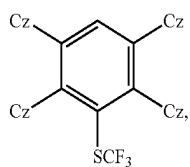
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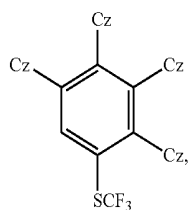
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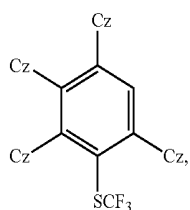
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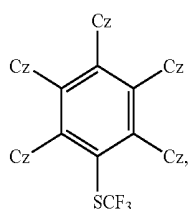
Compound 497



Compound 498

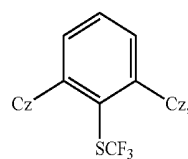


Compound 499

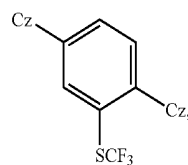


Compound 500

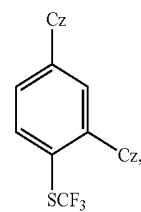
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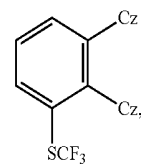
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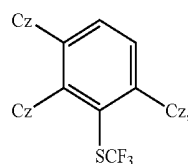
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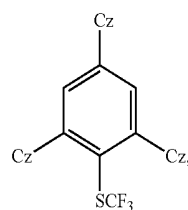
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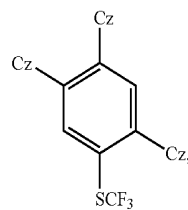
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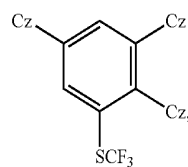
Compound 519



Compound 520

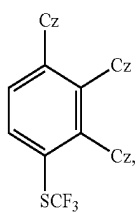


Compound 522

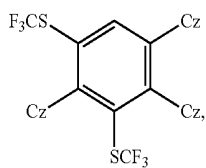


Compound 523

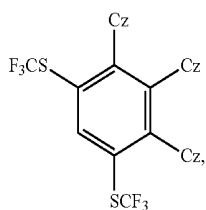
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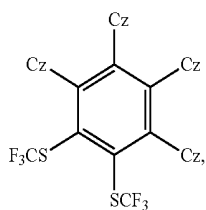
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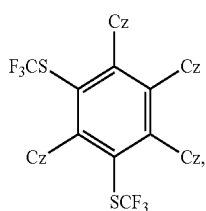
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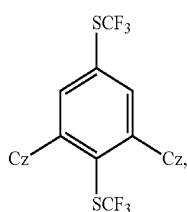
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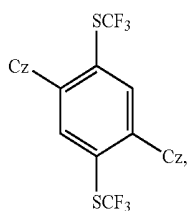
Compound 527



Compound 528

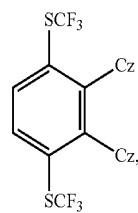


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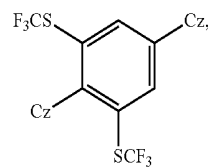


Compound 530

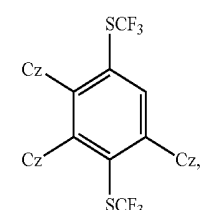
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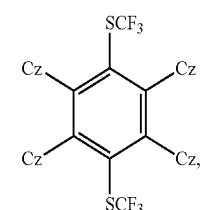
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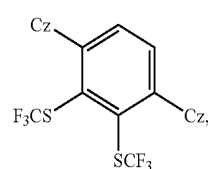
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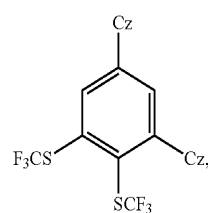
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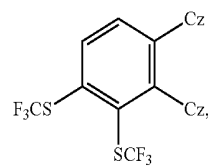
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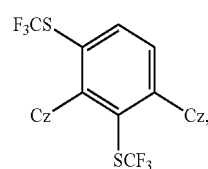
Compound 535



Compound 536

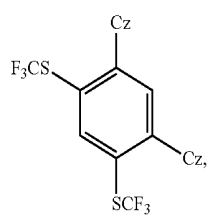


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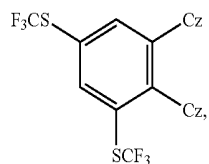


Compound 538

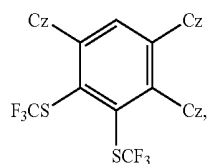
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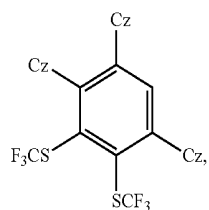
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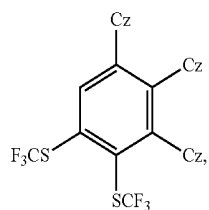
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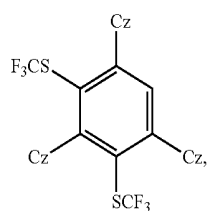
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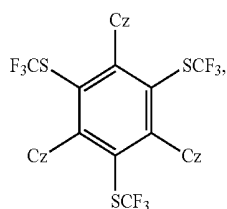
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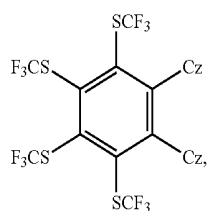
Compound 543



Compound 544

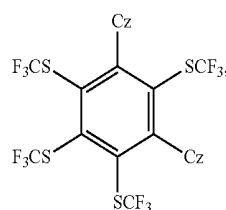


Compound 545

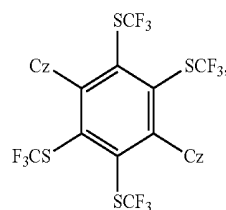


Compound 546

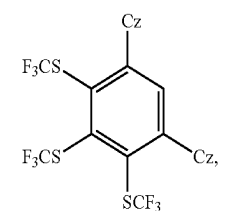
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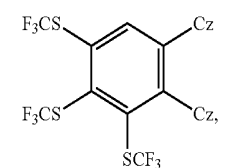
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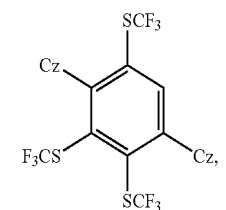
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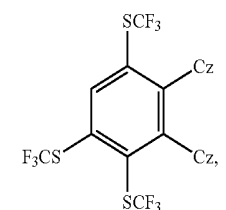
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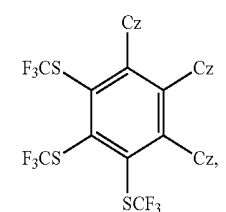
Compound 550



Compound 551

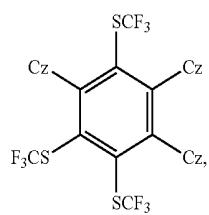


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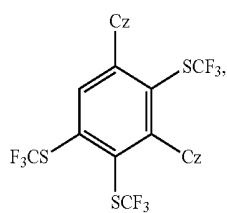


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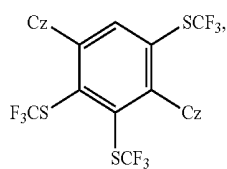
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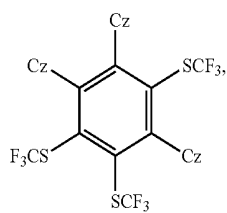
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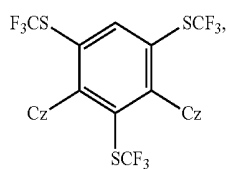
Compound 555



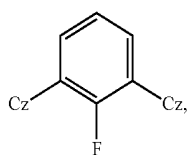
Compound 556



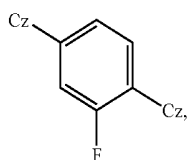
Compound 557



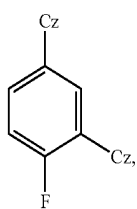
Compound 558



Compound 559

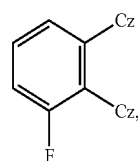


Compound 560

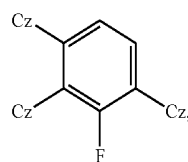


Compound 561

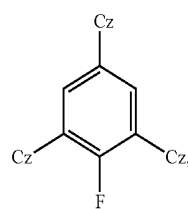
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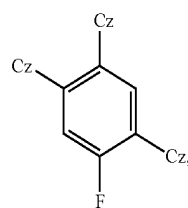
Compound 562



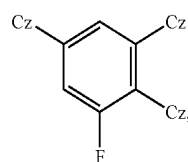
Compound 563



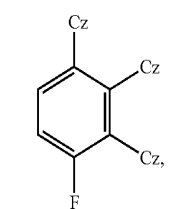
Compound 564



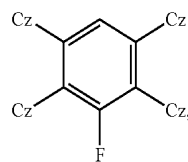
Compound 566



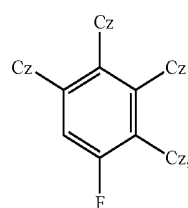
Compound 567



Compound 568

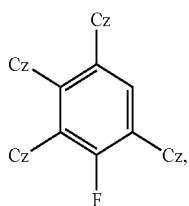


Compound 569

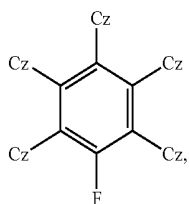


Compound 570

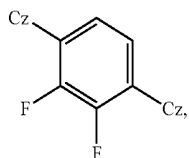
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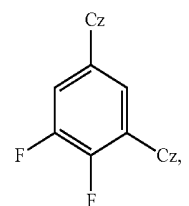
Compound 571



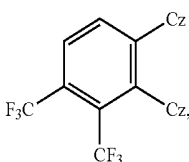
Compound 572



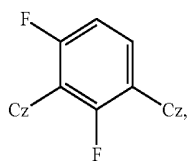
Compound 587



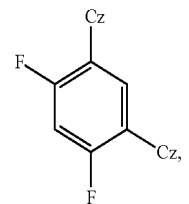
Compound 588



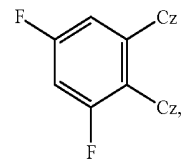
Compound 589



Compound 590

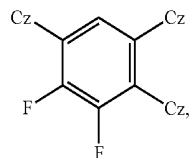


Compound 591

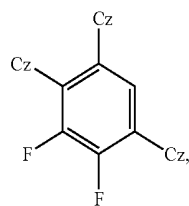


Compound 592

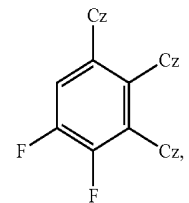
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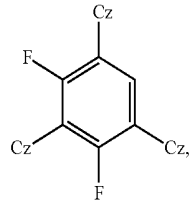
Compound 593



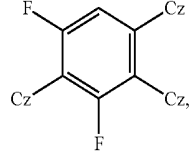
Compound 594



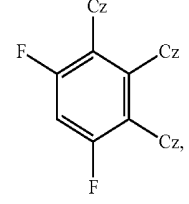
Compound 595



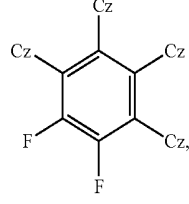
Compound 596



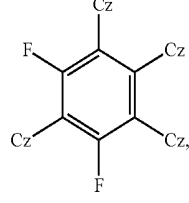
Compound 597



Compound 598

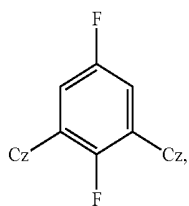


Compound 599

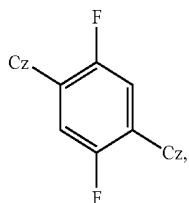


Compound 600

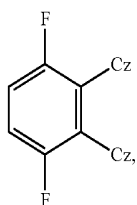
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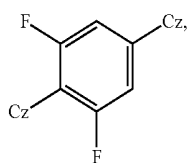
Compound 601



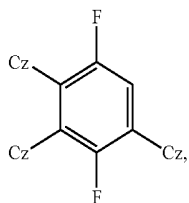
Compound 602



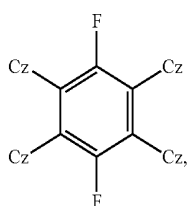
Compound 603



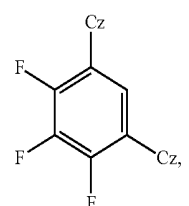
Compound 604



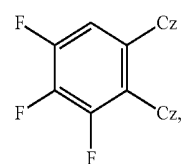
Compound 605



Compound 606

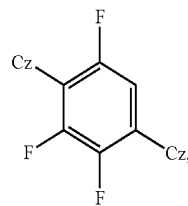


Compound 607

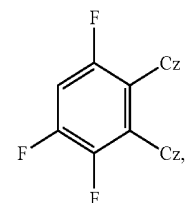


Compound 608

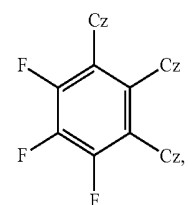
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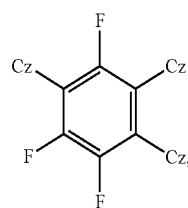
Compound 609



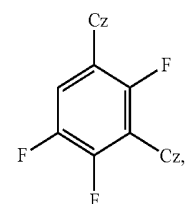
Compound 610



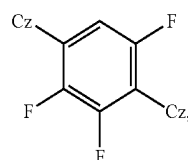
Compound 611



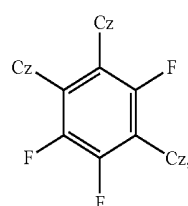
Compound 612



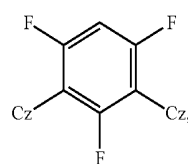
Compound 613



Compound 614

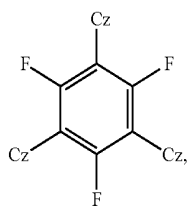


Compound 615

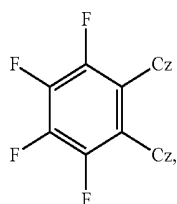


Compound 616

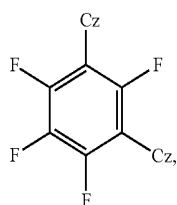
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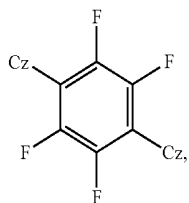
Compound 617



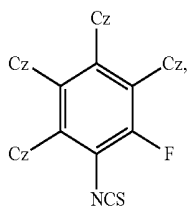
Compound 618



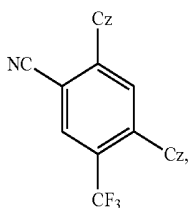
Compound 619



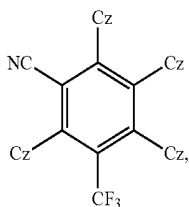
Compound 620



Compound 736

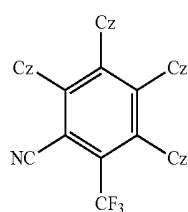


Compound 737

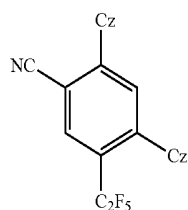


Compound 738

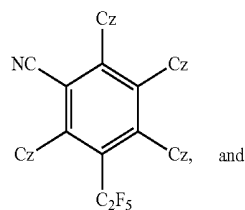
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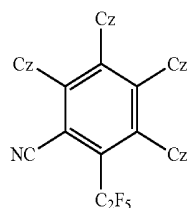
Compound 739



Compound 740

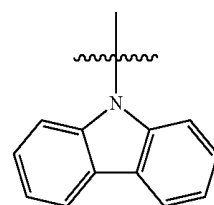


Compound 741

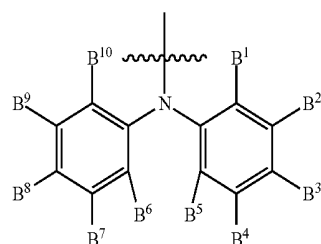


Compound 742

As used herein, Cz is

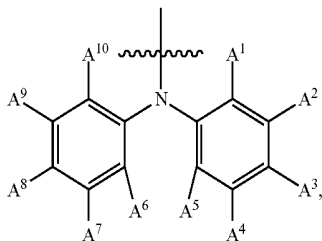


[0071] In some embodiments, R⁵ is



and R¹ is

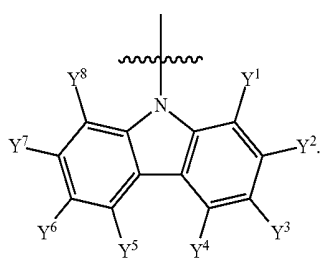
[0072]



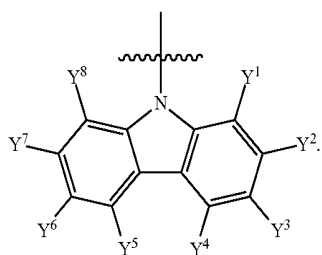
In some embodiments, A⁵ and A⁶ are joined by a single bond.
In some embodiments, B⁵ and B⁶ are joined by a single bond.

[0073] In some such embodiments, at least one of R²-R⁴ comprises an acceptor group selected from the group consisting of —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCO, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, and —SC_mF_{2m+1}. In some embodiments, at least two of R²-R⁴ comprise an acceptor group selected from the group consisting of —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCO, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, and —SC_mF_{2m+1}. In some embodiments, at least three of R²-R⁴ comprise an acceptor group selected from the group consisting of —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCO, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, and —SC_mF_{2m+1}.

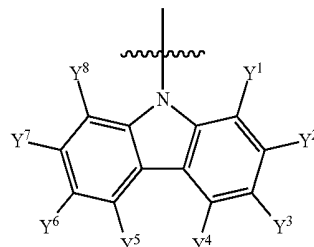
[0074] In some embodiments, at least one of R²-R⁴ is



In some embodiments, at least two of R²-R⁴ are

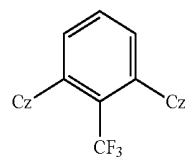


In some embodiments, all three of R²-R⁴ are

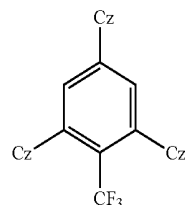


[0075] In some embodiments, at least one of R²-R⁴ is an electron withdrawing group with a Hammett value (σ_{para}) of at least 0.05. In some embodiments, at least two of R²-R⁴ are electron withdrawing groups with a Hammett value (σ_{para}) of at least 0.05. In some embodiments, at least three of R²-R⁴ are electron withdrawing groups with a Hammett value (σ_{para}) of at least 0.05.

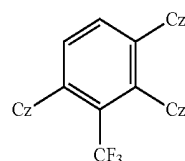
[0076] In some more specific embodiments, the compound is selected from the group consisting of:



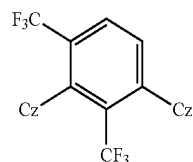
Compound 1



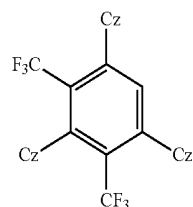
Compound 6



Compound 7

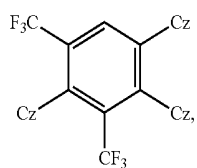


Compound 31

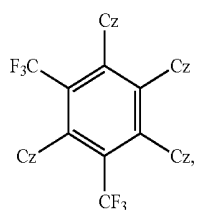


Compound 37

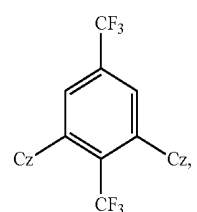
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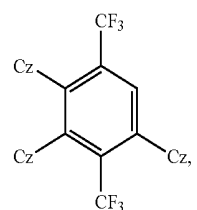
Compound 38



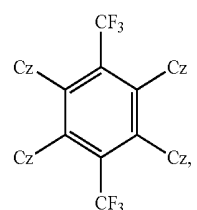
Compound 41



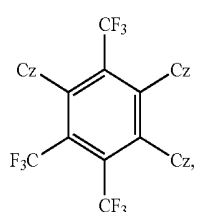
Compound 42



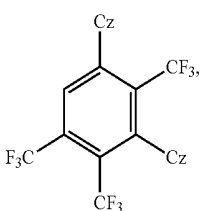
Compound 46



Compound 47

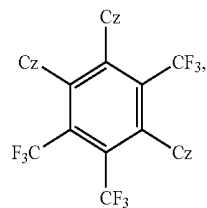


Compound 53

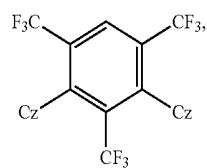


Compound 54

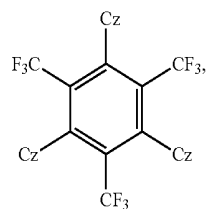
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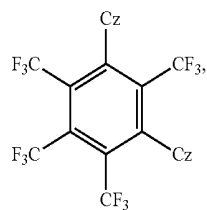
Compound 56



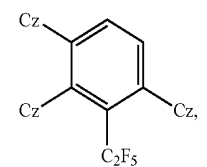
Compound 57



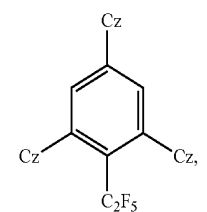
Compound 58



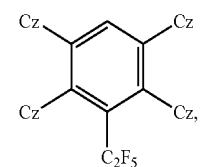
Compound 61



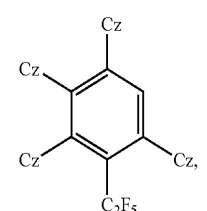
Compound 66



Compound 67

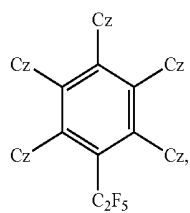


Compound 72

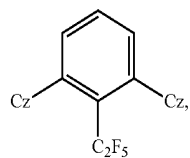


Compound 74

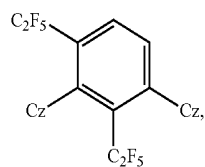
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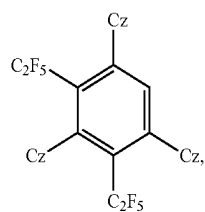
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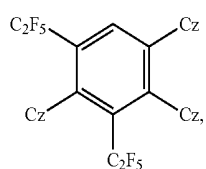
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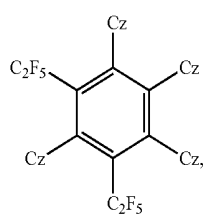
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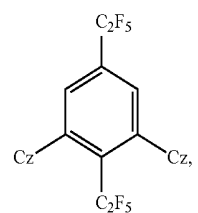
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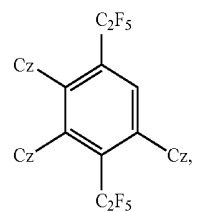
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Compound 103

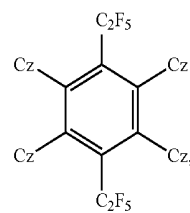


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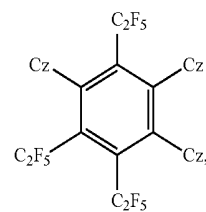


Compound 108

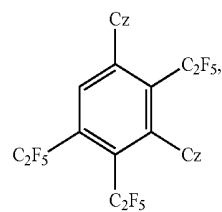
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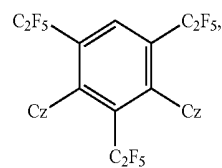
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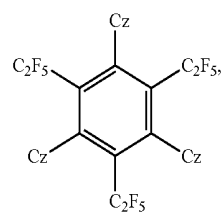
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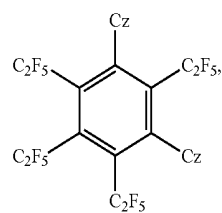
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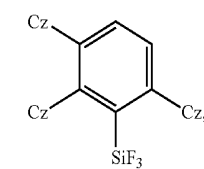
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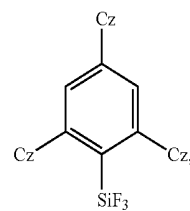
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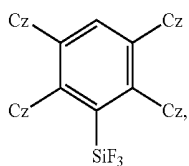


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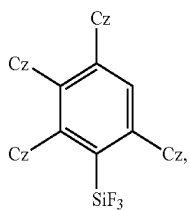


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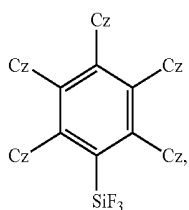
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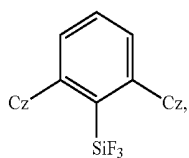
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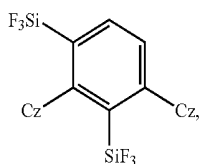
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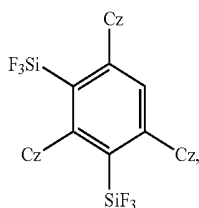
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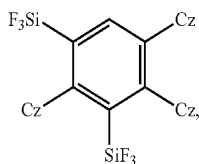
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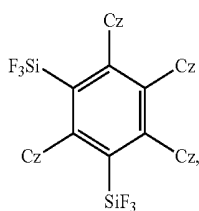
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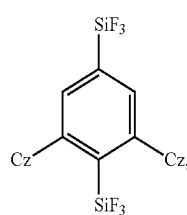


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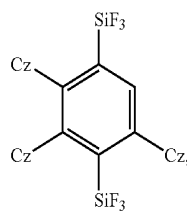


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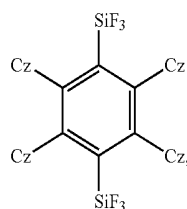
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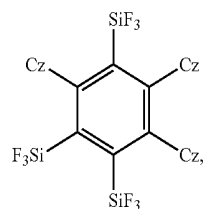
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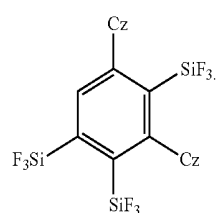
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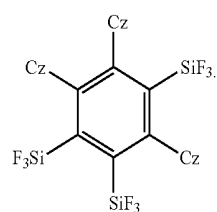
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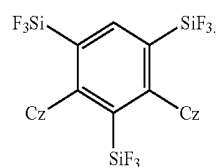
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Compound 178

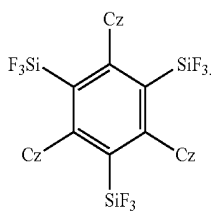


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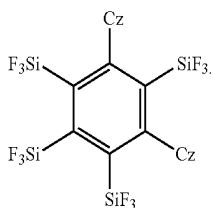


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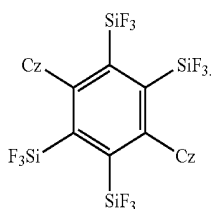
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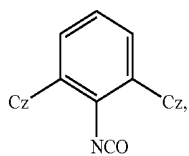
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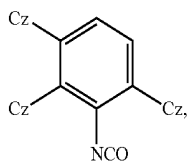
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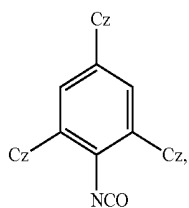
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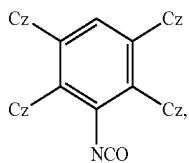
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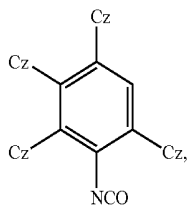
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Compound 192

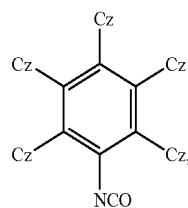


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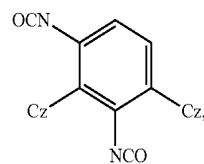


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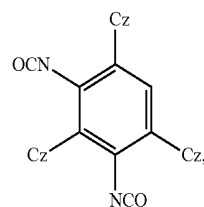
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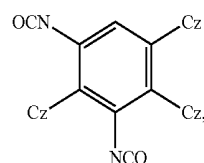
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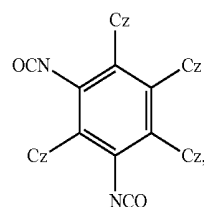
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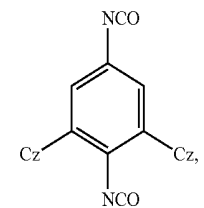
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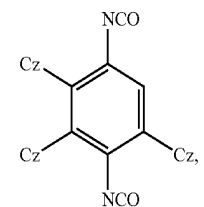
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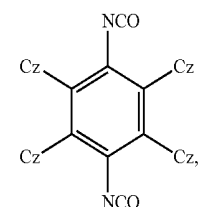
Compound 228



Compound 229

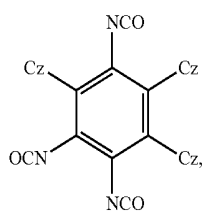


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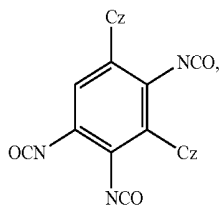


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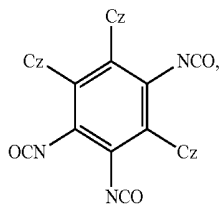
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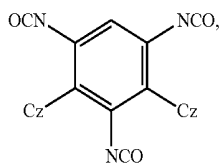
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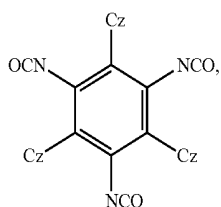
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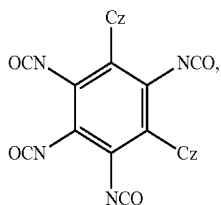
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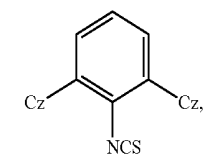
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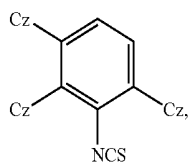
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Compound 247

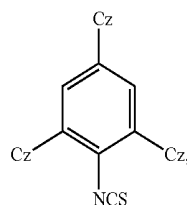


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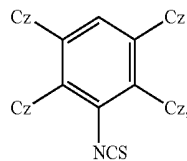


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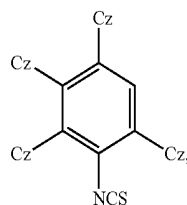
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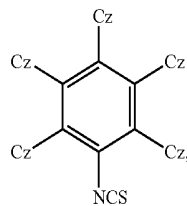
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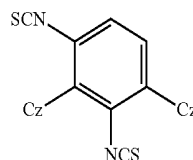
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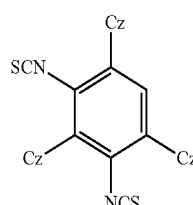
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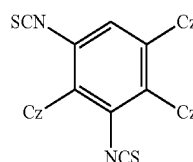
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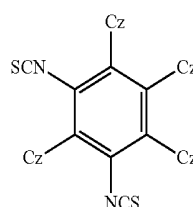
Compound 281



Compound 287

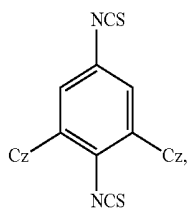


Compound 288

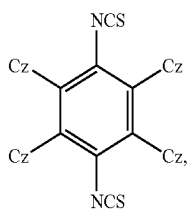


Compound 291

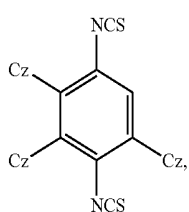
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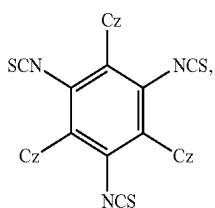
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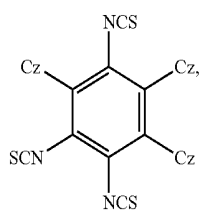
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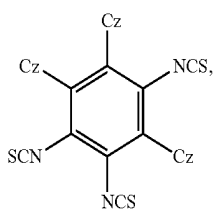
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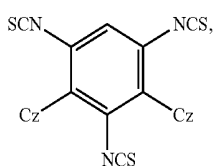
Compound 297



Compound 303

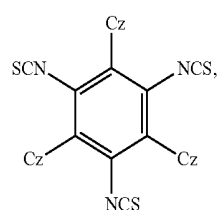


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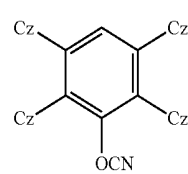


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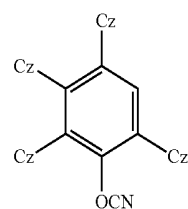
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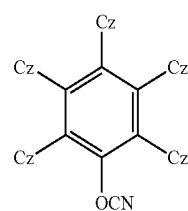
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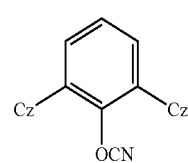
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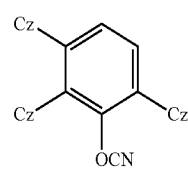
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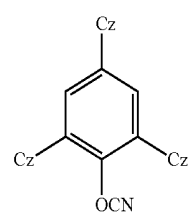
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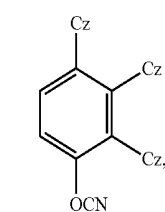
Compound 329



Compound 333

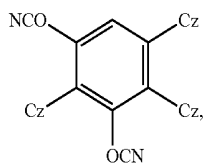


Compound 334

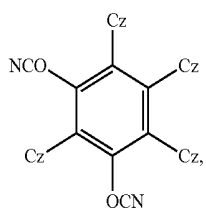


Compound 338

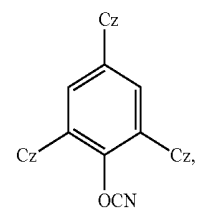
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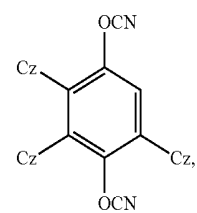
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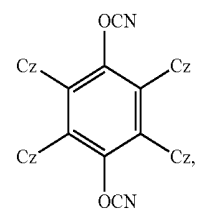
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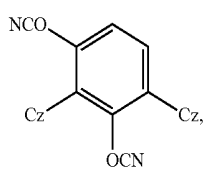
Compound 343



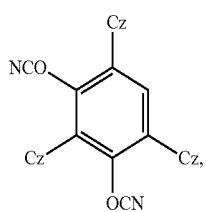
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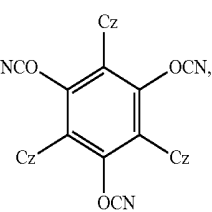
Compound 348



Compound 352

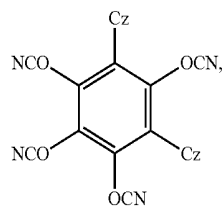


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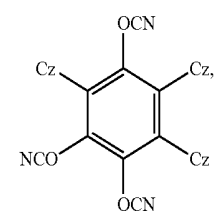


Compound 359

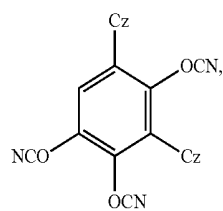
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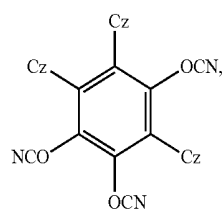
Compound 361



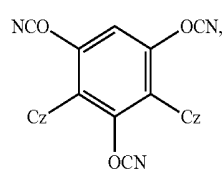
Compound 368



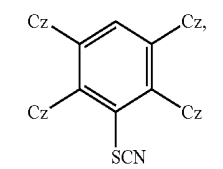
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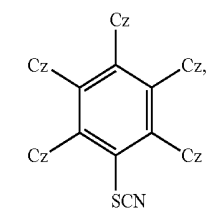
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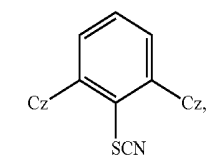
Compound 372



Compound 373

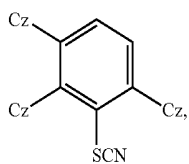


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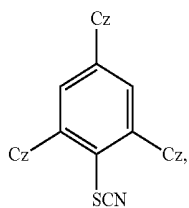


Compound 391

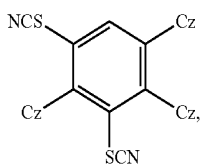
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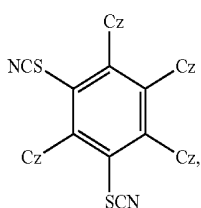
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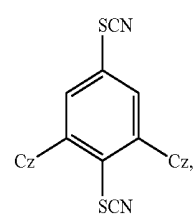
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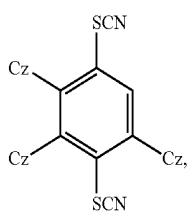
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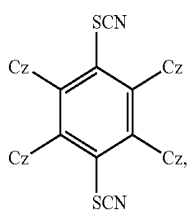
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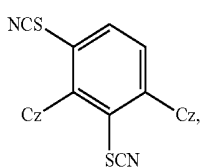
Compound 405



Compound 409

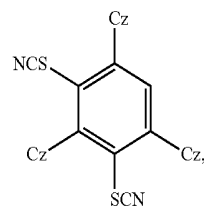


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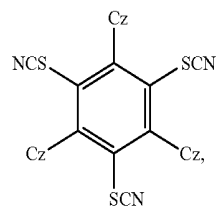


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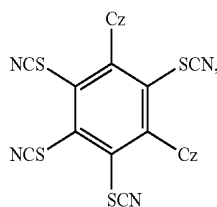
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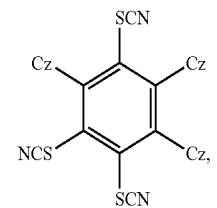
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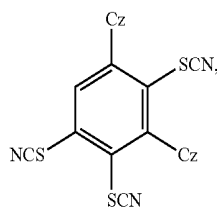
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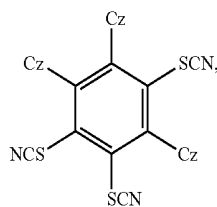
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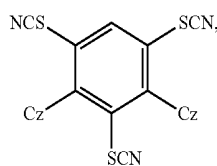
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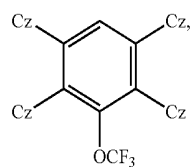
Compound 431



Compound 433

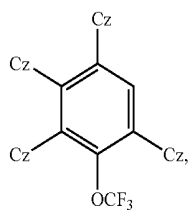


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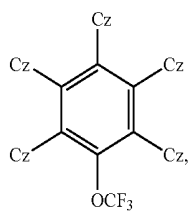


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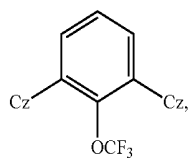
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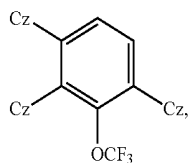
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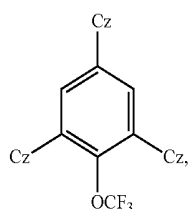
Compound 438



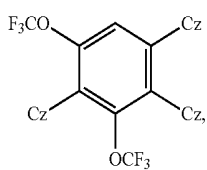
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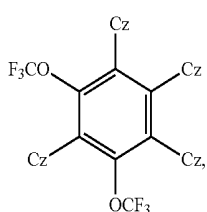
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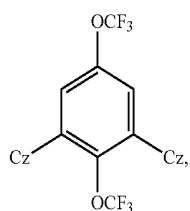
Compound 458



Compound 463

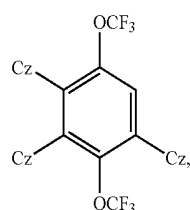


Compound 466

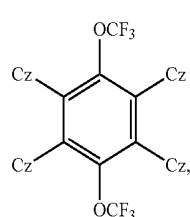


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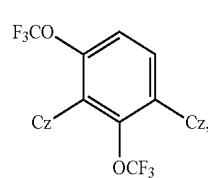
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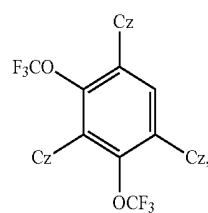
Compound 471



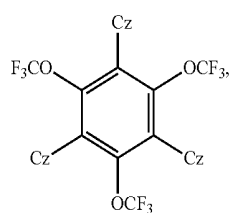
Compound 472



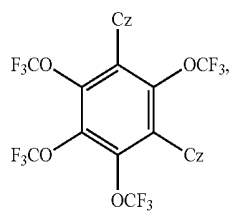
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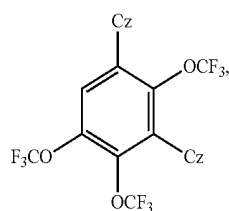
Compound 482



Compound 483

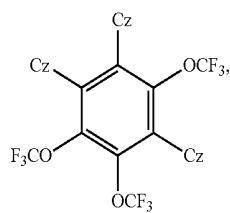


Compound 485

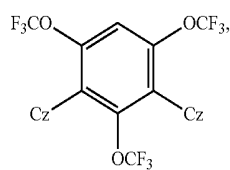


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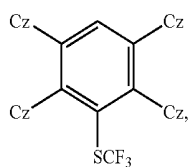
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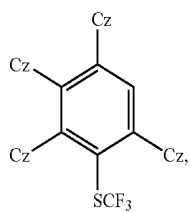
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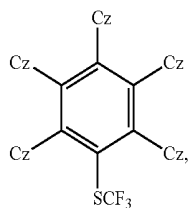
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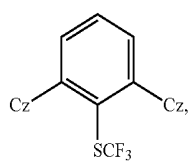
Compound 497



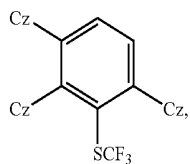
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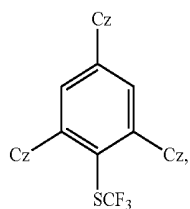
Compound 500



Compound 515

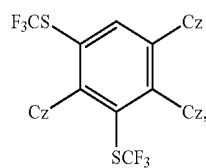


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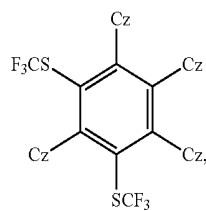


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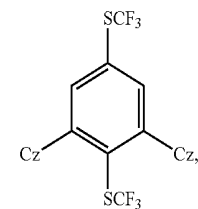
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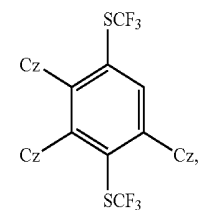
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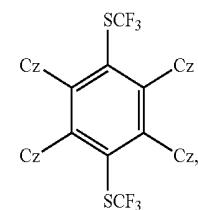
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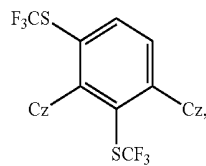
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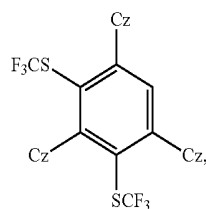
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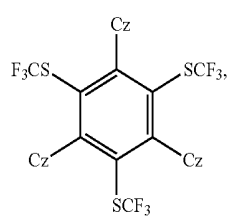
Compound 534



Compound 538

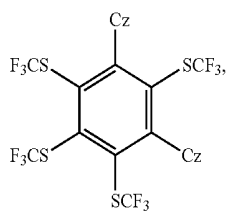


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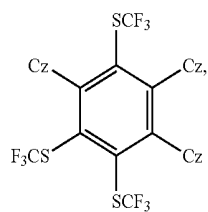


Compound 545

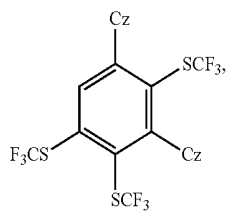
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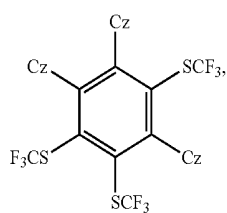
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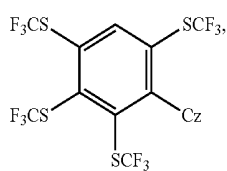
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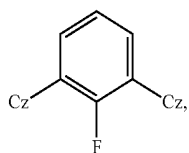
Compound 555



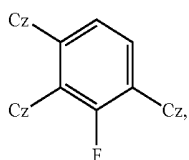
Compound 557



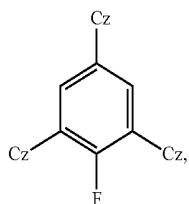
Compound 558



Compound 559

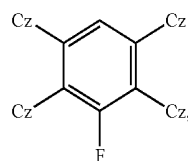


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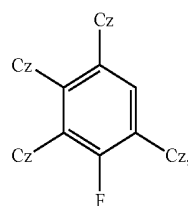


Compound 564

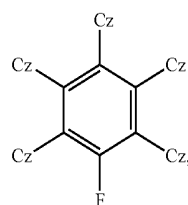
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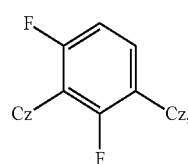
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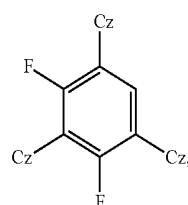
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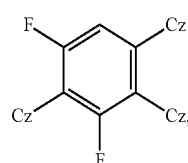
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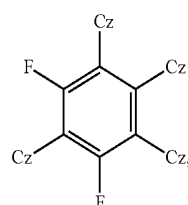
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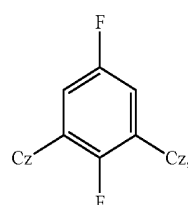
Compound 596



Compound 597

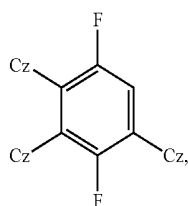


Compound 600

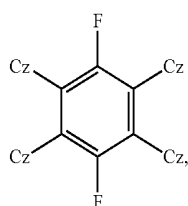


Compound 601

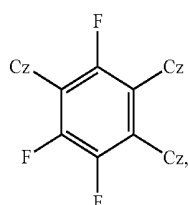
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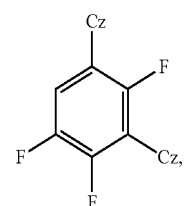
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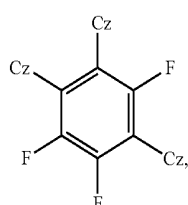
Compound 606



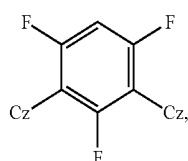
Compound 612



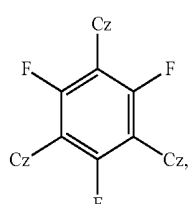
Compound 613



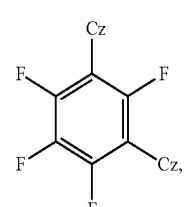
Compound 617



Compound 619

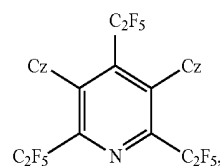


Compound 619

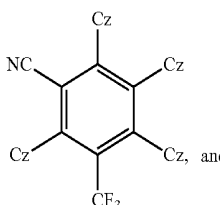


Compound 619

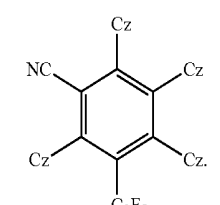
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Compound 731

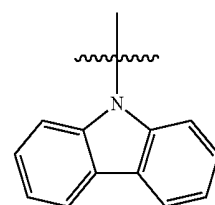


Compound 738



Compound 741

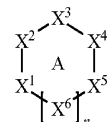
As used herein, Cz is



Compound 615

[0077] According to another aspect of the present disclosure, a first device is also provided. The first device can include a first organic light emitting device that includes an anode; a cathode; and an emissive layer disposed between the anode and the cathode. The emissive layer can include a first emitting compound comprising a structure according to Formula 2:

Formula 2



In the compound of Formula 2,

[0078] ring A is an aromatic or heteroaromatic ring;

[0079] n is 0 or 1;

[0080] when n is 0, X¹, X², X³, X⁴, and X⁵ are independently selected from the group consisting of CR, N, NR, O, S, and Se, and at least one of X¹ to X⁵ is CR;[0081] when n is 1, X¹, X², X³, X⁴, X⁵, and X⁶ are independently selected from the group consisting of CR and N, and at least one of X¹ to X⁶ is CR;

[0082] each R is independently selected from the group consisting of hydrogen, deuterium, halide, alkyl, haloalkyl,

cycloalkyl, heteroalkyl, arylalkyl, alkoxy, thioalkoxy, aryloxy, thioaryloxy, amino, arylamino, diarylamino, carbazolyl, silyl, halosilyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, $-C_mF_{2m+1}$, $-Si_mF_{2m+1}$, $-NCO$, $-NCS$, $-OCN$, $-SCN$, $-OC_mF_{2m+1}$, $-SC_mF_{2m+1}$, and combinations thereof;

[0083] adjacent R groups are, optionally, joined to form a fused ring structure;

[0084] $m \geq 1$;

[0085] at least one R group comprises a donor group with at least one electron-donating nitrogen; and

[0086] at least one R group comprises an acceptor group selected from the group consisting of $-F$, $-C_mF_{2m+1}$, $-Si_mF_{2m+1}$, $-NCO$, $-NCS$, $-OCN$, $-SCN$, $-OC_mF_{2m+1}$, and $-SC_mF_{2m+1}$.

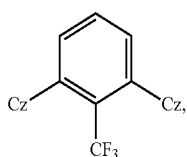
[0087] In some embodiments, at least two R groups comprise a donor group with at least one electron-donating nitrogen. In some embodiments, at least three R groups comprise a donor group with at least one electron-donating nitrogen, or at least four R groups comprise a donor group with at least one electron-donating nitrogen, or at least five R groups comprise a donor group with at least one electron-donating nitrogen. In some embodiments the donor group comprising at least one electron-donating nitrogen is a carbazole.

[0088] In some embodiments, at least two R groups comprise an acceptor group selected from the group consisting of $-F$, $-C_mF_{2m+1}$, $-Si_mF_{2m+1}$, $-NCO$, $-NCS$, $-OCN$, $-SCN$, $-OC_mF_{2m+1}$, and $-SC_mF_{2m+1}$. In some embodiment, at least three R groups, at least four R groups, or at least five R groups comprise an acceptor group selected from the group consisting of $-F$, $-C_mF_{2m+1}$, $-Si_mF_{2m+1}$, $-NCO$, $-NCS$, $-OCN$, $-SCN$, $-OC_mF_{2m+1}$, and $-SC_mF_{2m+1}$.

[0089] In some embodiments, $n=1$, at least two of X^1 to X^6 are CR, and at least two R groups are independently selected from the group consisting of $-F$, $-C_mF_{2m+1}$, $-Si_mF_{2m+1}$, $-NCO$, $-NCS$, $-OCN$, $-SCN$, $-OC_mF_{2m+1}$, and $-SC_mF_{2m+1}$. In some embodiments, $n=1$, wherein at least two of X^1 to X^6 are CR, at least one R group is selected from the group consisting of $-F$, $-C_mF_{2m+1}$, $-Si_mF_{2m+1}$, $-NCO$, $-NCS$, $-OCN$, $-SCN$, $-OC_mF_{2m+1}$, and $-SC_mF_{2m+1}$, and at least one R is an electron withdrawing group with a Hammett value (σ_{para}) of at least 0.05.

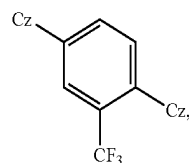
[0090] In some embodiments, the compound in the emissive layer is a compound according to the structure of Formula 1, and all its variants, as described herein, with the provision that in addition to any other substituents listed for R^1 , R^2 , R^3 , R^4 , Y^1 , Y^2 , Y^3 , Y^4 , Y^5 , Y^6 , Y^7 , Y^8 , Z^1 , Z^2 , Z^3 , Z^4 , Z^5 , Z^6 , Z^7 , and Z^8 each of R^1 , R^2 , R^3 , R^4 , Y^1 , Y^2 , Y^3 , Y^4 , Y^5 , Y^6 , Y^7 , Y^8 , Z^1 , Z^2 , Z^3 , Z^4 , Z^5 , Z^6 , Z^7 , and Z^8 can independently also be $-F$.

[0091] In some embodiments, the compound of formula 2 can be selected from the group consisting of:

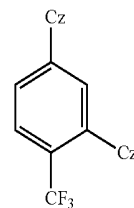


Compound 1

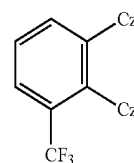
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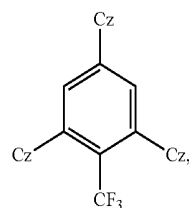
Compound 2



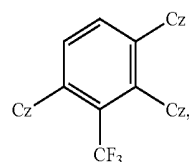
Compound 3



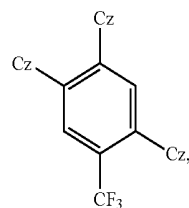
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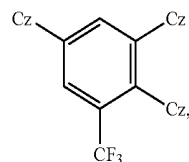
Compound 6



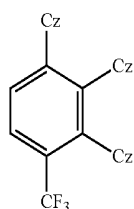
Compound 7



Compound 8

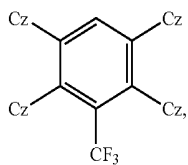


Compound 9

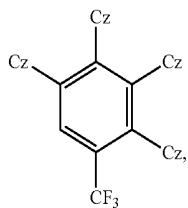


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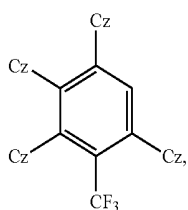
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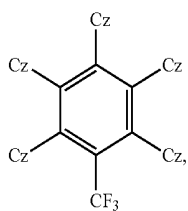
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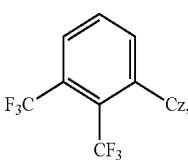
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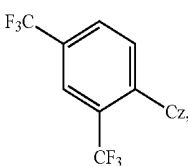
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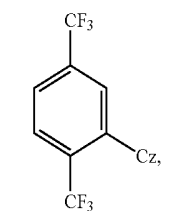
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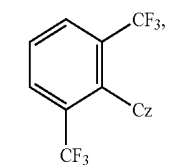
Compound 15



Compound 16

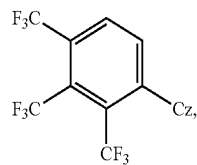


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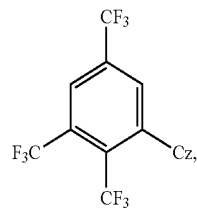


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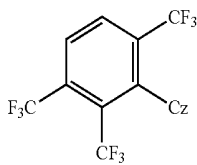
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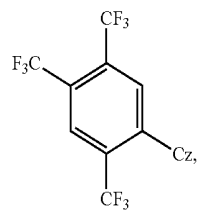
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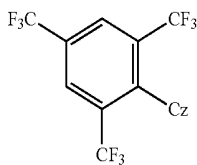
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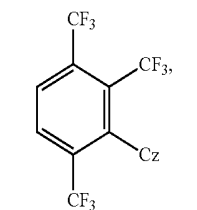
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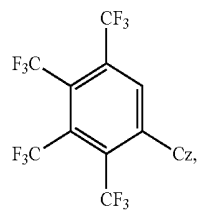
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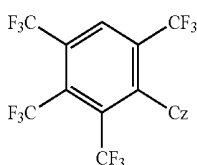
Compound 23



Compound 24

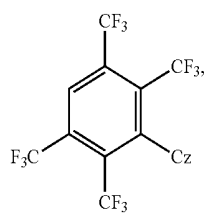


Compound 25

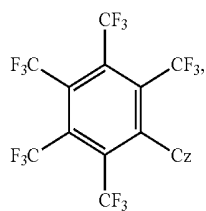


Compound 26

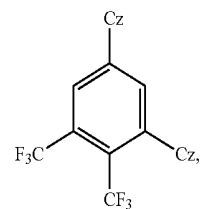
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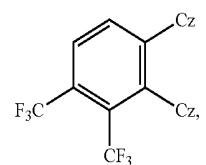
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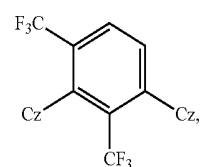
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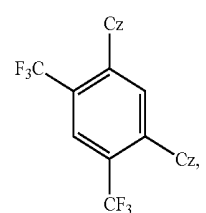
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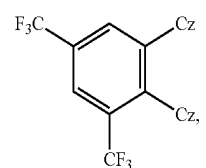
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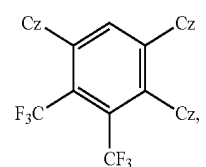
Compound 31



Compound 32

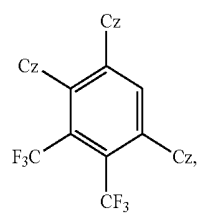


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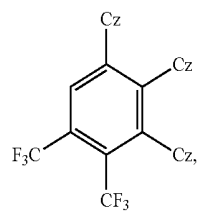


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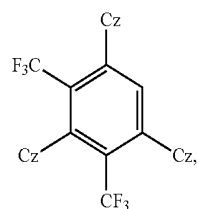
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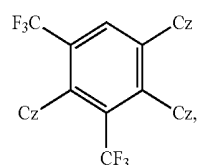
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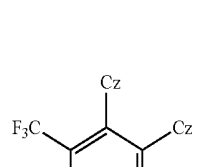
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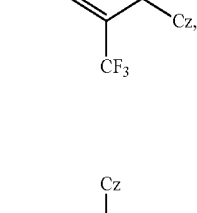
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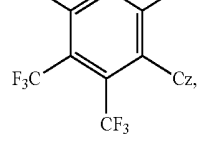
Compound 38



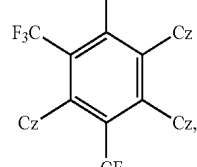
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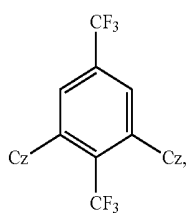
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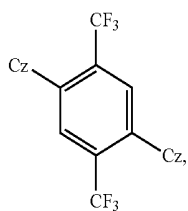
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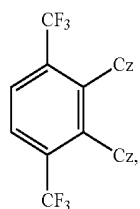
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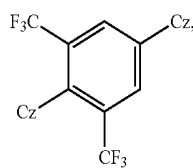
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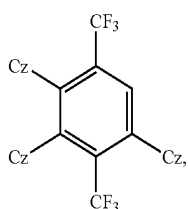
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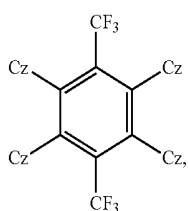
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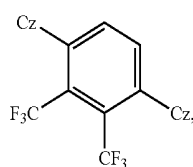
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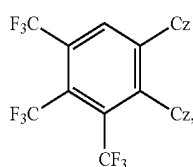
Compound 46



Compound 47

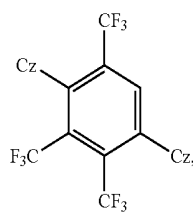


Compound 48

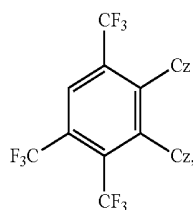


Compound 49

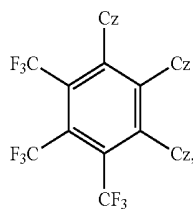
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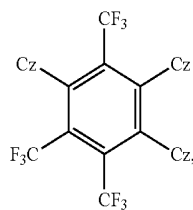
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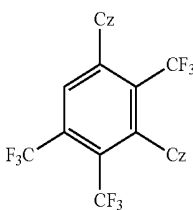
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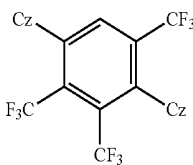
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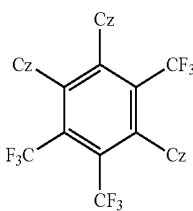
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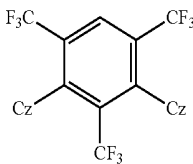
Compound 54



Compound 55

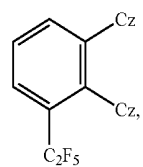
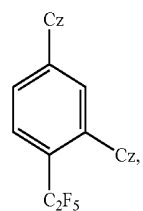
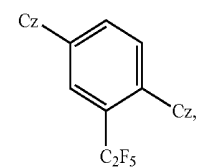
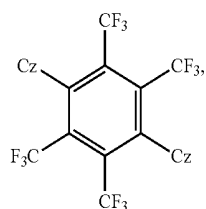
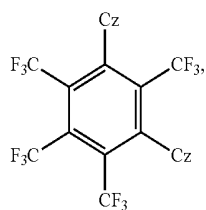
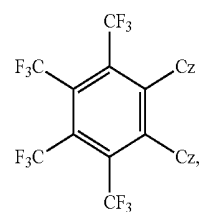
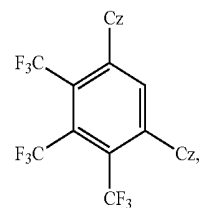
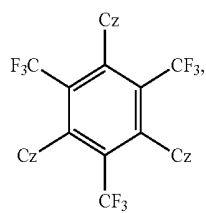


Compound 56



Compound 57

-continued



Compound 58

Compound 59

Compound 60

Compound 61

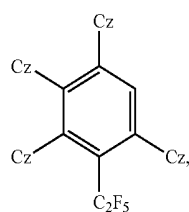
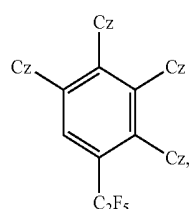
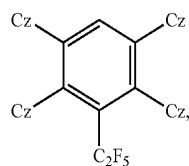
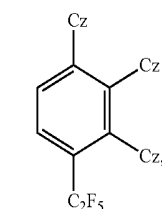
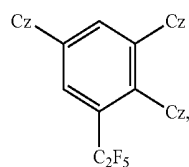
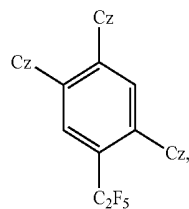
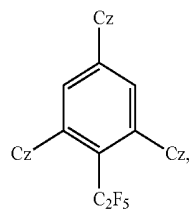
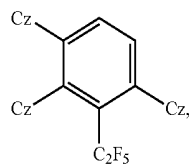
Compound 62

Compound 63

Compound 64

Compound 65

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Compound 66

Compound 67

Compound 69

Compound 70

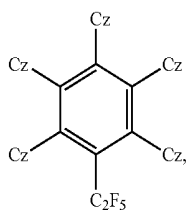
Compound 71

Compound 72

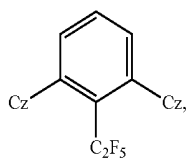
Compound 73

Compound 74

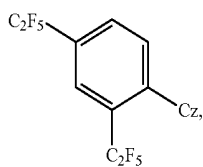
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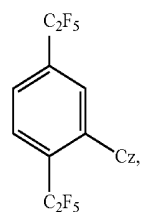
Compound 75



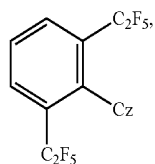
Compound 76



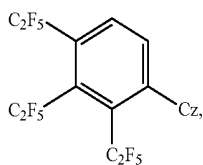
Compound 77



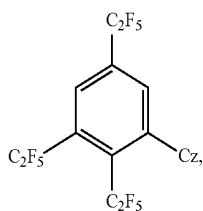
Compound 78



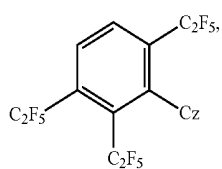
Compound 79



Compound 80

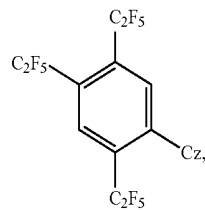


Compound 81

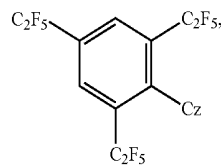


Compound 82

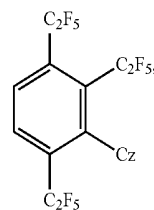
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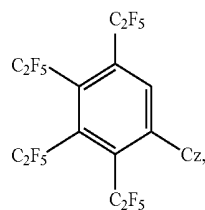
Compound 83



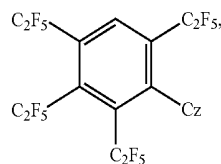
Compound 84



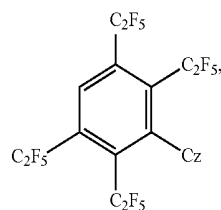
Compound 85



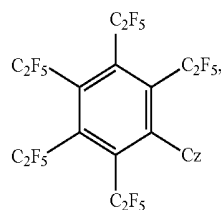
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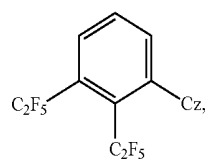
Compound 87



Compound 88

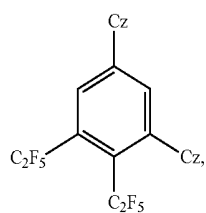


Compound 89

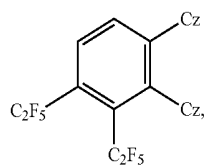


Compound 90

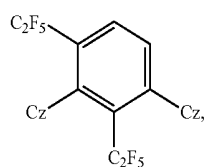
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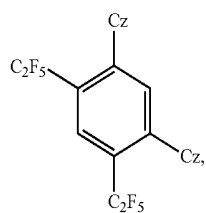
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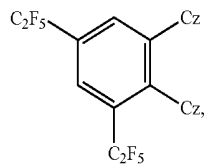
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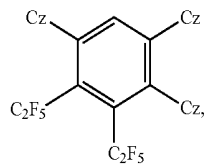
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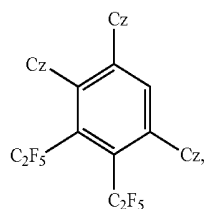
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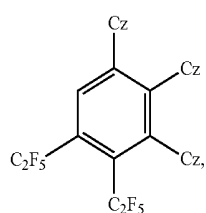
Compound 95



Compound 96

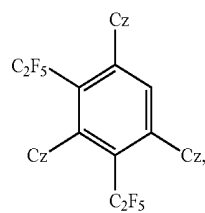


Compound 97

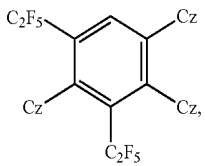


Compound 98

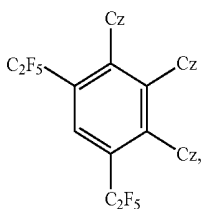
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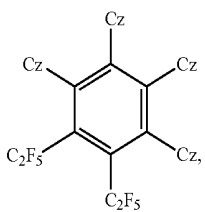
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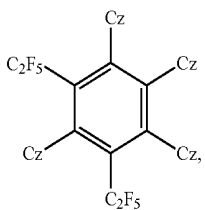
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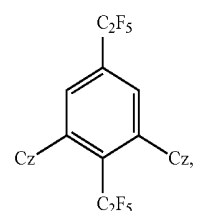
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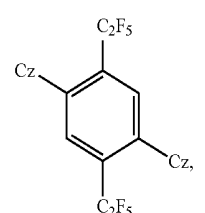
Compound 102



Compound 103

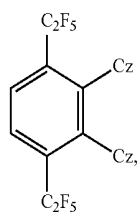


Compound 104

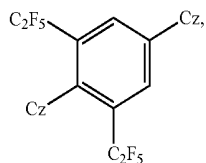


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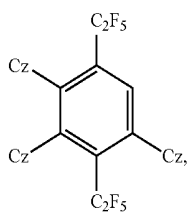
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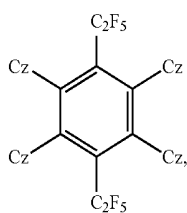
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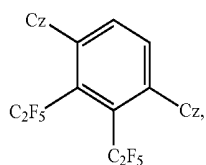
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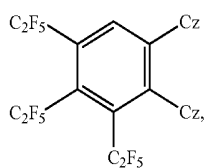
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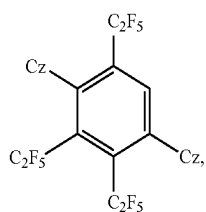
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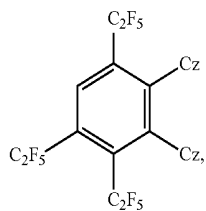
Compound 110



Compound 111

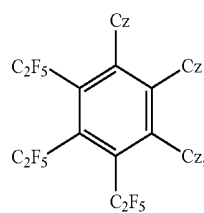


Compound 112

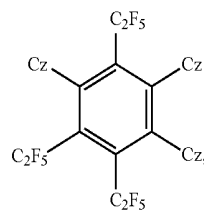


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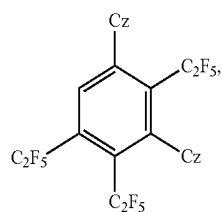
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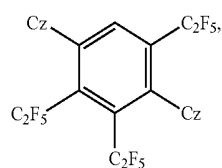
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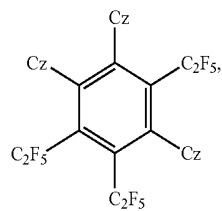
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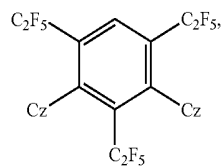
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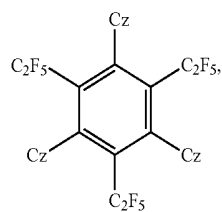
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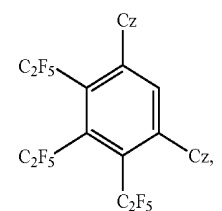
Compound 118



Compound 119

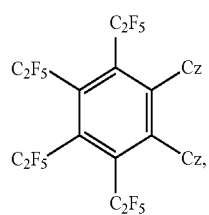


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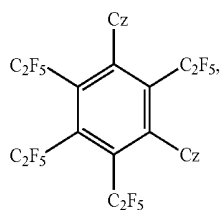


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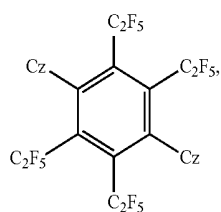
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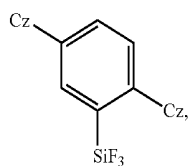
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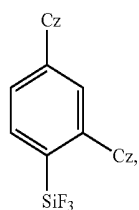
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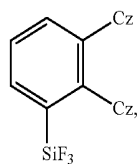
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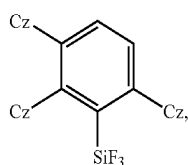
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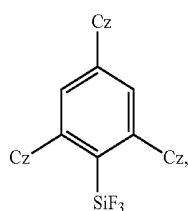
Compound 126



Compound 127

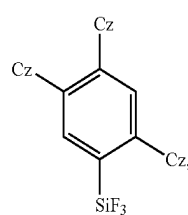


Compound 128

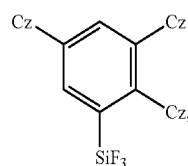


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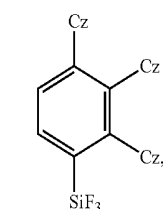
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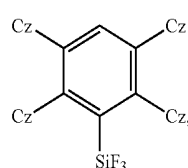
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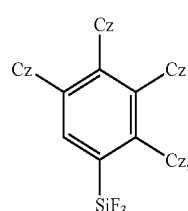
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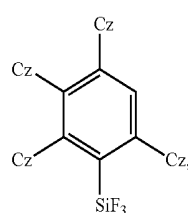
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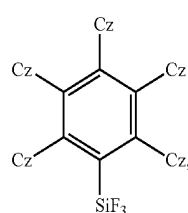
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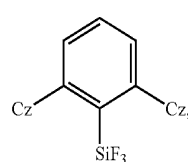
Compound 135



Compound 136

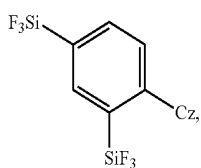


Compound 137

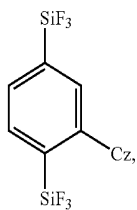


Compound 138

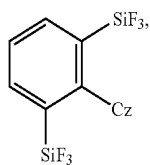
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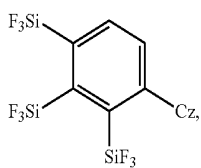
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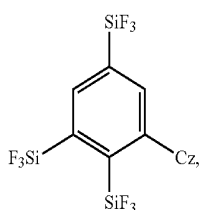
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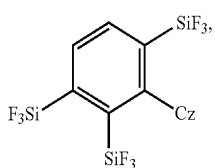
Compound 141



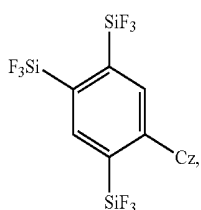
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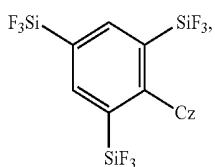
Compound 143



Compound 144

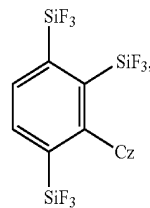


Compound 145

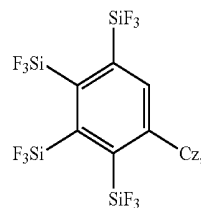


Compound 146

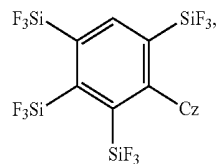
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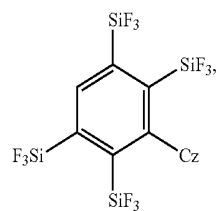
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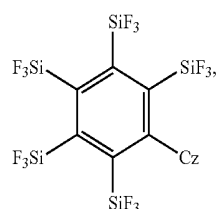
Compound 148



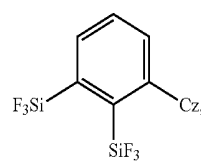
Compound 149



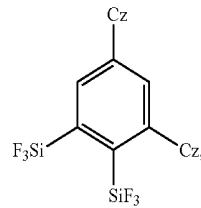
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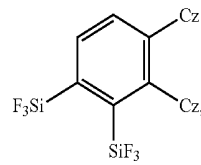
Compound 151



Compound 152

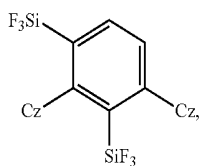


Compound 153

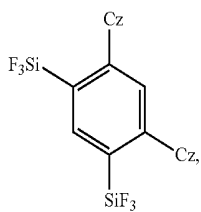


Compound 154

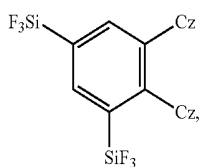
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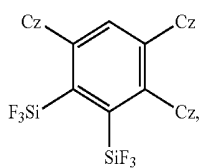
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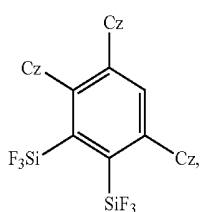
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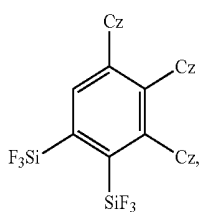
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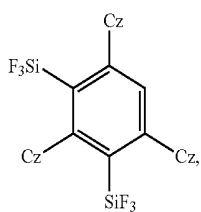
Compound 158



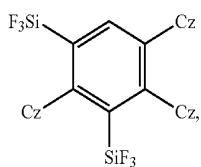
Compound 159



Compound 160

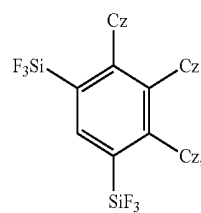


Compound 161

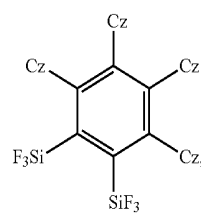


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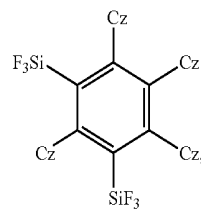
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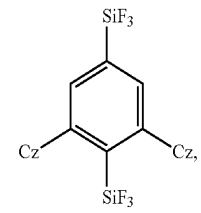
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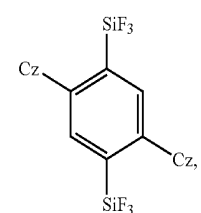
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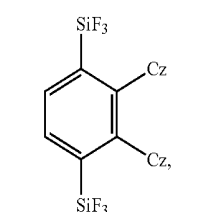
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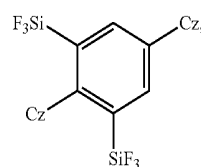
Compound 166



Compound 167

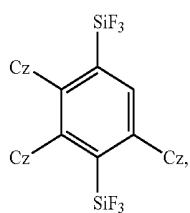


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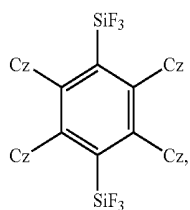


Compound 169

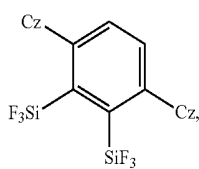
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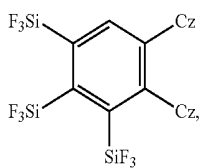
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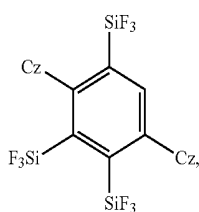
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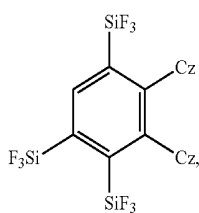
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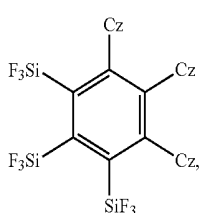
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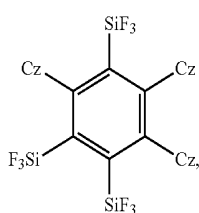
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Compound 175

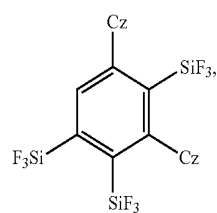


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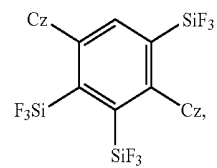


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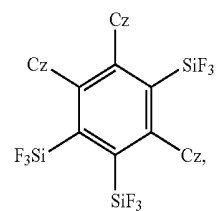
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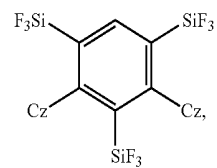
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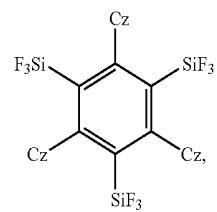
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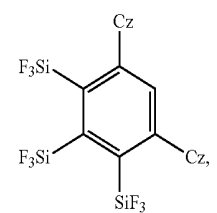
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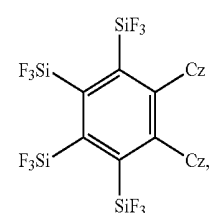
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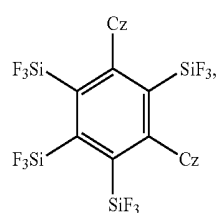
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Compound 183

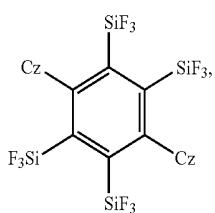


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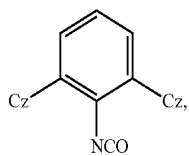


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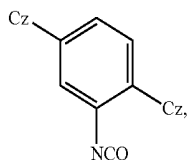
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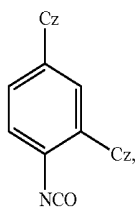
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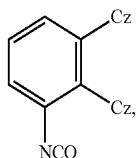
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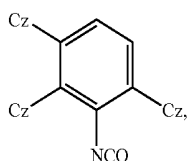
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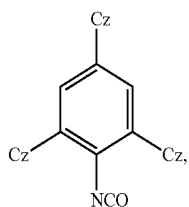
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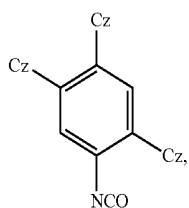
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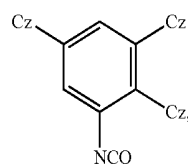


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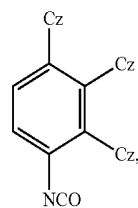


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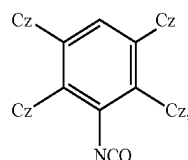
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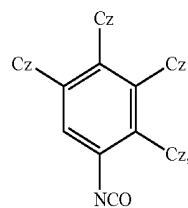
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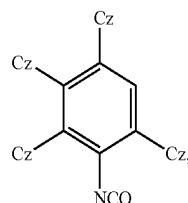
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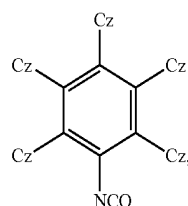
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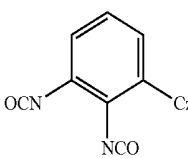
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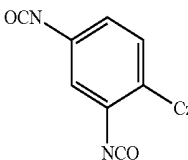
Compound 199



Compound 200

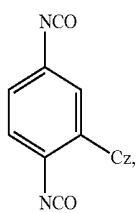


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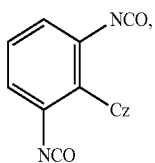


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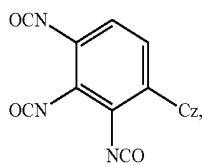
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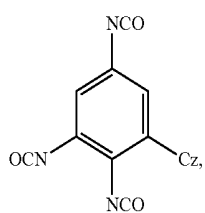
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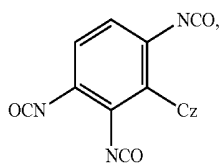
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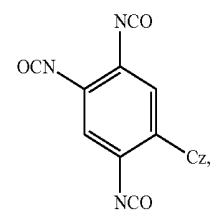
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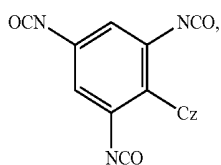
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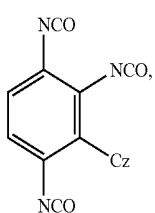
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Compound 208

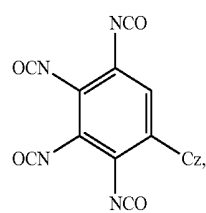


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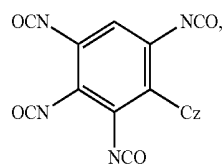


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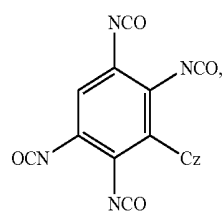
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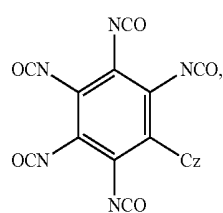
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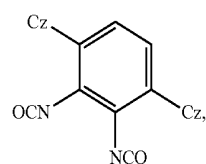
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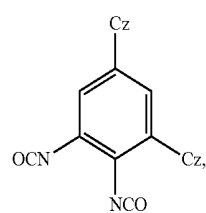
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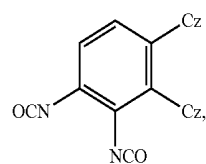
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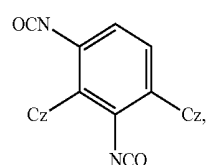
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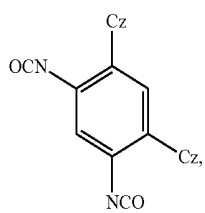


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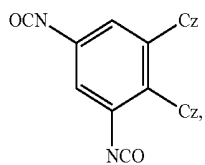


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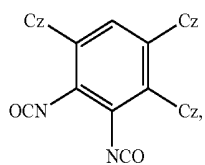
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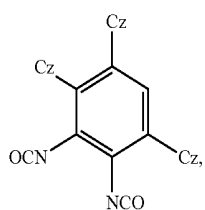
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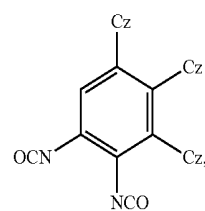
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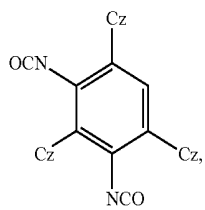
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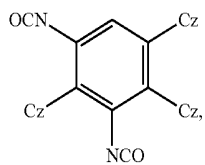
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Compound 22

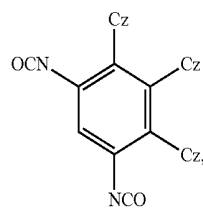


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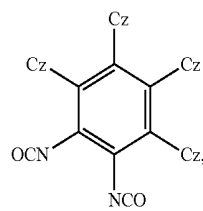


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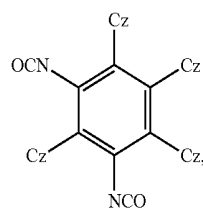
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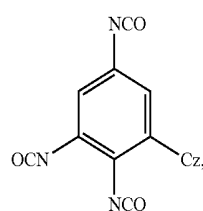
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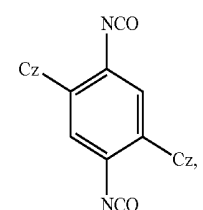
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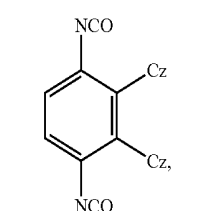
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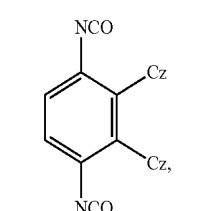
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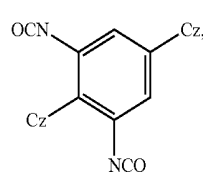
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Compound 231

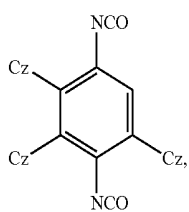


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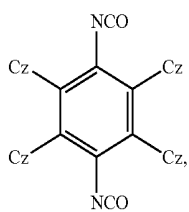


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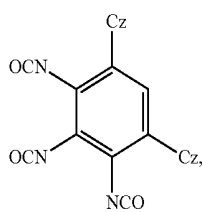
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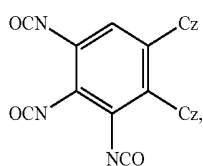
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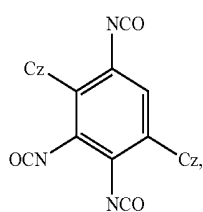
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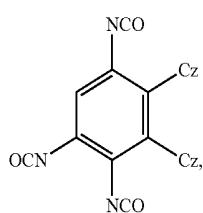
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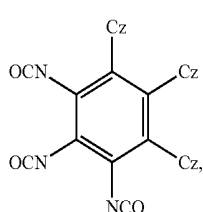
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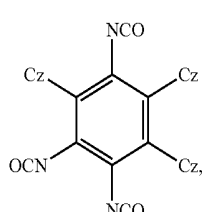
Compound 237



Compound 238

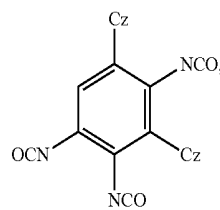


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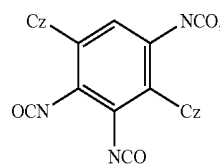


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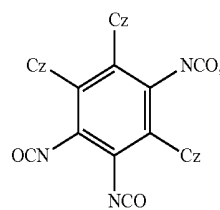
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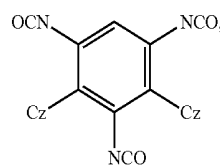
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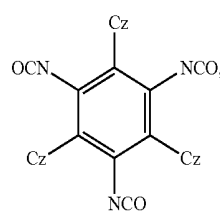
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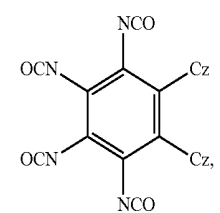
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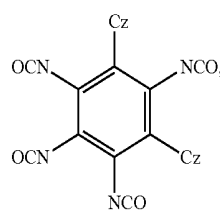
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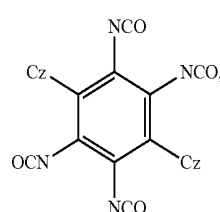
Compound 245



Compound 246

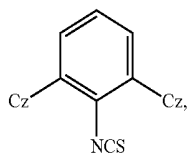


Compound 247

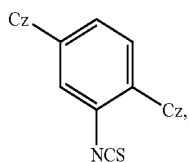


Compound 248

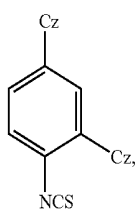
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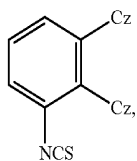
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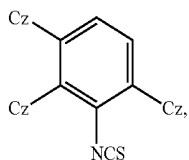
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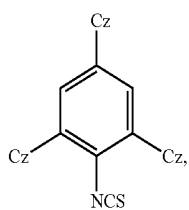
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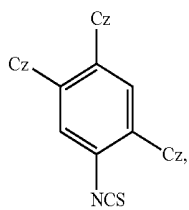
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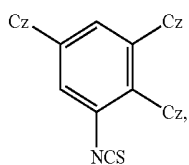
Compound 253



Compound 254

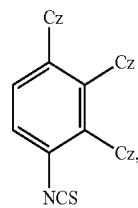


Compound 255

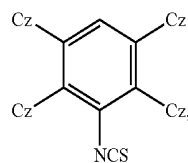


Compound 256

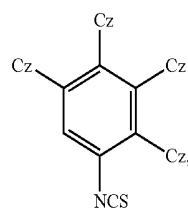
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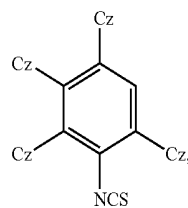
Compound 257



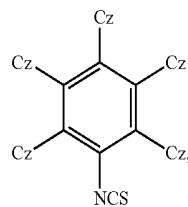
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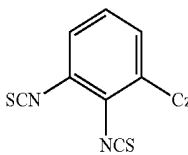
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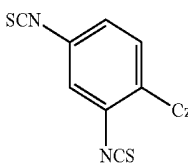
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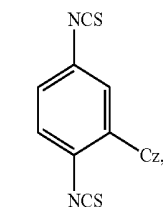
Compound 261



Compound 262



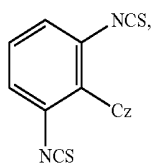
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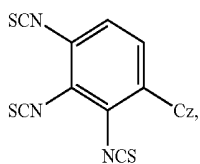
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Compound 265

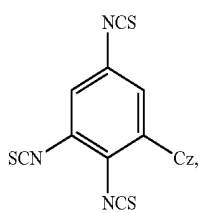
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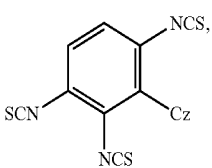
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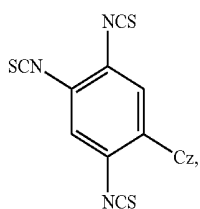
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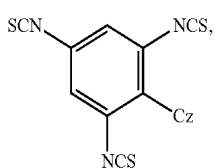
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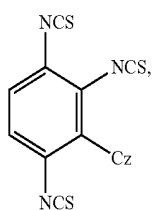
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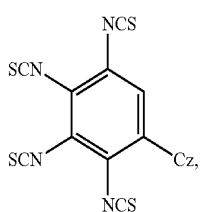
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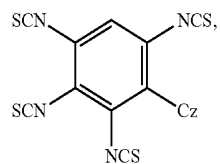


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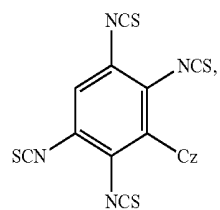


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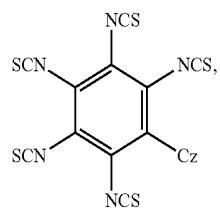
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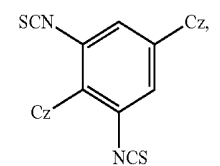
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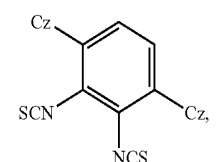
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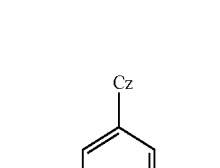
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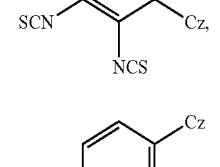
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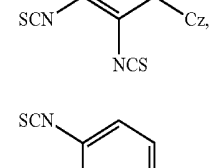
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Compound 279

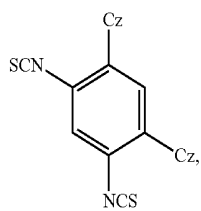


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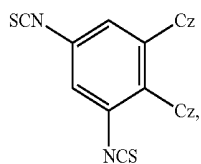


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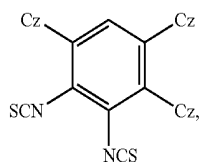
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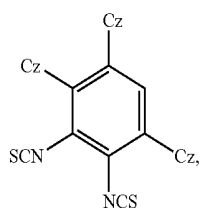
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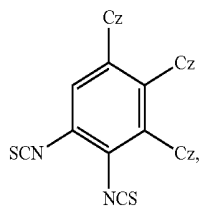
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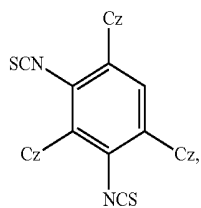
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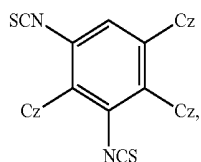
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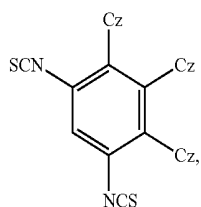
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Compound 287

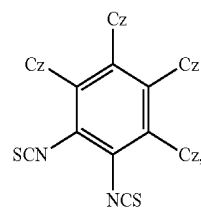


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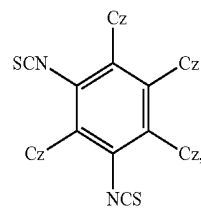


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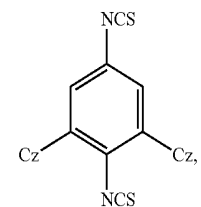
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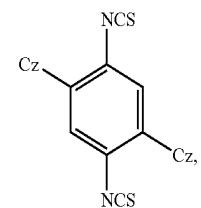
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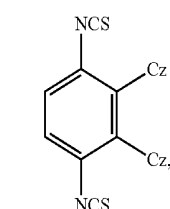
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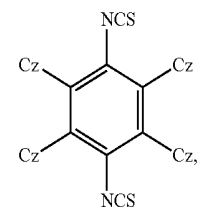
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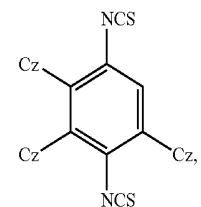
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Compound 294

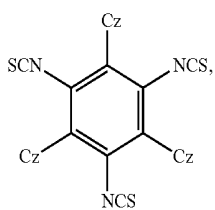


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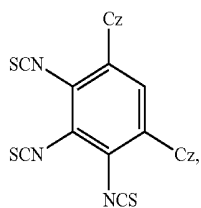


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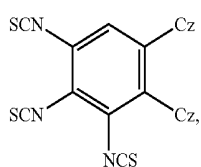
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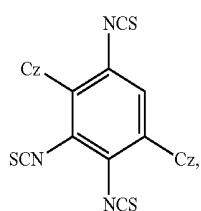
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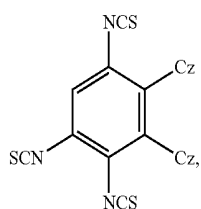
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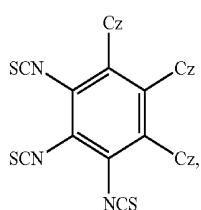
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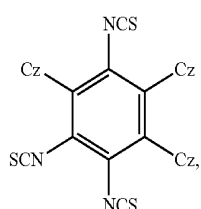
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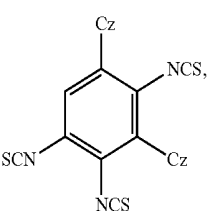
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Compound 302

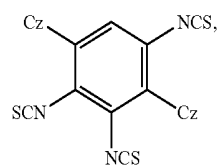


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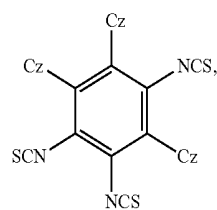


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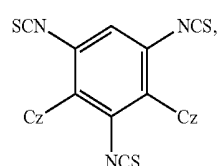
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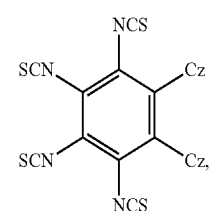
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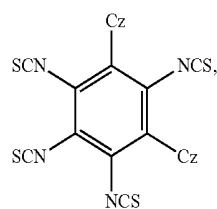
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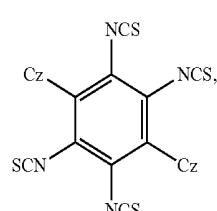
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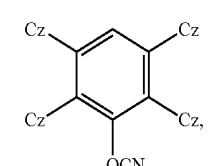
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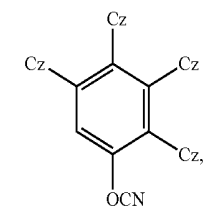
Compound 309



Compound 310

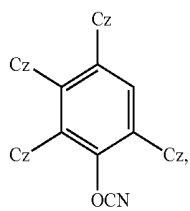


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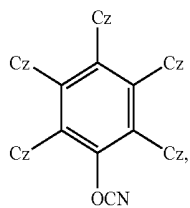


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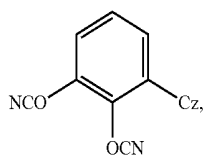
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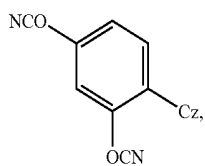
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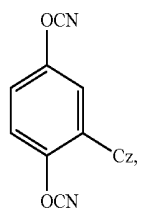
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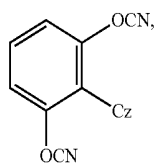
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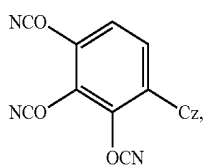
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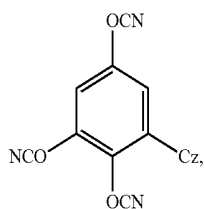
Compound 317



Compound 318

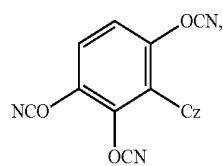


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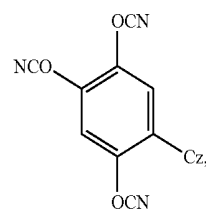


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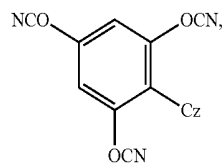
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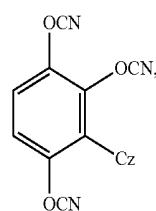
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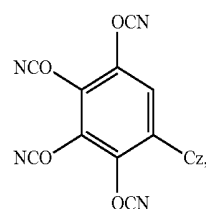
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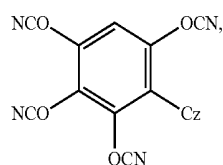
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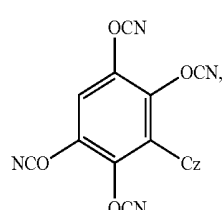
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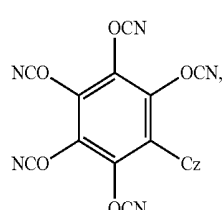
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Compound 326

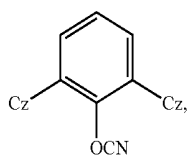


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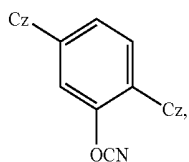


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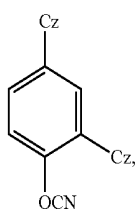
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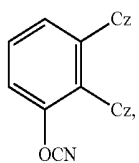
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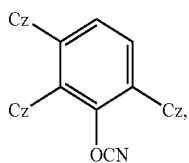
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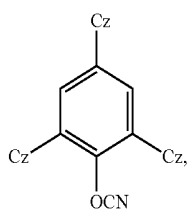
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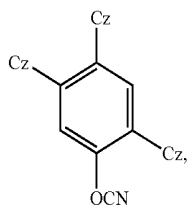
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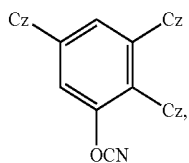
Compound 333



Compound 334

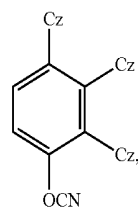


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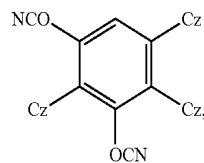


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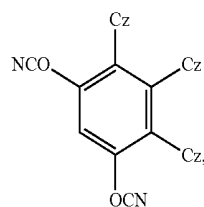
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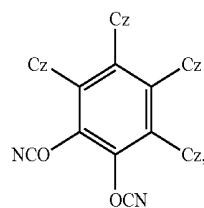
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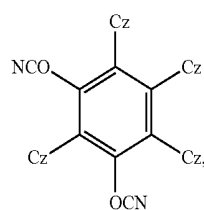
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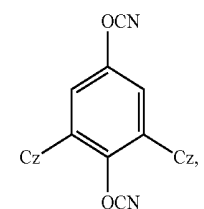
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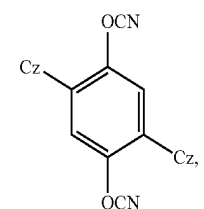
Compound 341



Compound 342

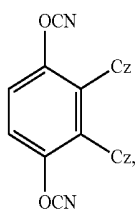


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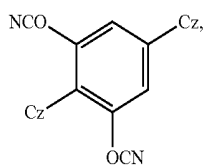


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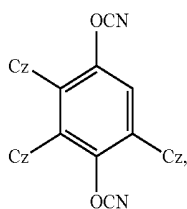
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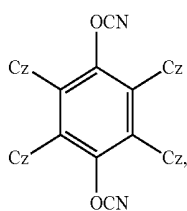
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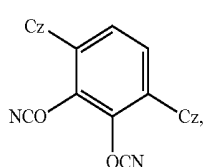
Compound 346



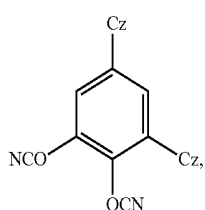
Compound 347



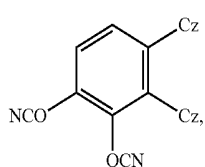
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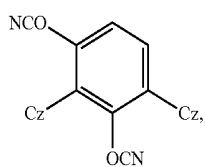
Compound 349



Compound 350

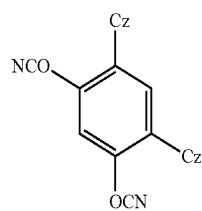


Compound 351

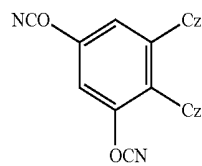


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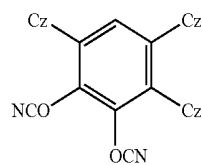
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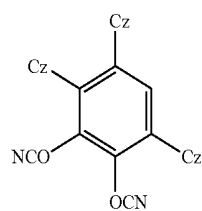
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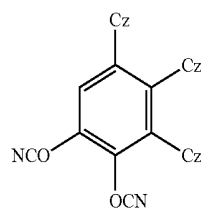
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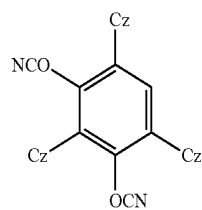
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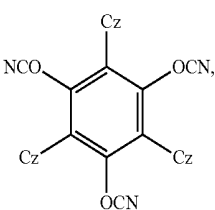
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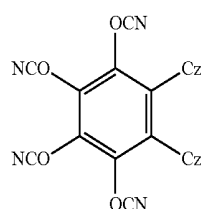
Compound 357



Compound 358

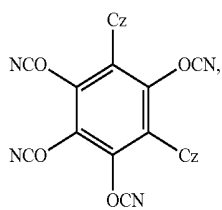


Compound 359

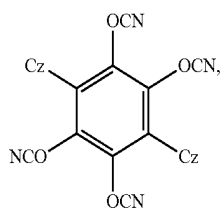


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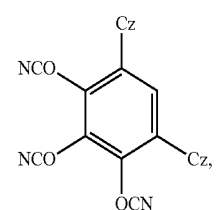
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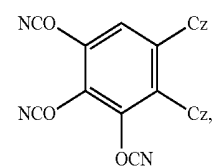
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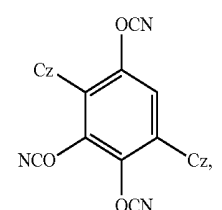
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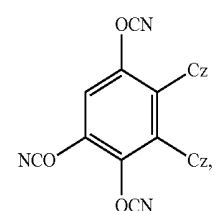
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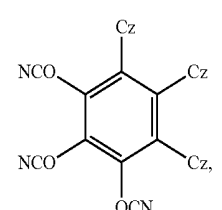
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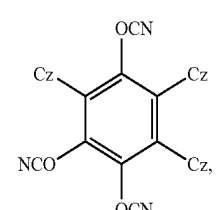
Compound 365



Compound 366

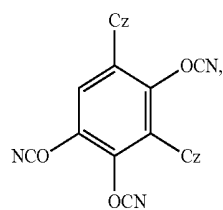


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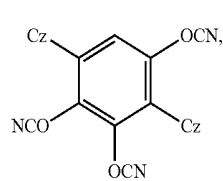


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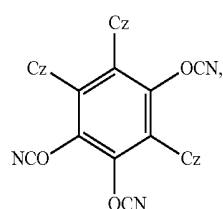
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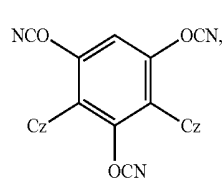
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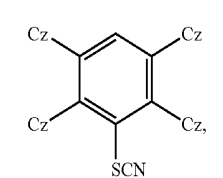
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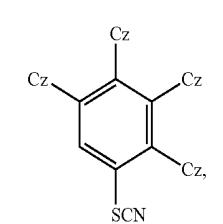
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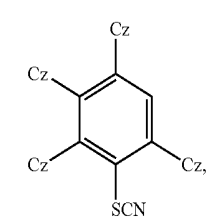
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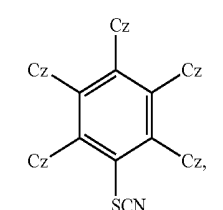
Compound 373



Compound 374

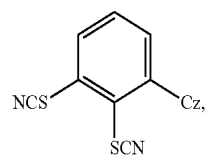


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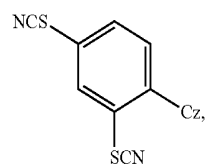


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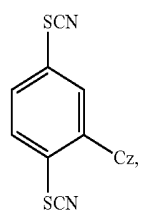
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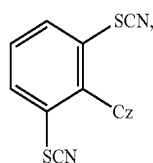
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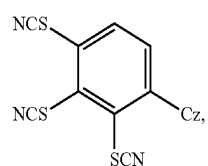
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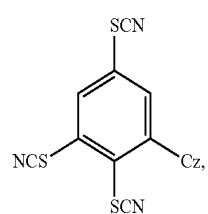
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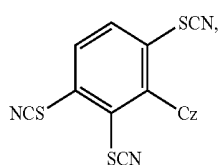
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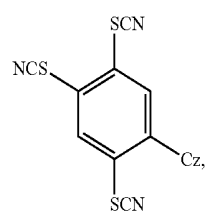
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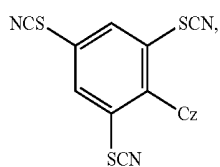
Compound 382



Compound 383

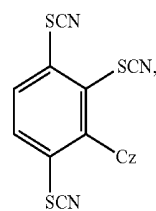


Compound 384

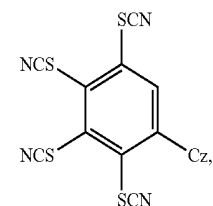


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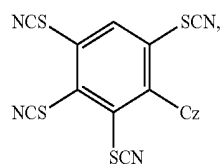
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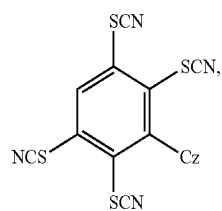
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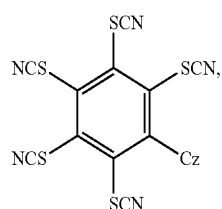
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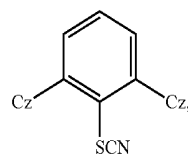
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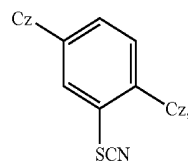
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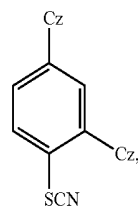
Compound 390



Compound 391

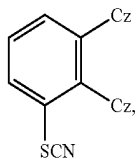


Compound 392

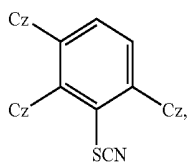


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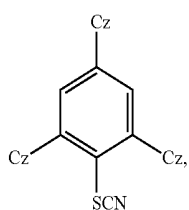
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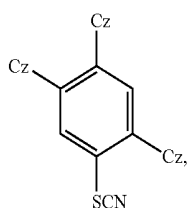
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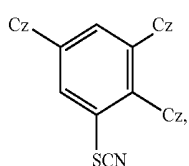
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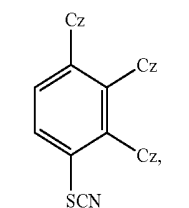
Compound 396



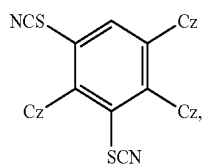
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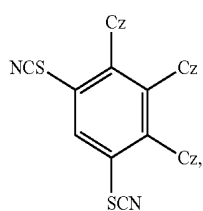
Compound 399



Compound 400

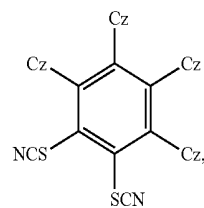


Compound 401

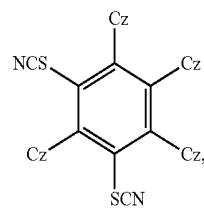


Compound 402

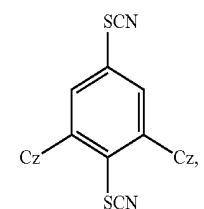
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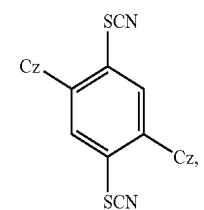
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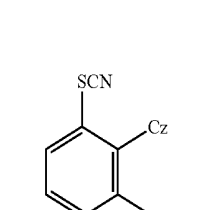
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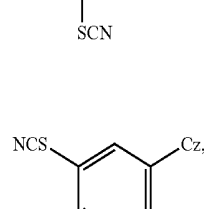
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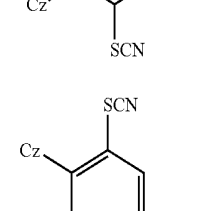
Compound 406



Compound 407

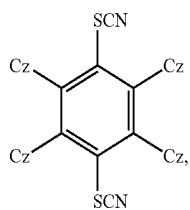


Compound 408

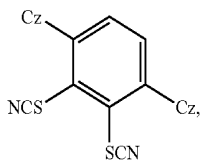


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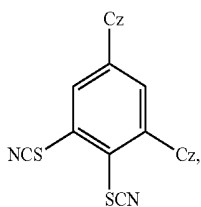
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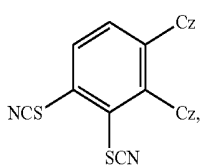
Compound 410



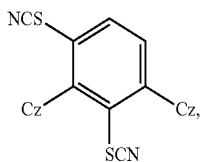
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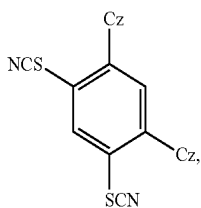
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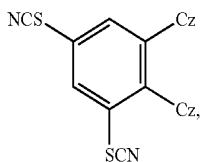
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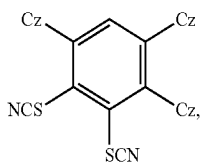
Compound 414



Compound 415

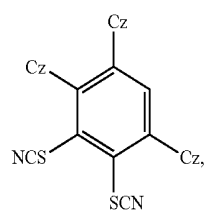


Compound 416

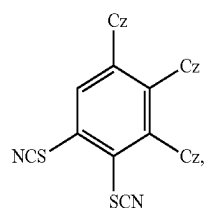


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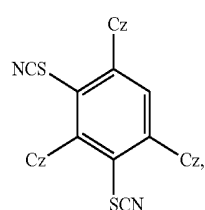
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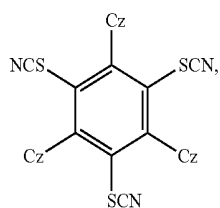
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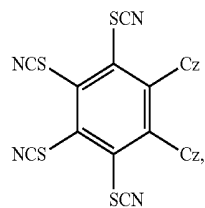
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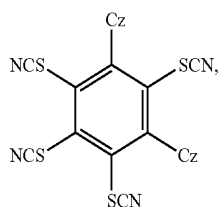
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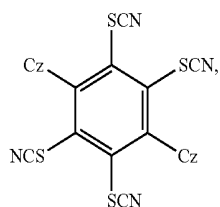
Compound 421



Compound 422

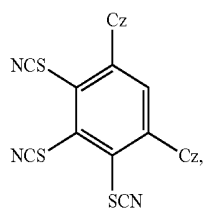


Compound 423

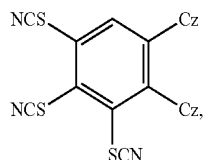


Compound 424

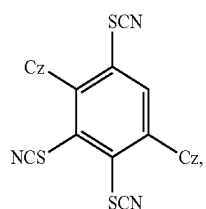
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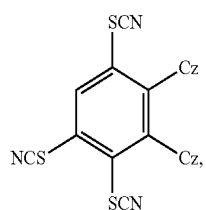
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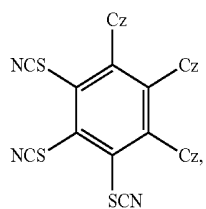
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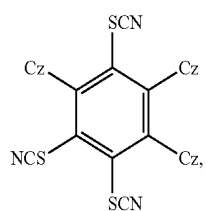
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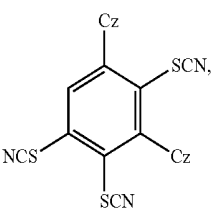
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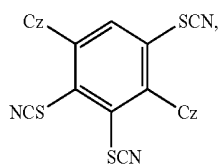
Compound 429



Compound 430

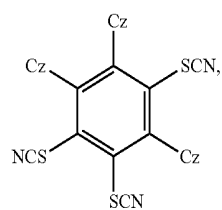


Compound 431

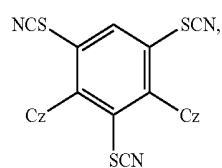


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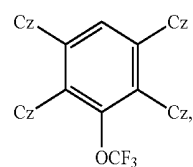
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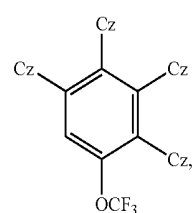
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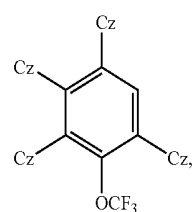
Compound 434



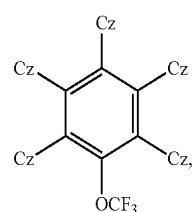
Compound 435



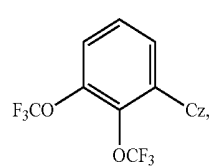
Compound 436



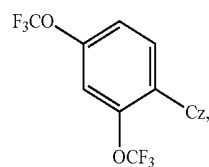
Compound 437



Compound 438

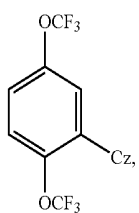


Compound 439

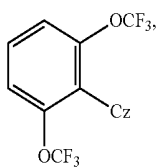


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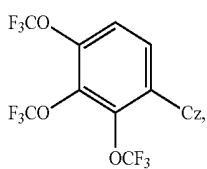
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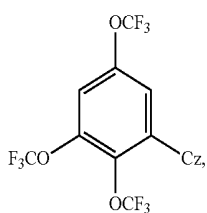
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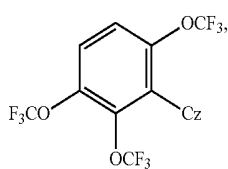
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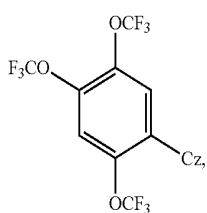
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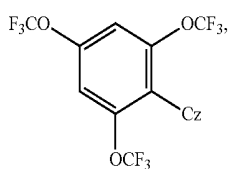
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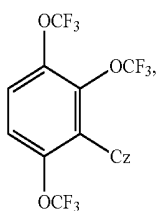
Compound 445



Compound 446

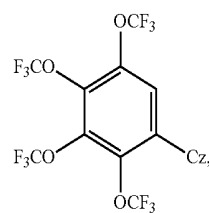


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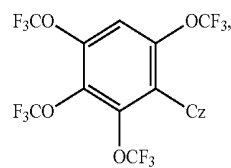


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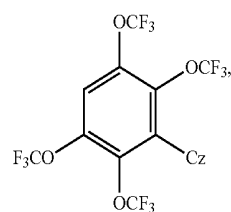
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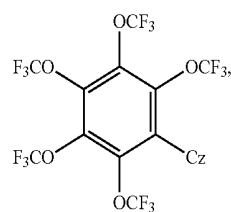
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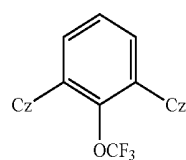
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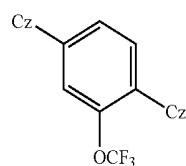
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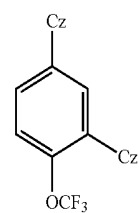
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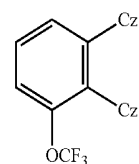
Compound 453



Compound 454

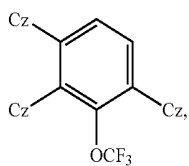


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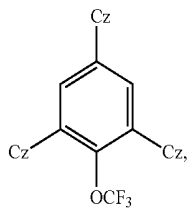


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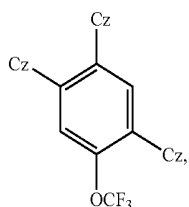
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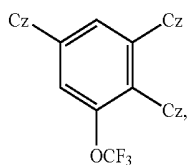
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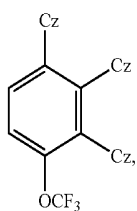
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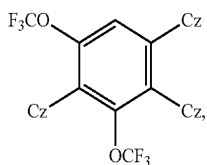
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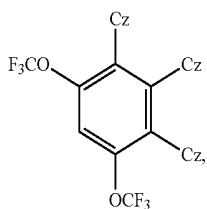
Compound 461



Compound 462

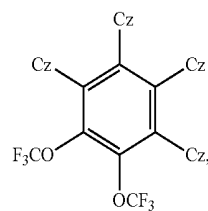


Compound 463

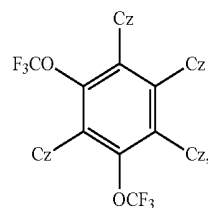


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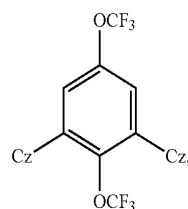
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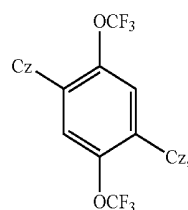
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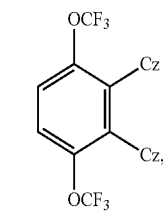
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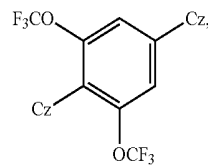
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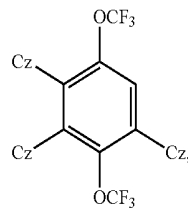
Compound 468



Compound 469

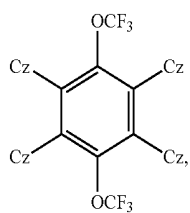


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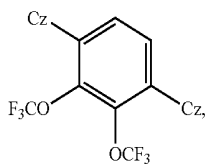


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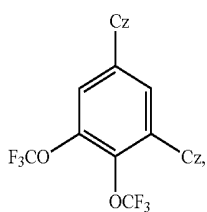
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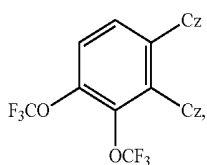
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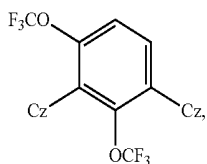
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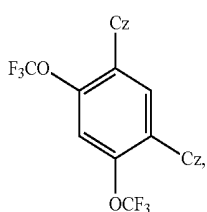
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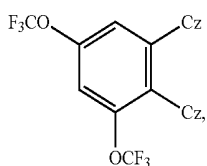
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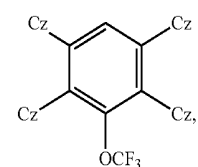
Compound 476



Compound 477

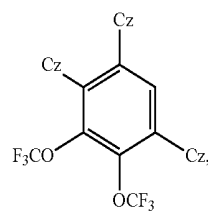


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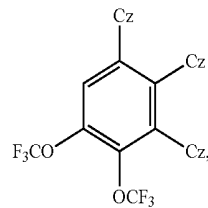


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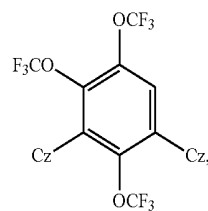
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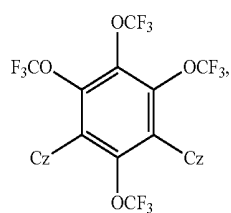
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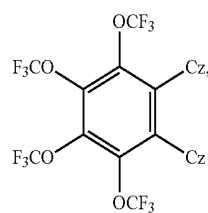
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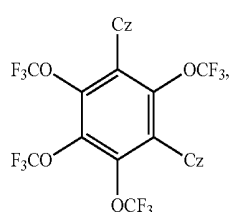
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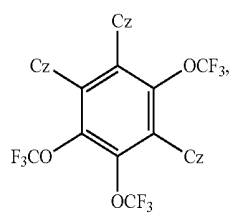
Compound 483



Compound 484

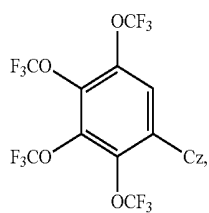


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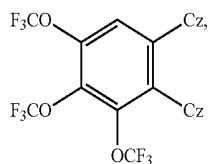


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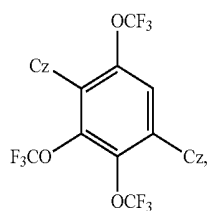
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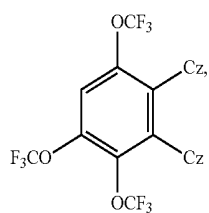
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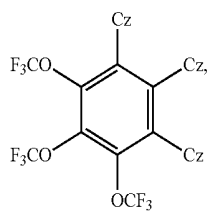
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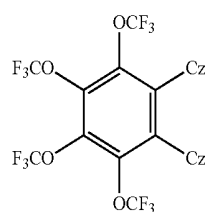
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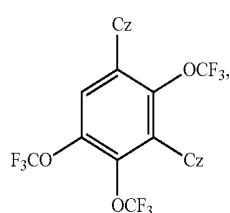
Compound 490



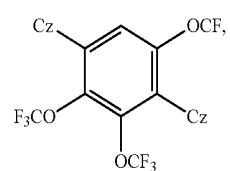
Compound 491



Compound 492

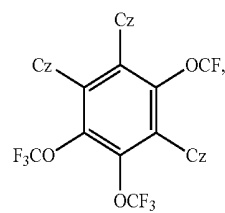


Compound 493

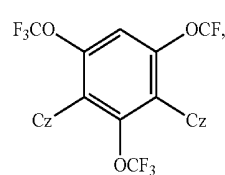


Compound 494

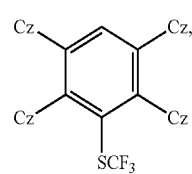
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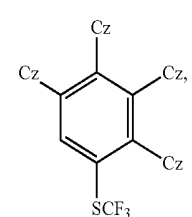
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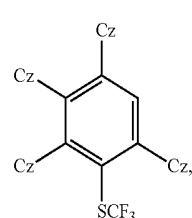
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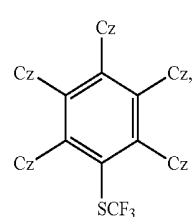
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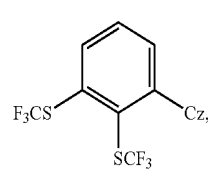
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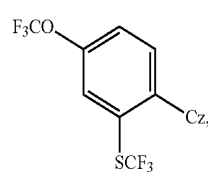
Compound 499



Compound 500

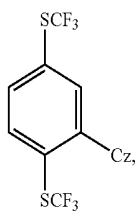


Compound 501

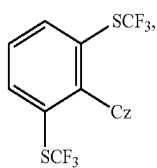


Compound 502

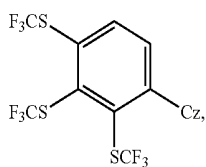
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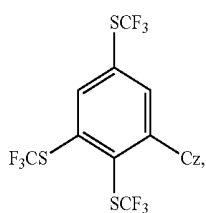
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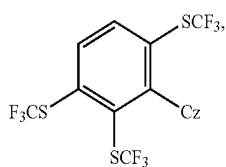
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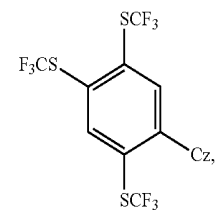
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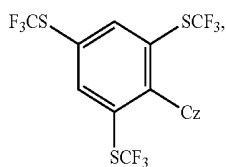
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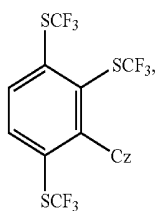
Compound 507



Compound 508

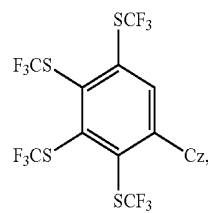


Compound 509

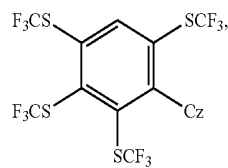


Compound 510

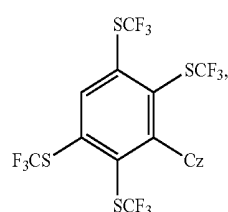
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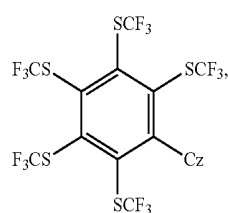
Compound 511



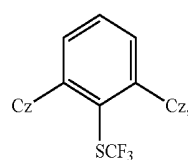
Compound 512



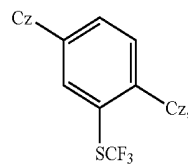
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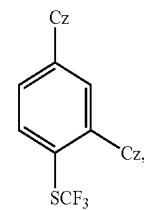
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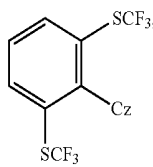
Compound 515



Compound 516

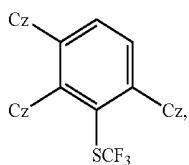


Compound 517

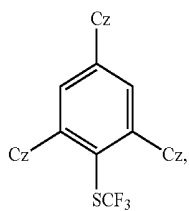


Compound 518

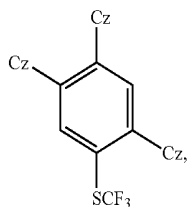
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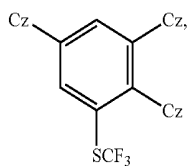
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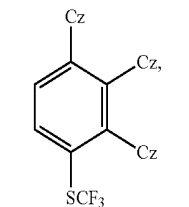
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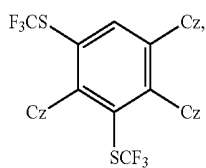
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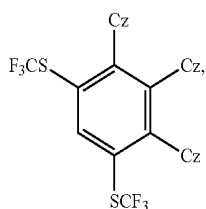
Compound 523



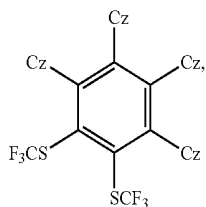
Compound 524



Compound 525

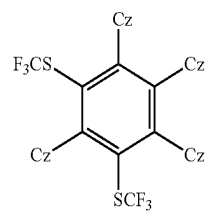


Compound 526

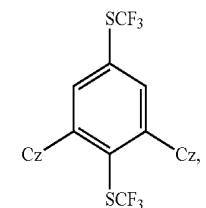


Compound 527

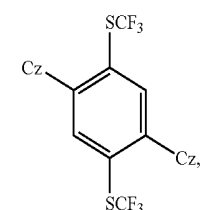
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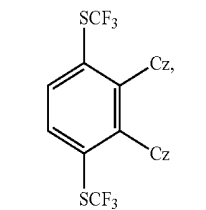
Compound 528



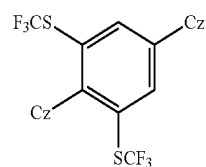
Compound 529



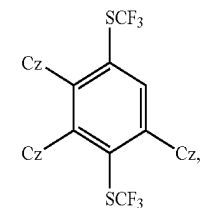
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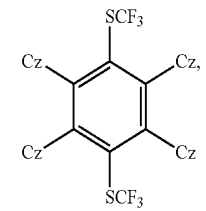
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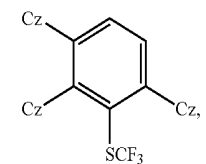
Compound 532



Compound 533

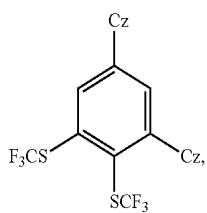


Compound 534

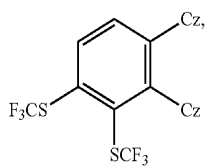


Compound 535

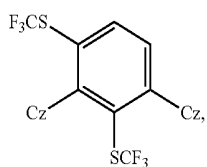
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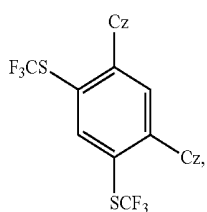
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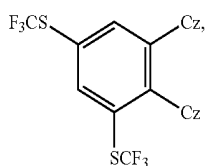
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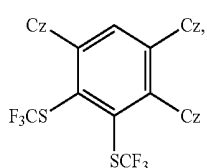
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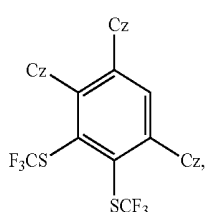
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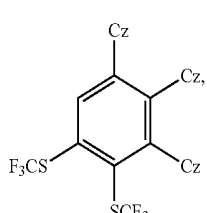
Compound 540



Compound 541

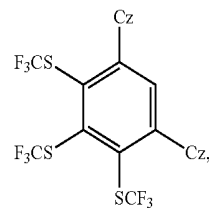


Compound 542

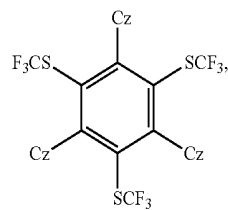


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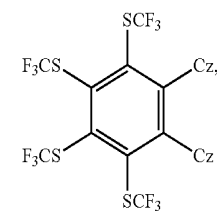
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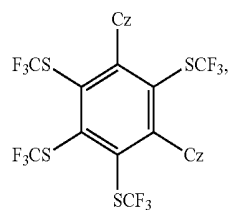
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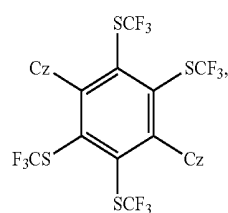
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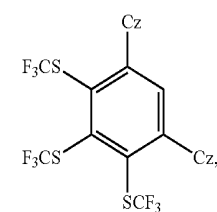
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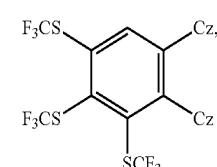
Compound 547



Compound 548

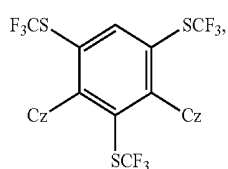
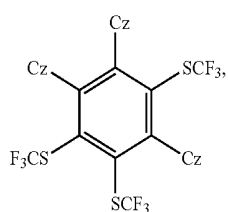
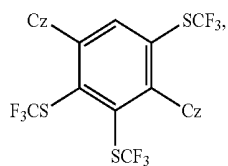
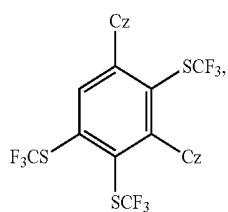
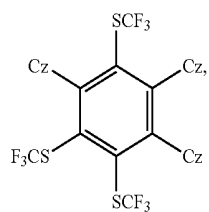
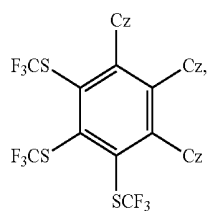
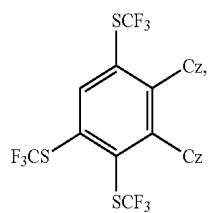
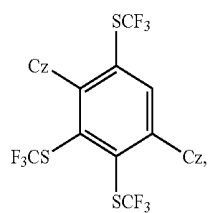


Compound 549



Compound 550

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Compound 551

Compound 552

Compound 553

Compound 554

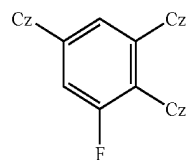
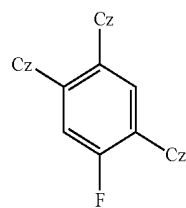
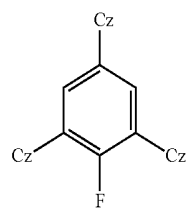
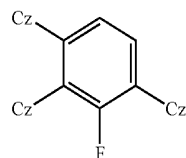
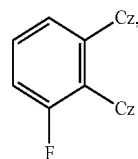
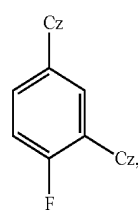
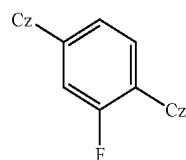
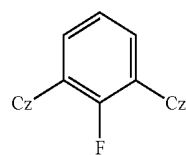
Compound 555

Compound 556

Compound 557

Compound 558

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Compound 559

Compound 560

Compound 561

Compound 562

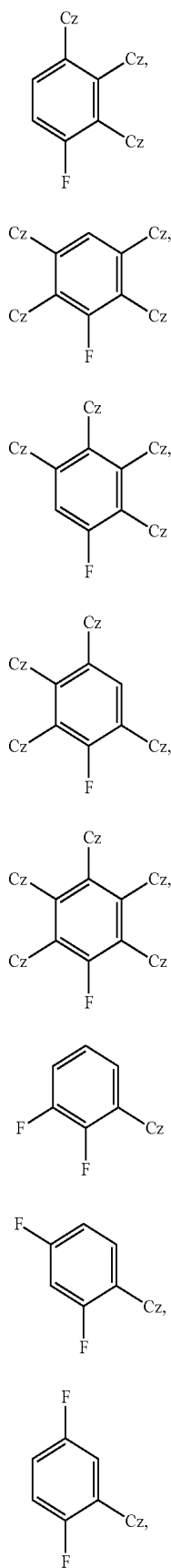
Compound 563

Compound 564

Compound 566

Compound 567

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Compound 568

Compound 569

Compound 570

Compound 571

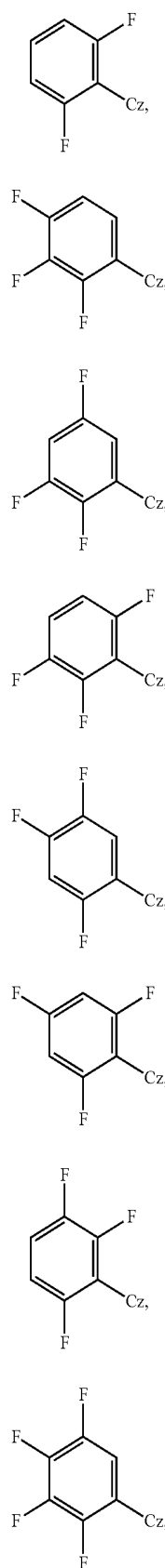
Compound 572

Compound 573

Compound 574

Compound 575

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Compound 576

Compound 577

Compound 578

Compound 579

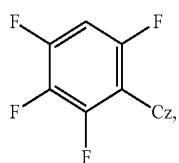
Compound 580

Compound 581

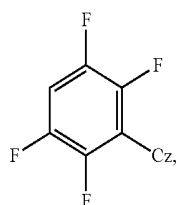
Compound 582

Compound 583

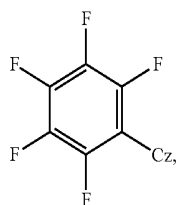
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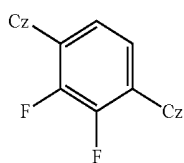
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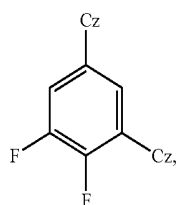
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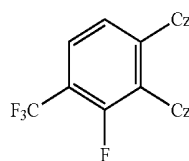
Compound 586



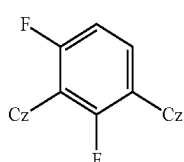
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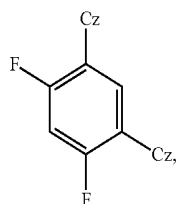
Compound 588



Compound 589

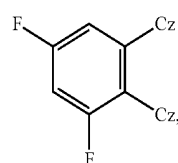


Compound 590

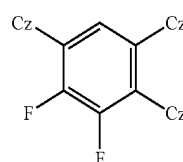


Compound 591

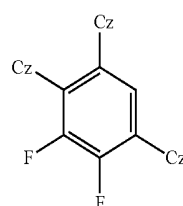
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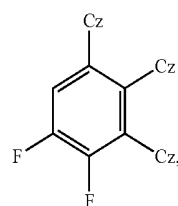
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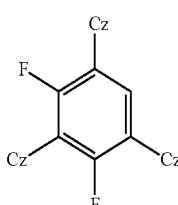
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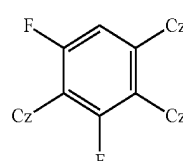
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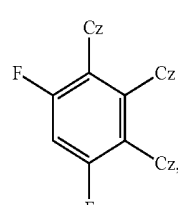
Compound 595



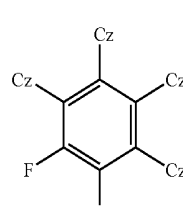
Compound 596



Compound 597

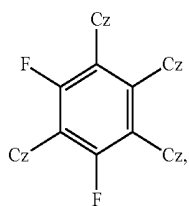


Compound 598

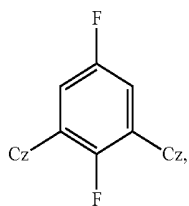


Compound 599

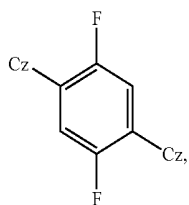
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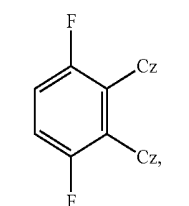
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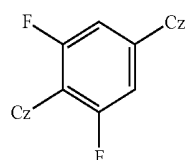
Compound 601



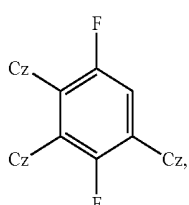
Compound 602



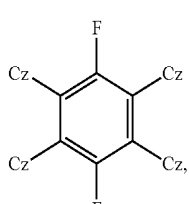
Compound 603



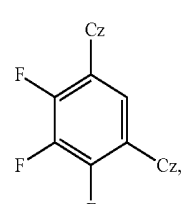
Compound 604



Compound 605

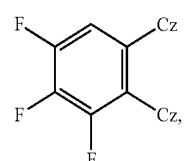


Compound 606

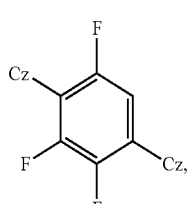


Compound 607

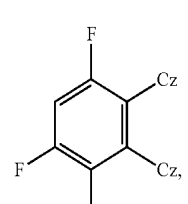
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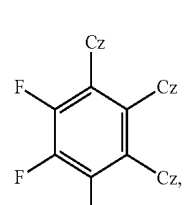
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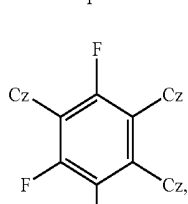
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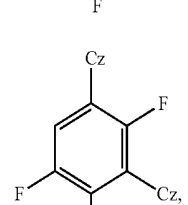
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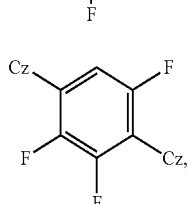
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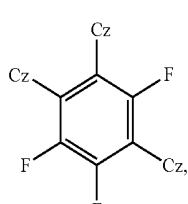
Compound 612



Compound 613

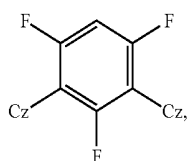


Compound 614

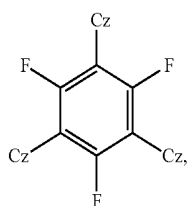


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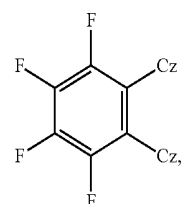
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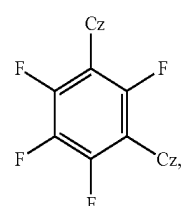
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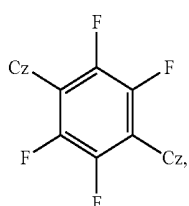
Compound 617



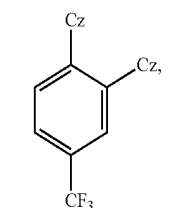
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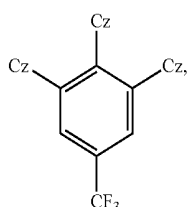
Compound 619



Compound 620

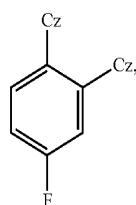


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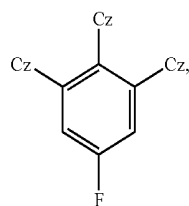


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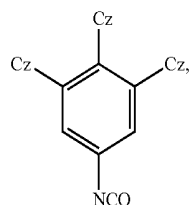
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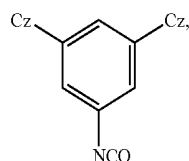
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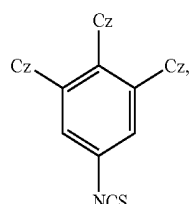
Compound 624



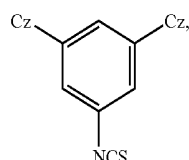
Compound 625



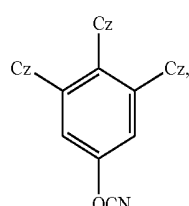
Compound 626



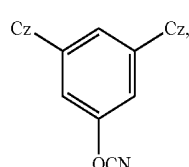
Compound 627



Compound 628

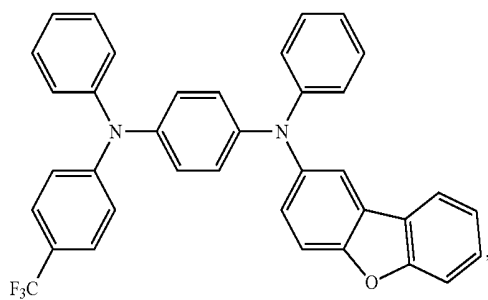
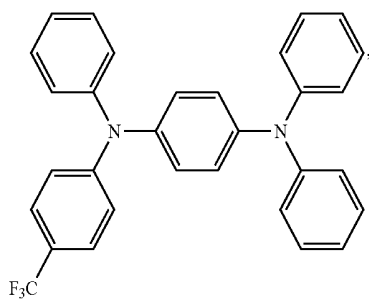
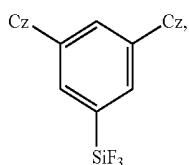
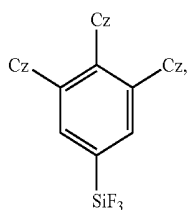
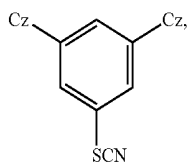
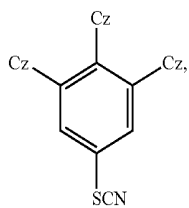


Compound 629



Compound 630

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Compound 631

Compound 632

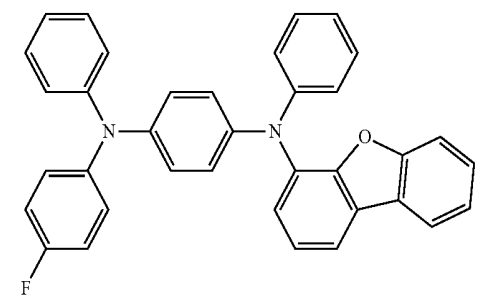
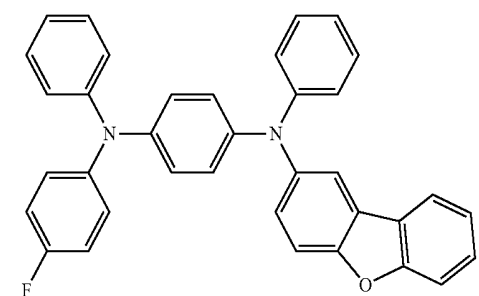
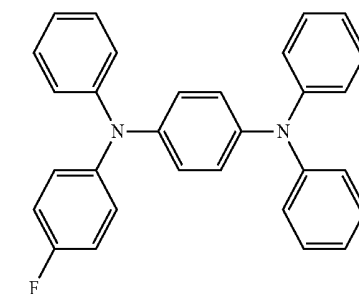
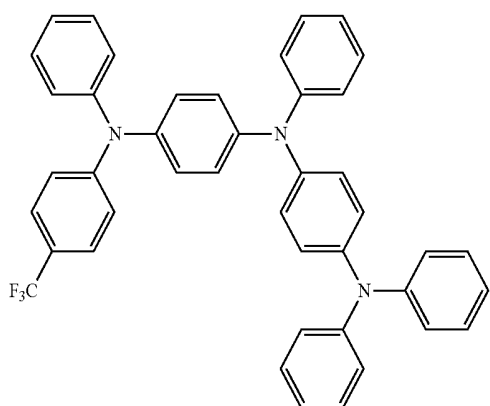
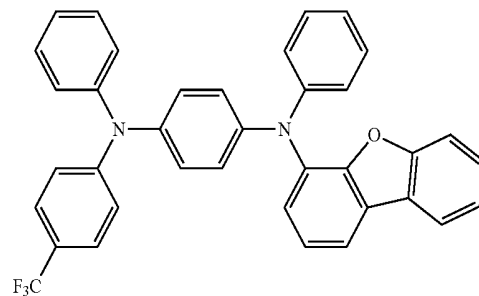
Compound 633

Compound 634

Compound 635

Compound 636

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Compound 637

Compound 638

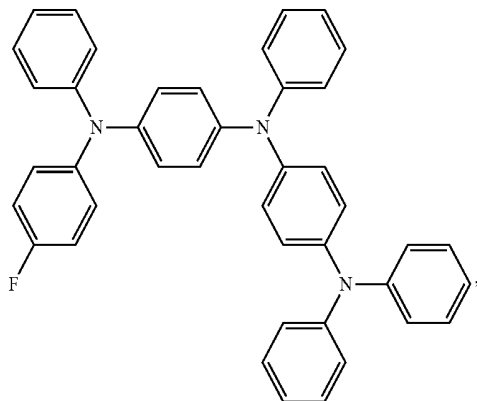
Compound 639

Compound 640

Compound 641

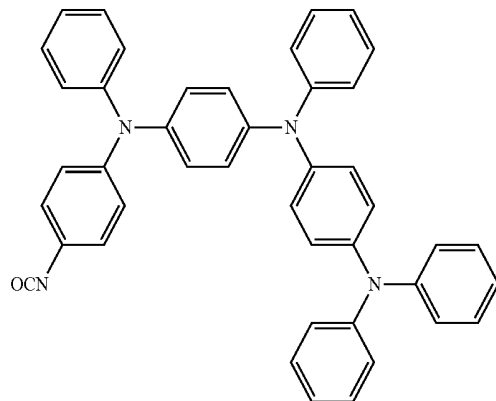
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Compound 642

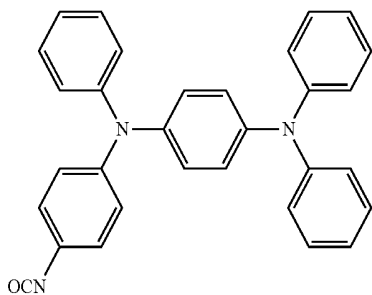


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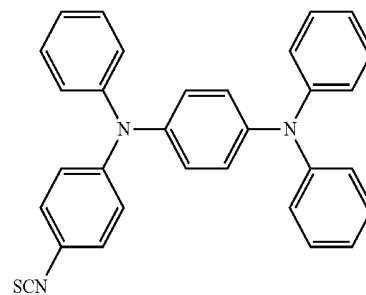
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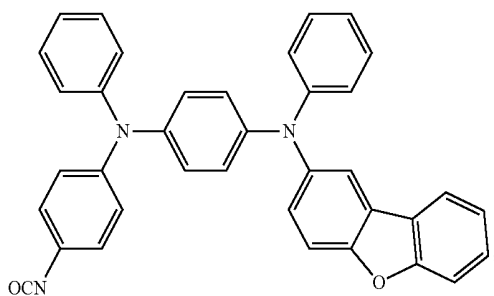
Compound 643



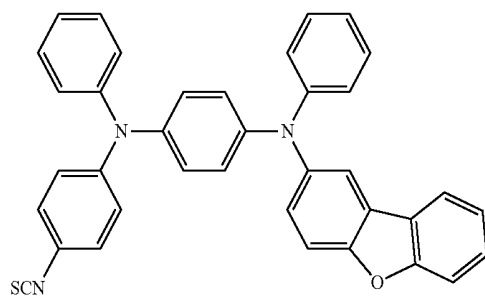
Compound 647



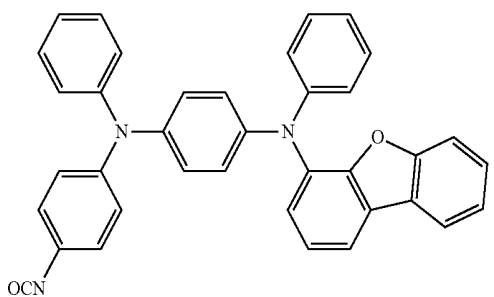
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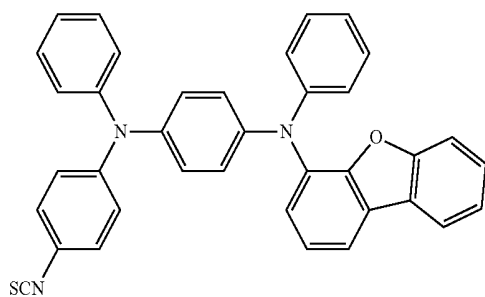
Compound 648



Compound 645

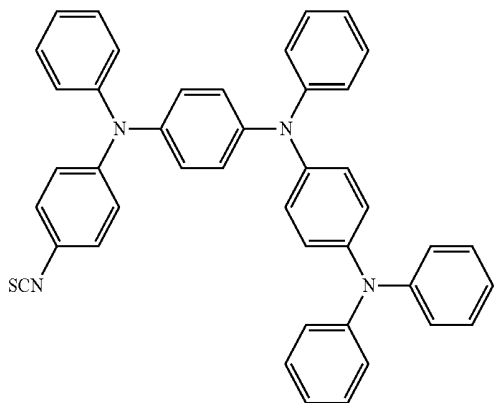


Compound 649

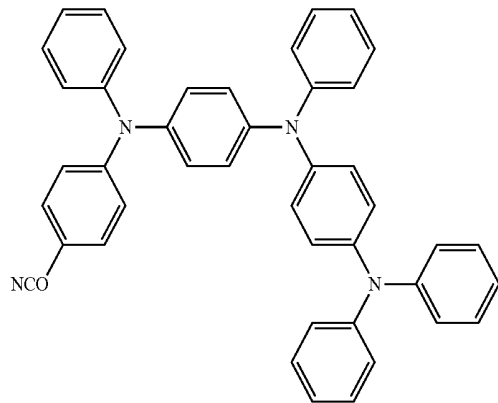


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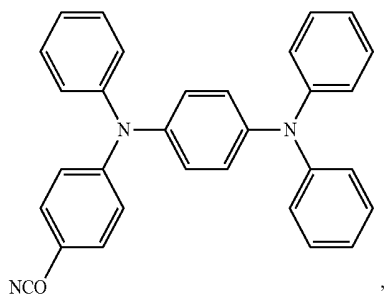
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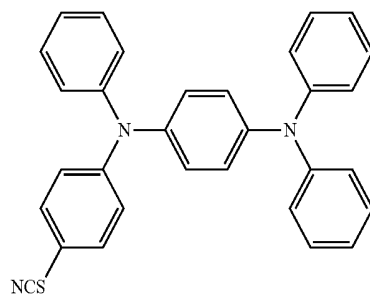
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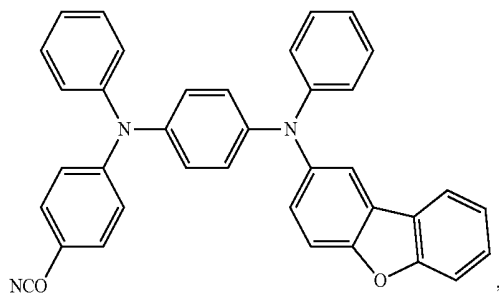
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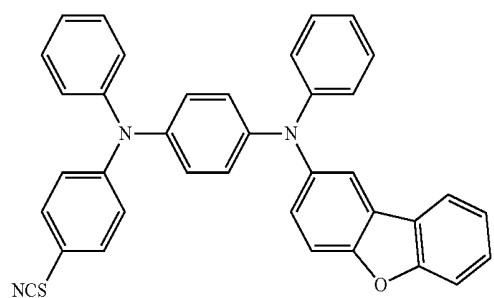
Compound 655



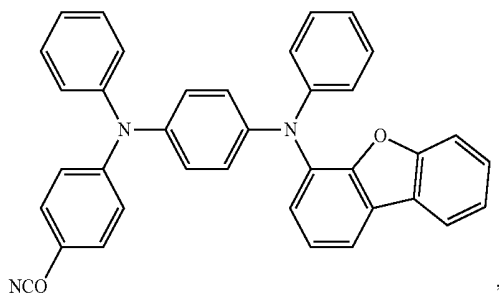
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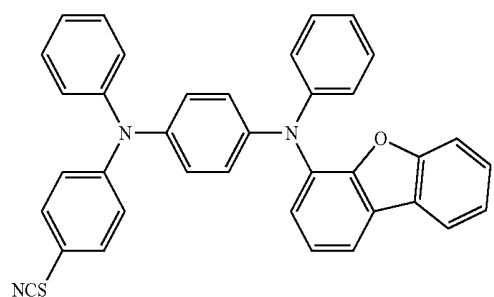
Compound 656



Compound 653

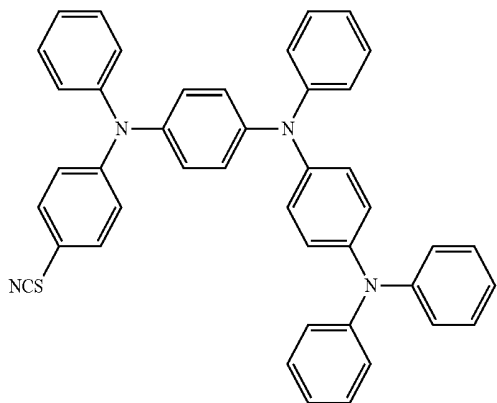


Compound 657



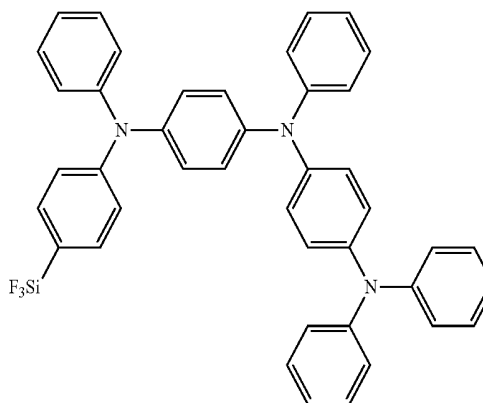
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Compound 658

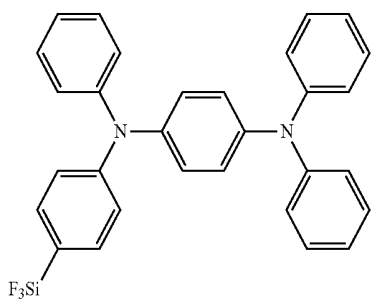


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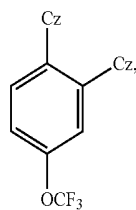
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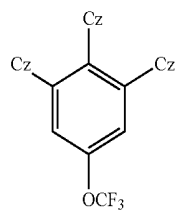
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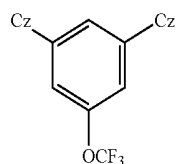
Compound 663



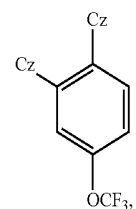
Compound 664



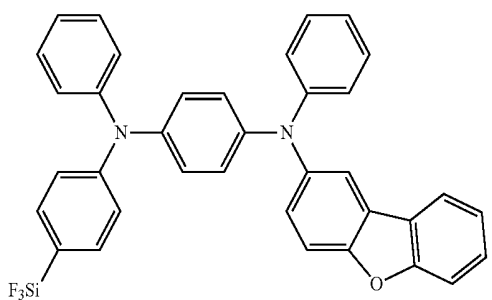
Compound 665



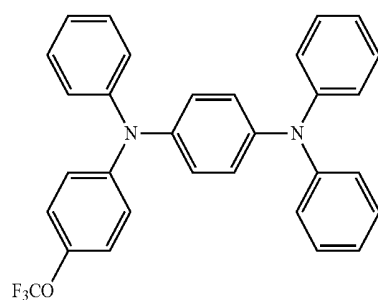
Compound 666



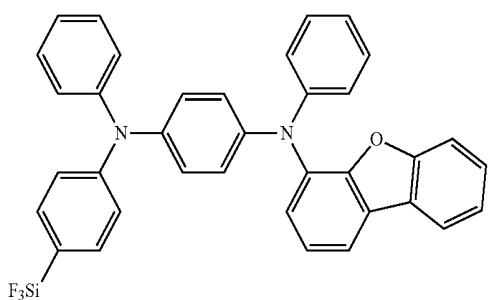
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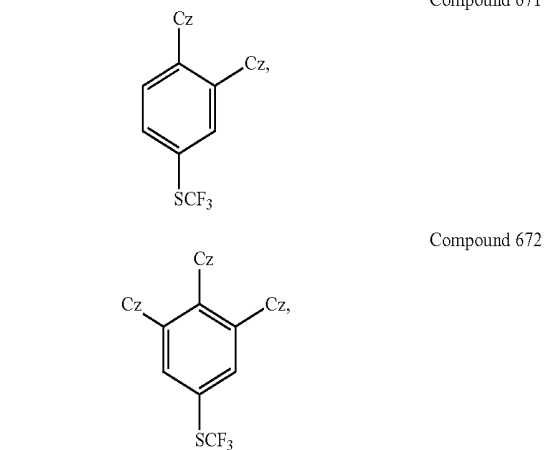
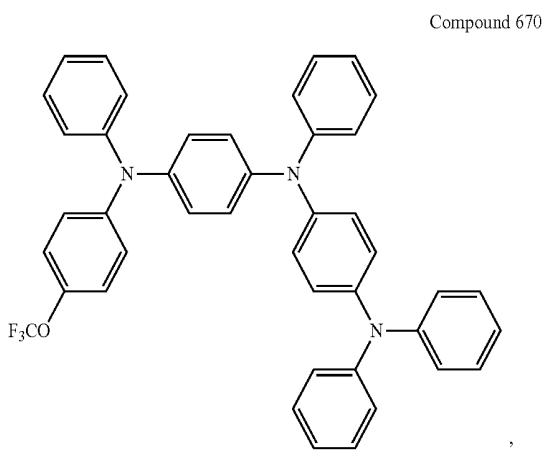
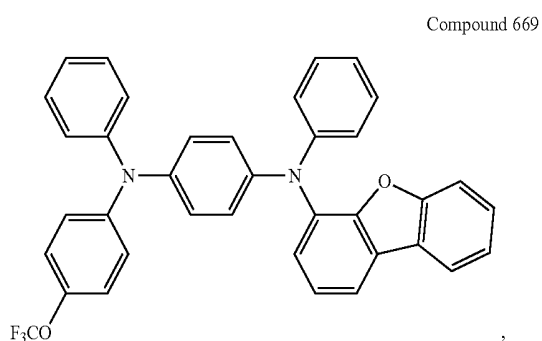
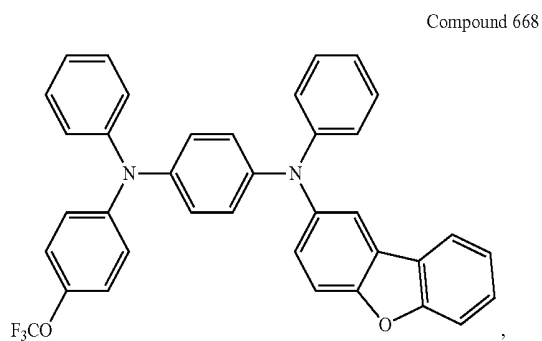
Compound 667



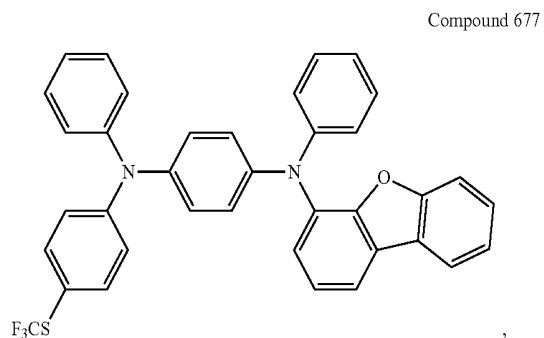
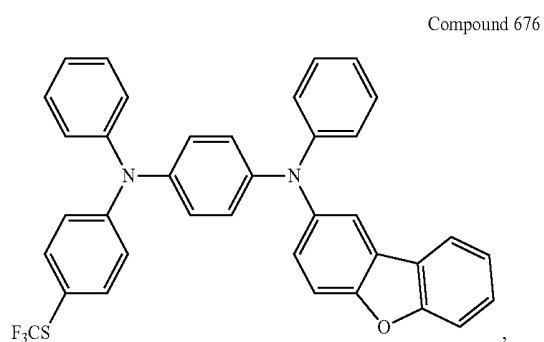
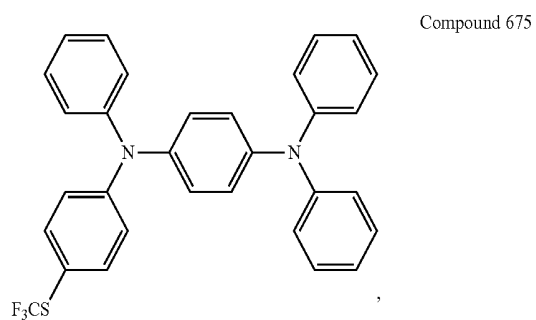
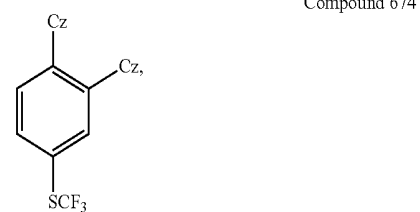
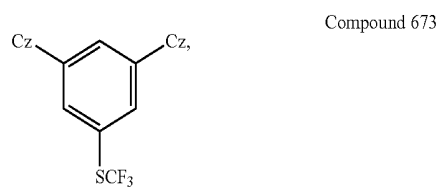
Compound 661



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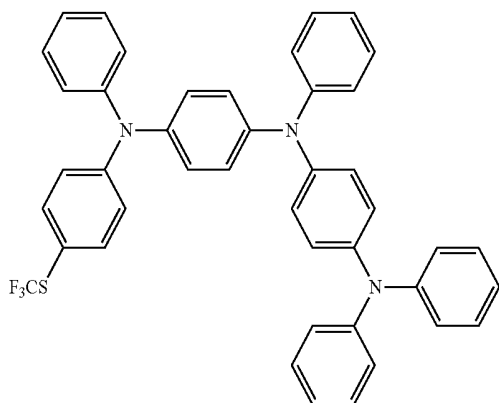


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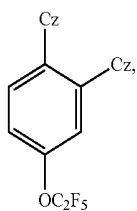


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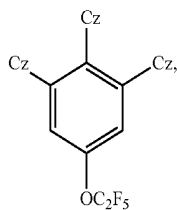
Compound 678



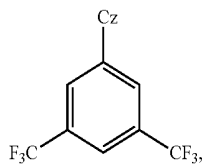
Compound 679



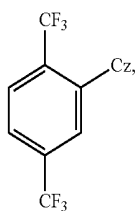
Compound 680



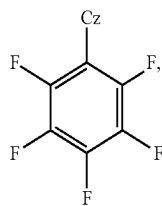
Compound 681



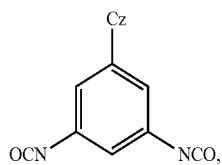
Compound 682



Compound 683

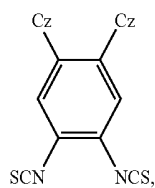


Compound 684

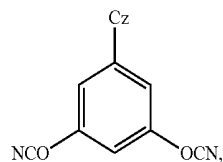


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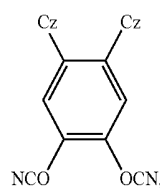
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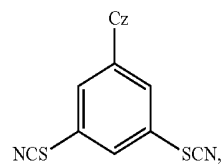
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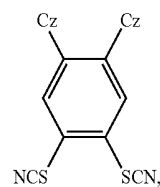
Compound 687



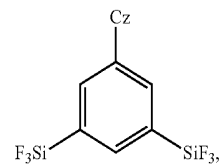
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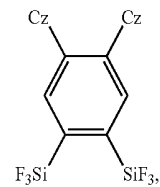
Compound 689



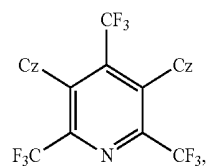
Compound 690



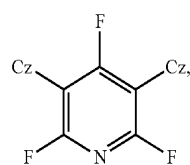
Compound 691



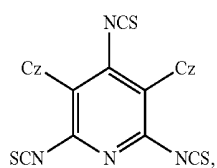
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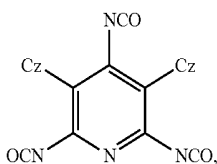
Compound 693



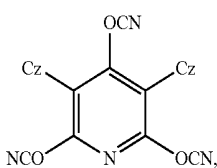
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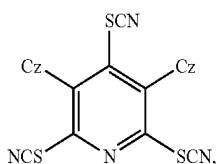
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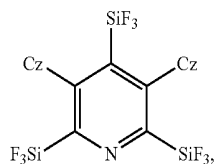
Compound 695



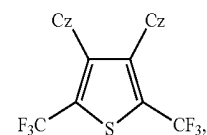
Compound 696



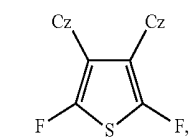
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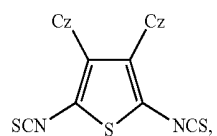
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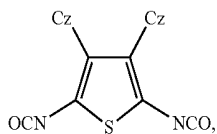
Compound 699



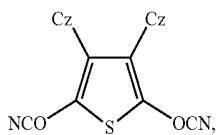
Compound 700



Compound 701

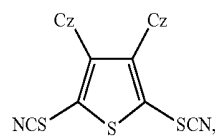


Compound 702

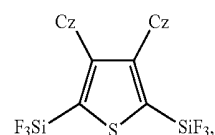


Compound 703

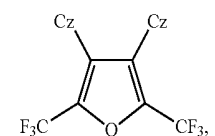
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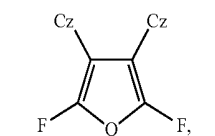
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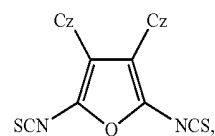
Compound 705



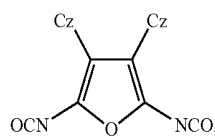
Compound 706



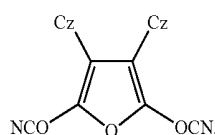
Compound 707



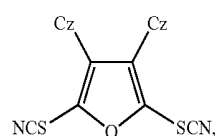
Compound 708



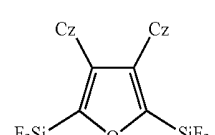
Compound 709



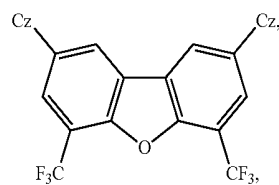
Compound 710



Compound 711

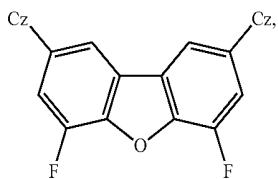


Compound 712

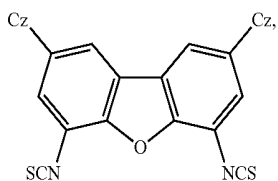


Compound 713

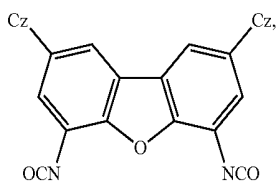
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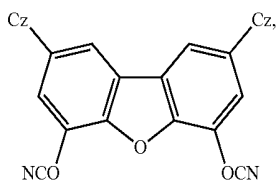
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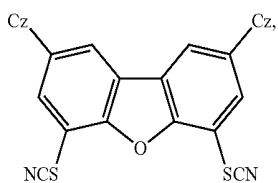
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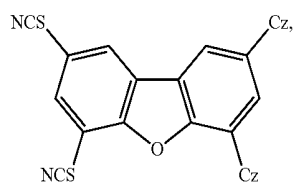
Compound 716



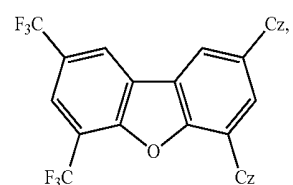
Compound 717



Compound 718

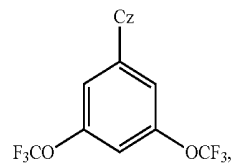


Compound 719

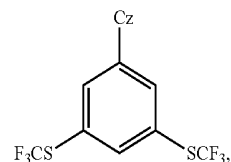


Compound 720

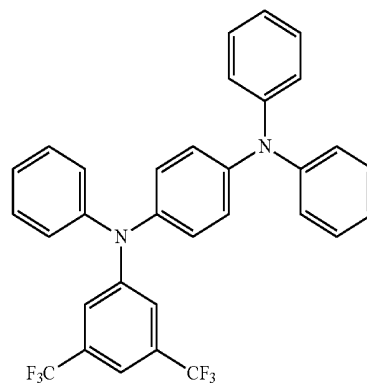
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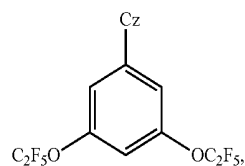
Compound 721



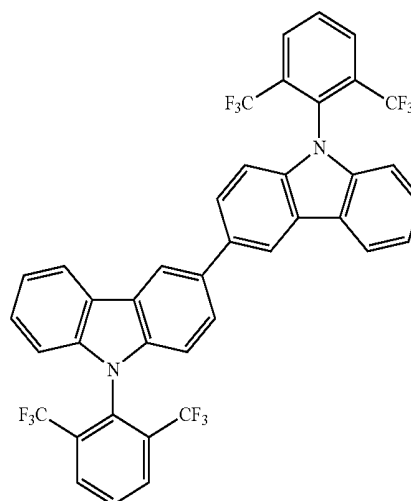
Compound 722



Compound 723

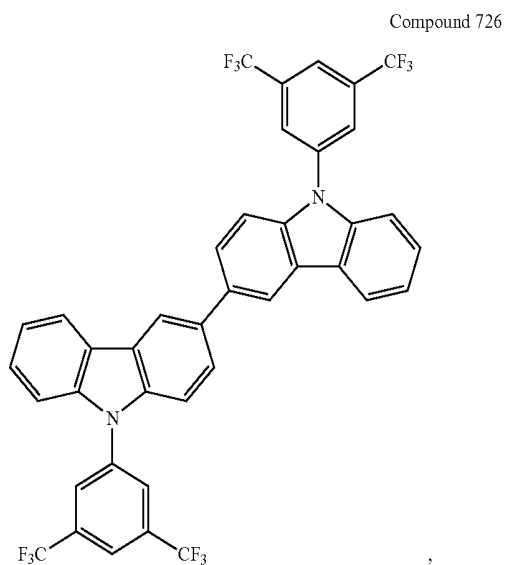


Compound 724

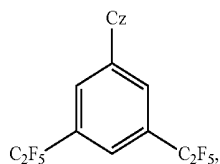


Compound 725

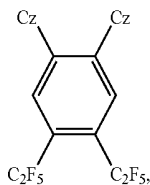
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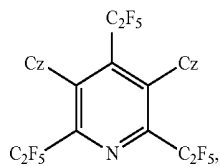
Compound 727



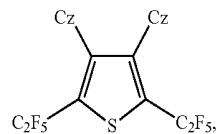
Compound 729



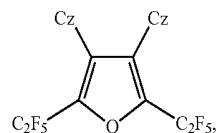
Compound 731



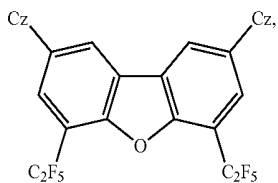
Compound 732



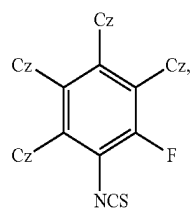
Compound 733



Compound 734

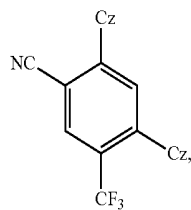


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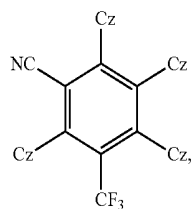


Compound 736

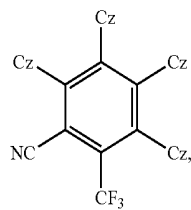
Compound 737



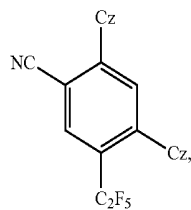
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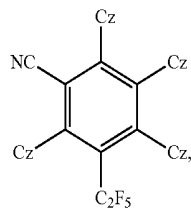
Compound 739



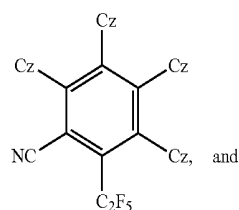
Compound 740



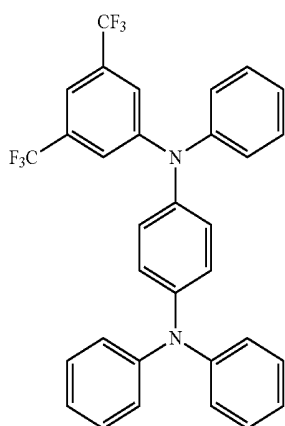
Compound 741



Compound 742

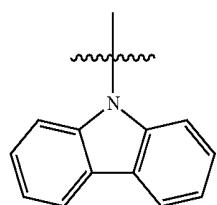


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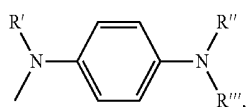
Compound 743

As used herein Cz is



[0092] In some embodiments, the compound comprises two structures according to Formula 2 bonded together. In some embodiments, the two structures of Formula 2 are part of a fused ring system.

[0093] In some embodiments, at least one R group comprises the structure of Formula 3:



Formula 3

wherein R', R'', and R''' are independently aryl or heteroaryl. In some embodiments, at least one of R'' and R''' comprises a structure of Formula 2.

[0094] In some embodiments, the first device emits a luminescent radiation at room temperature when a voltage is applied across the organic light emitting device, and the luminescent radiation comprises a delayed fluorescence process.

[0095] In some embodiments, the emissive layer further comprises a host material. In some embodiments, the emissive layer further comprises a first phosphorescent emitting material. In some embodiments, the emissive layer also includes a second phosphorescent emitting material.

[0096] In some embodiments, the first device emits a white light at room temperature when a voltage is applied across the organic light emitting device.

[0097] In some embodiments, the compound comprising a structure according to Formula 2 emits a blue light with a peak wavelength of about 400 nm to about 500 nm. In some embodiments, the compound comprising a structure accord-

ing to Formula 2 emits a yellow light with a peak wavelength of about 530 nm to about 580 nm.

[0098] In yet another aspect of the present disclosure, a formulation that comprises a compound according to Formula 1 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.

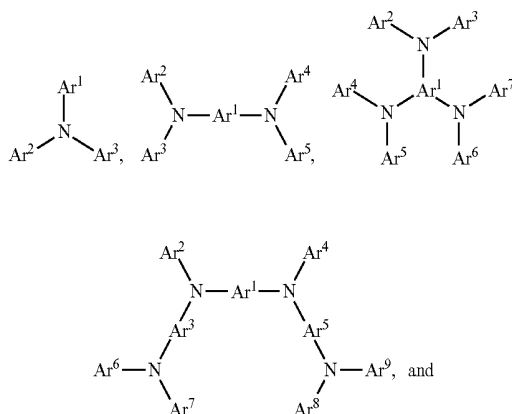
Combination with Other Materials

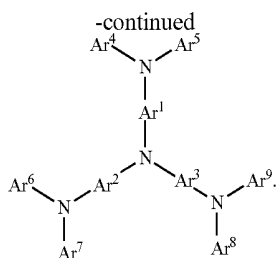
[0099] The materials described herein as useful for a particular layer in an organic light emitting device may be used in combination with a wide variety of other materials present in the device. For example, emissive dopants disclosed herein may be used in conjunction with a wide variety of hosts, transport 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:

[0100] 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.

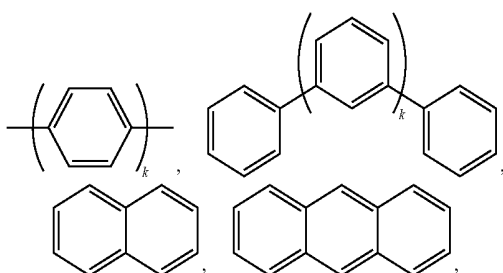
[0101] Examples of aromatic amine derivatives used in HIL or HTL include, but not limit to the following general structures:



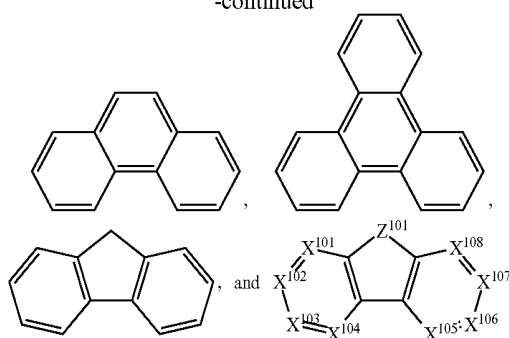


[0102] Each of Ar¹ to Ar⁹ is selected from the group consisting of aromatic hydrocarbon cyclic compounds such as benzene, biphenyl, triphenyl, triphenylene, naphthalene, anthracene, phenalene, phenanthrene, fluorene, pyrene, chrysene, perylene, and azulene; the group consisting of aromatic heterocyclic 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, cinoline, quinazoline, quinoxaline, naphthyridine, phthalazine, pteridine, xanthene, acridine, phenazine, phenothiazine, phenoxazine, benzofuropridine, furodipyridine, benzothienopyridine, thienodipyridine, benzoselenophenopyridine, and selenophenodipyridine; and the group consisting of 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.

[0103] In one aspect, Ar¹ to Ar⁹ is independently selected from the group consisting of:

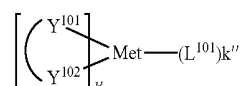


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wherein k is an integer from 1 to 20; X¹⁰¹ to X¹⁰⁷ is C (including CH) or N; Z¹⁰¹ is NAr¹, O, or S; Ar¹ has the same group defined above.

[0104] Examples of metal complexes used in HIL or HTL include, but not limit to the following general formula:



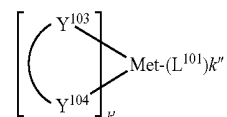
wherein Met is a metal, which can have an atomic weight greater than 40; (Y¹⁰¹-Y¹⁰²) is a bidentate ligand, Y¹⁰¹ and Y¹⁰² are independently selected from C, N, O, P, and S; L¹⁰¹ is an ancillary ligand; k' is an integer value from 1 to the maximum number of ligands that may be attached to the metal; and k'+k'' is the maximum number of ligands that may be attached to the metal.

[0105] In one aspect, (Y¹⁰¹-Y¹⁰²) is a 2-phenylpyridine derivative. In another aspect, (Y¹⁰¹-Y¹⁰²) 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:

[0106] 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.

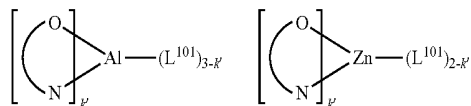
[0107] Examples of metal complexes used as host are preferred to have the following general formula:



wherein Met is a metal; (Y¹⁰³-Y¹⁰⁴) is a bidentate ligand, Y¹⁰³ and Y¹⁰⁴ are independently selected from C, N, O, P, and S; L¹⁰¹ is 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.

[0108] In one aspect, the metal complexes are:

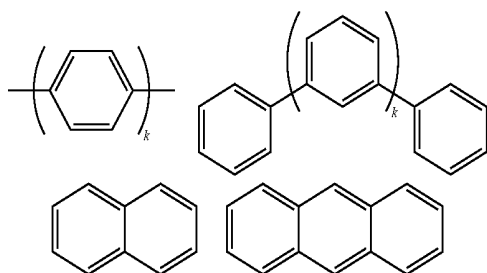


wherein (O—N) is a bidentate ligand, having metal coordinated to atoms O and N.

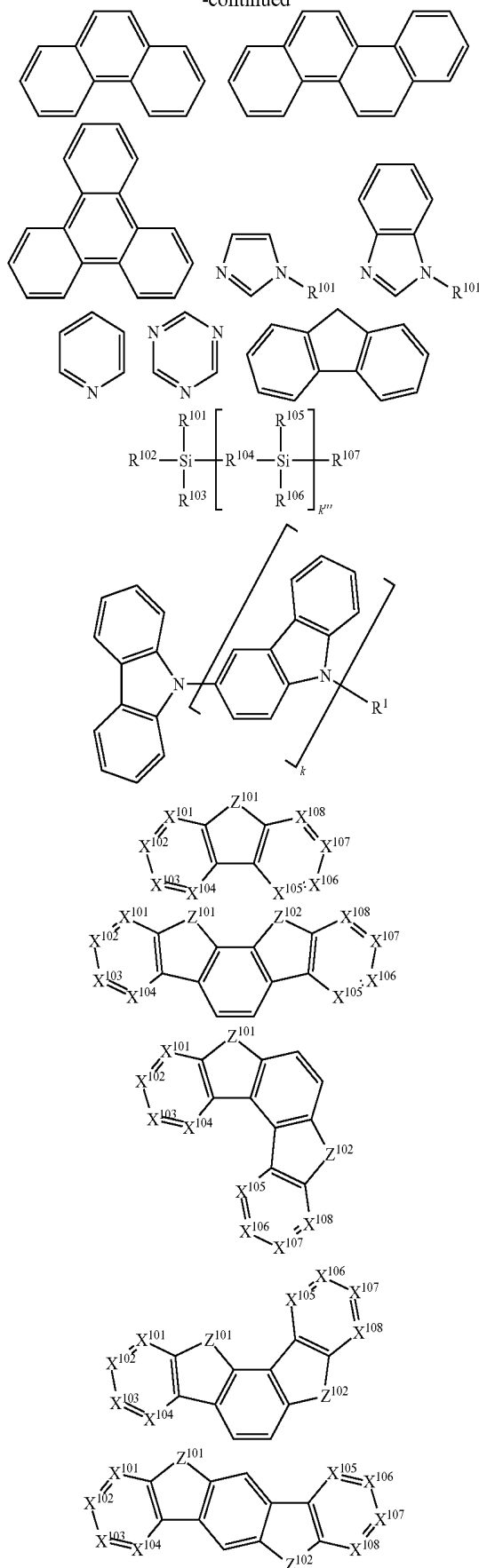
[0109] In another aspect, Met is selected from Ir and Pt. In a further aspect, $(\text{Y}^{103}-\text{Y}^{104})$ is a carbene ligand.

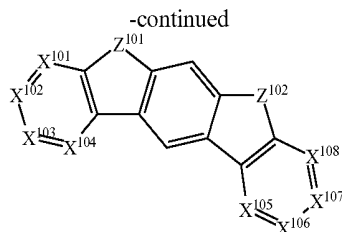
[0110] Examples of organic compounds used as host are selected from the group consisting of aromatic hydrocarbon cyclic compounds such as benzene, biphenyl, triphenyl, triphenylene, naphthalene, anthracene, phenalene, phenanthrene, fluorene, pyrene, chrysene, perylene, and azulene; the group consisting of aromatic heterocyclic compounds such as dibenzothiophene, dibenzofuran, dibenzoselenophene, furan, thiophene, benzofuran, benzothiophene, benzosele-nophene, carbazole, indolocarbazole, pyridylindole, pyrrolo-dipyridine, 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, iso-quinoline, cinnoline, quinazoline, quinoxaline, naphthyri-dine, phthalazine, pteridine, xanthene, acridine, phenazine, phenothiazine, phenoxazine, benzofuopyridine, furodipyri-dine, benzothienopyridine, thienodipyridine, benzosele-nophenopyridine, and selenophenodipyridine; and the group consisting of 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 substi-tuted by a substituent selected from the group consisting of hydrogen, deuterium, halide, alkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, aryloxy, amino, silyl, alkenyl, cycloalk-enyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, and combinations thereof.

[0111] In one aspect, host compound contains at least one of the following groups in the molecule:



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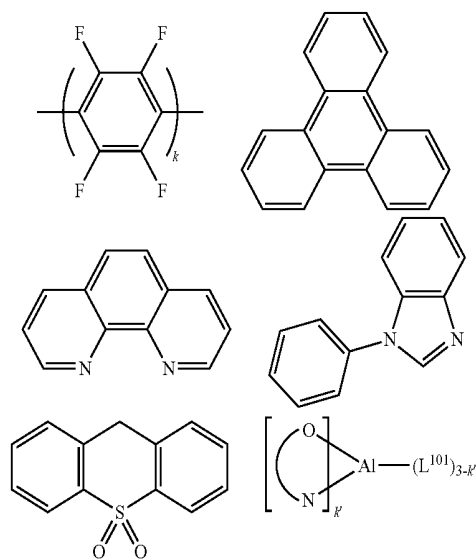
wherein R¹⁰¹ to R¹⁰⁷ is independently selected from the group consisting of hydrogen, deuterium, halide, alkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, aryloxy, amino, silyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, 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^m is an integer from 0 to 20. X¹⁰¹ to X¹⁰⁸ is selected from C (including CH) or N. Z¹⁰¹ and Z¹⁰² is selected from NR¹⁰¹, O, or S.

HBL:

[0112] 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.

[0113] In one aspect, compound used in HBL contains the same molecule or the same functional groups used as host described above.

[0114] In another aspect, compound used in HBL contains at least one of the following groups in the molecule:



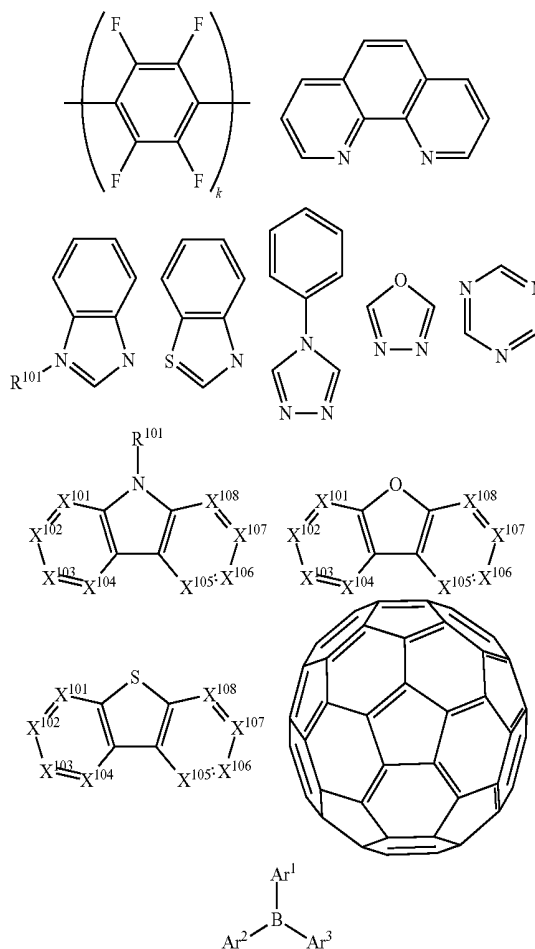
wherein k is an integer from 1 to 20; L¹⁰¹ is another ligand, k' is an integer from 1 to 3.

ETL:

[0115] Electron transport layer (ETL) may include a material capable of transporting electrons. Electron transport layer

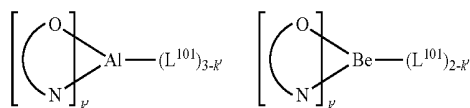
may be intrinsic (undoped), or doped. Doping may be used to enhance conductivity. Examples of the ETL material are not particularly limited, and any metal complexes or organic compounds may be used as long as they are typically used to transport electrons.

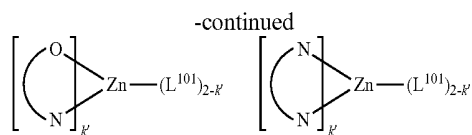
[0116] In one aspect, compound used in ETL contains at least one of the following groups in the molecule:



wherein R¹⁰¹ 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. Ar¹ to Ar³ has the similar definition as Ar's mentioned above. k is an integer from 1 to 20. X¹⁰¹ to X¹⁰⁸ is selected from C (including CH) or N.

[0117] 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; L¹⁰¹ is another ligand; k' is an integer value from 1 to the maximum number of ligands that may be attached to the metal.

[0118] 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.

[0119] In addition to and/or in combination with the materials disclosed herein, many hole injection materials, hole transporting materials, host materials, dopant materials, exciton/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 A below. Table A lists non-limiting classes of materials, non-limiting examples of compounds for each class, and references that disclose the materials.

TABLE A

MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Hole injection materials		
Phthalocyanine and porphyrin compounds		Appl. Phys. Lett. 69, 2160 (1996)
Starburst triarylaminines		J. Lumin. 72-74, 985 (1997)
CF _x Fluorohydrocarbon polymer	$\text{—}[\text{CH}_x\text{F}_y]_n\text{—}$	Appl. Phys. Lett. 78, 673 (2001)

TABLE A-continued

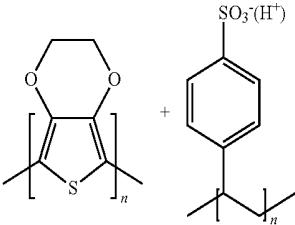
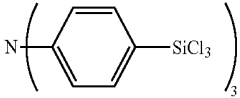
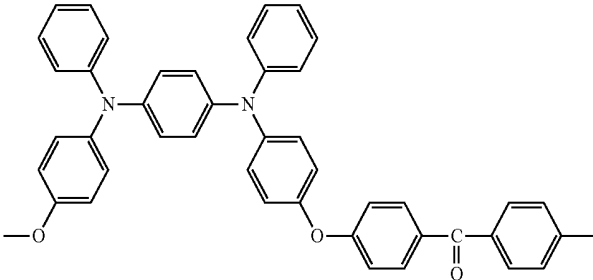
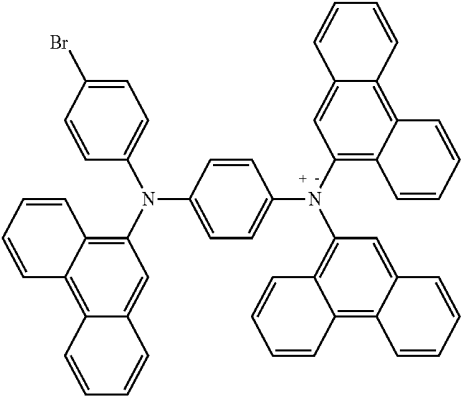
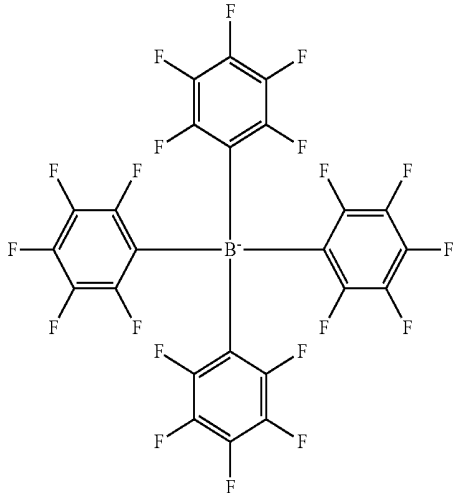
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Conducting polymers (e.g., PEDOT:PSS, polyaniline, polythiophene)		Synth. Met. 87, 171 (1997) WO2007002683
Phosphonic acid and silane SAMs		US20030162053
Triarylamine or polythiophene polymers with conductivity dopants		EP1725079A1
	and	
		
		

TABLE A-continued

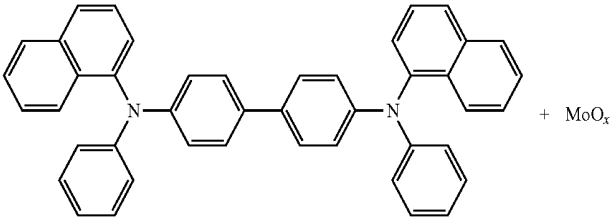
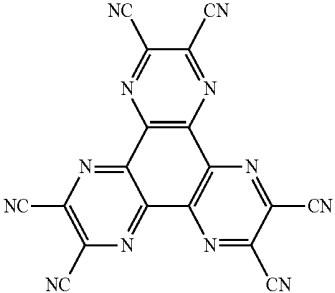
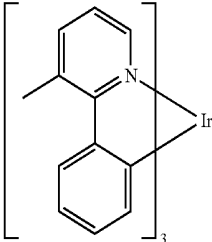
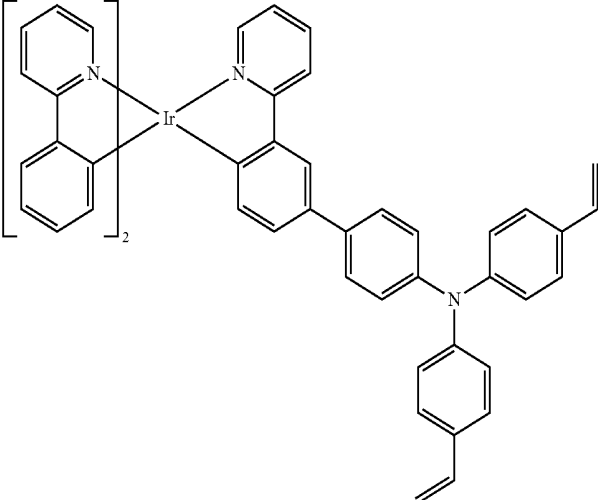
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Organic compounds with conductive inorganic compounds, such as molybdenum tungsten oxides	 <p>The structure shows a central nitrogen atom bonded to two phenyl rings. This nitrogen is also bonded to a biphenyl group. The biphenyl group is further linked to a para-phenylene ring, which is connected to another para-phenylene ring, which is finally bonded to another nitrogen atom. This second nitrogen atom is bonded to two phenyl rings. To the right of the structure is the text "+ MoO_x".</p>	US20050123751 SID Symposium Digest, 37, 923 (2006) WO2009018009
n-type semiconducting organic complexes	 <p>The structure is a porphyrin ring system with four nitrogen atoms at the corners. Each of the four meso positions (the carbons between the nitrogens) is substituted with a cyano group (-CN).</p>	US20020158242
Metal organometallic complexes	 <p>The structure shows an iridium (Ir) atom coordinated to three nitrogen atoms of a terpyridine-like ligand. The ligand consists of three pyridine rings fused together. The entire complex is enclosed in large square brackets with a subscript '3' at the bottom right.</p>	US20060240279
Cross-linkable compounds	 <p>The structure shows an iridium (Ir) atom coordinated to two nitrogen atoms of a terpyridine-like ligand (enclosed in brackets with a subscript '2') and one nitrogen atom of a separate ligand. This separate ligand consists of a central benzene ring connected to two para-phenylene rings. One of these para-phenylene rings is further connected to another para-phenylene ring that has a vinyl group (-CH=CH₂) attached to it. The other para-phenylene ring is also connected to a para-phenylene ring with a vinyl group attached to it.</p>	US20080220265

TABLE A-continued

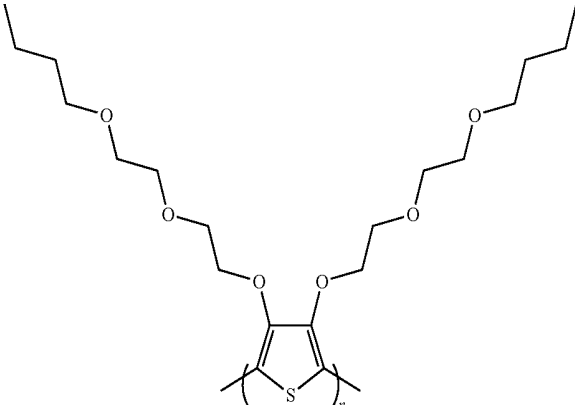
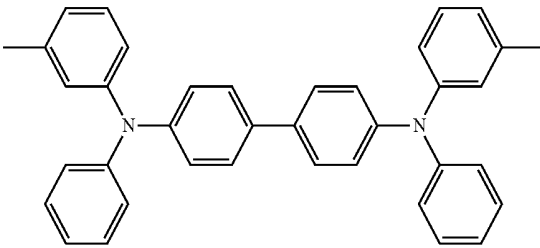
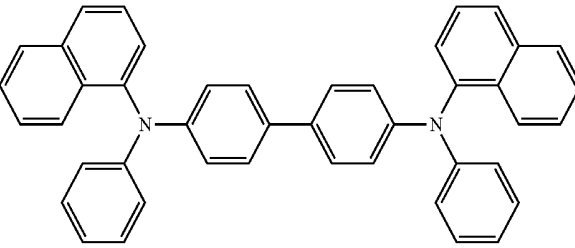
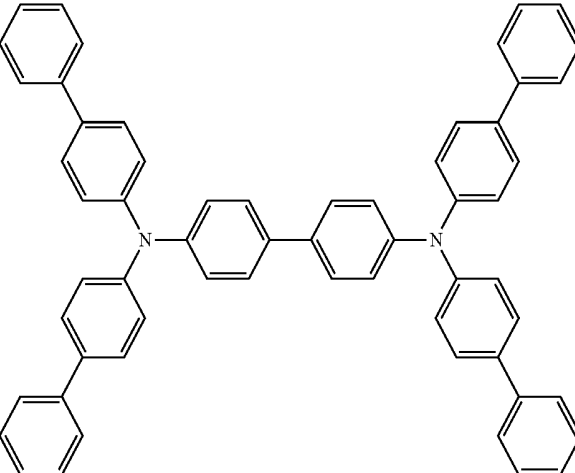
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Polythiophene based polymers and copolymers		WO 2011075644 EP2350216
Hole transporting materials		
Triarylamines (e.g., TPD, α -NPD)		Appl. Phys. Lett. 51, 913 (1987)
		US5061569
		EP650955

TABLE A-continued

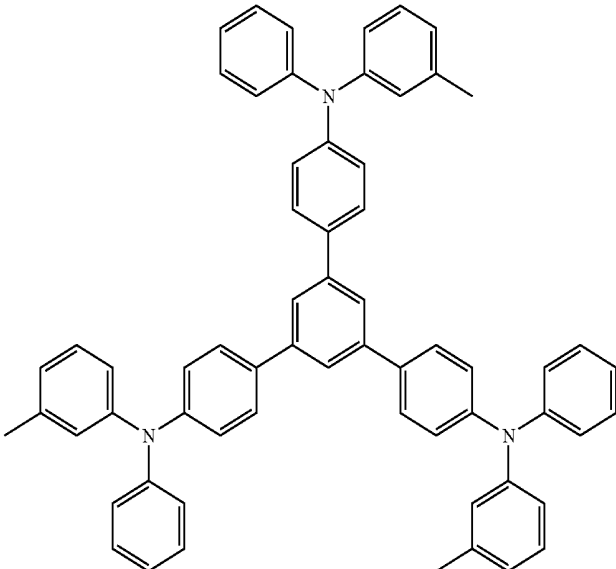
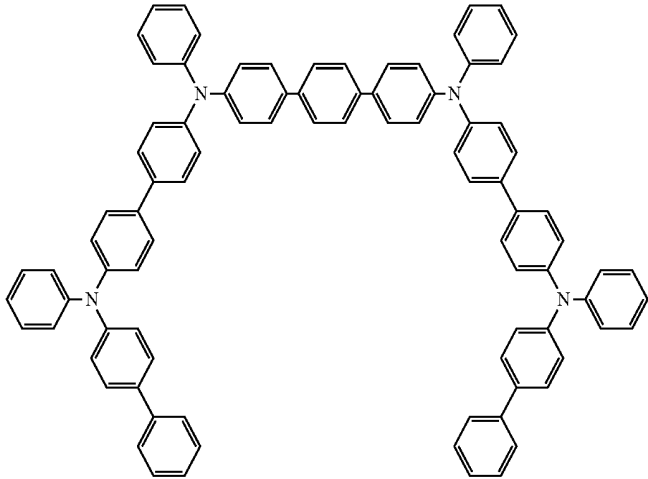
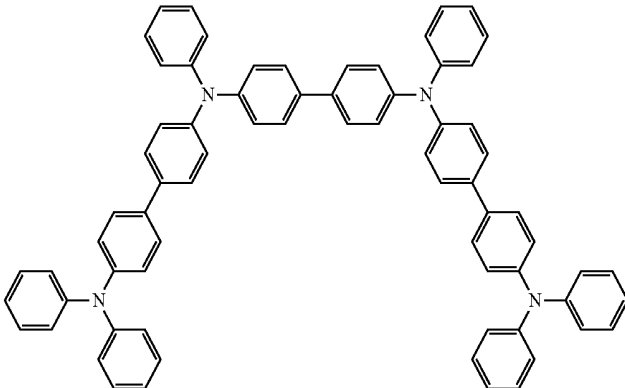
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
		J. Mater. Chem. 3, 319 (1993)
		Appl. Phys. Lett. 90, 183503 (2007)
		Appl. Phys. Lett. 90, 183503 (2007)

TABLE A-continued

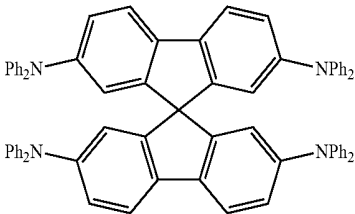
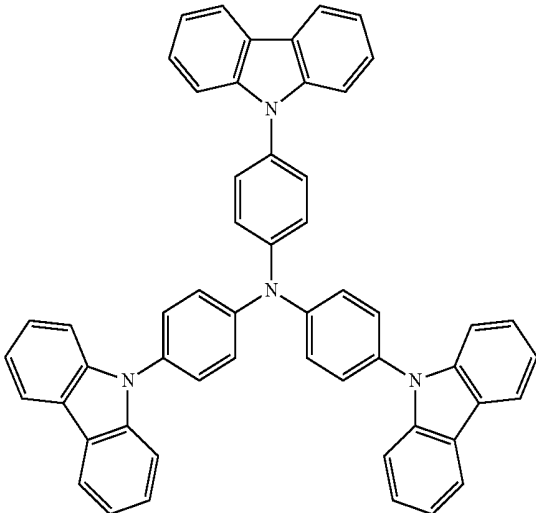
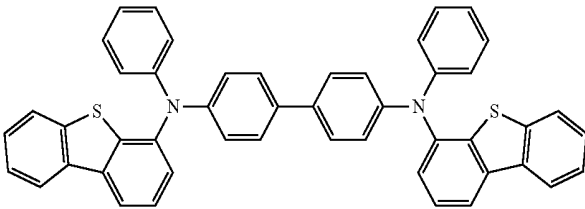
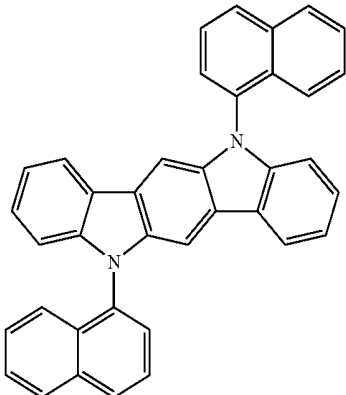
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Triarylamine on spirofluorene core		Synth. Met. 91, 209 (1997)
Arylamine carbazole compounds		Adv. Mater. 6, 677 (1994), US20080124572
Triarylamine with (di)benzothiophene/ (di)benzofuran		US200702789238, US20080106190 US20110163302
Indolocarbazoles		Synth. Met. 111, 421 (2000)

TABLE A-continued

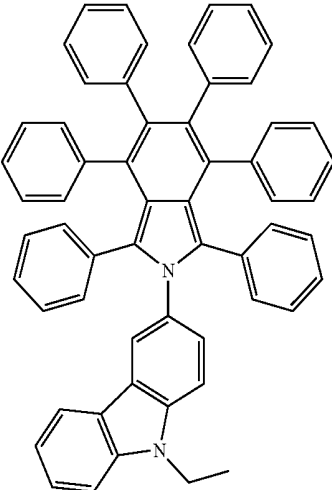
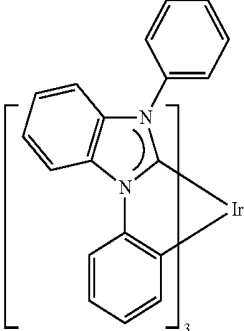
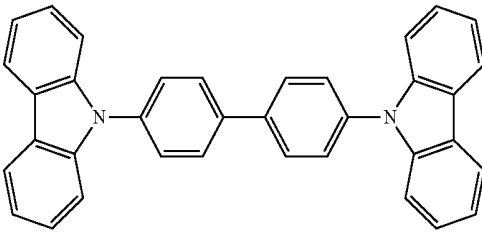
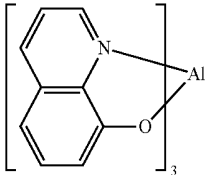
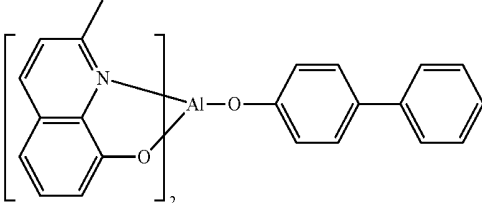
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Isoindole compounds		Chem. Mater. 15, 3148 (2003)
Metal carbene complexes		US20080018221
Phosphorescent OLED host materials Red hosts		
Arylcarbazoles		Appl. Phys. Lett. 78, 1622 (2001)
Metal 8-hydroxyquinolates (e.g., Alq ₃ , BAlq)		Nature 395, 151 (1998)
		US20060202194

TABLE A-continued

MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Metal phenoxybenzothiazole compounds		WO2005014551
		WO2006072002
Conjugated oligomers and polymers (e.g., polyfluorene)		Appl. Phys. Lett. 90, 123509 (2007)
Aromatic fused rings		WO2009066779, WO2009066778, WO2009063833, US20090045731, US20090045730, WO2009008311, US20090008605, US20090009065
Zinc complexes		WO2010056066

TABLE A-continued

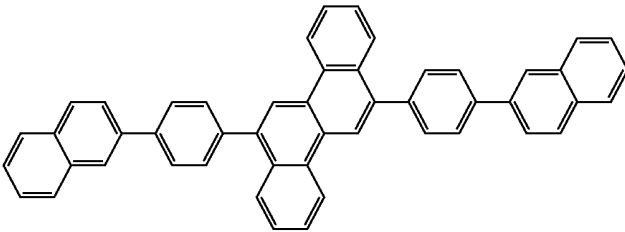
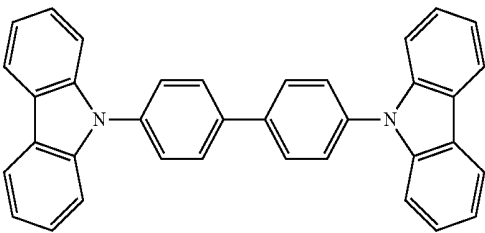
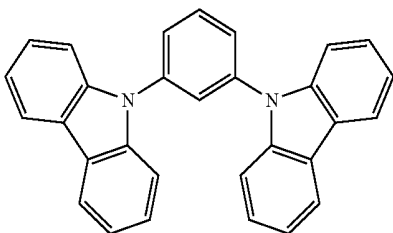
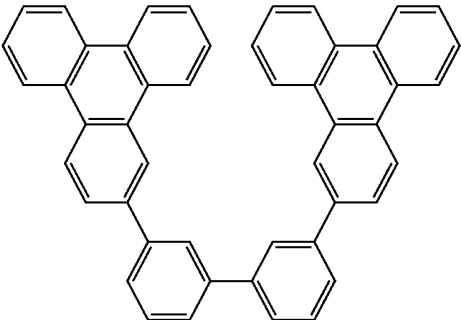
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Chrysene based compounds		WO2011086863
Green hosts	Arylcarbazoles	Appl. Phys. Lett. 78, 1622 (2001)
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		WO2001039234
Aryltriphenylene compounds		US20060280965

TABLE A-continued

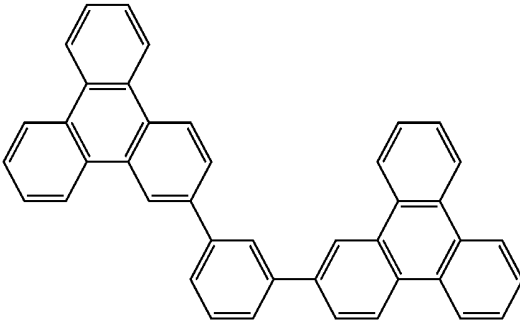
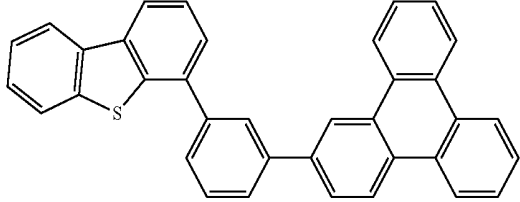
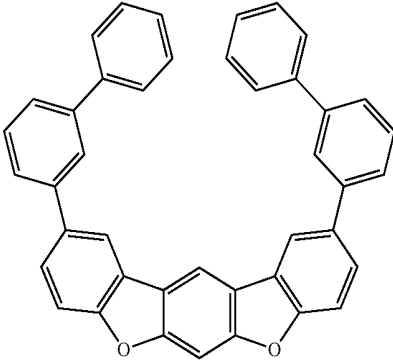
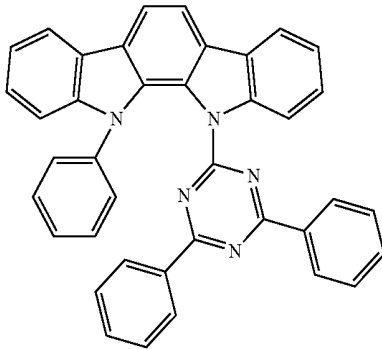
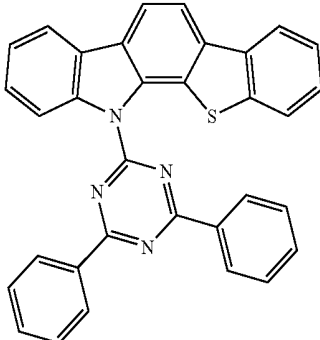
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Poly-fused heteroaryl compounds		US20060280965
		WO2009021126
Donor acceptor type molecules		US20090309488 US20090302743 US20100012931
		WO2008056746
		WO2010107244

TABLE A-continued

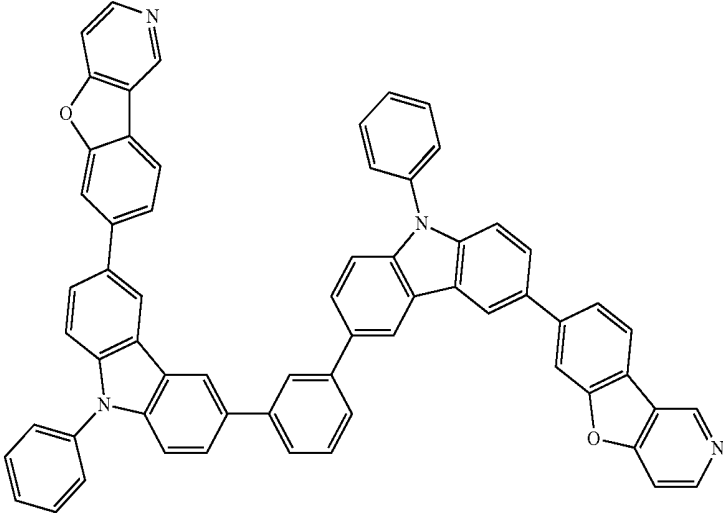
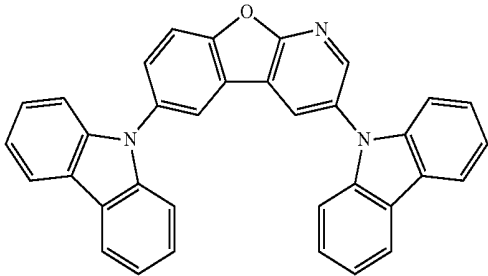
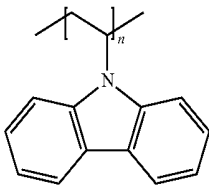
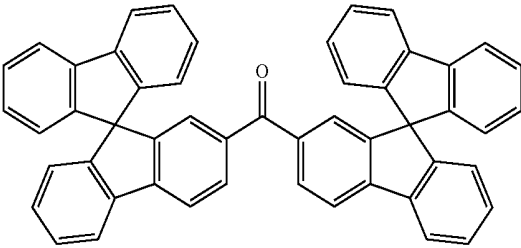
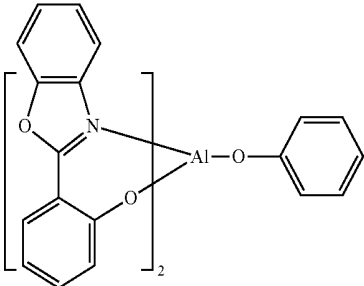
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Aza-carbazole/ DBT/DBF		JP2008074939
		US20100187984
Polymers (e.g., PVK)		Appl. Phys. Lett. 77, 2280 (2000)
Spirofluorene compounds		WO2004093207
Metal phenoxybenzoxazole compounds		WO2005089025

TABLE A-continued

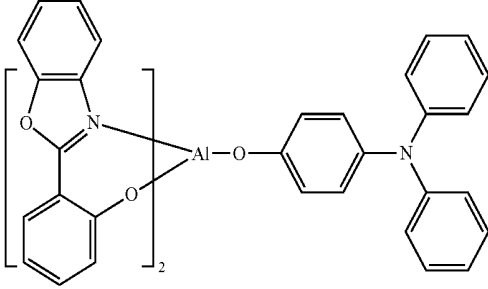
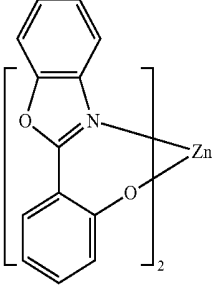
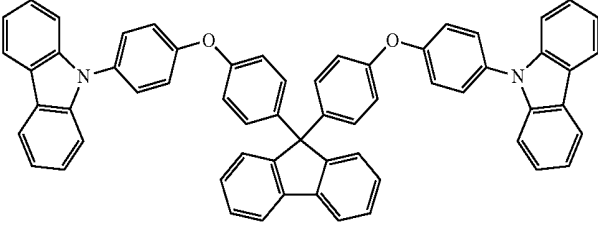
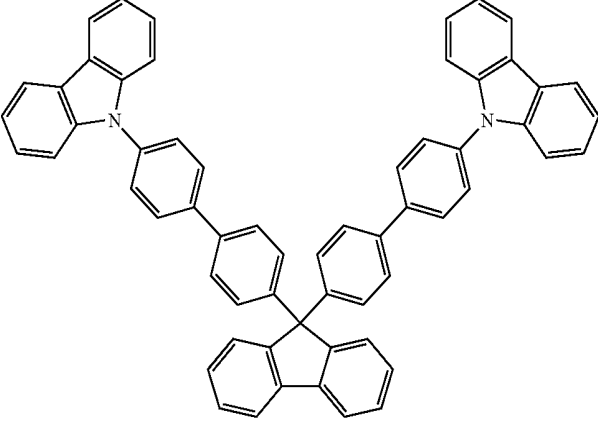
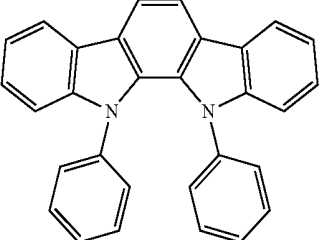
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
		WO2006132173
		JP200511610
Spirofluorene-carbazole compounds		JP2007254297
		JP2007254297
Indolocarbazoles		WO2007063796

TABLE A-continued

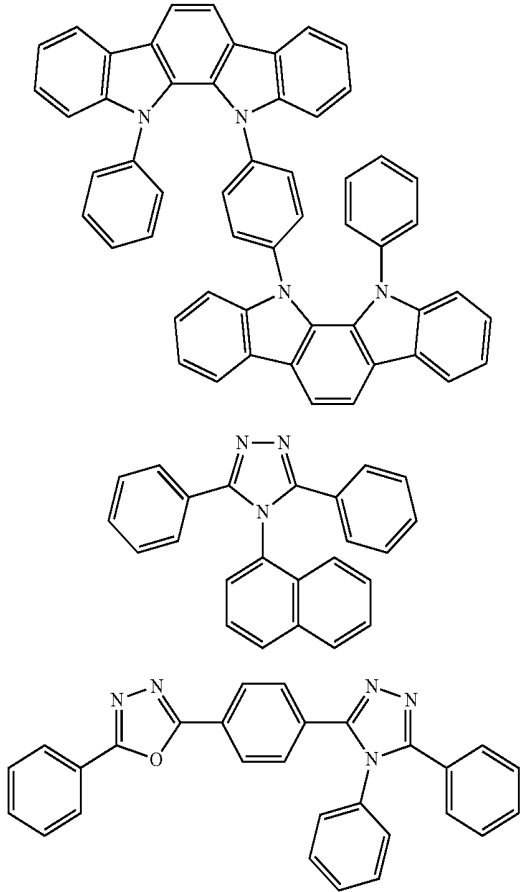
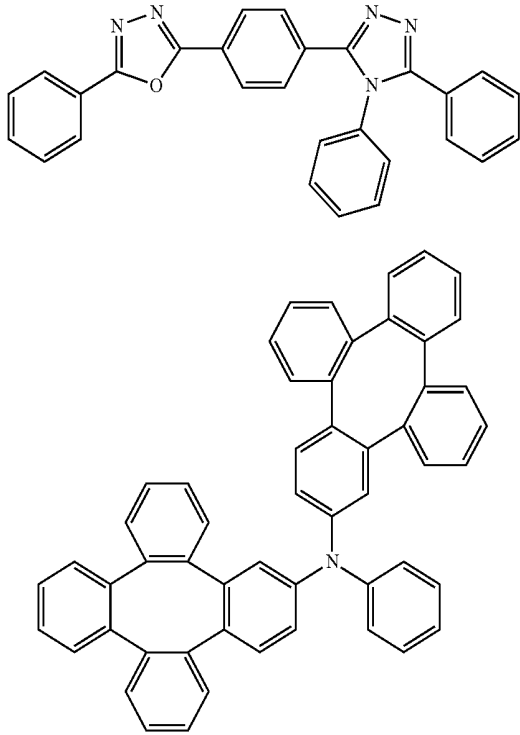
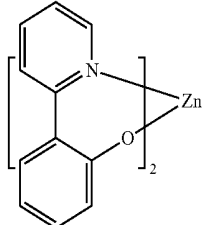
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
5-member ring electron deficient heterocycles (e.g., triazole, oxadiazole)		<p>WO2007063754</p> <p>J. Appl. Phys. 90, 5048 (2001)</p>
Tetraphenylene complexes		<p>WO2004107822</p> <p>US20050112407</p>
Metal phenoxy pyridine compounds		<p>WO2005030900</p>

TABLE A-continued

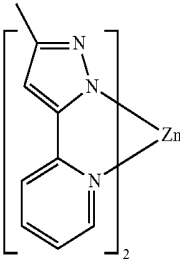
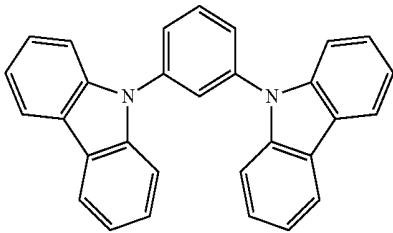
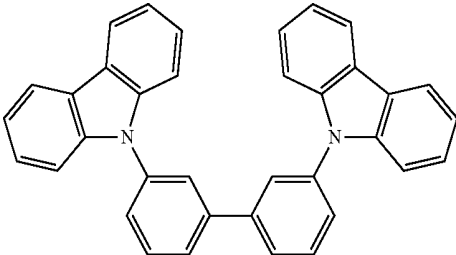
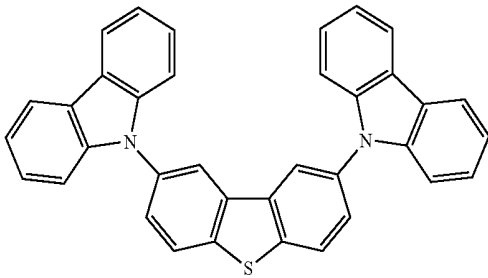
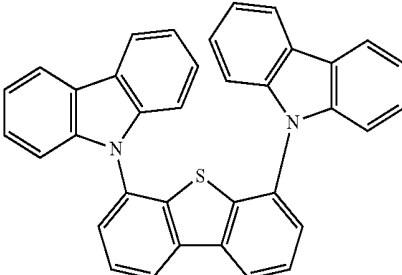
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Metal coordination complexes (e.g., Zn, Al with N ⁻ N ligands)		US20040137268, US20040137267
Blue hosts		
Arylcarbazoles		Appl. Phys. Lett, 82, 2422 (2003)
		US20070190359
Dibenzothiophene/ Dibenzofuran- carbazole compounds		WO2006114966, US20090167162
		US20090167162

TABLE A-continued

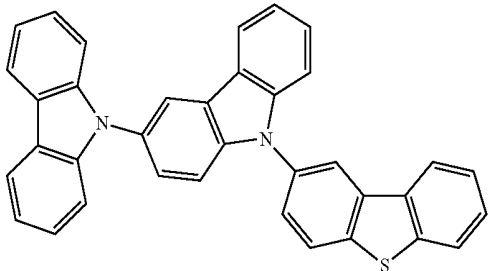
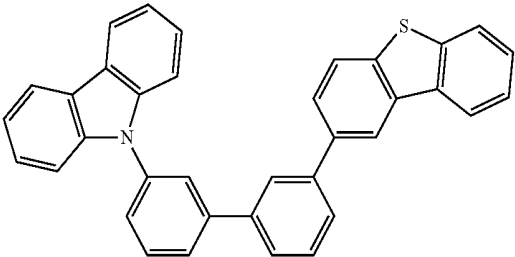
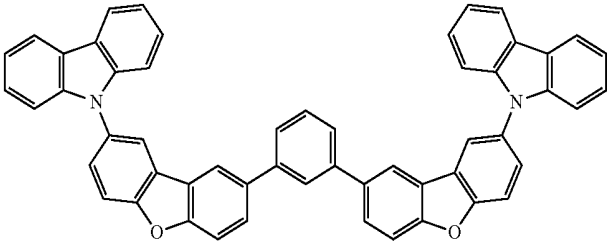
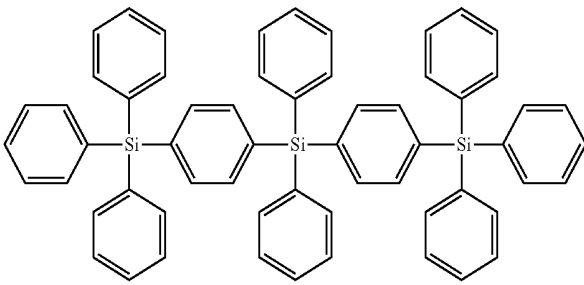
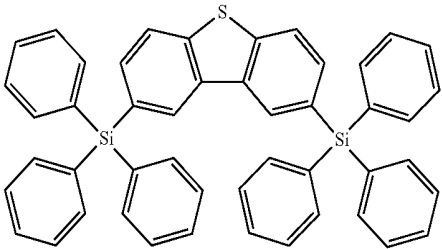
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
	 <p>A chemical structure consisting of two indole rings connected at their 3-positions to a central benzene ring. The 2-positions of the indole rings are also fused to benzene rings.</p>	WO2009086028
	 <p>A chemical structure consisting of two indole rings connected at their 3-positions to a biphenyl bridge. The 2-positions of the indole rings are also fused to benzene rings.</p>	US20090030202, US20090017330
	 <p>A chemical structure consisting of two indole rings connected at their 3-positions to a fluorene bridge. The 2-positions of the indole rings are also fused to benzene rings.</p>	US20100084966
Silicon aryl compounds	 <p>A chemical structure consisting of three phenyl rings connected to a central silicon atom. Each silicon atom is also bonded to two other phenyl rings, forming a chain of three silicon atoms connected by phenyl rings.</p>	US20050238919
	 <p>A chemical structure consisting of two indole rings connected at their 3-positions to a fluorene bridge. The 2-positions of the indole rings are also fused to benzene rings.</p>	WO2009003898

TABLE A-continued

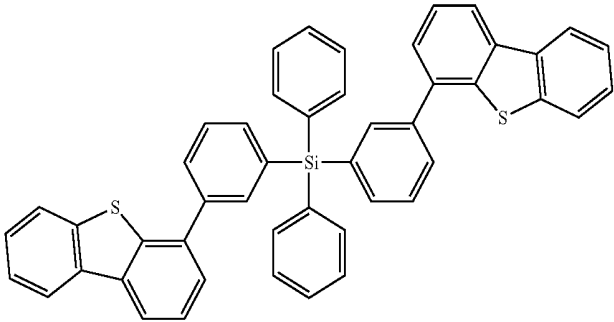
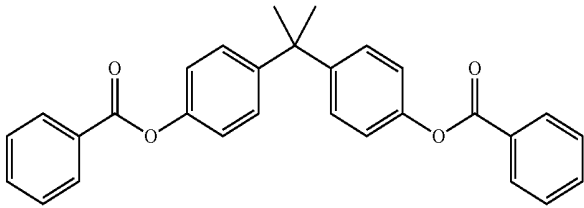
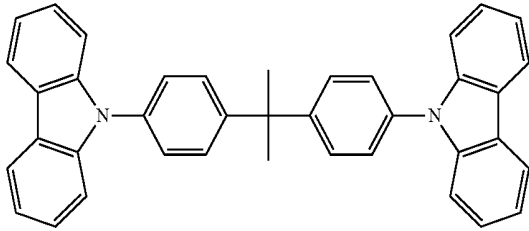
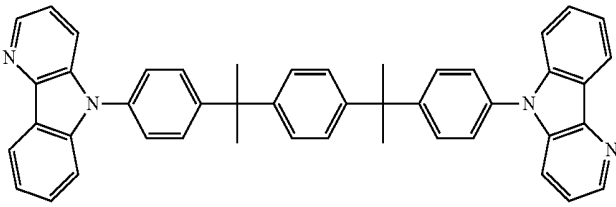
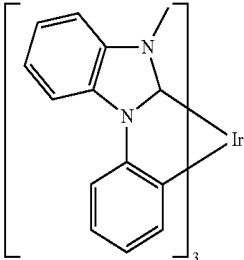
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Silicon/Germanium aryl compounds		EP2034538A
Aryl benzoyl ester		WO2006100298
Carbazole linked by non-conjugated groups		US20040115476
Aza-carbazoles		US20060121308
High triplet metal organometallic complex		US7154114

TABLE A-continued

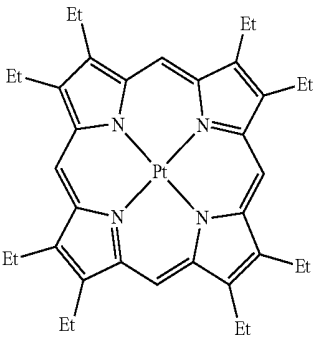
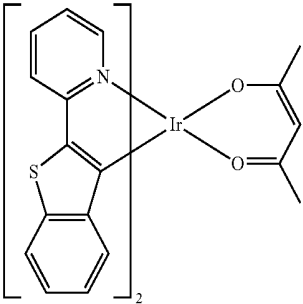
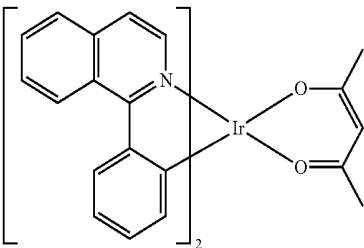
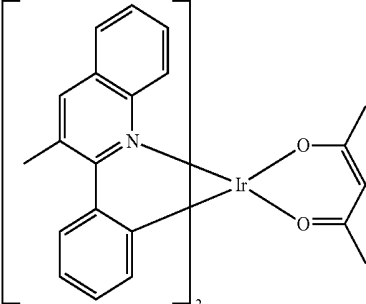
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Phosphorescent dopants Red dopants		
Heavy metal porphyrins (e.g., PtOEP)		Nature 395, 151 (1998)
Iridium (III) organometallic complexes		Appl. Phys. Lett. 78, 1622 (2001)
		US20030072964
		US20030072964

TABLE A-continued

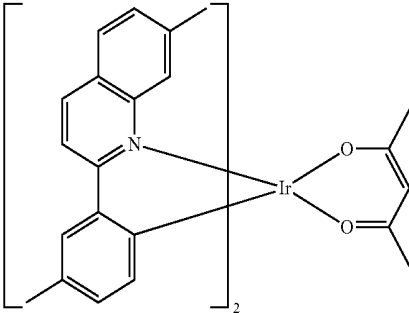
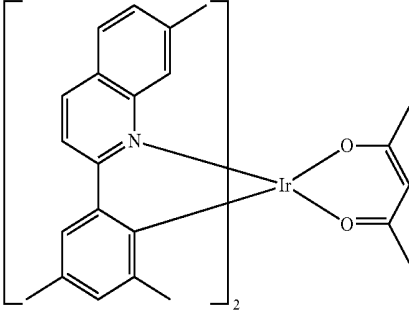
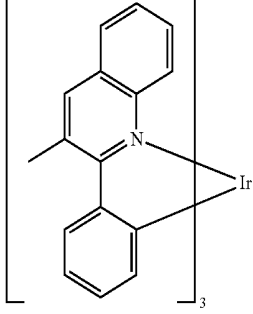
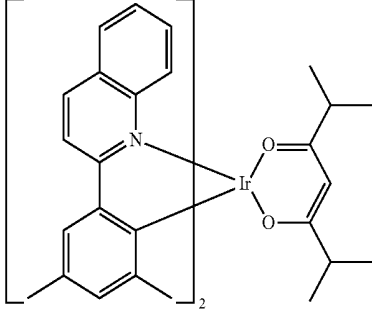
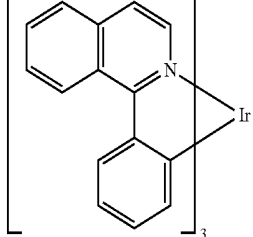
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		US20070087321
		US20080261076 US20100090591
		US20070087321

TABLE A-continued

MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
		Adv. Mater. 19, 739 (2007)
		WO2009100991
		WO2008101842
		US7232618
Platinum (II) organometallic complexes		WO2003040257

TABLE A-continued

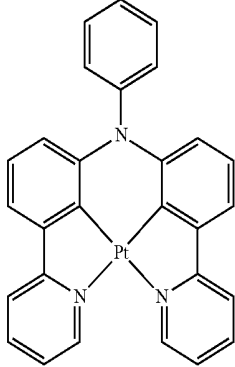
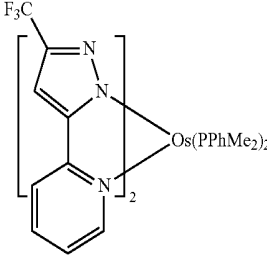
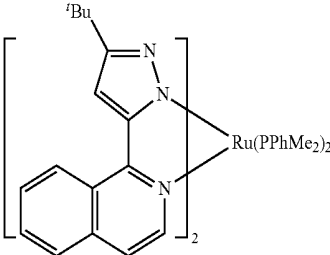
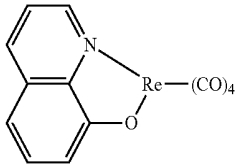
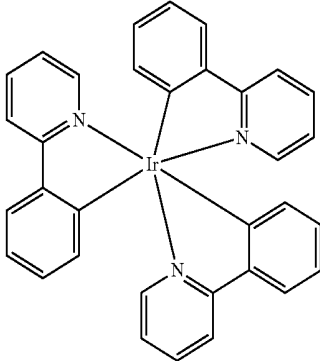
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
		US20070103060
Osmium (III) complexes		Chem. Mater. 17, 3532 (2005)
Ruthenium (II) complexes		Adv. Mater. 17, 1059 (2005)
Rhenium (I), (II), and (III) complexes		US20050244673
Green dopants Iridium (III) organometallic complexes	 <p style="text-align: center;">and its derivatives</p>	Inorg. Chem. 40, 1704 (2001)

TABLE A-continued

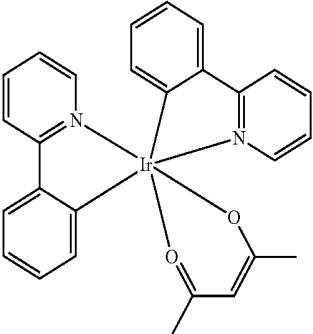
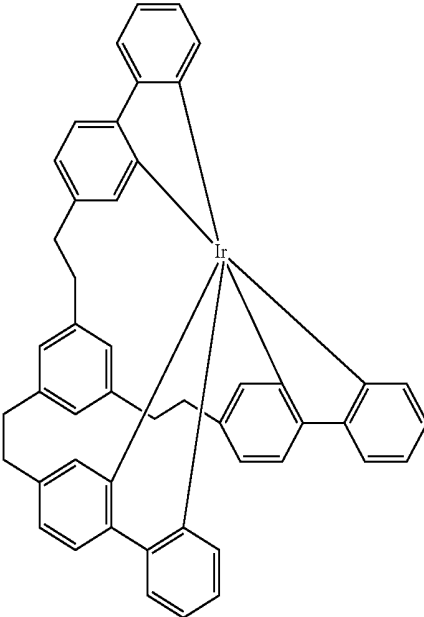
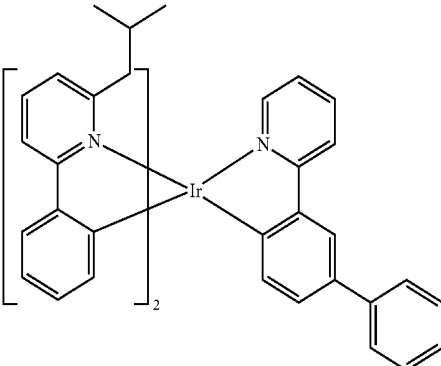
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
		US20020034656
		US7332232
		US20090108737

TABLE A-continued

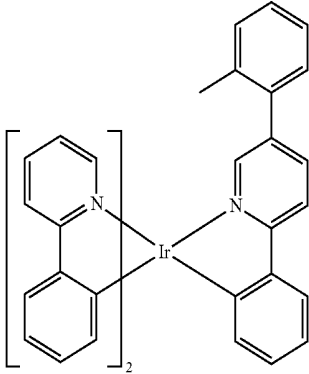
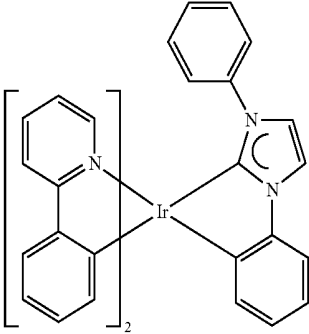
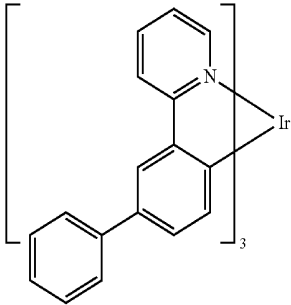
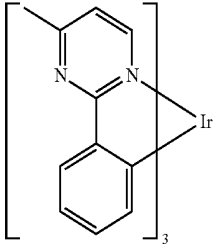
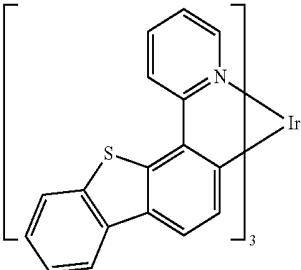
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
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		EP1841834B
		US20060127696
		US20090039776
		US6921915

TABLE A-continued

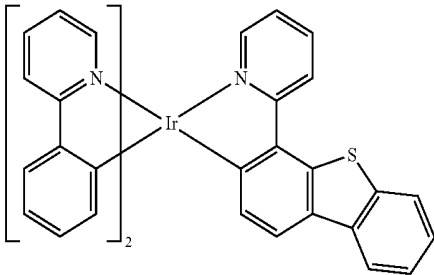
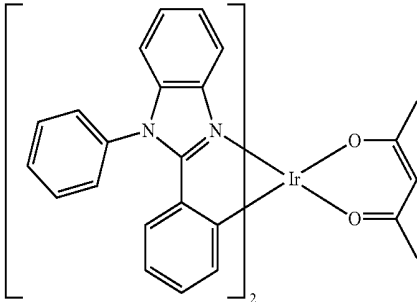
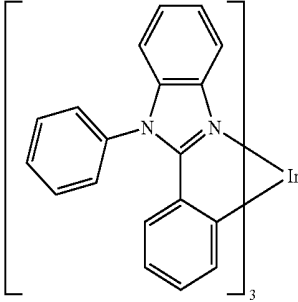
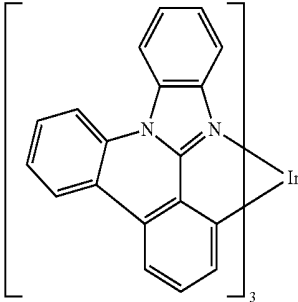
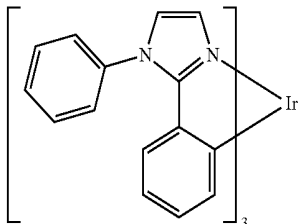
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
	 <p>The structure shows an Ir atom coordinated to two bipyridine ligands (one in brackets with a subscript 2) and one thienopyridine ligand.</p>	US20100244004
	 <p>The structure shows an Ir atom coordinated to a phenylpyridine ligand (in brackets with a subscript 2), a pyridine ligand, and a chelating ligand with two oxygen atoms.</p>	US6687266
	 <p>The structure shows an Ir atom coordinated to a phenylpyridine ligand (in brackets with a subscript 3) and a pyridine ligand.</p>	Chem. Mater. 16, 2480 (2004)
	 <p>The structure shows an Ir atom coordinated to a phenylpyridine ligand (in brackets with a subscript 3) and a pyridine ligand.</p>	US20070190359
	 <p>The structure shows an Ir atom coordinated to a phenylpyridine ligand (in brackets with a subscript 3) and a pyridine ligand.</p>	US 20060008670 JP2007123392

TABLE A-continued

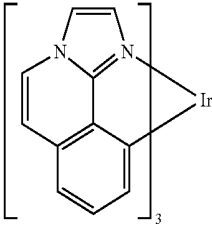
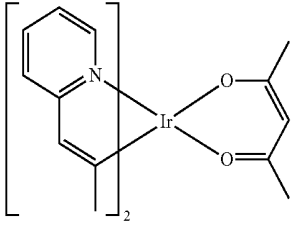
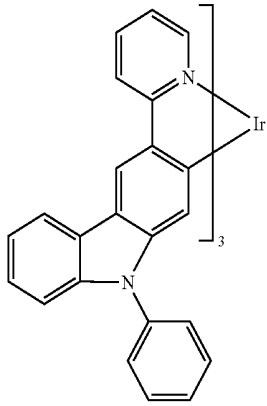
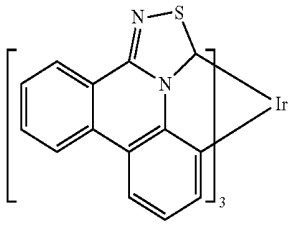
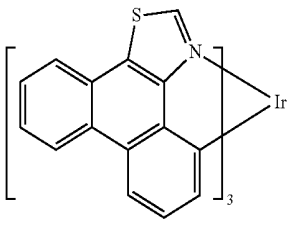
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
	 <p>The structure shows an Ir atom coordinated to a tricyclic ligand consisting of a benzene ring fused to a five-membered ring containing two nitrogen atoms, which is further fused to another benzene ring. The Ir atom is coordinated to the two nitrogen atoms and one of the carbons of the five-membered ring. The entire complex is enclosed in brackets with a subscript 3, indicating a trimeric species.</p>	WO2010086089, WO2011044988
	 <p>The structure shows an Ir atom coordinated to a bipyridine-like ligand (two pyridine rings connected at the 2 and 6 positions) and a cyclic ligand consisting of a six-membered ring with two oxygen atoms and two methyl groups. The Ir atom is coordinated to the two nitrogen atoms of the bipyridine and one of the oxygen atoms of the cyclic ligand. The bipyridine part is enclosed in brackets with a subscript 2, indicating a dimeric species.</p>	Adv. Mater. 16, 2003 (2004)
	 <p>The structure shows an Ir atom coordinated to a complex ligand consisting of a benzene ring fused to a five-membered ring containing one nitrogen atom, which is further fused to another benzene ring. The Ir atom is coordinated to the nitrogen atom and two carbons of the five-membered ring. The entire complex is enclosed in brackets with a subscript 3, indicating a trimeric species.</p>	Angew. Chem. Int. Ed. 2006, 45, 7800
	 <p>The structure shows an Ir atom coordinated to a tricyclic ligand consisting of a benzene ring fused to a five-membered ring containing one nitrogen atom and one sulfur atom, which is further fused to another benzene ring. The Ir atom is coordinated to the nitrogen atom and two carbons of the five-membered ring. The entire complex is enclosed in brackets with a subscript 3, indicating a trimeric species.</p>	WO2009050290
	 <p>The structure shows an Ir atom coordinated to a tricyclic ligand consisting of a benzene ring fused to a five-membered ring containing one nitrogen atom and one sulfur atom, which is further fused to another benzene ring. The Ir atom is coordinated to the nitrogen atom and two carbons of the five-membered ring. The entire complex is enclosed in brackets with a subscript 3, indicating a trimeric species.</p>	US20090165846

TABLE A-continued

MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
		US20080015355
		US20010015432
		US20100295032
Monomer for polymeric metal organometallic compounds		US7250226, US7396598
Pt (II) organometallic complexes, including polydentate ligands		Appl. Phys. Lett. 86, 153505 (2005)

TABLE A-continued

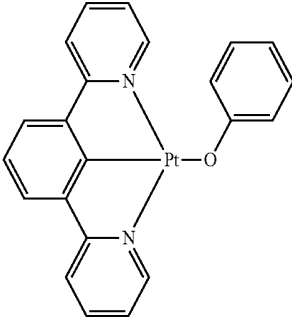
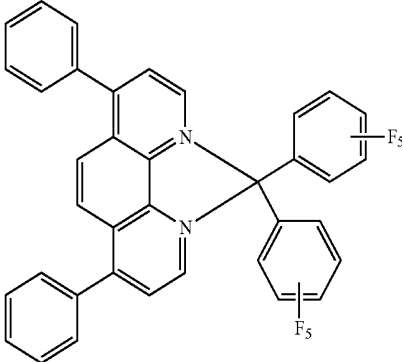
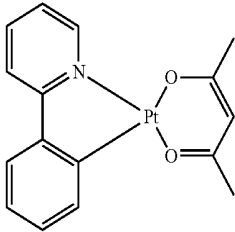
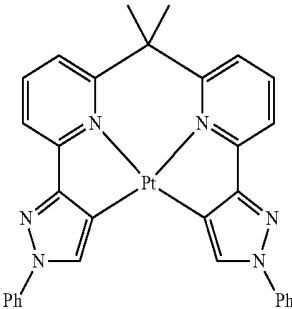
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
		Appl. Phys. Lett. 86, 153505 (2005)
		Chem. Lett. 34, 592 (2005)
		WO2002015645
		US20060263635

TABLE A-continued

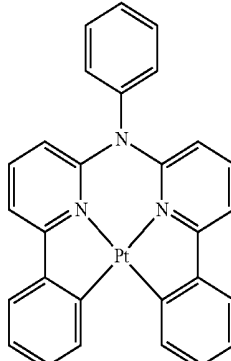
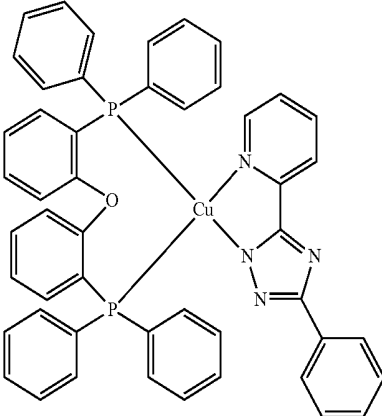
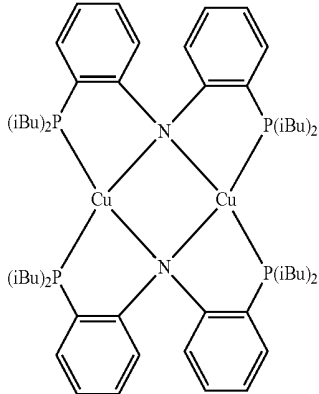
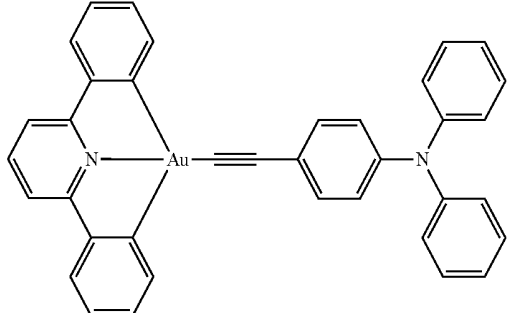
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
		US20060182992 US20070103060
Cu complexes		WO2009000673
		US20070111026
Gold complexes		Chem. Commun. 2906 (2005)

TABLE A-continued

MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Rhenium (III) complexes		Inorg. Chem. 42, 1248 (2003)
Osmium (II) complexes		US7279704
Deuterated organometallic complexes		US20030138657
Organometallic complexes with two or more metal centers		US20030152802

TABLE A-continued

MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
		US7090928
Blue dopants		
Iridium (III) organometallic complexes		WO2002002714
		WO2006009024
		US20060251923 US20110057559 US20110204333
		US7393599, WO2006056418, US20050260441, WO2005019373

TABLE A-continued

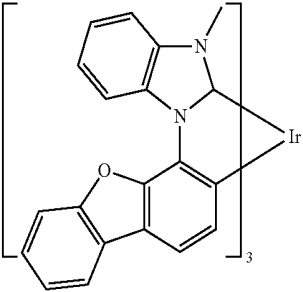
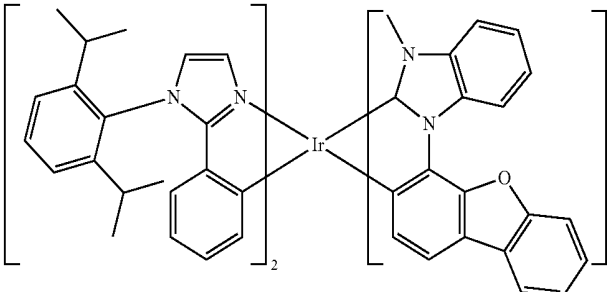
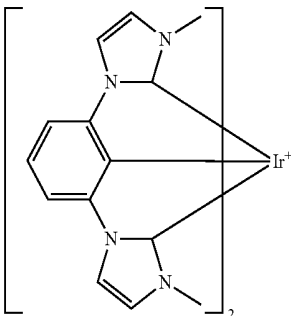
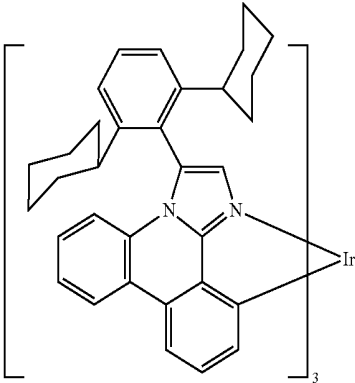
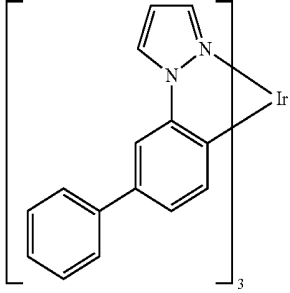
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
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		WO2011051404
		US7445855
		US20070190359, US20080297033 US20100148663
		US7338722

TABLE A-continued

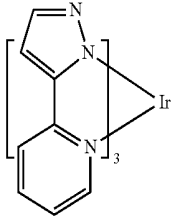
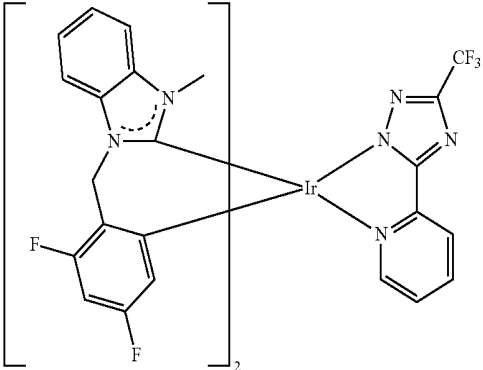
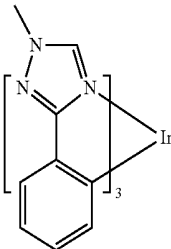
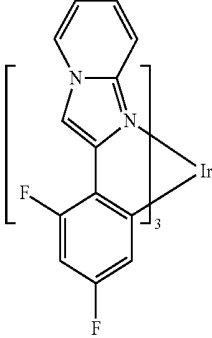
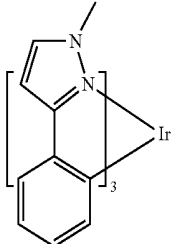
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
		US20020134984
		Angew. Chem. Int. Ed. 47, 4542 (2008)
		Chem. Mater. 18, 5119 (2006)
		Inorg. Chem. 46, 4308 (2007)
		WO2005123873

TABLE A-continued

MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
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		WO2007004380
		WO2006082742
Osmium (II) complexes		US7279704
		Organometallics 23, 3745 (2004)

TABLE A-continued

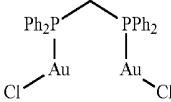
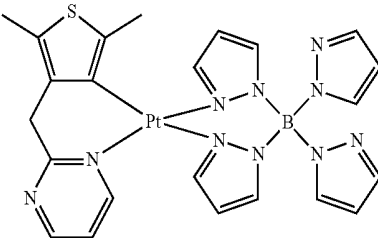
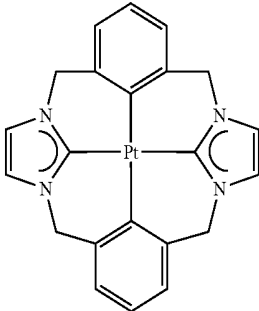
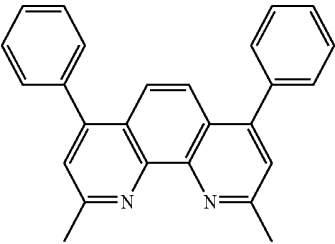
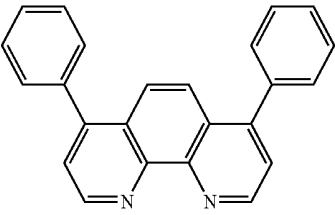
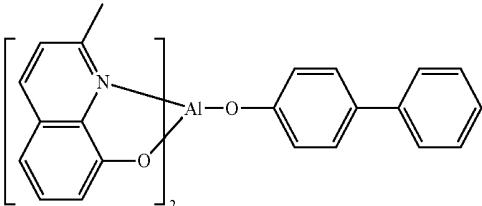
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Gold complexes		Appl. Phys. Lett. 74, 1361 (1999)
Platinum (II) complexes		WO2006098120, WO2006103874
Pt tetradenate complexes with at least one metal-carbene bond		US7655323
Exciton/hole blocking layer materials		
Bathocuprine compounds (e.g., BCP, BPhen)		Appl. Phys. Lett. 75, 4 (1999)
		Appl. Phys. Lett. 79, 449 (2001)
Metal 8-hydroxyquinolates (e.g., BA1q)		Appl. Phys. Lett. 81, 162 (2002)

TABLE A-continued

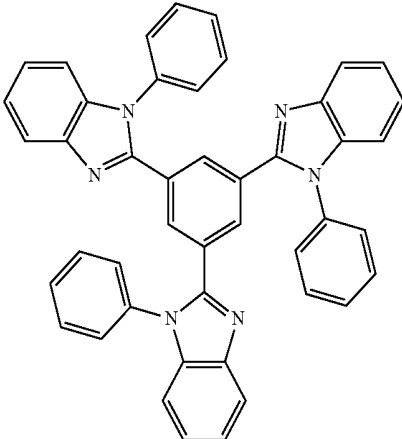
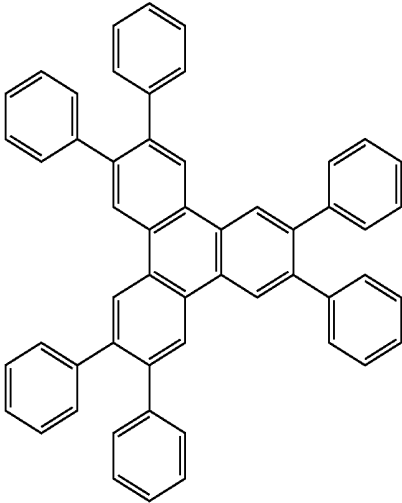
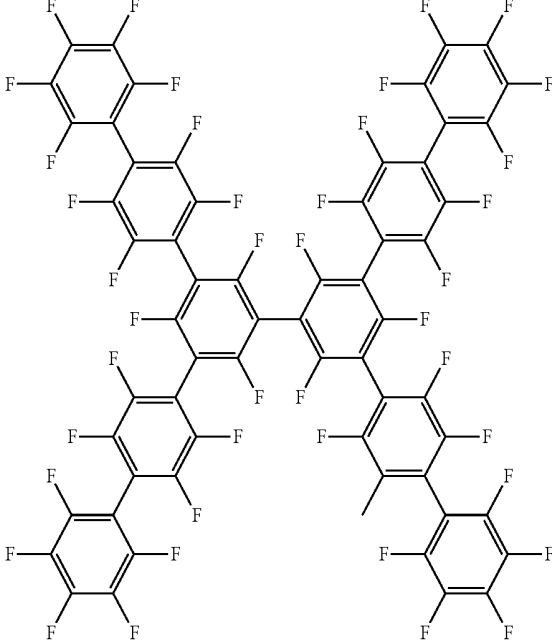
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
5-member ring electron deficient heterocycles such as triazole, oxadiazole, imidazole, benzoimidazole		Appl. Phys. Lett. 81, 162 (2002)
Triphenylene compounds		US20050025993
Fluorinated aromatic compounds		Appl. Phys. Lett. 79, 156 (2001)

TABLE A-continued

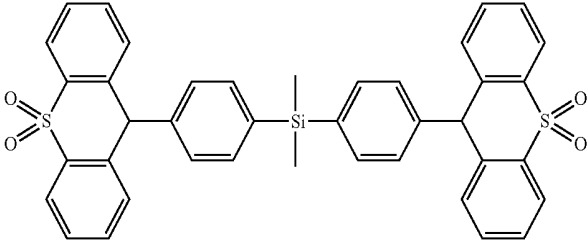
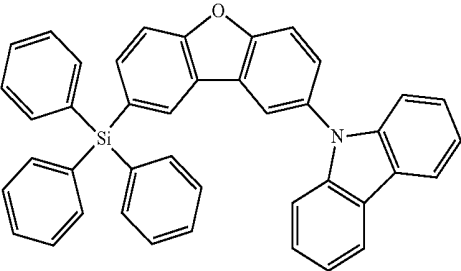
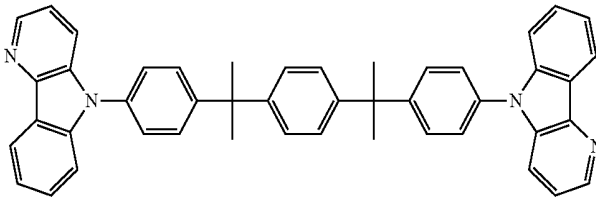
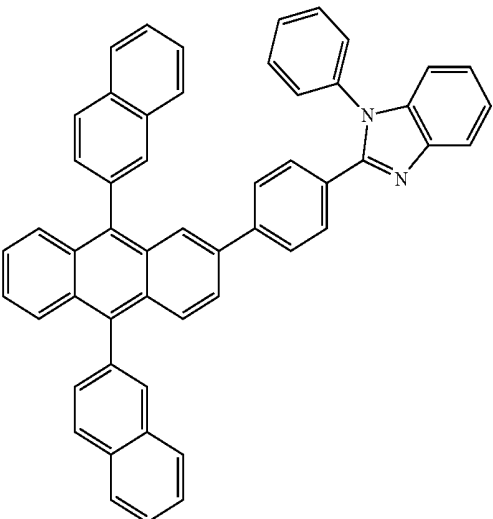
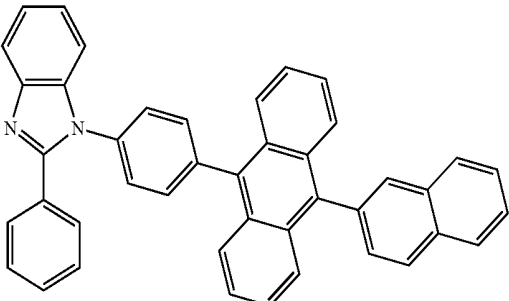
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Phenothiazine-S-oxide		WO20080132085
Silylated five-membered nitrogen, oxygen, sulfur or phosphorus dibenzoheterocycles		WO2010079051
Aza-carbazoles		US20060121308
Electron transporting materials		
Anthracene-benzimidazole compounds		WO2003060956
		US20090179554

TABLE A-continued

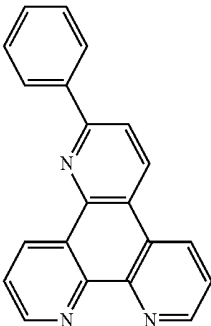
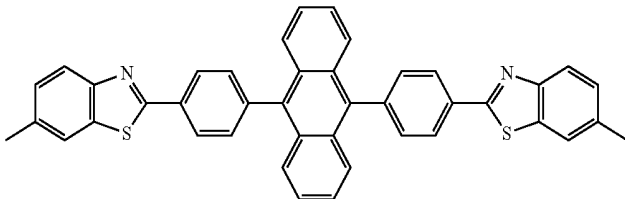
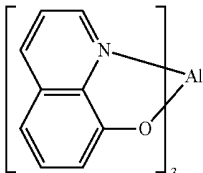
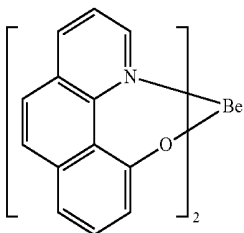
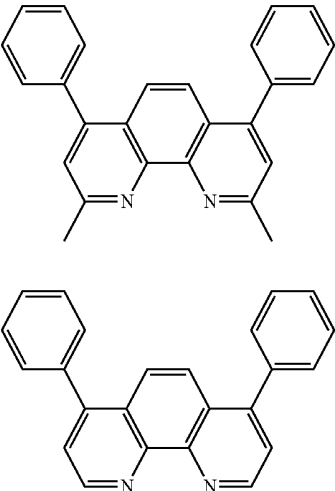
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Aza triphenylene derivatives		US20090115316
Anthracene-benzothiazole compounds		Appl. Phys. Lett. 89, 063504 (2006)
Metal 8-hydroxyquinolates (e.g., Alq ₃ , Zrq ₄)		Appl. Phys. Lett. 51, 913 (1987) US7230107
Metal hydroxybenzoquinolates		Chem. Lett. 5, 905 (1993)
Bathocuprine compounds such as BCP, BPhen, etc		Appl. Phys. Lett. 91, 263503 (2007) Appl. Phys. Lett. 79, 449 (2001)

TABLE A-continued

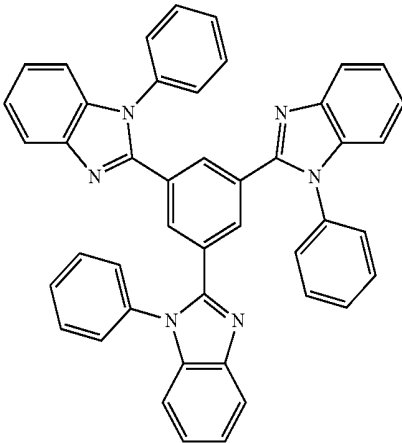
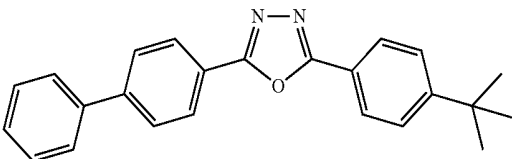
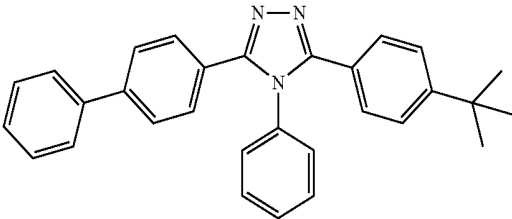
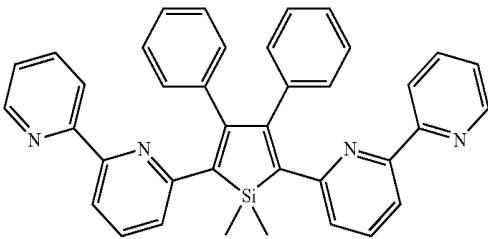
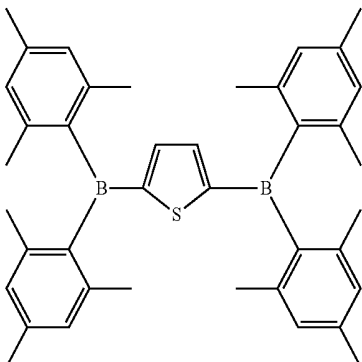
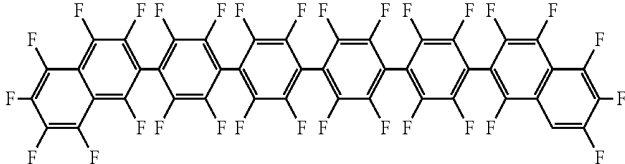
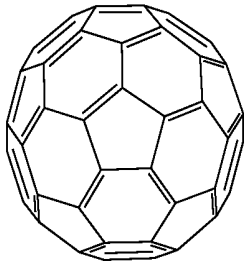
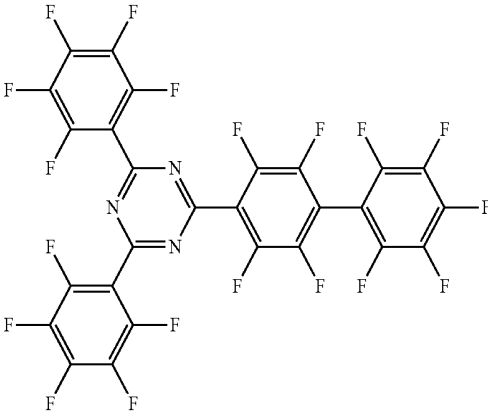
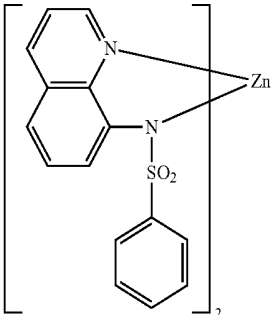
MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
5-member ring electron deficient heterocycles (e.g., triazole, oxadiazole, imidazole, benzoimidazole)		Appl. Phys. Lett. 74, 865 (1999)
		Appl. Phys. Lett. 55, 1489 (1989)
		Jpn. J. Apply. Phys. 32, L917 (1993)
Silole compounds		Org. Electron. 4, 113 (2003)
Arylborane compounds		J. Am. Chem. Soc. 120, 9714 (1998)

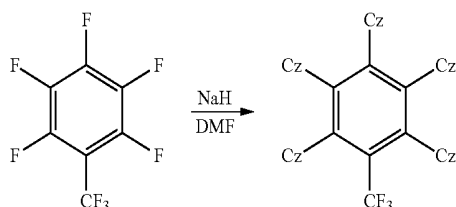
TABLE A-continued

MATERIAL	EXAMPLES OF MATERIAL	PUBLICATIONS
Fluorinated aromatic compounds		J. Am. Chem. Soc. 122, 1832 (2000)
Fullerene (e.g., C60)		US20090101870
Triazine complexes		US20040036077
Zn (N^N) complexes		US6528187

EXPERIMENTAL

Synthesis of Compound 14

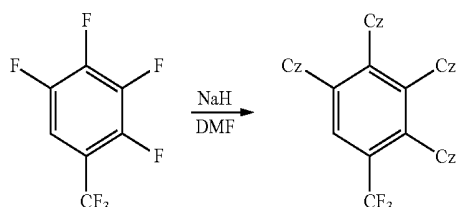
[0120]



[0121] Carbazole (5.3 g, 32.0 mmol) and sodium hydride (1.9 g, 47.0 mmol) were mixed in 50 mL of dry (i.e., anhydrous) dimethylformamide (DMF). The solution was stirred for 1 hour at room temperature. Octafluorotoluene (0.5 g, 2.2 mmol) was added to the solution. The mixture was then stirred for 3 days under nitrogen. The reaction mixture was poured into water and the precipitate was filtered. The residue was then suspended in tetrahydrofuran (THF):heptane (1:3, v/v) and heated for 1 hour. After cooling, 1.3 g (61%) of compound 14 was obtained as a pale yellow solid by filtration.

Synthesis of Compound 12

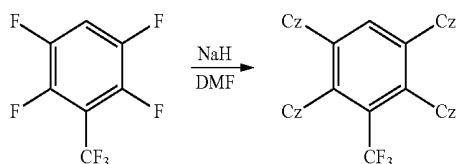
[0122]



[0123] Carbazole (2.9 g, 17 mmol) and sodium hydride (1 g, 25 mmol) were mixed in 30 mL of dry DMF. The solution was stirred for 1 hour at room temperature. 2,3,4,5-tetrafluorobenzotrifluoride (0.38 g, 1.7 mmol) was then added to the mixture. The mixture was then stirred for 3 days under nitrogen. The reaction mixture was poured into water and the precipitate was filtered. The residue was then suspended in THF:heptane (1:3, v/v) and heated for 1 hour. Upon cooling, 1.0 g (71%) of compound 12 was obtained as a white solid by filtration.

Synthesis of Compound 11

[0124]

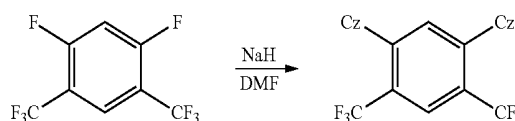


[0125] Carbazole (2.9 g, 17 mmol) and sodium hydride (1 g, 25 mmol) were mixed in 30 mL of dry DMF. The solution

was stirred for 1 hour at room temperature. 2,3,5,6-tetrafluorobenzotrifluoride (0.38 g, 1.7 mmol) was then added to the mixture. The mixture was stirred for 3 days under nitrogen. The reaction mixture was poured into water and the precipitate was filtered. The residue was then suspended in THF:heptane (1:3, v/v) and heated for 1 hour. Upon cooling, 1.0 g (71%) of compound 12 was obtained as a white solid by filtration.

Synthesis of Compound 32

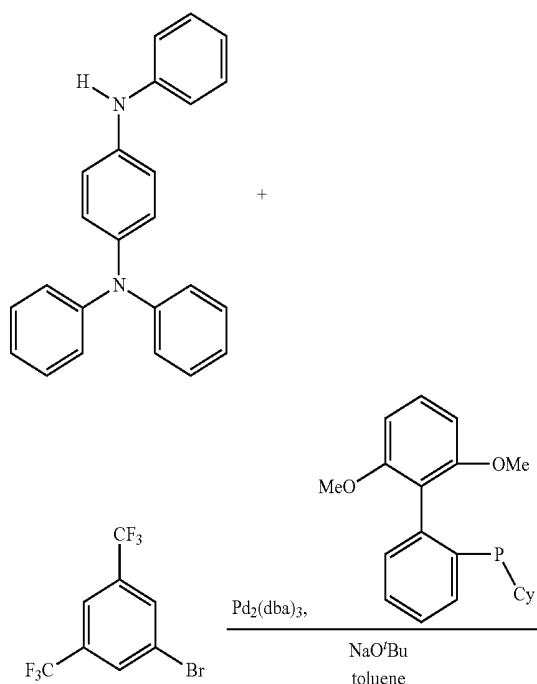
[0126]



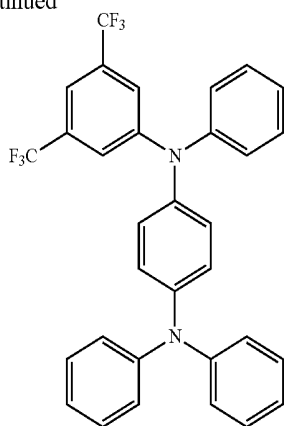
[0127] Carbazole (0.53 g, 3.2 mmol) and sodium hydride (0.2 g, 4.7 mmol) were mixed in 10 mL of dry DMF. The solution was stirred for 1 hour at room temperature. 1,5-dichloro-2,4-bis(trifluoromethyl)benzene (0.3 g, 1.1 mmol) was then added to the mixture. The mixture was stirred for 3 days under nitrogen. The reaction mixture was poured into water and the precipitate was filtered. The residue was then suspended in THF:heptane (1:3, v/v) and heated for 1 hour. Upon cooling, 0.35 g (59%) of compound 32 was obtained as a white solid by filtration.

Synthesis of Compound 743

[0128]



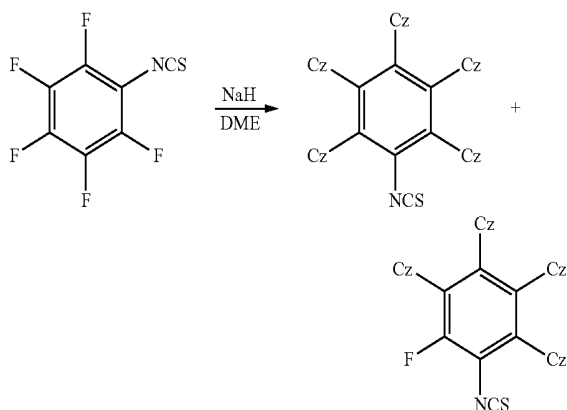
-continued



[0129] N^1, N^1, N^4 -triphenylbenzene-1,4-diamine (1.0 g, 3.0 mmol) and 1-bromo-3,5-bis(trifluoromethyl)benzene (1.15 g, 3.9 mmol) were mixed in 70 mL of dry xylene. The solution was bubbled with nitrogen for 15 min. $Pd_2(dba)_3$ (0.29 g, 0.32 mmol), 2-dicyclohexylphosphino-2',6'-dimethoxybiphenyl (0.58 g, 1.20 mmol) and $tBuONa$ (0.44 g, 4.50 mmol) were then added to the solution. The mixture was refluxed overnight under nitrogen. After cooling, the reaction mixture was filtered through a celite/silica pad and the filtrate was concentrated. The residue was then purified by column chromatography using DCM:hexane (1:4, v/v) as the eluent. 1.3 g (80%) of compound 743 was collected.

Synthesis of Compound 262 and Compound 736

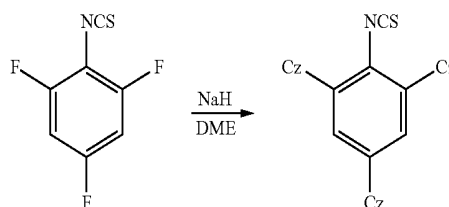
[0130]



[0131] Carbazole (19.6 g, 117.6 mmol) and sodium hydride (7.0 g, 176.4 mmol) were mixed in 300 mL of dry 1,2-dimethoxyethane. The solution was stirred for 2 hours and 1,2,3,4,5-pentafluoro-6-isothiocyanatobenzene (2.0 g, 7.8 mmol) was added. The mixture was stirred under nitrogen for 1 week at room temperature. The reaction mixture was poured into water and the precipitate was filtered. The residue was then purified by column chromatography using gradient from hexane to toluene:hexane (1:1, v/v) as the eluent. 1.9 g (25%) of Compound 262 and 0.3 g (5%) of Compound 736 were collected.

Synthesis of Compound 254

[0132]



[0133] Carbazole (4.0 g, 23.8 mmol) and sodium hydride (1.4 g, 35.7 mmol) were mixed in 60 mL of dry 1,2-dimethoxyethane. The solution was stirred for 2 hours, then 1,3,5-trifluoro-2-isothiocyanatobenzene (0.5 g, 2.6 mmol) was added to the solution. The mixture was stirred under nitrogen for 4 days at room temperature. The reaction mixture was poured into water and the precipitate was filtered. The residue was then purified by column chromatography using gradient from hexane to toluene:hexane (1:1, v/v) as the eluent. 57 mg (3%) of Compound 254 was isolated.

[0134] The photoluminescence quantum yields of the synthesized compounds are summarized in Table 1 (below):

TABLE 1

Cmpd	PLQY in PMMA (5 wt % of Cmpd)	Em_{max} in PMMA [nm]
14	53%	475
743	5%	493
262	16%	489
736	10%	406
12	21%	423
11	55%	436
254	5%	406
32	42%	433

[0135] The photoluminescence data in 2-methylTHF (2Me-THF), toluene, and 3-methylpentane (3-MP) are summarized in Table 2 (below):

TABLE 2

Cmpd	Em_{max} at RT in 2Me-THF [nm]	Em_{max} at RT in toluene [nm]	Em_{max} at RT in 3-MP [nm]	Em_{max} at 77 K in 3-MP [nm]
14	494	487	459	452
743	522	510	468	458
12	443	431	421	440
11	446	441	432	436
32	448	430	403	439

[0136] The photoluminescence in 2-methylTHF (2Me-THF), toluene, and 3-methylpentane shows significant redshift from non-polar to polar solvents, suggesting the charge transfer nature of the emission. The PLQY of the CF_3 acceptor compounds reach as high as 55% in the blue region.

Device Examples

[0137] In the OLED experiments, all device examples were fabricated by high vacuum (<10-Torr) thermal evaporation. The anode electrode is ~800 Å of indium tin oxide (ITO). The cathode was 10 Å of LiF followed by 1,000 Å of Al. All

devices were encapsulated with a glass lid sealed with an epoxy resin in a nitrogen glove box (<1 ppm of H₂O and O₂) and a moisture getter was incorporated inside the package.

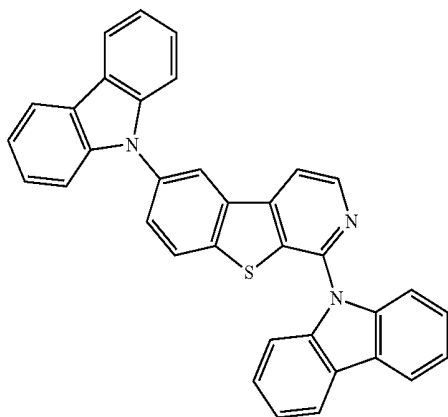
[0138] The organic stack of the Device Examples in Table 3 consists of, sequentially from the ITO surface, 100 Å of LG101 as the hole injection layer (HIL), 300 Å of TAPC as the hole transporting layer (HTL), 300 Å of mCP doped with 10% or 15% or neat of dopant Compound 11 or 12 or 14 as the emissive layer (EML), 0 or 50 Å of Compound A or B as the ETL2, and 400 Å of TmPyPB or LG201 as the ETL1.

TABLE 3

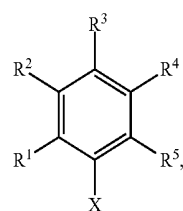
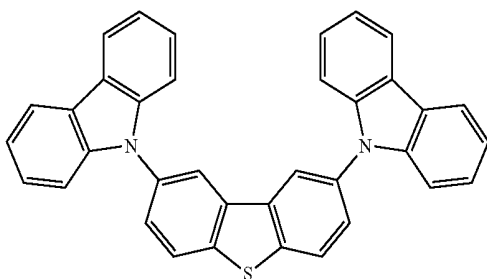
Example	EML		1931 CIE						At 1,000 nits			
	Host 300Å	dopant [conc. %]	ETL250Å	ETL1 400Å	CIE x	CIE y	Em _{max} [nm]	FWHM [nm]	V [V]	LE [cd/A]	EQE [%]	PE [lm/W]
Device 1		Cmpd 14 [100]	A	TmPyPB	0.215	0.393	490	88	7.4	6.6	2.8	2.8
Device 2		Cmpd 14 [100]	—	TmPyPB	0.211	0.392	490	86	7.0	7.8	3.3	3.5
Device 3	mCP	Cmpd 14 [0]	A	TmPyPB	0.177	0.319	482	78	8.0	16.3	8.1	6.4
Device 4	mCP	Cmpd 14 [0]	—	TmPyPB	0.174	0.295	482	76	8.3	11.0	5.7	4.2
Device 5		Cmpd 12 [100]	A	TmPyPB	0.191	0.197	458	88	12.6	0.8	0.6	0.2

1. A compound comprising a structure according to Formula 1:

Compound A

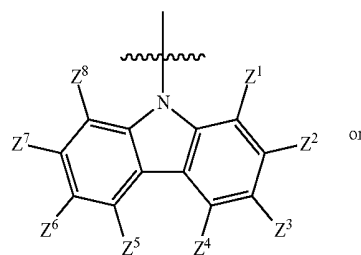


Compound B



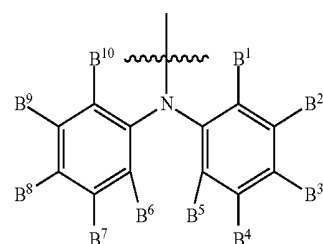
Formula 1

wherein R⁵ is



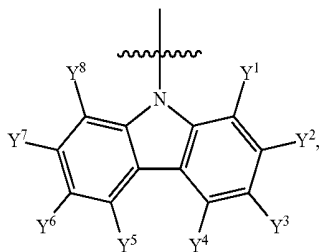
[0139] Device 3 with Compound 14 as the emitter has an external quantum efficiency of 10% at 100 cd/m² and 8.1% at 1000 cd/m². The result demonstrates that charge transfer luminescent compounds with strong acceptors as emitters in OLED can lead to device efficiency higher than the theoretical limit of fluorescent OLED, by harvesting the triplet through delayed fluorescence.

[0140] It is understood that the various embodiments described herein are by way of example only, and are not

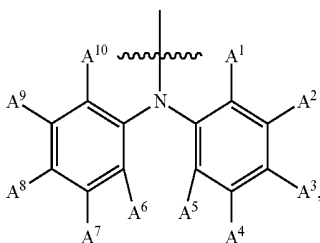


and

wherein (a) at least one of R¹-R⁴ is



or (b) R¹ is

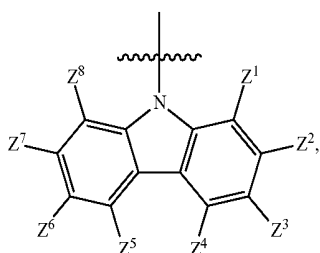


wherein R¹, R², R³, R⁴, A¹, A², A³, A⁴, A⁵, A⁶, A⁷, A⁸, A⁹, A¹⁰, B¹, B², B³, B⁴, B⁵, B⁶, B⁷, B⁸, B⁹, B¹⁰, Y¹, Y², Y³, Y⁴, Y⁵, Y⁶, Y⁷, Y⁸, Z¹, Z², Z³, Z⁴, Z⁵, Z⁶, Z⁷, and Z⁸, are each independently selected from the group consisting of hydrogen, deuterium, halide, alkyl, haloalkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, thioalkoxy, aryloxy, thioaryloxy, amino, arylamino, diarylamino, carbazolyl, silyl, halosilyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCO, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, —SC_mF_{2m+1}, and combinations thereof;

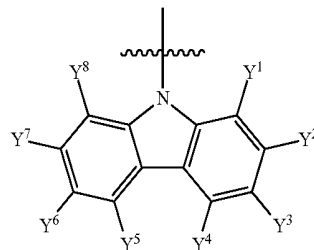
wherein adjacent A, B, Y, and Z groups are, optionally, joined to form a fused ring structure; and

wherein X comprises an acceptor group selected from the group consisting of —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCO, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, and —SC_mF_{2m+1}.

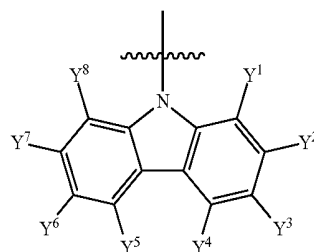
2. The compound of claim 1, wherein R⁵ is



and at least one of R¹-R⁴ is



3. The compound according to claim 2, wherein at least two of R¹-R⁴ are



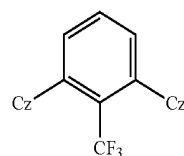
4-7. (canceled)

8. The compound of claim 2, wherein at least one of R¹-R⁴ comprises an acceptor group selected from the group consisting of —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCO, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, and —SC_mF_{2m+1}.

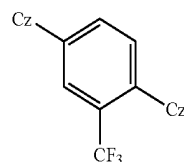
9. (canceled)

10. The compound of claim 2, wherein at least one of R¹-R⁴ is an electron withdrawing group with a Hammett value (σ_{para}) of at least 0.05.

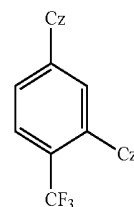
11. The compound of claim 2, wherein the compound is selected from the group consisting of:



Compound 1

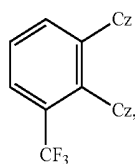


Compound 2

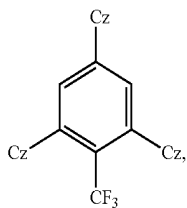


Compound 3

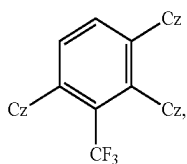
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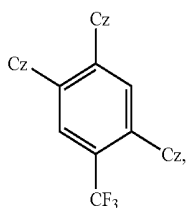
Compound 4



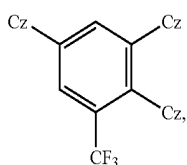
Compound 6



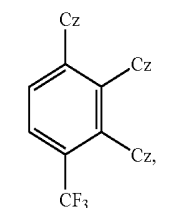
Compound 7



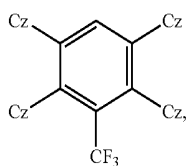
Compound 8



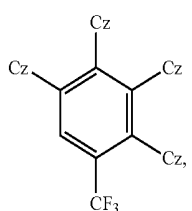
Compound 9



Compound 10

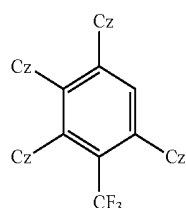


Compound 11

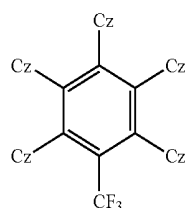


Compound 12

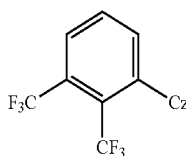
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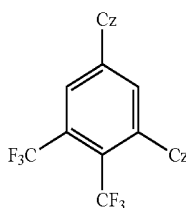
Compound 13



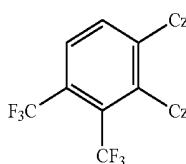
Compound 14



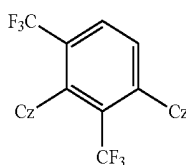
Compound 15



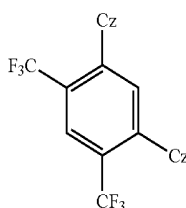
Compound 29



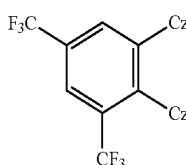
Compound 30



Compound 31

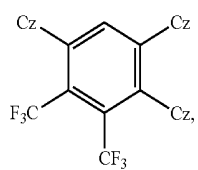


Compound 32

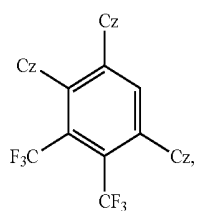


Compound 33

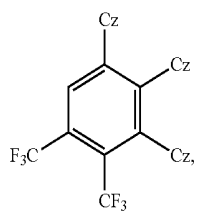
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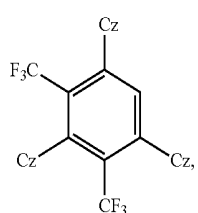
Compound 34



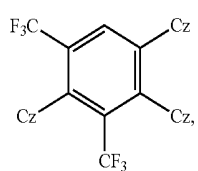
Compound 35



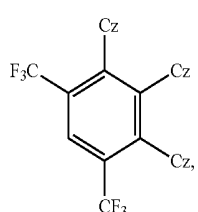
Compound 36



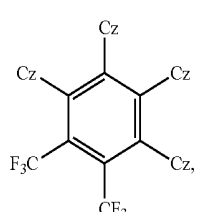
Compound 37



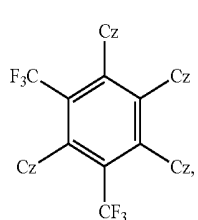
Compound 38



Compound 39

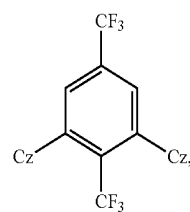


Compound 40

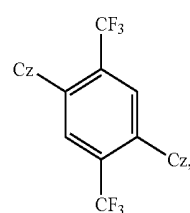


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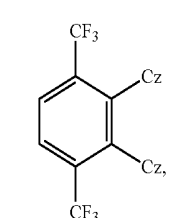
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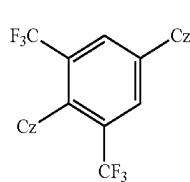
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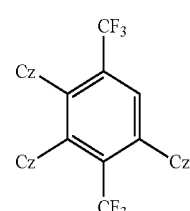
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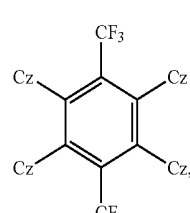
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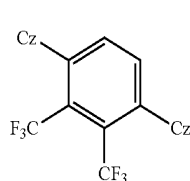
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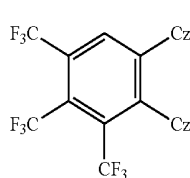
Compound 46



Compound 47

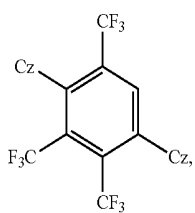


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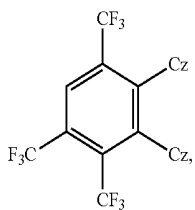


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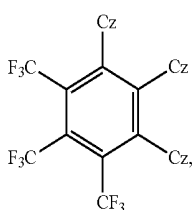
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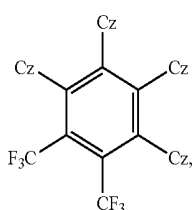
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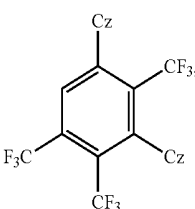
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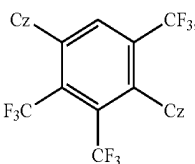
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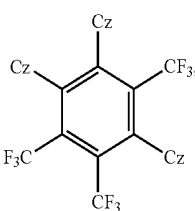
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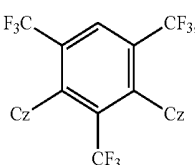
Compound 54



Compound 55

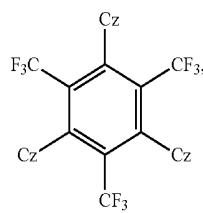


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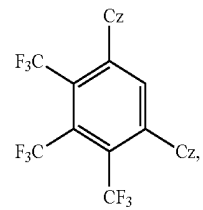


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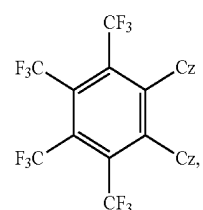
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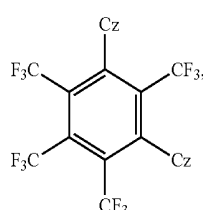
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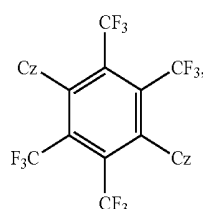
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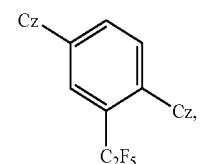
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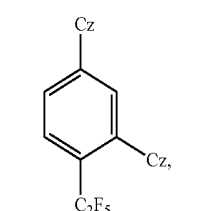
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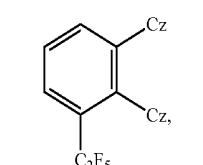
Compound 62



Compound 63

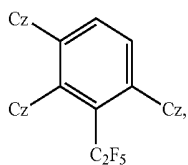


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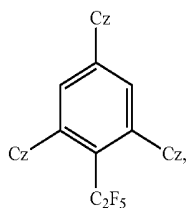


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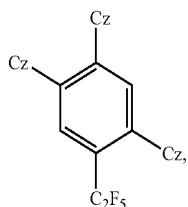
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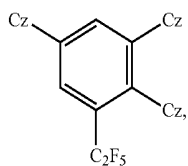
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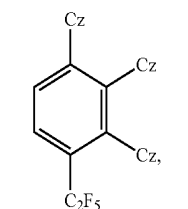
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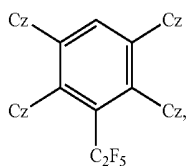
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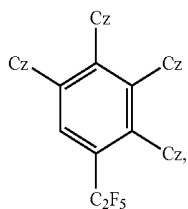
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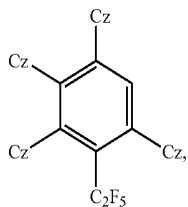
Compound 71



Compound 72

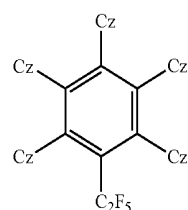


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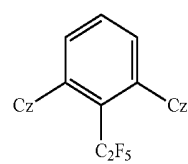


Compound 74

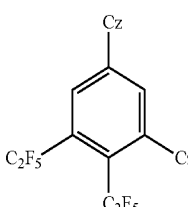
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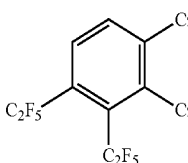
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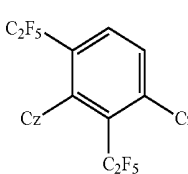
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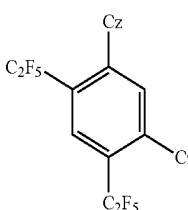
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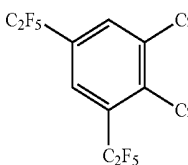
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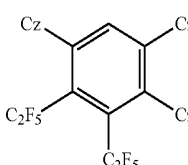
Compound 93



Compound 94

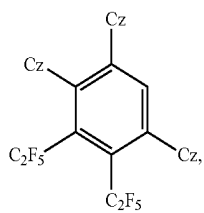


Compound 95

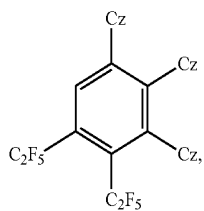


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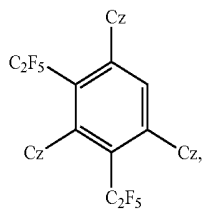
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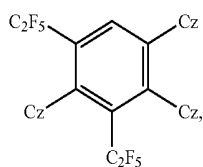
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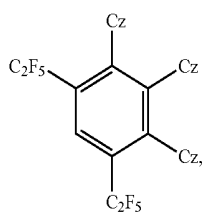
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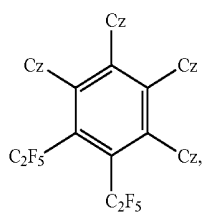
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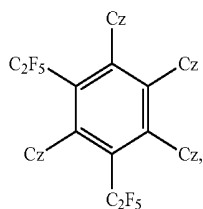
Compound 100



Compound 101

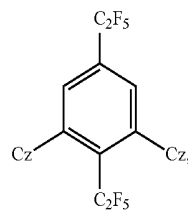


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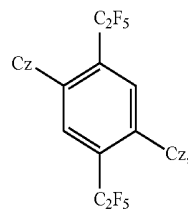


Compound 103

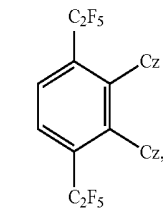
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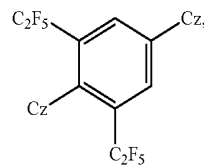
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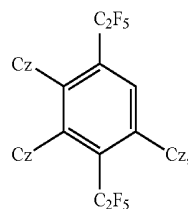
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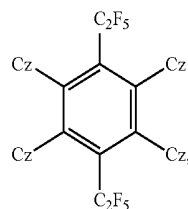
Compound 106



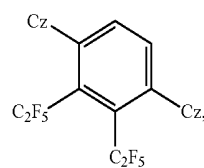
Compound 107



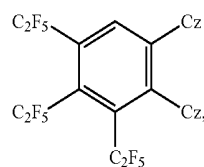
Compound 108



Compound 109

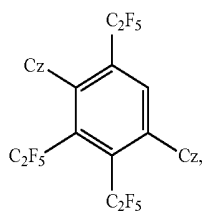


Compound 110

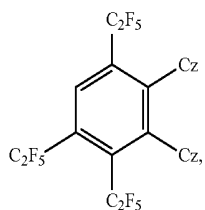


Compound 111

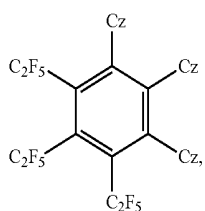
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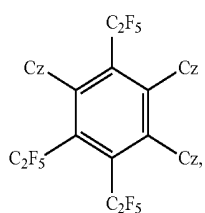
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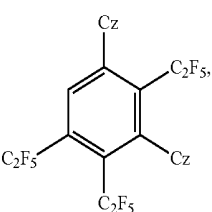
Compound 113



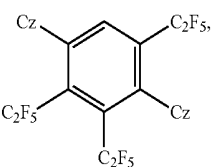
Compound 114



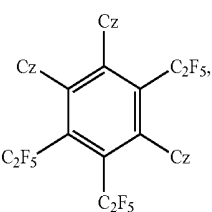
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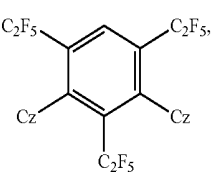
Compound 116



Compound 117

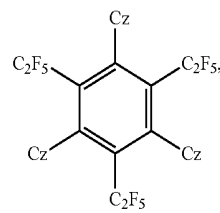


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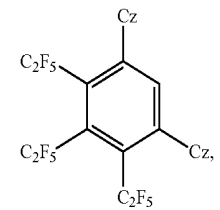


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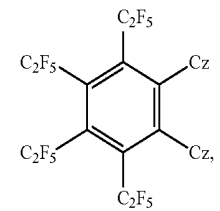
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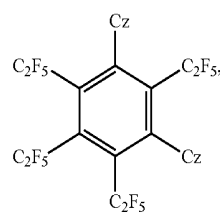
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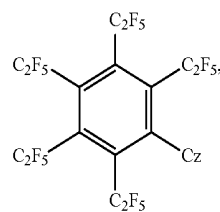
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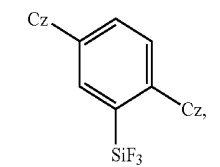
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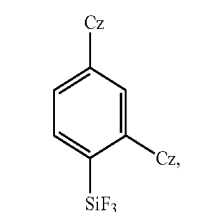
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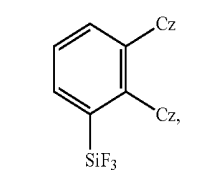
Compound 124



Compound 125

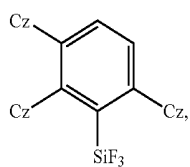


Compound 126

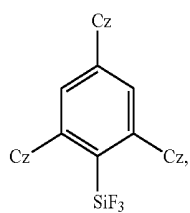


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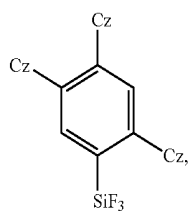
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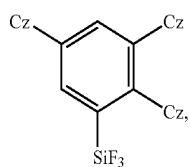
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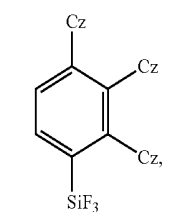
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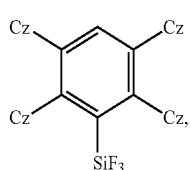
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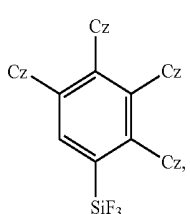
Compound 132



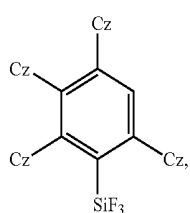
Compound 133



Compound 134

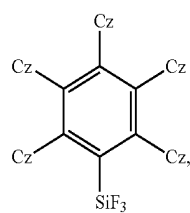


Compound 135,

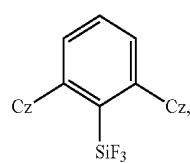


Compound 136

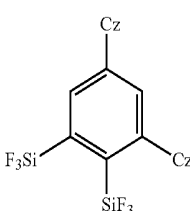
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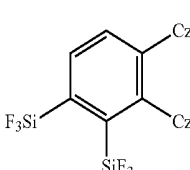
Compound 137



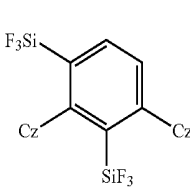
Compound 138



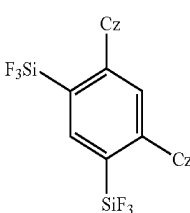
Compound 153



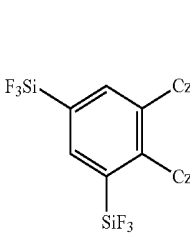
Compound 154



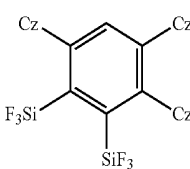
Compound 155



Compound 156

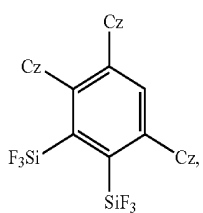


Compound 157

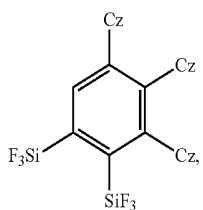


Compound 158

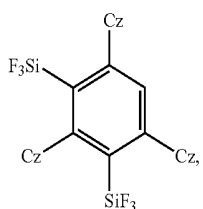
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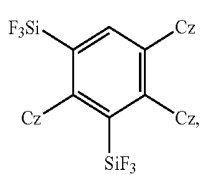
Compound 159



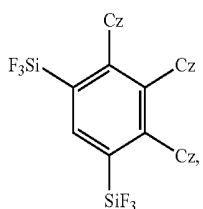
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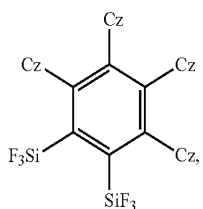
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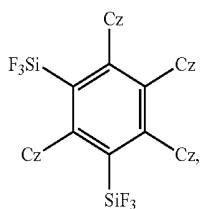
Compound 162



Compound 163

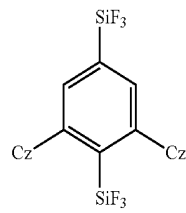


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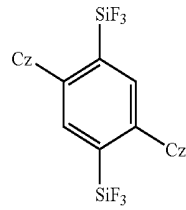


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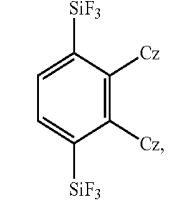
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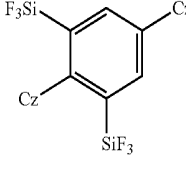
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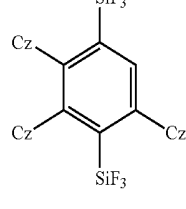
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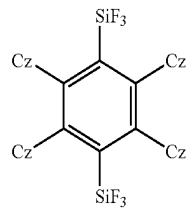
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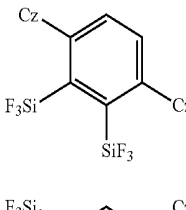
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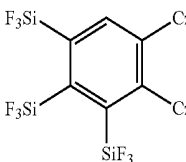
Compound 170



Compound 171

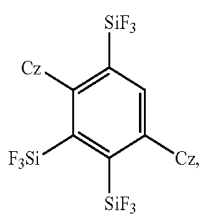


Compound 172

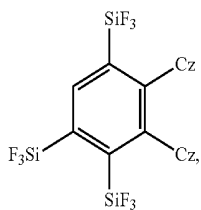


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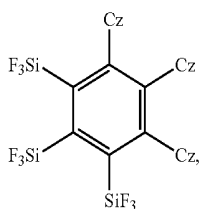
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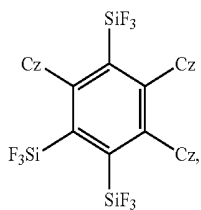
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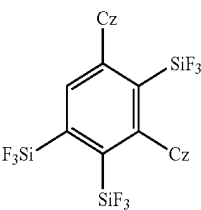
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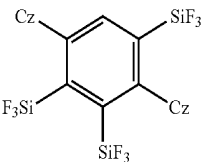
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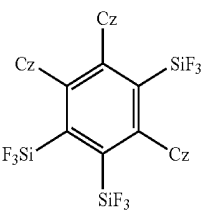
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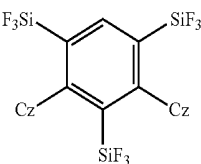
Compound 178



Compound 179

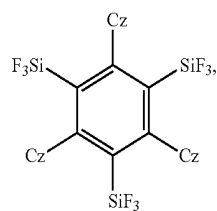


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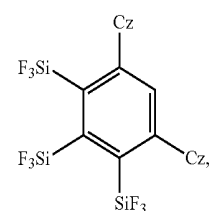


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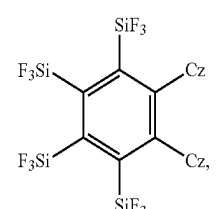
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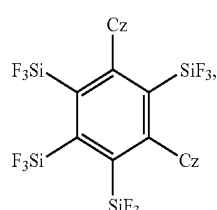
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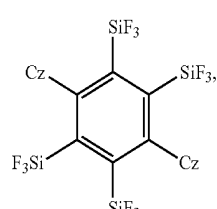
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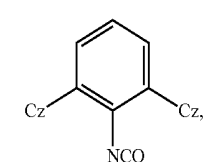
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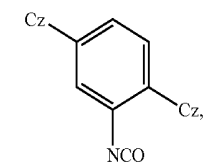
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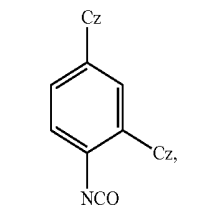
Compound 186



Compound 187

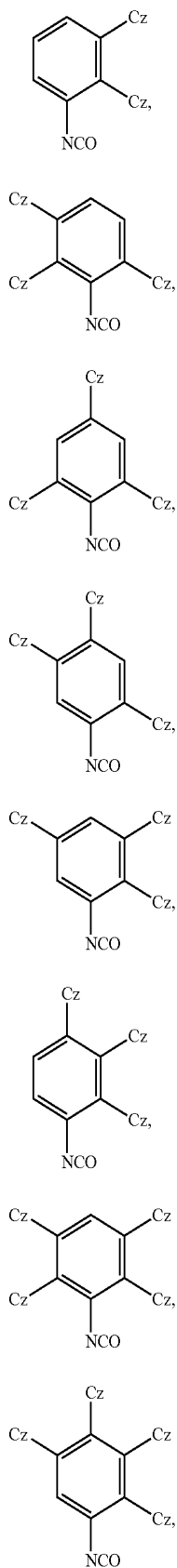


Compound 188



Compound 189

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Compound 190

Compound 191

Compound 192

Compound 194

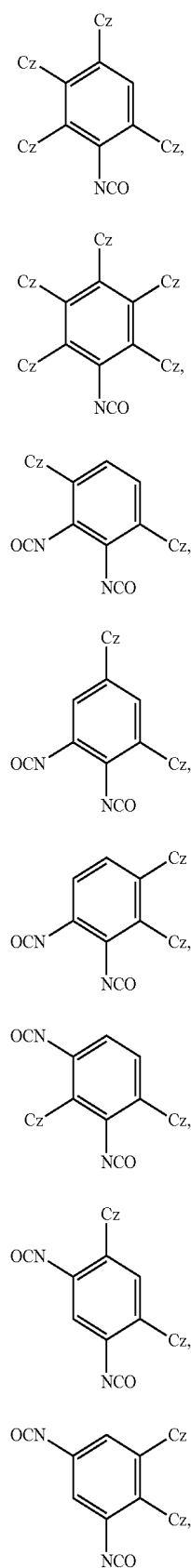
Compound 195

Compound 196

Compound 197

Compound 198

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Compound 199

Compound 200

Compound 215

Compound 216

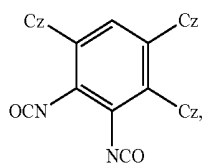
Compound 217

Compound 218

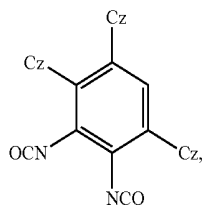
Compound 219

Compound 220

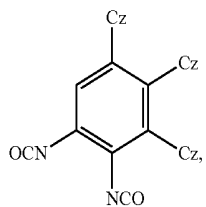
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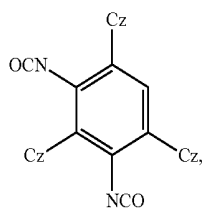
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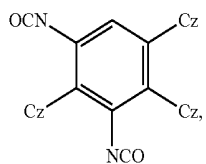
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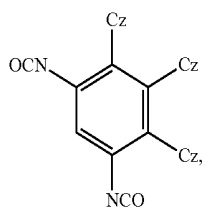
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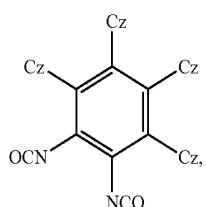
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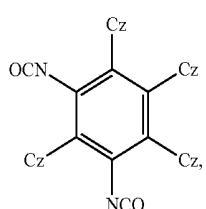
Compound 225



Compound 226

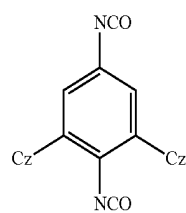


Compound 227

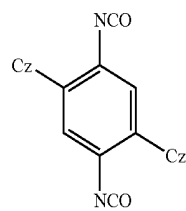


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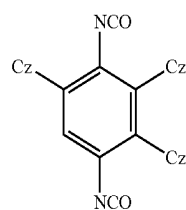
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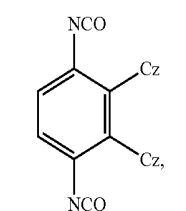
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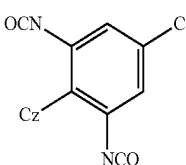
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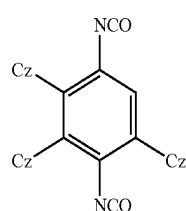
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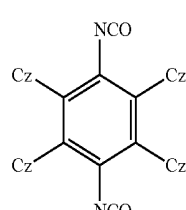
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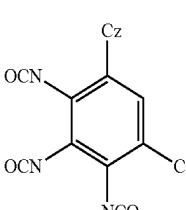
Compound 232



Compound 233

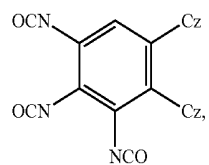


Compound 234

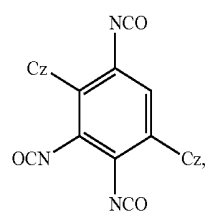


Compound 235

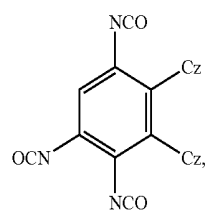
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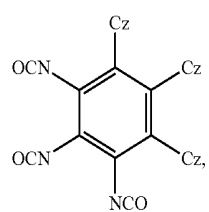
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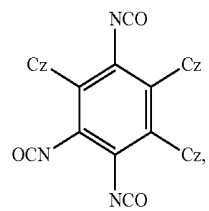
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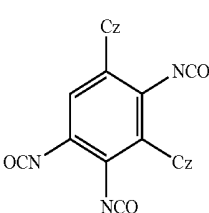
Compound 238



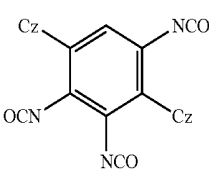
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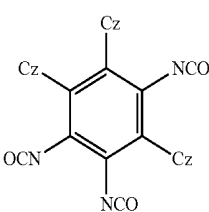
Compound 240



Compound 241

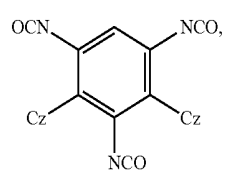


Compound 242

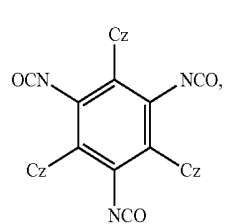


Compound 243

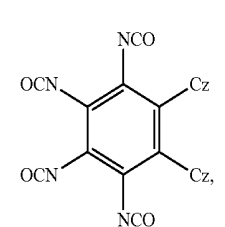
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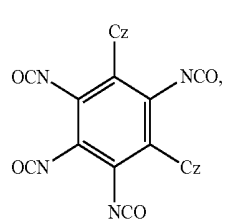
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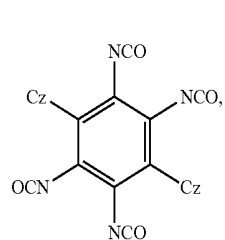
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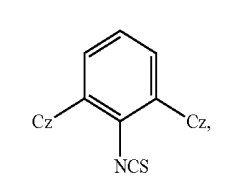
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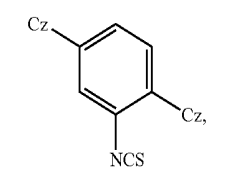
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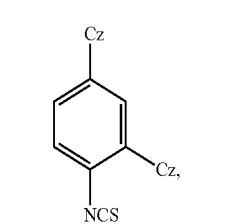
Compound 248



Compound 249

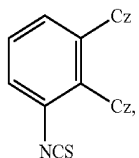


Compound 250

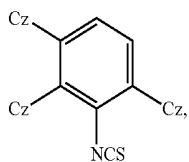


Compound 251

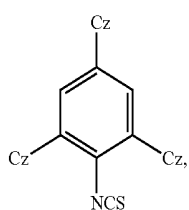
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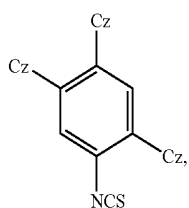
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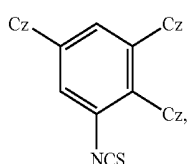
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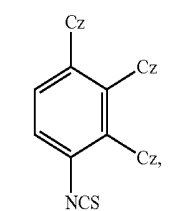
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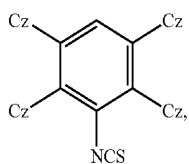
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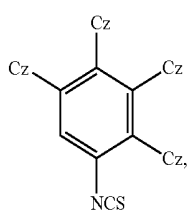
Compound 257



Compound 258

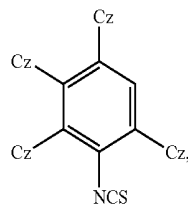


Compound 259

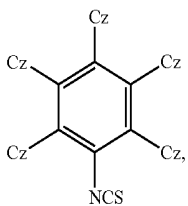


Compound 260

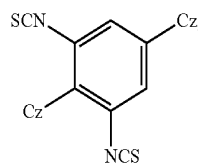
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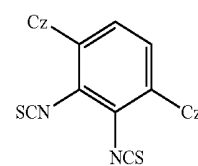
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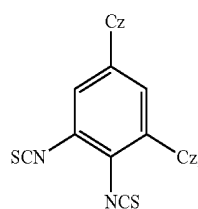
Compound 262



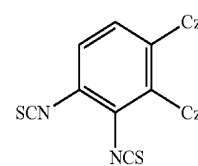
Compound 277



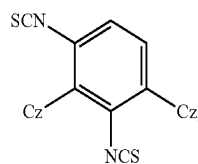
Compound 278



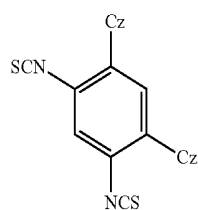
Compound 279



Compound 280

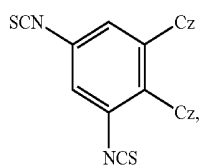


Compound 281

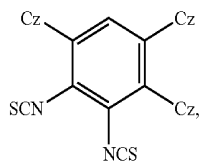


Compound 282

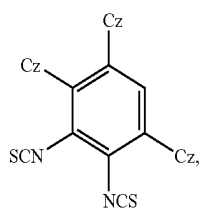
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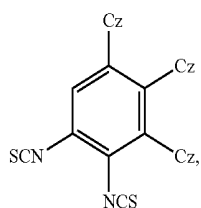
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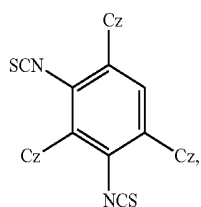
Compound 284



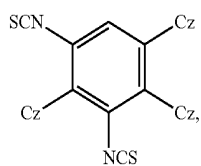
Compound 285



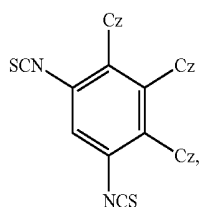
Compound 286



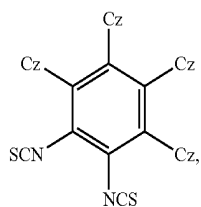
Compound 287



Compound 288

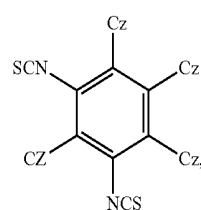


Compound 289

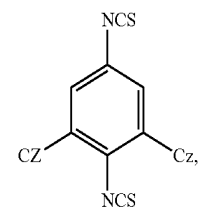


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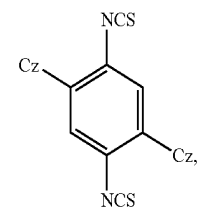
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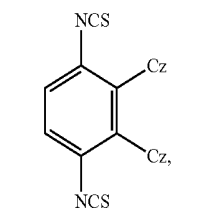
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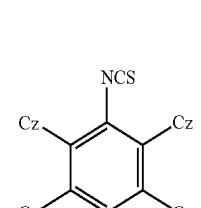
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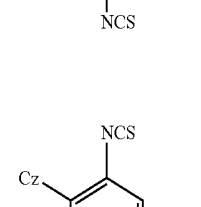
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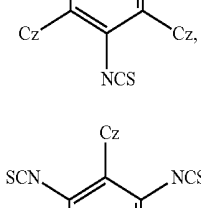
Compound 294



Compound 295

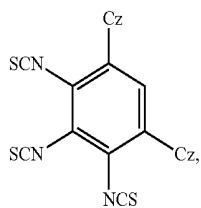


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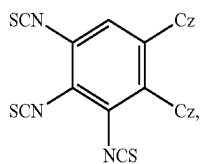


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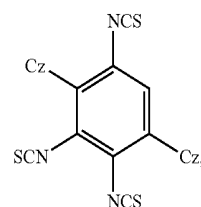
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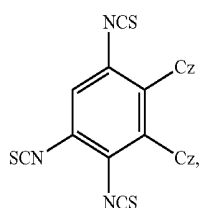
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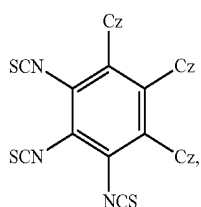
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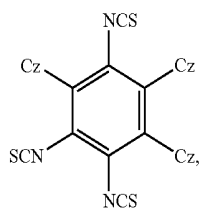
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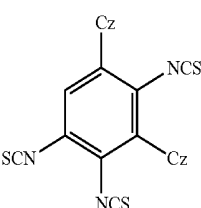
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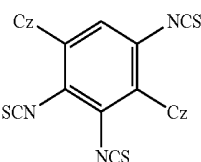
Compound 302



Compound 303

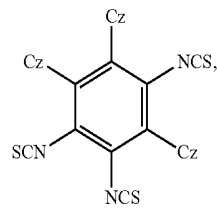


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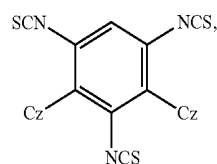


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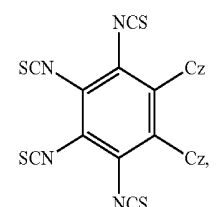
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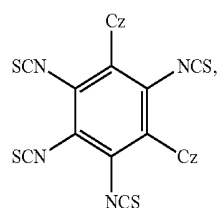
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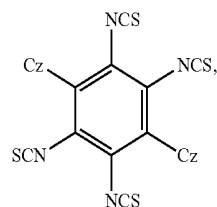
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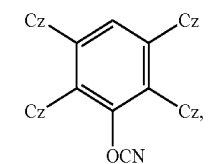
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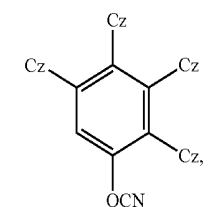
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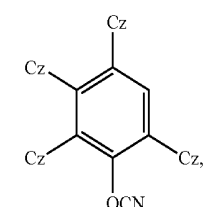
Compound 310



Compound 311

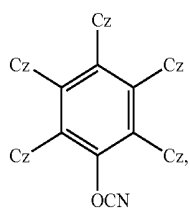


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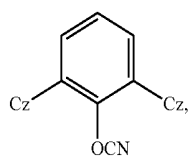


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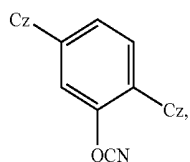
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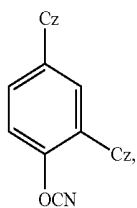
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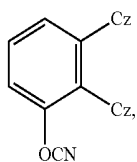
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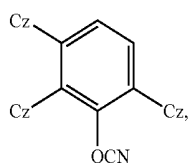
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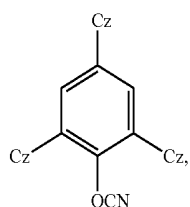
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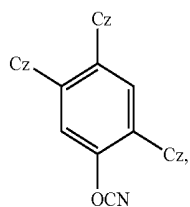
Compound 332



Compound 333

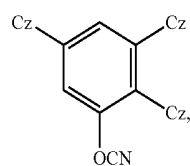


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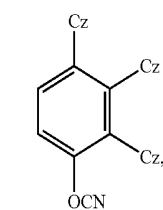


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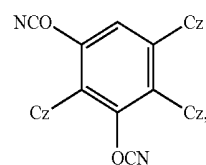
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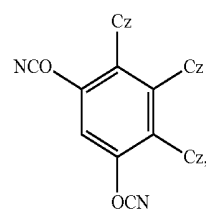
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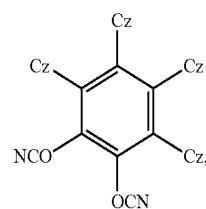
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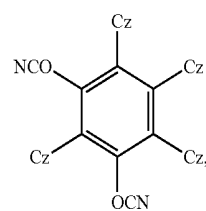
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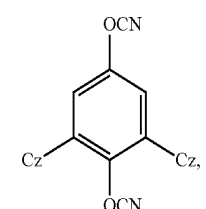
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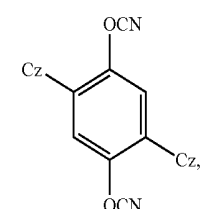
Compound 341



Compound 342

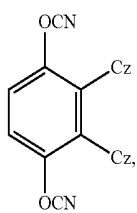


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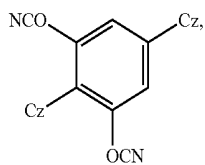


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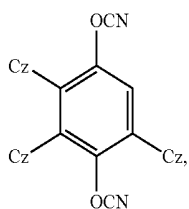
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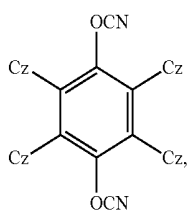
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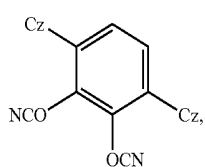
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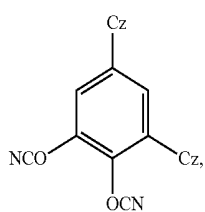
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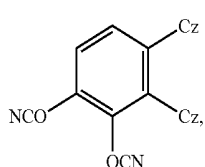
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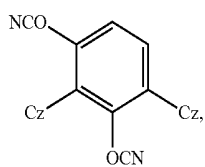
Compound 349



Compound 350

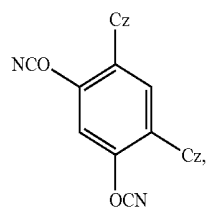


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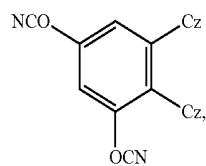


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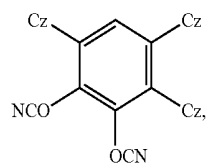
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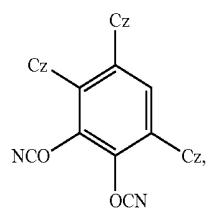
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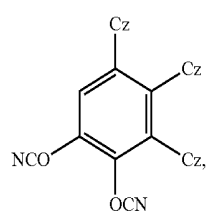
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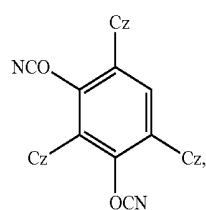
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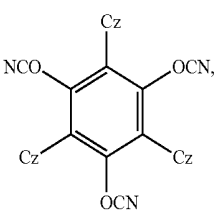
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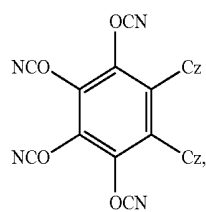
Compound 357



Compound 358

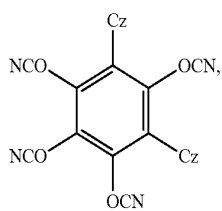


Compound 359

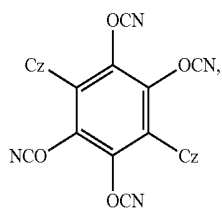


Compound 360

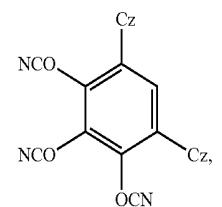
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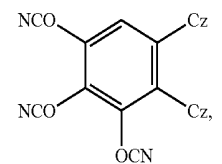
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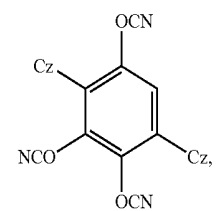
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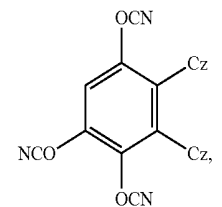
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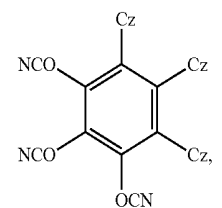
Compound 364



Compound 365

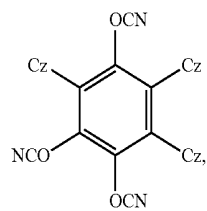


Compound 366

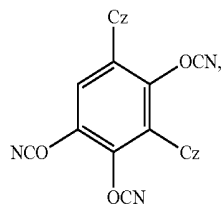


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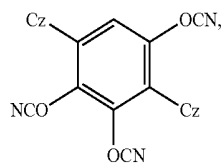
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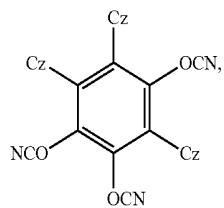
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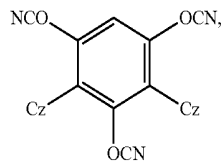
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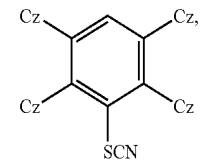
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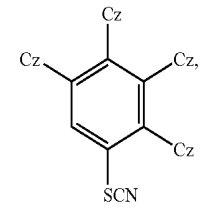
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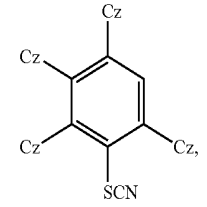
Compound 372



Compound 373

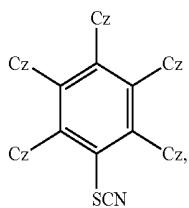


Compound 374

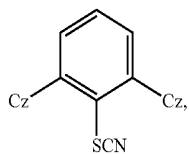


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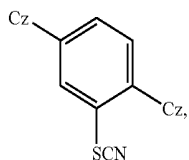
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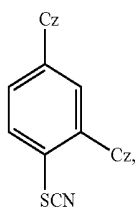
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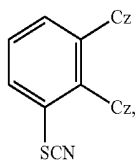
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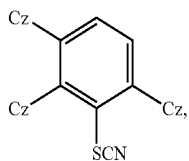
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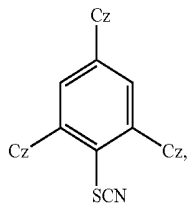
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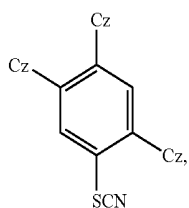
Compound 394



Compound 395

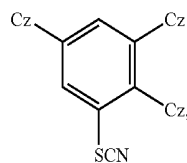


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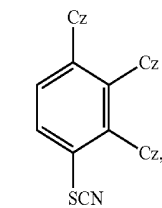


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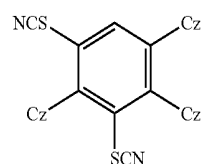
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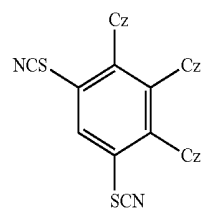
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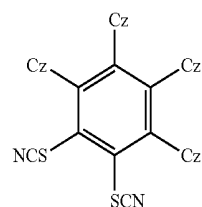
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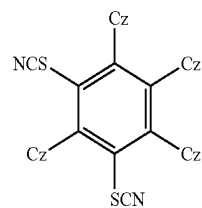
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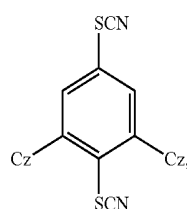
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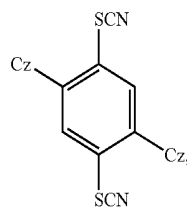
Compound 403



Compound 404

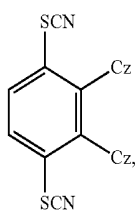


Compound 405

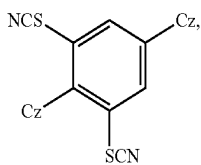


Compound 406

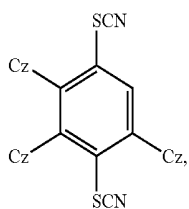
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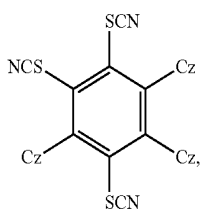
Compound 407



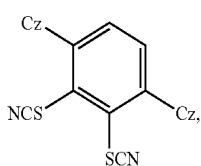
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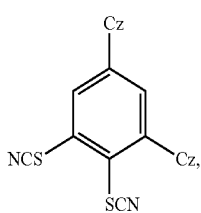
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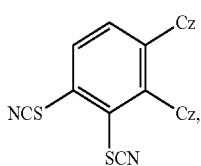
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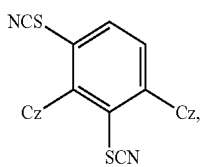
Compound 411



Compound 412

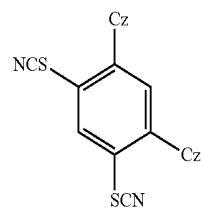


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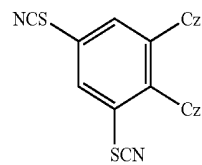


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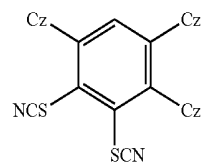
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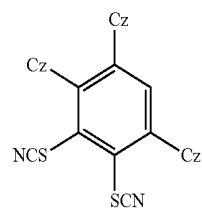
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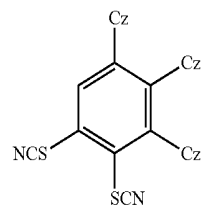
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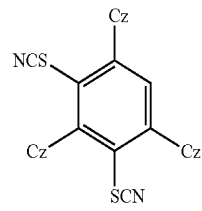
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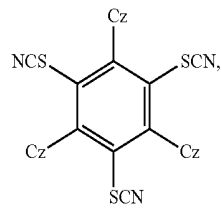
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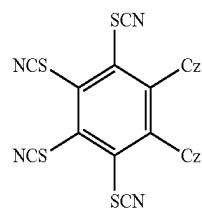
Compound 419



Compound 420

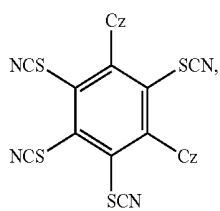


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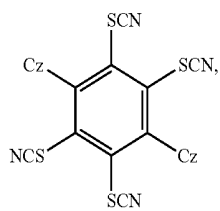


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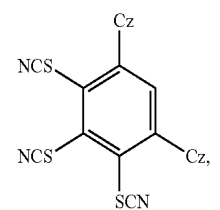
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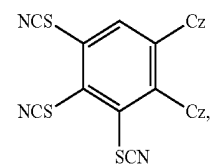
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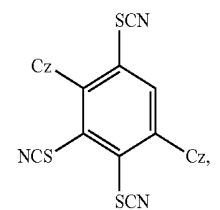
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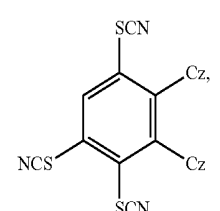
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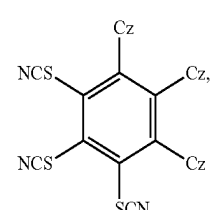
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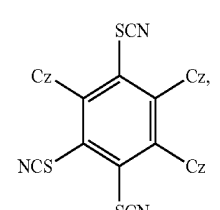
Compound 427



Compound 428

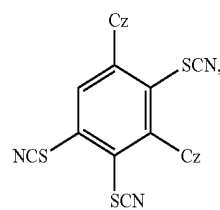


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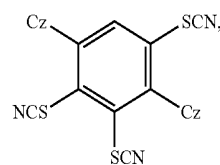


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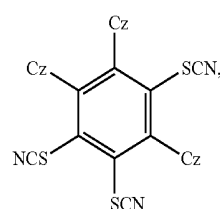
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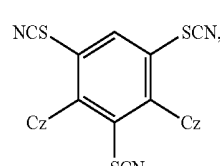
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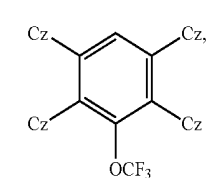
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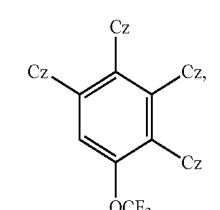
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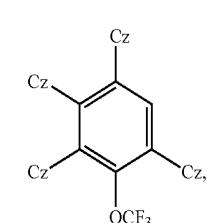
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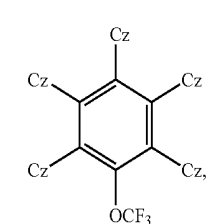
Compound 435



Compound 436

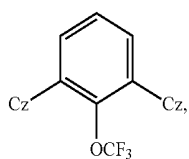


Compound 437

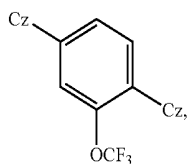


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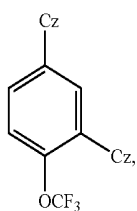
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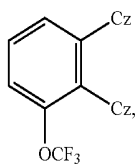
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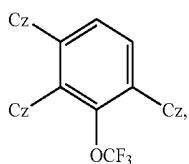
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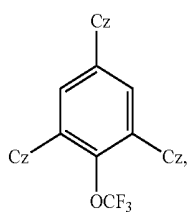
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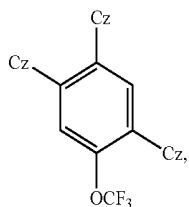
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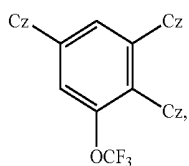
Compound 457



Compound 458

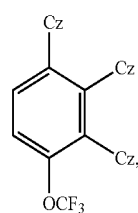


Compound 460

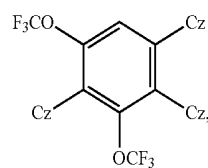


Compound 461

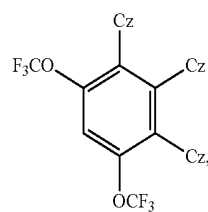
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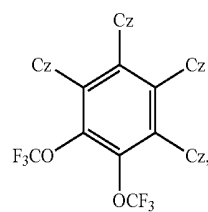
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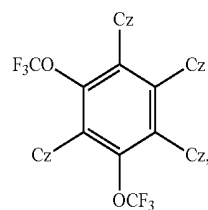
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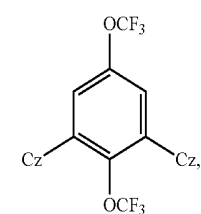
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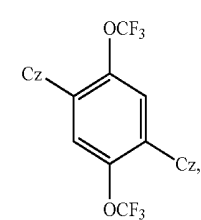
Compound 465



Compound 466

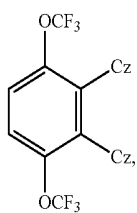


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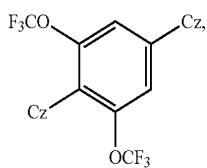


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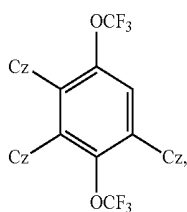
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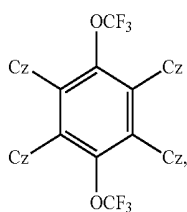
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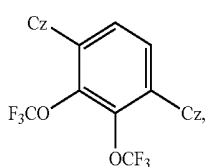
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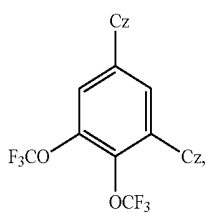
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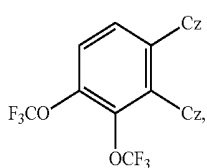
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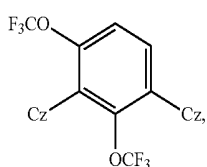
Compound 473



Compound 474

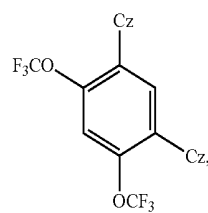


Compound 475

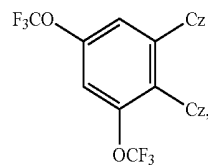


Compound 476

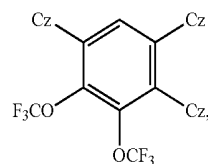
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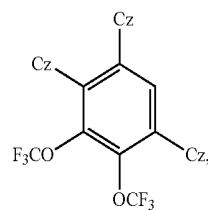
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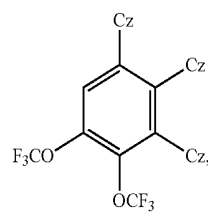
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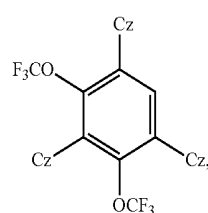
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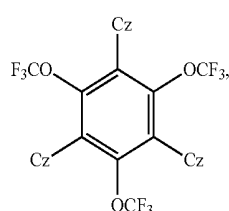
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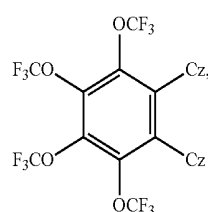
Compound 481



Compound 482

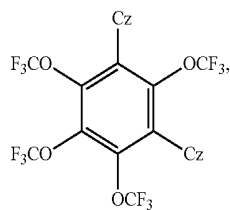


Compound 483

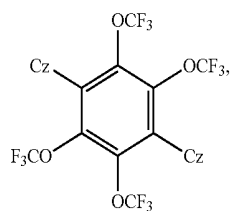


Compound 484

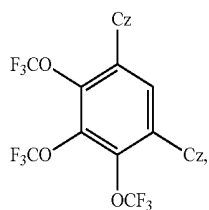
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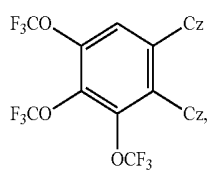
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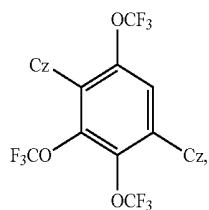
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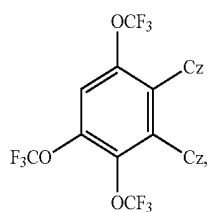
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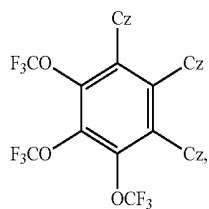
Compound 488



Compound 489

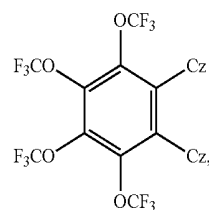


Compound 490

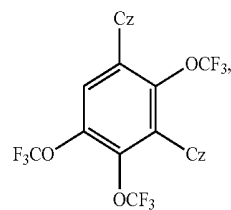


Compound 491

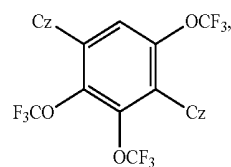
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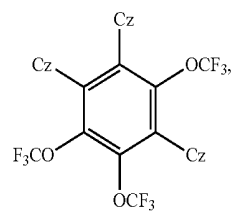
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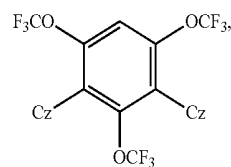
Compound 493



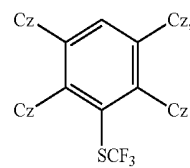
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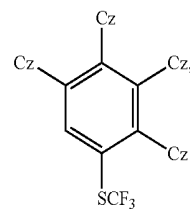
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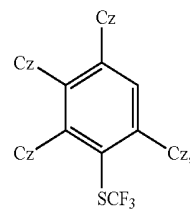
Compound 496



Compound 497

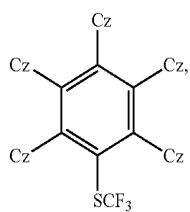


Compound 498

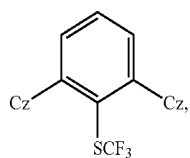


Compound 499

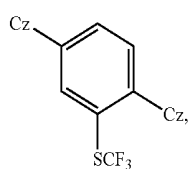
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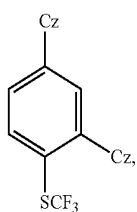
Compound 500



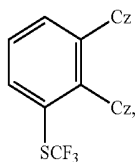
Compound 515



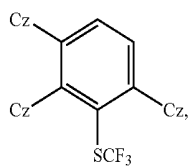
Compound 516



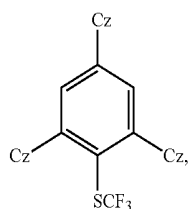
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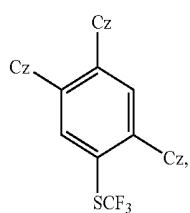
Compound 518



Compound 519

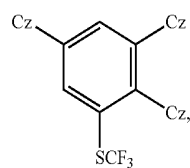


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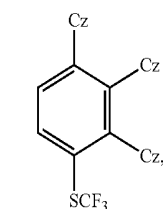


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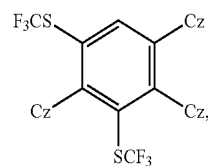
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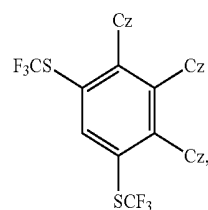
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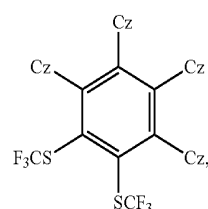
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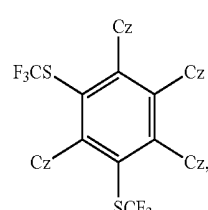
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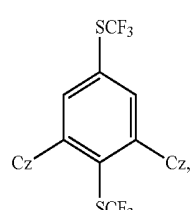
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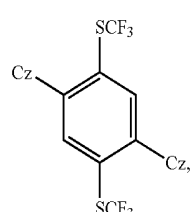
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Compound 528

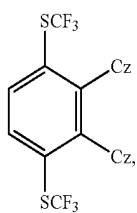


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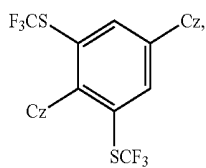


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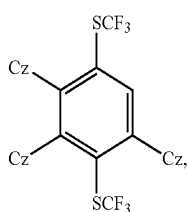
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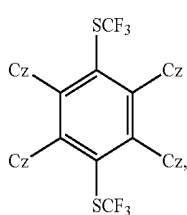
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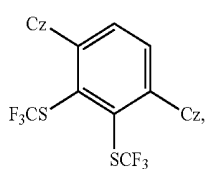
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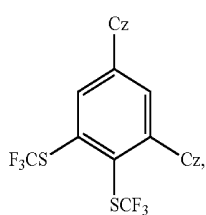
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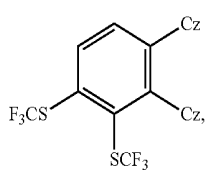
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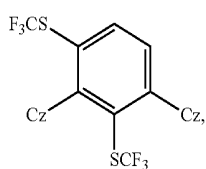
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Compound 536

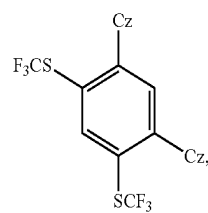


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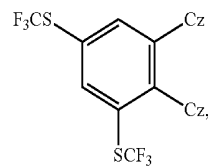


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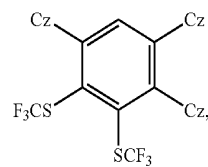
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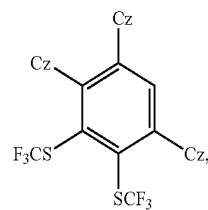
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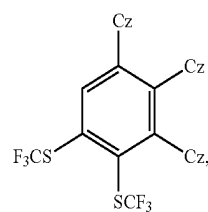
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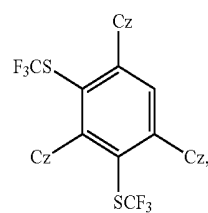
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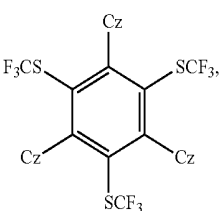
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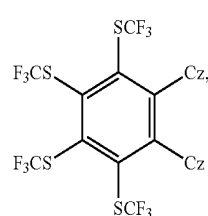
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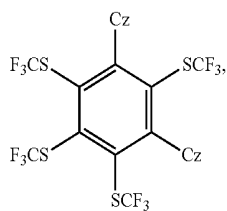


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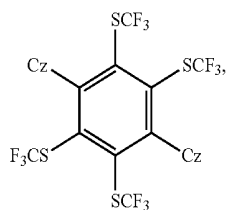


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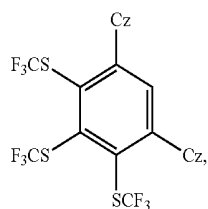
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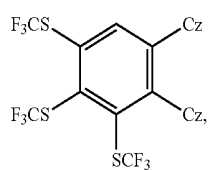
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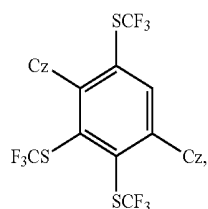
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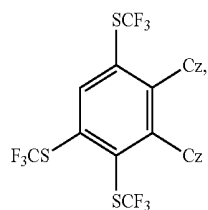
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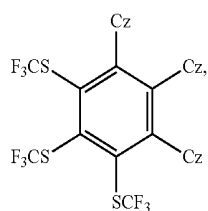
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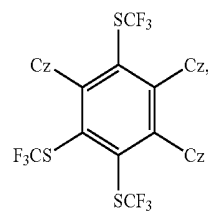


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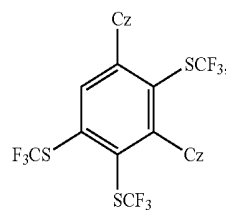


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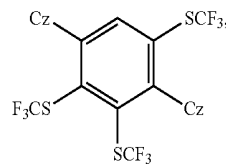
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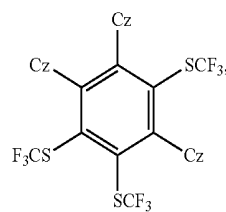
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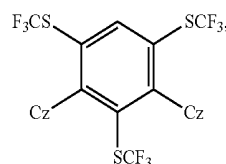
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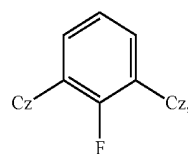
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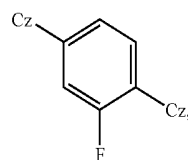
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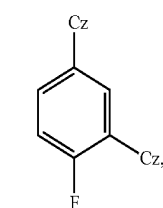
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Compound 559

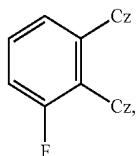


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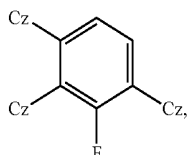


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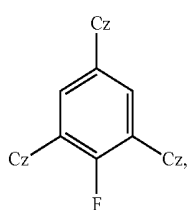
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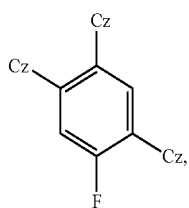
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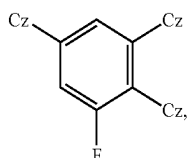
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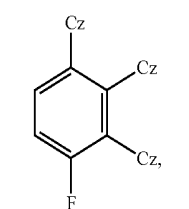
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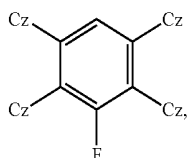
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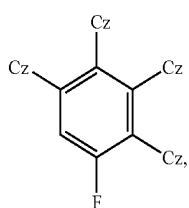
Compound 567



Compound 568

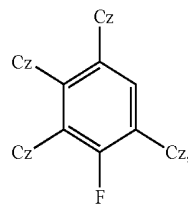


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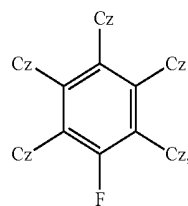


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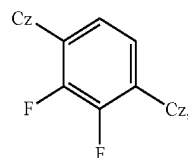
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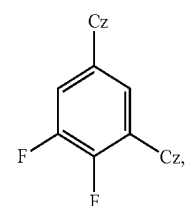
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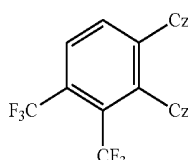
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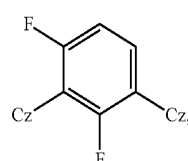
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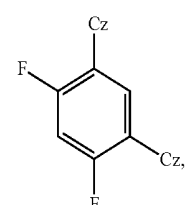
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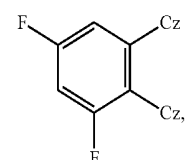
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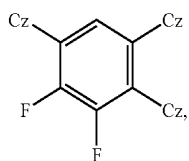


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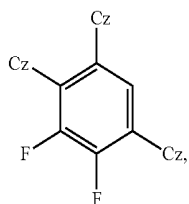


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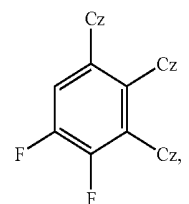
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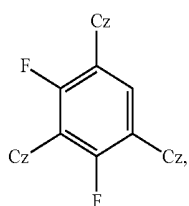
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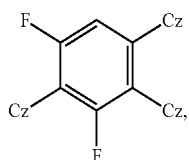
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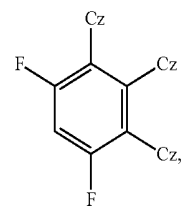
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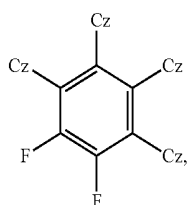
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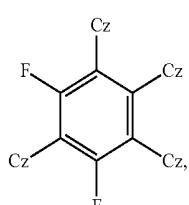
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Compound 598

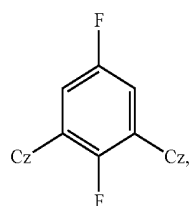


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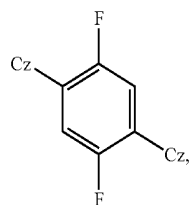


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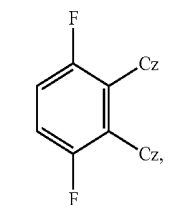
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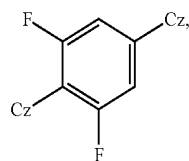
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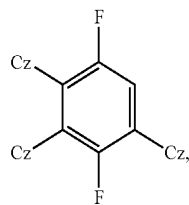
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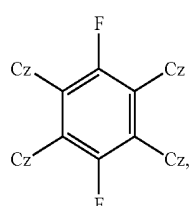
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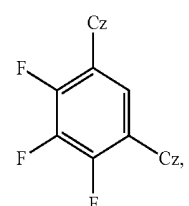
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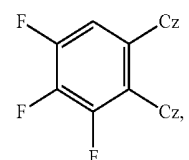
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Compound 606

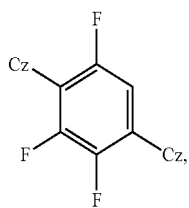


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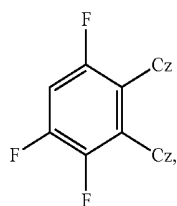


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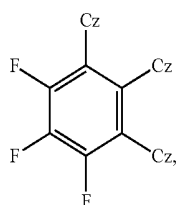
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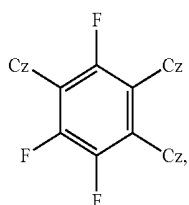
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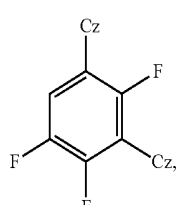
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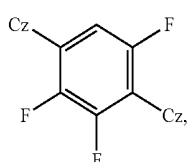
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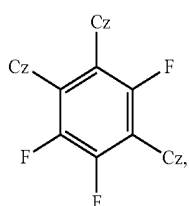
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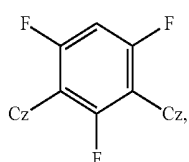
Compound 613



Compound 614

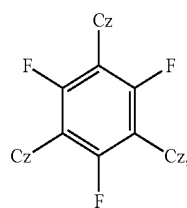


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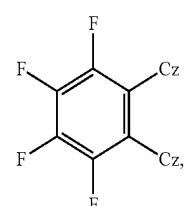


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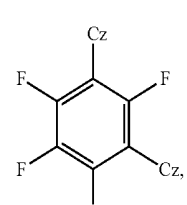
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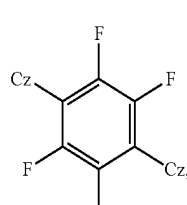
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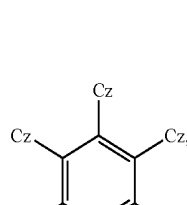
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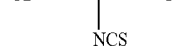
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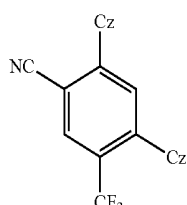
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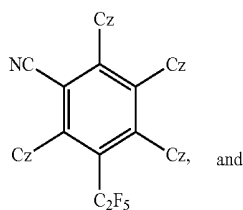
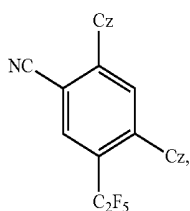
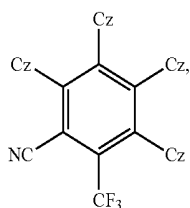


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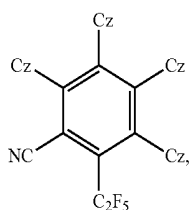


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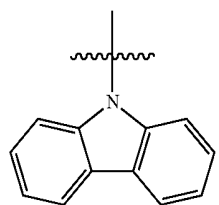
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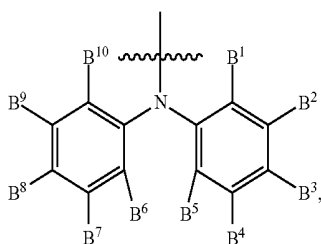
and



wherein Cz is

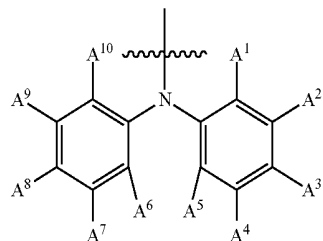


12. The compound of claim 1, wherein R⁵ is



and R¹ is

Compound 739



Compound 740

13. The compound of claim 12, wherein A⁵ and A⁶ are joined by a single bond.

14-15. (canceled)

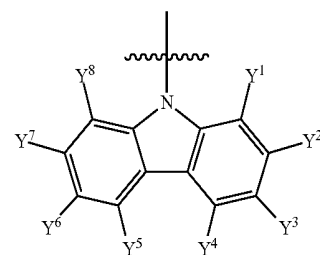
16. The compound of claim 12, wherein A⁵ and A⁶ are joined by a single bond; and wherein B⁵ and B⁶ are joined by a single bond.

17-18. (canceled)

19. The compound of claim 12, wherein at least one of R²-R⁴ is

Compound 741

Compound 742



20-21. (canceled)

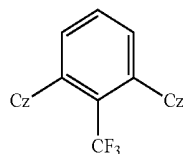
22. The compound of claim 12, wherein at least one of R²-R⁴ comprises an acceptor group selected from the group consisting of —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, and —SC_mF_{2m+1}.

23. (canceled)

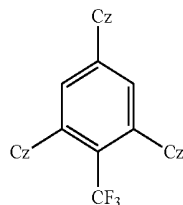
24. The compound of claim 12 wherein at least one R¹-R⁴ is an electron withdrawing group with a Hammett value (σ_{para}) of at least 0.05.

25. The compound of claim 12, wherein the compound is selected from the group consisting of:

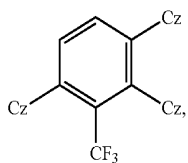
Compound 1



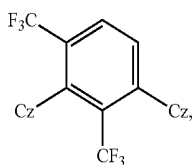
Compound 6



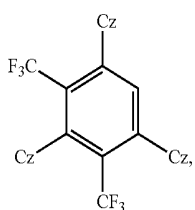
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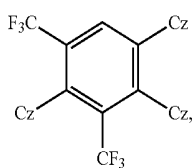
Compound 7



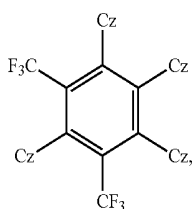
Compound 31



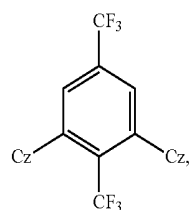
Compound 37



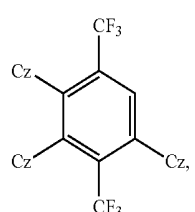
Compound 38



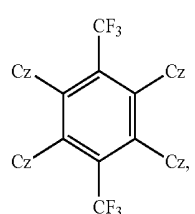
Compound 41



Compound 42

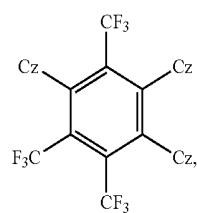


Compound 46

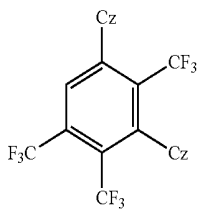


Compound 47

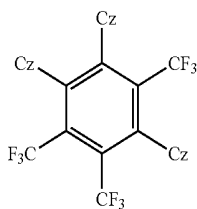
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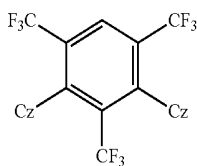
Compound 53



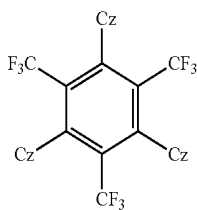
Compound 54



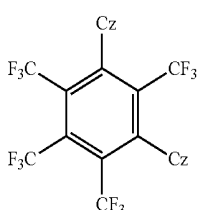
Compound 56



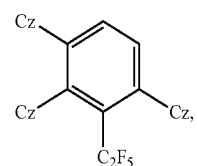
Compound 57



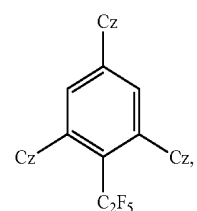
Compound 58



Compound 61

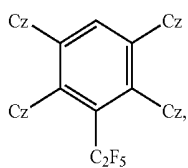


Compound 66

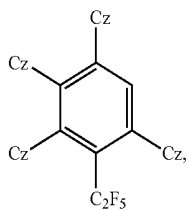


Compound 67

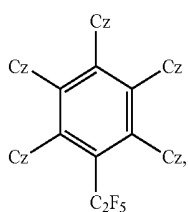
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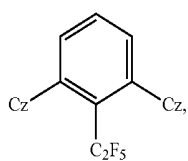
Compound 72



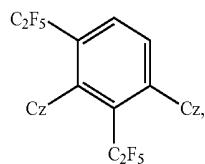
Compound 74



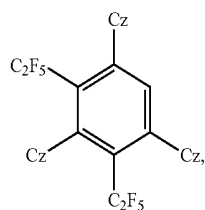
Compound 75



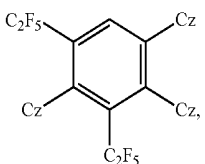
Compound 76



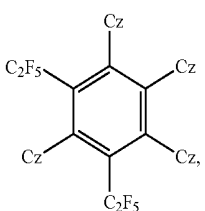
Compound 93



Compound 99

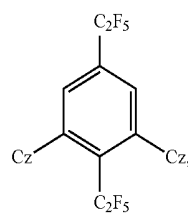


Compound 100

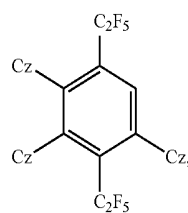


Compound 103

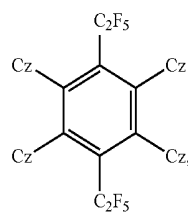
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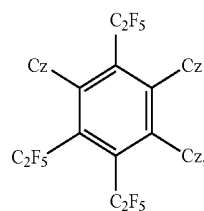
Compound 104



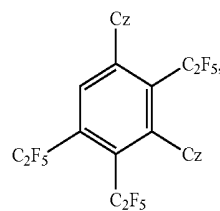
Compound 108



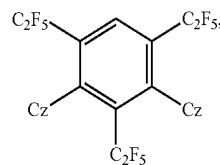
Compound 109



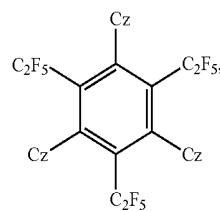
Compound 115



Compound 116

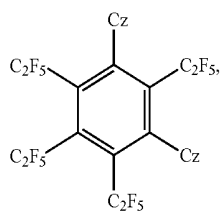


Compound 119

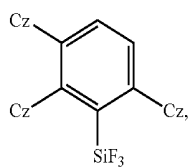


Compound 120

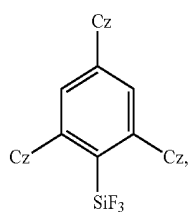
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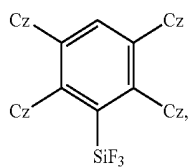
Compound 123



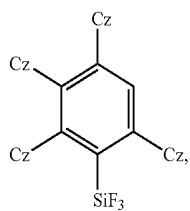
Compound 128



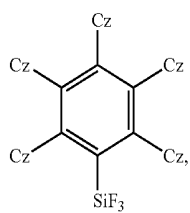
Compound 129



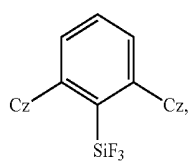
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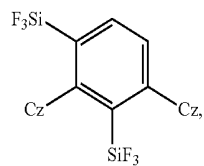
Compound 136



Compound 137

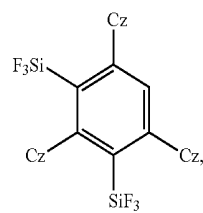


Compound 138

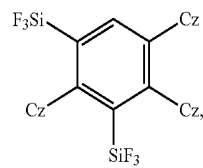


Compound 155

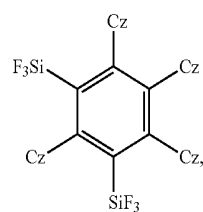
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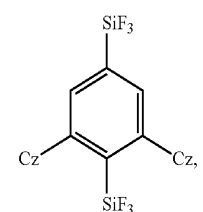
Compound 161



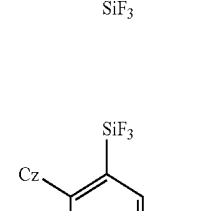
Compound 162



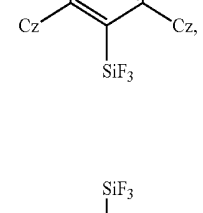
Compound 165



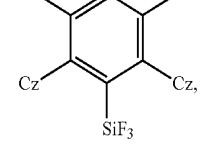
Compound 166



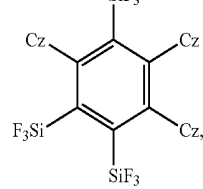
Compound 170



Compound 171

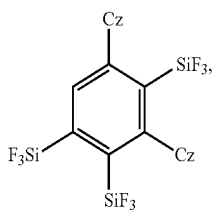


Compound 177

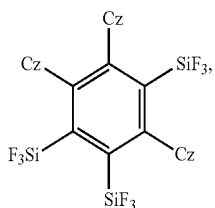


Compound 177

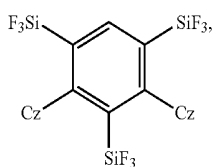
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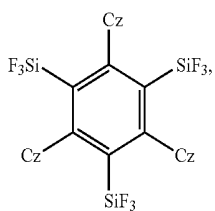
Compound 178



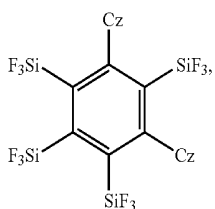
Compound 180



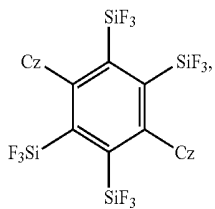
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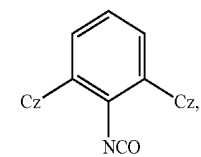
Compound 182



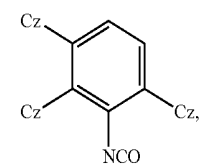
Compound 185



Compound 186

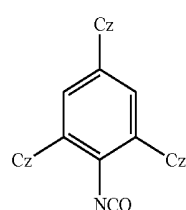


Compound 187

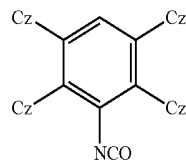


Compound 191

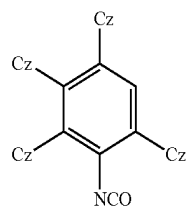
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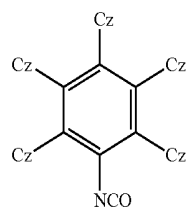
Compound 192



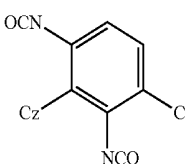
Compound 197



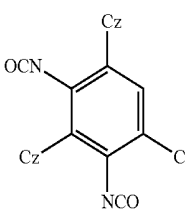
Compound 199



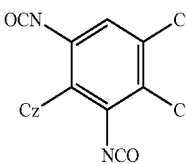
Compound 200



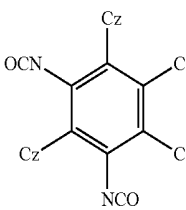
Compound 218



Compound 224

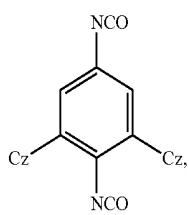


Compound 225

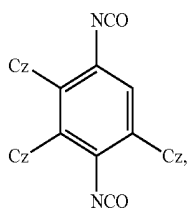


Compound 228

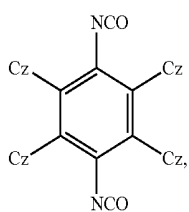
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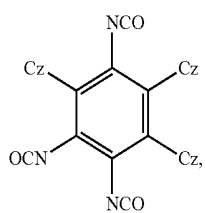
Compound 229



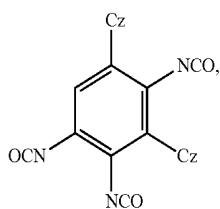
Compound 233



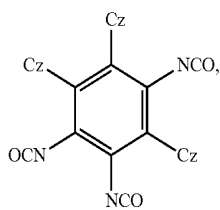
Compound 234



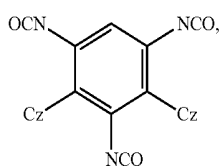
Compound 240



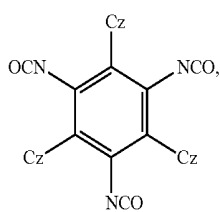
Compound 241



Compound 243

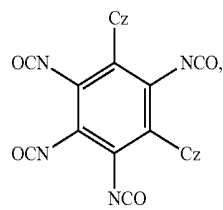


Compound 244

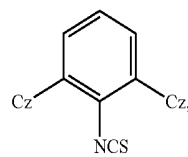


Compound 245

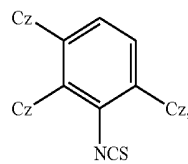
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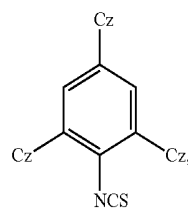
Compound 247



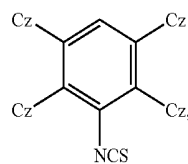
Compound 249



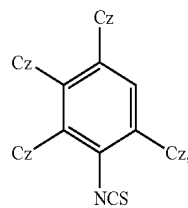
Compound 253



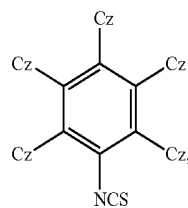
Compound 254



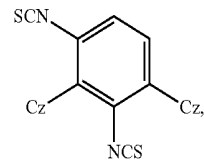
Compound 259



Compound 261

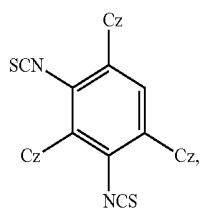


Compound 262

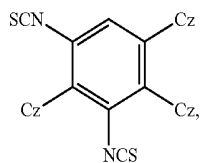


Compound 281

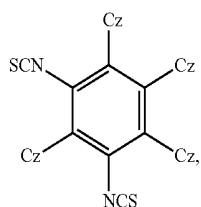
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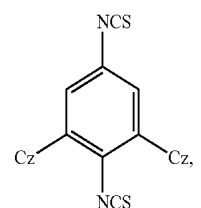
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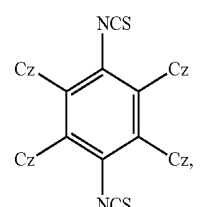
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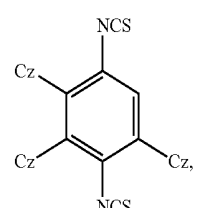
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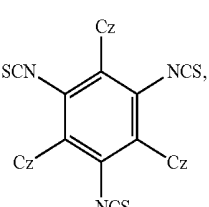
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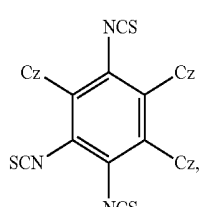
Compound 295



Compound 296

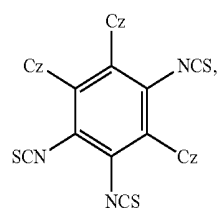


Compound 297

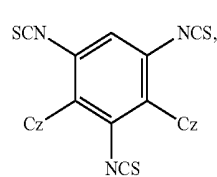


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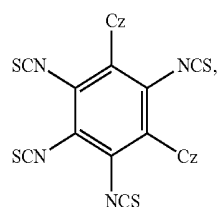
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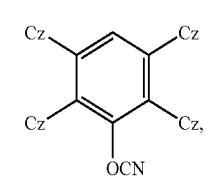
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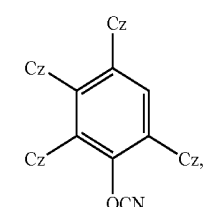
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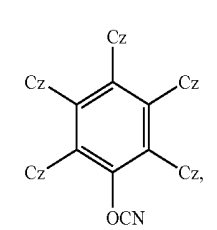
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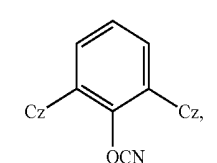
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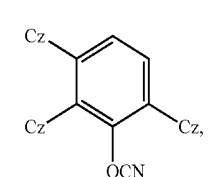
Compound 313



Compound 314

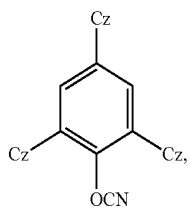


Compound 329

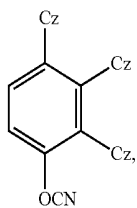


Compound 333

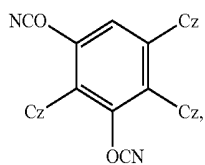
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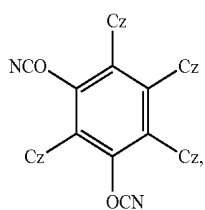
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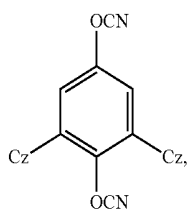
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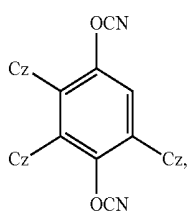
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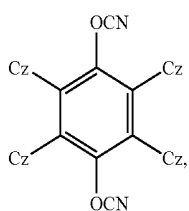
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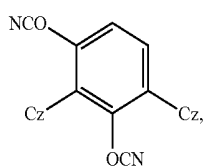
Compound 343



Compound 347

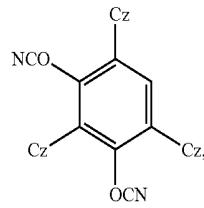


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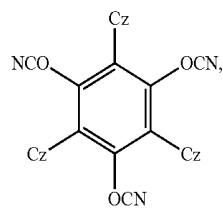


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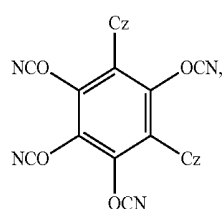
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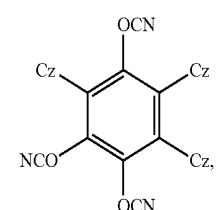
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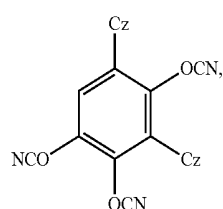
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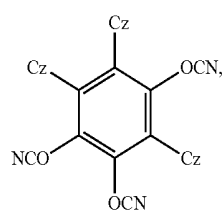
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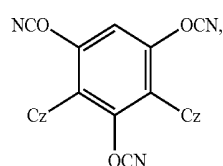
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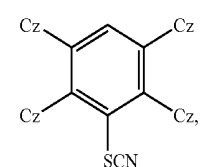
Compound 369



Compound 371

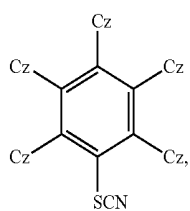


Compound 372

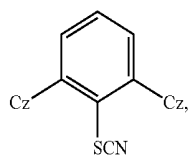


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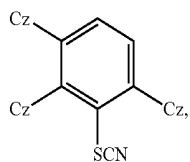
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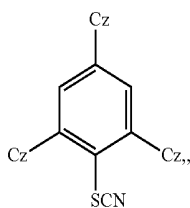
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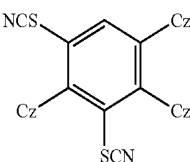
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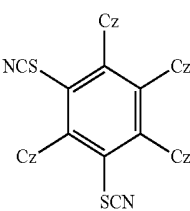
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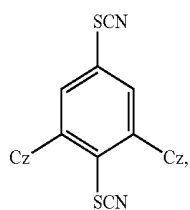
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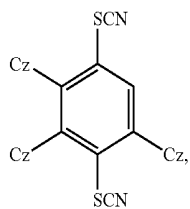
Compound 401



Compound 404

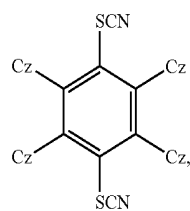


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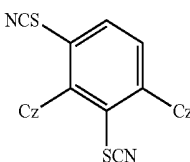


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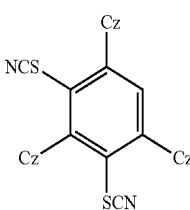
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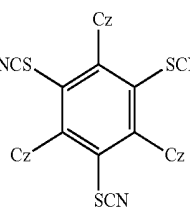
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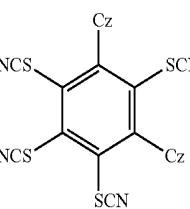
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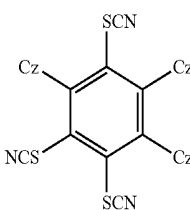
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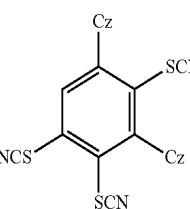
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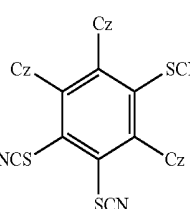
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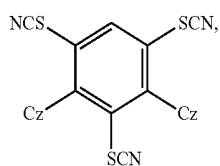


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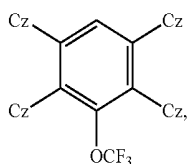


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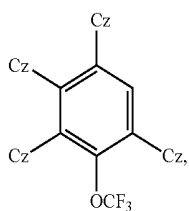
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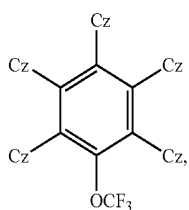
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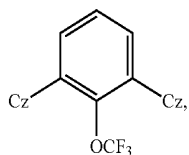
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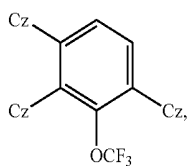
Compound 437



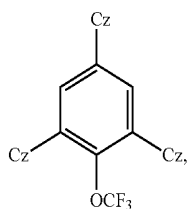
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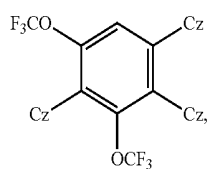
Compound 453



Compound 457

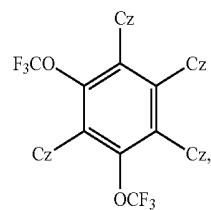


Compound 458

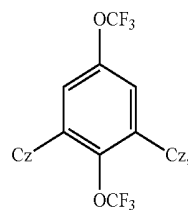


Compound 463

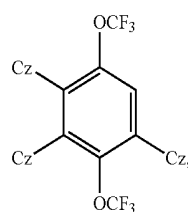
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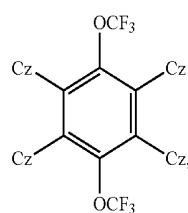
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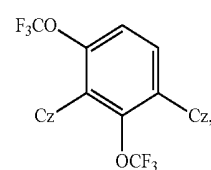
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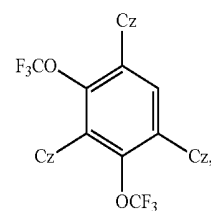
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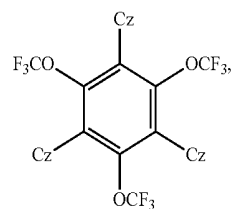
Compound 472



Compound 476

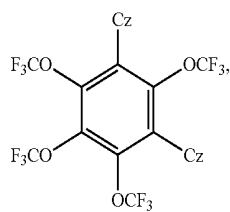


Compound 482

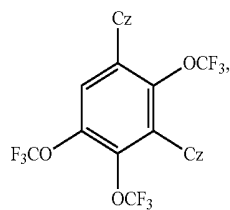


Compound 483

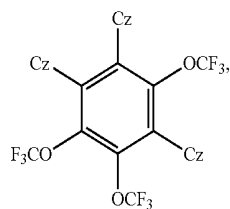
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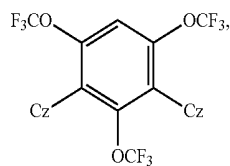
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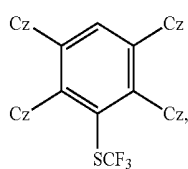
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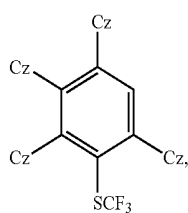
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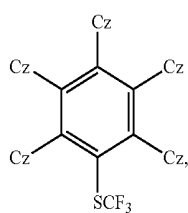
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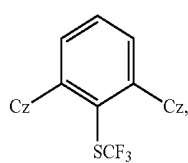
Compound 497



Compound 499

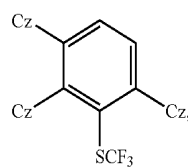


Compound 500

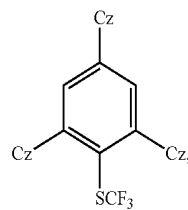


Compound 515

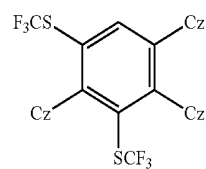
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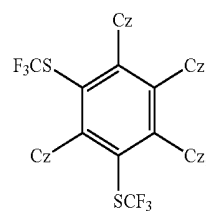
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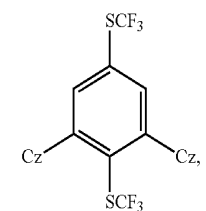
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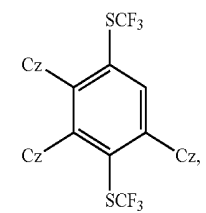
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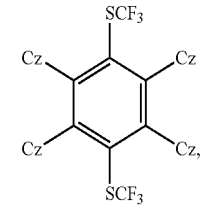
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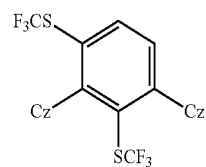
Compound 529



Compound 533

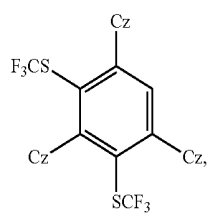


Compound 534

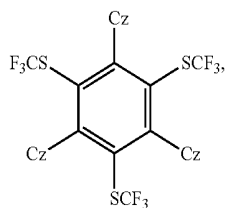


Compound 538

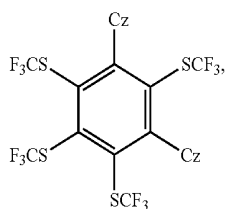
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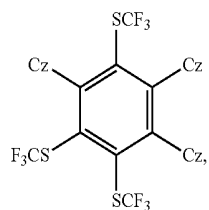
Compound 544



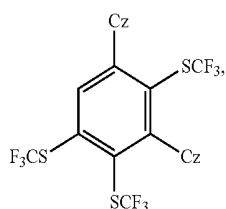
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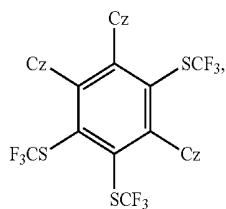
Compound 547



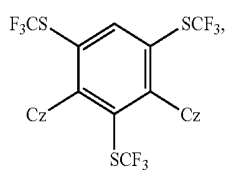
Compound 554



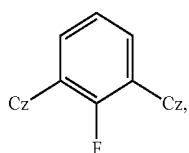
Compound 555



Compound 557

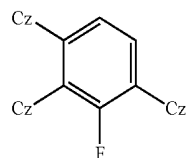


Compound 558

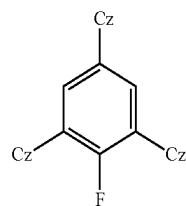


Compound 559

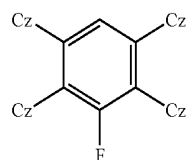
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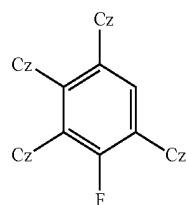
Compound 563



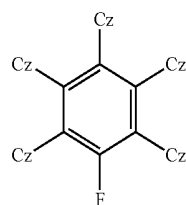
Compound 564



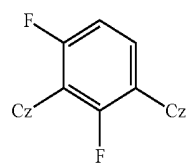
Compound 569



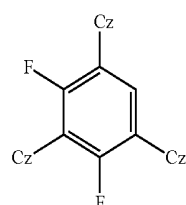
Compound 571



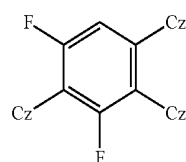
Compound 572



Compound 590

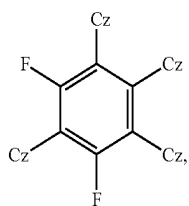


Compound 596

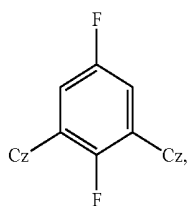


Compound 597

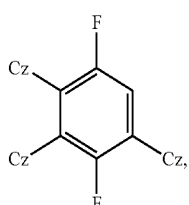
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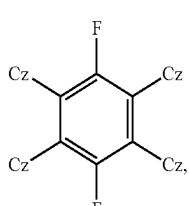
Compound 600



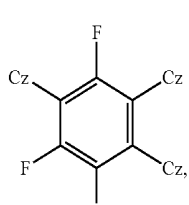
Compound 601



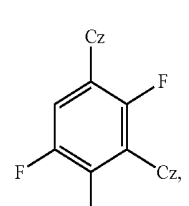
Compound 605



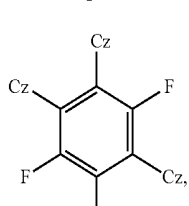
Compound 606



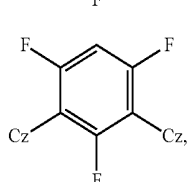
Compound 612



Compound 613

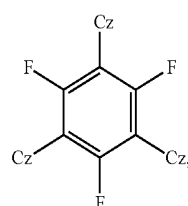


Compound 615

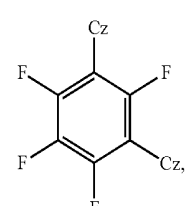


Compound 616

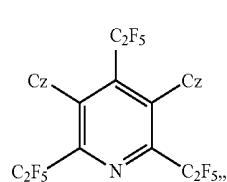
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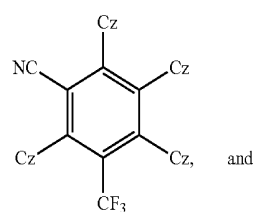
Compound 617



Compound 619

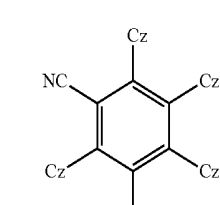


Compound 731



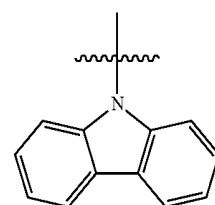
Compound 738

Compound 612



Compound 741

wherein Cz is



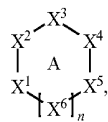
26. A first device comprising a first organic light emitting device, the first organic light emitting device comprising:

an anode;

a cathode; and

an emissive layer, disposed between the anode and the cathode;

wherein the emissive layer comprises a first emitting compound comprising a structure according to Formula 2:



Formula 2

wherein ring A is an aromatic or heteroaromatic ring;

wherein n is 0 or 1;

wherein, when n is 0, X¹, X², X³, X⁴, and X⁵ are independently selected from the group consisting of CR, N, NR, O, S, and Se, and at least one of X¹ to X⁵ is CR;

wherein, when n is 1, X¹, X², X³, X⁴, X⁵, and X⁶ are independently selected from the group consisting of CR and N, and at least one of X¹ to X⁶ is CR;

wherein each R is independently selected from the group consisting of hydrogen, deuterium, halide, alkyl, haloalkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, thioalkoxy, aryloxy, thioaryloxy, amino, arylamino, diarylamino, carbazolyl, silyl, halosilyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfonyl, sulfanyl, sulfonyl, phosphino, —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCO, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, —SC_mF_{2m+1}, and combinations thereof;

wherein adjacent R groups are, optionally, joined to form a fused ring structure;

wherein m ≥ 1;

wherein at least one R group comprises a donor group with at least one electron-donating nitrogen; and

wherein at least one R group comprises an acceptor group selected from the group consisting of —F, —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCO, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, and —SC_mF_{2m+1}.

27. The first device of claim 26, wherein at least two R groups comprise a donor group with at least one electron-donating nitrogen.

28. (canceled)

29. The first device of claim 26, wherein at least two R groups comprise an acceptor group selected from the group consisting of —F, —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCO, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, and —SC_mF_{2m+1}.

30. The first device of claim 26, wherein n=1,

wherein at least two of X¹ to X⁶ are CR, and

wherein at least two R groups are independently selected from the group consisting of F, C_mF_{2m+1}, Si_mF_{2m+1}, NCO, NCS, OCN, SCN, OC_mF_{2m+1} and SC_mF_{2m+1},

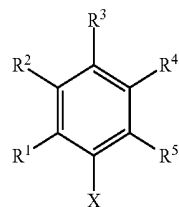
31. The first device of claim 26, wherein n=1,

wherein at least two of X¹ to X⁶ are CR,

wherein at least one R group is selected from the group consisting of —F, —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCO, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, and —SC_mF_{2m+1}, and

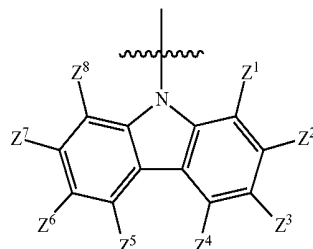
wherein at least one R is an electron withdrawing group with a Hammett value (σ_{para}) of at least 0.05.

32. The first device of claim 26, wherein the compound comprises a structure according to Formula 1:

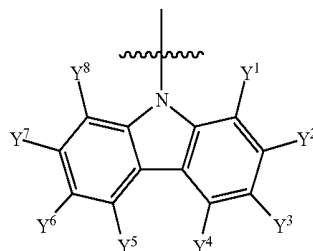


Formula 1

wherein R⁵ is



wherein at least one of R¹-R⁴ is

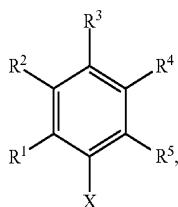


wherein R¹, R², R³, R⁴, Y¹, Y², Y³, Y⁴, Y⁵, Y⁶, Y⁷, Y⁸, Z¹, Z², Z³, Z⁴, Z⁵, Z⁶, Z⁷, and Z⁸, are each independently selected from the group consisting of hydrogen, deuterium, halide, alkyl, haloalkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, thioalkoxy, aryloxy, thioaryloxy, amino, arylamino, diarylamino, carbazolyl, silyl, halosilyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfonyl, sulfanyl, sulfonyl, phosphino, —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCO, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, —SC_mF_{2m+1}, and combinations thereof;

wherein adjacent Y, and Z groups are, optionally, joined to form a fused ring structure; and

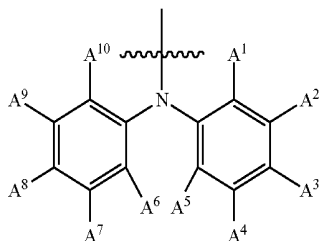
wherein X comprises an acceptor group selected from the group consisting of —F, —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCO, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, and —SC_mF_{2m+1}.

33. The first device of claim 26, wherein the compound comprises a structure according to Formula 1:

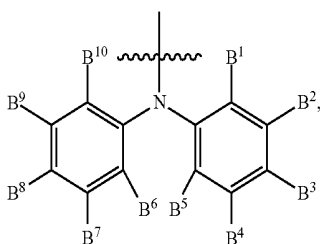


Formula 1

wherein R¹ is



and R⁵ is

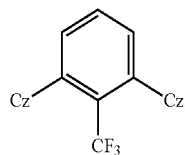


wherein R², R³, A¹, A², A³, A⁴, A⁵, A⁶, A⁷, A⁸, A⁹, A¹⁰, B¹, B², B³, B⁴, B⁵, B⁶, B⁷, B⁸, B⁹, and B¹⁰, are each independently selected from the group consisting of hydrogen, deuterium, halide, alkyl, haloalkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, thioalkoxy, aryloxy, thioaryloxy, amino, arylamino, diarylamino, carbazolyl, silyl, halosilyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCO, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, —SC_mF_{2m+1}, and combinations thereof,

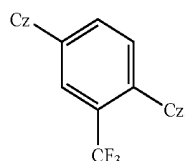
wherein adjacent R, A, and B groups are, optionally, joined to form a fused ring structure; and

wherein X is —F, —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCO, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, and —SC_mF_{2m+1}.

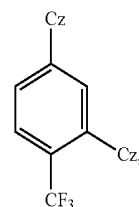
34. The first device of claim 26, wherein the compound is selected from the group consisting of:



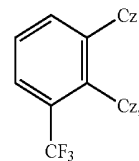
Compound 1



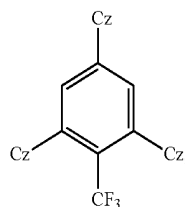
Compound 2



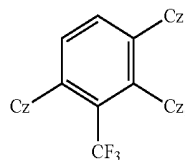
Compound 3



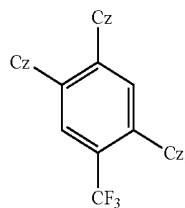
Compound 4



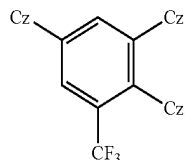
Compound 6



Compound 7

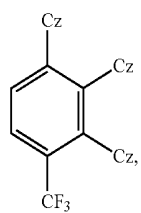


Compound 8

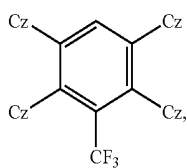


Compound 9

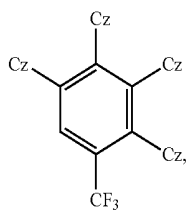
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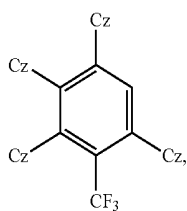
Compound 10



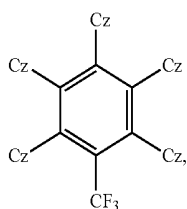
Compound 11



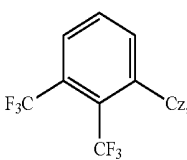
Compound 12



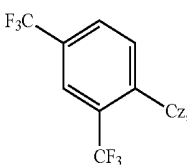
Compound 13



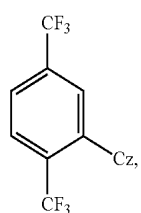
Compound 14



Compound 15

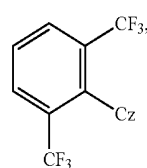


Compound 16

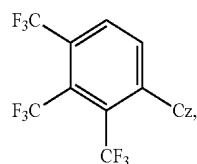


Compound 17

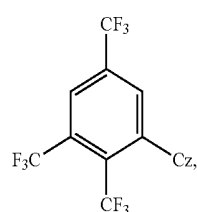
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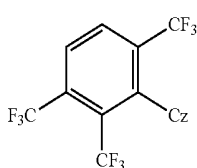
Compound 18



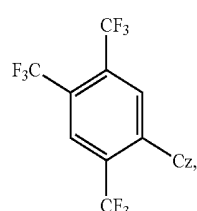
Compound 19



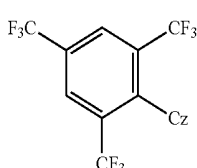
Compound 20



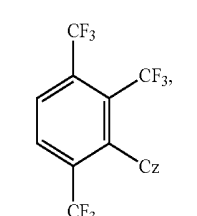
Compound 21



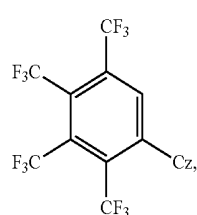
Compound 22



Compound 23

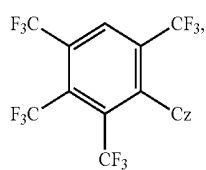


Compound 24

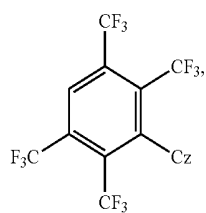


Compound 25

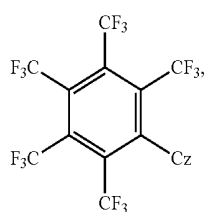
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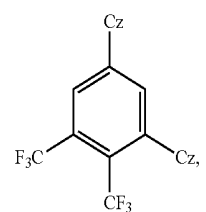
Compound 26



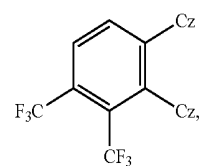
Compound 27



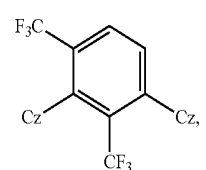
Compound 28



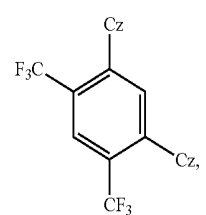
Compound 29



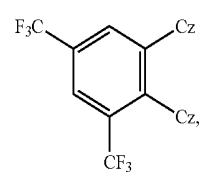
Compound 30



Compound 31

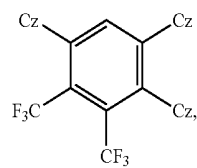


Compound 32

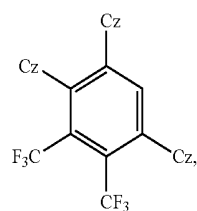


Compound 33

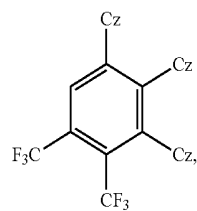
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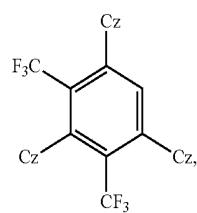
Compound 34



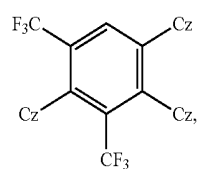
Compound 35



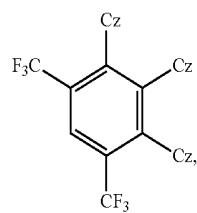
Compound 36



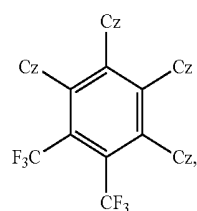
Compound 37



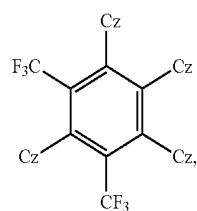
Compound 38



Compound 39

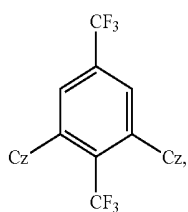


Compound 40

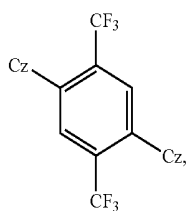


Compound 41

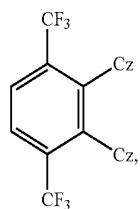
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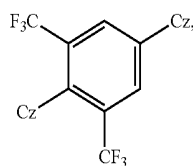
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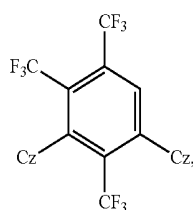
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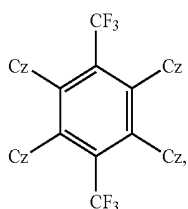
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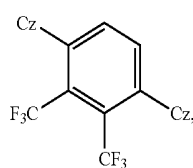
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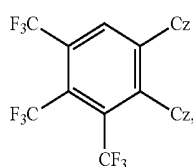
Compound 46



Compound 47

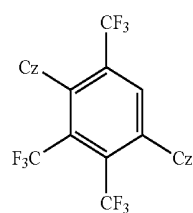


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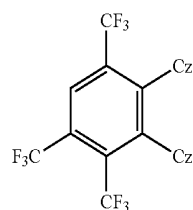


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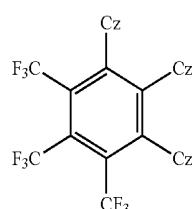
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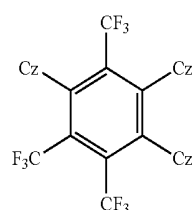
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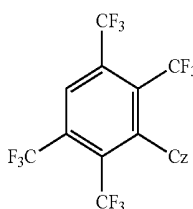
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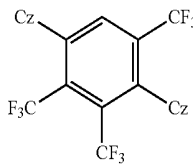
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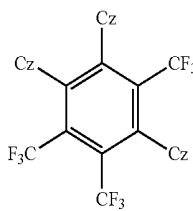
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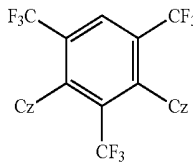
Compound 54



Compound 55

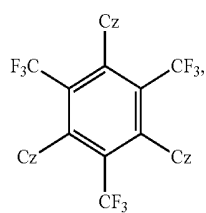


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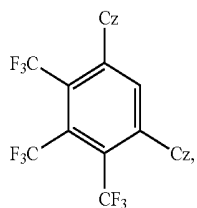


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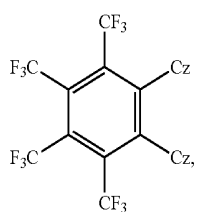
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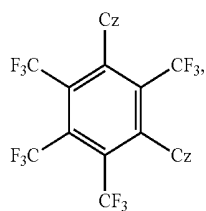
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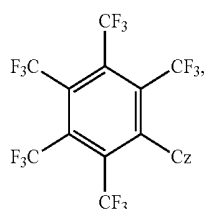
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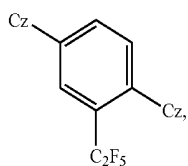
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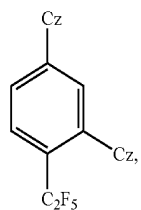
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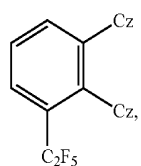
Compound 62



Compound 63

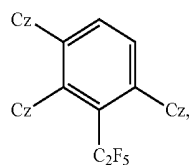


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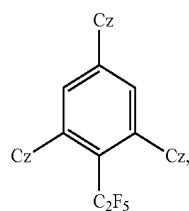


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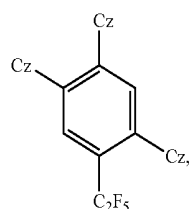
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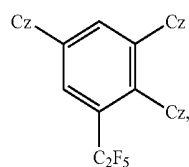
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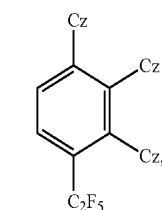
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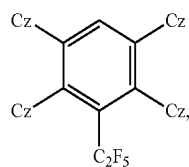
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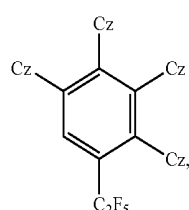
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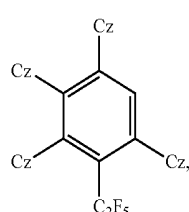
Compound 71



Compound 72

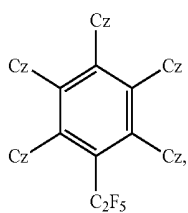


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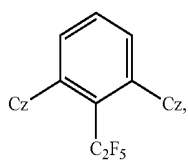


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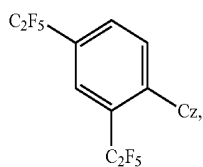
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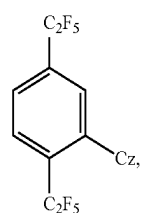
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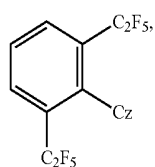
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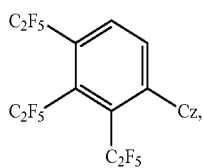
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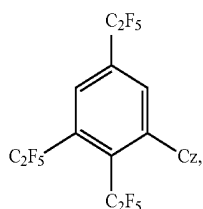
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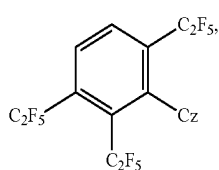
Compound 79



Compound 80

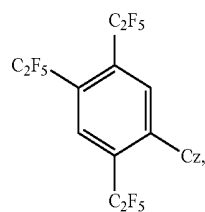


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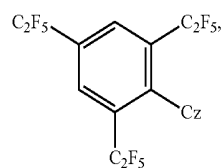


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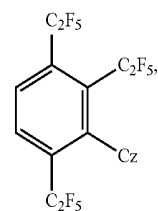
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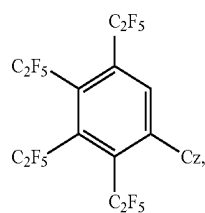
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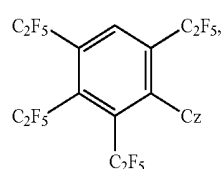
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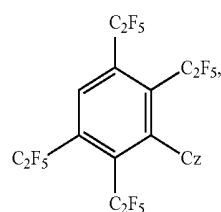
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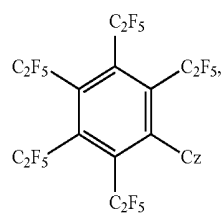
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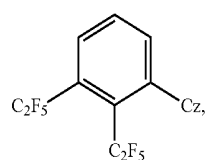
Compound 87



Compound 88

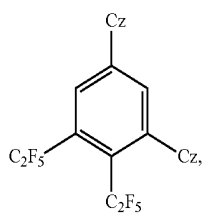


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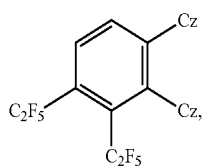


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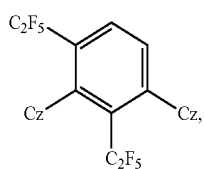
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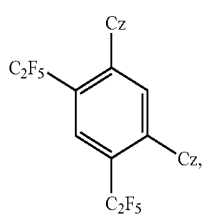
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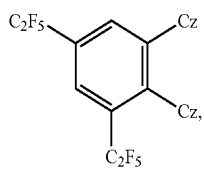
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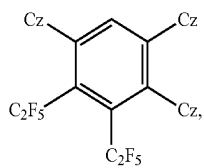
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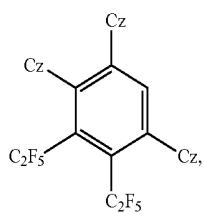
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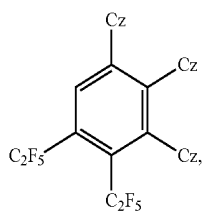
Compound 95



Compound 96

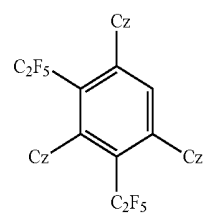


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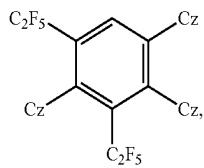


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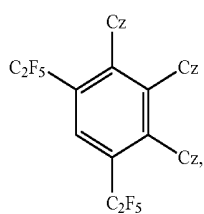
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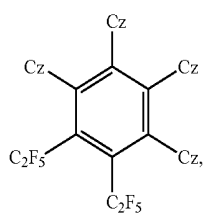
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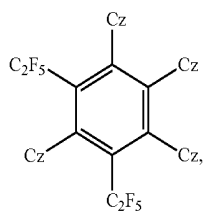
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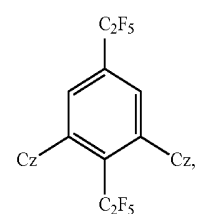
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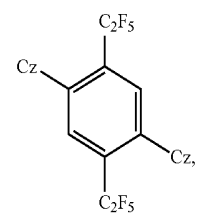
Compound 102



Compound 103

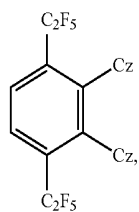


Compound 104

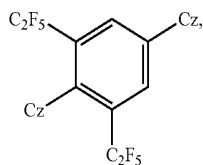


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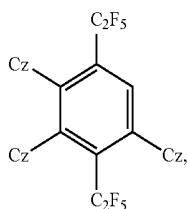
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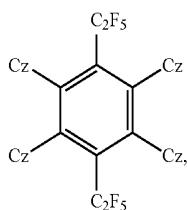
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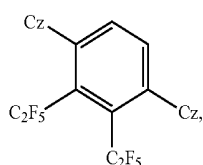
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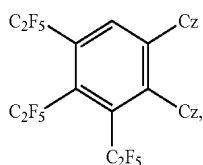
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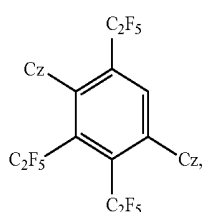
Compound 109



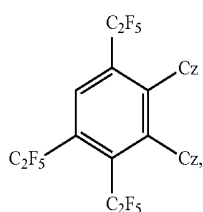
Compound 110



Compound 111

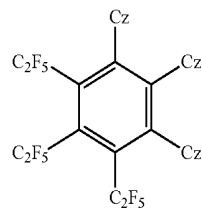


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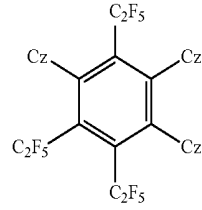


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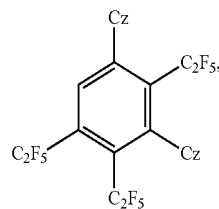
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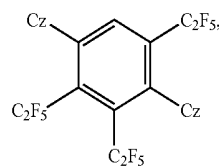
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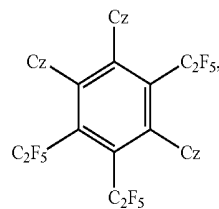
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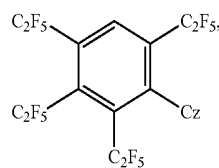
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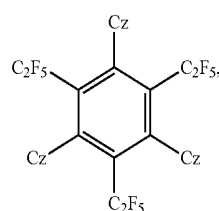
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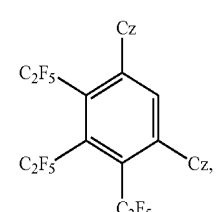
Compound 118



Compound 119

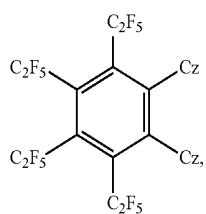


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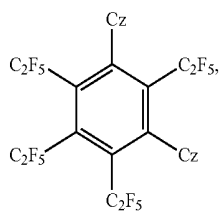


Compound 121

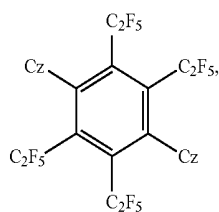
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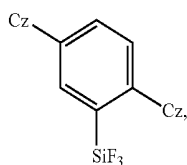
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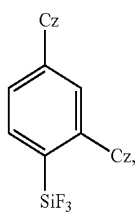
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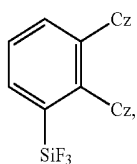
Compound 124



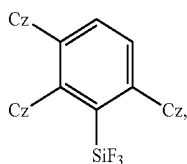
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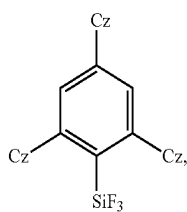
Compound 126



Compound 127

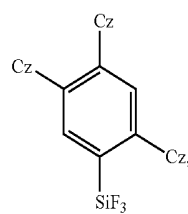


Compound 128

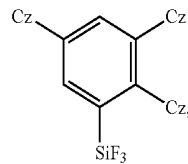


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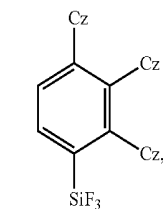
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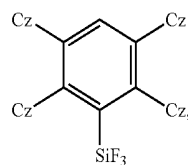
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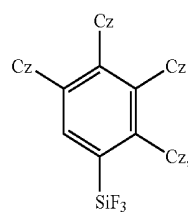
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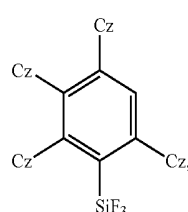
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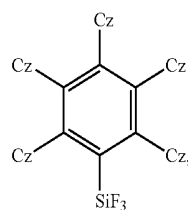
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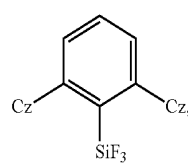
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Compound 136

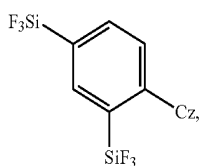


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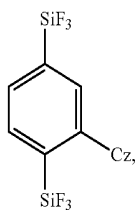


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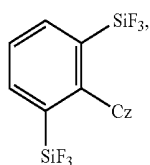
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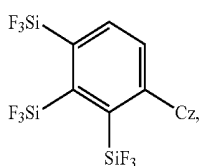
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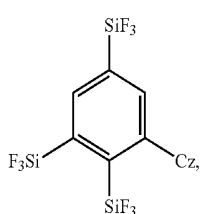
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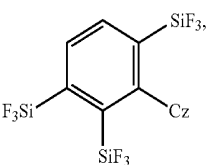
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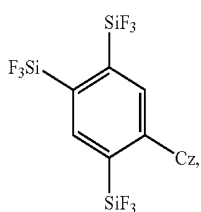
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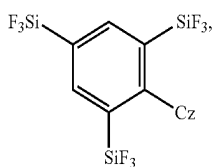
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Compound 144

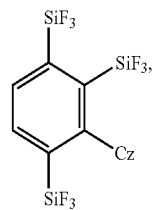


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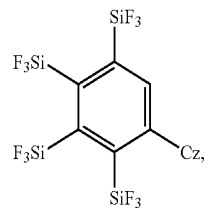


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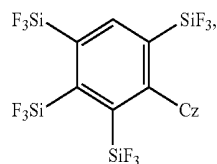
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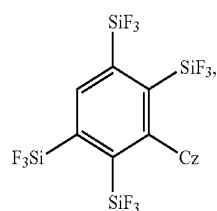
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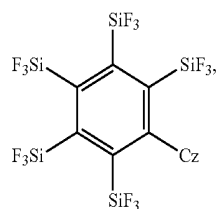
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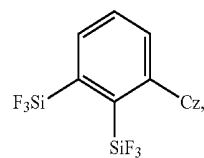
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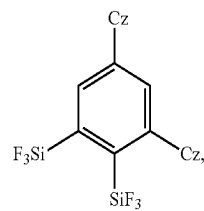
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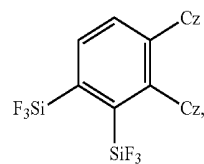
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Compound 152

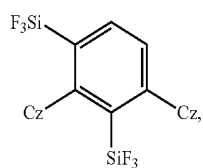


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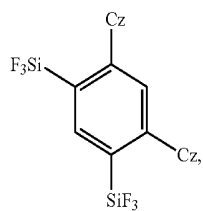


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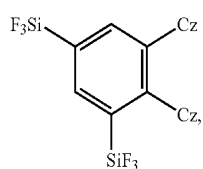
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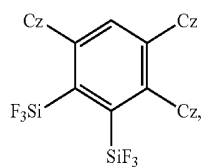
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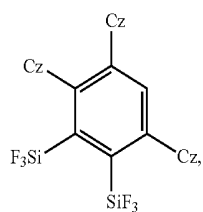
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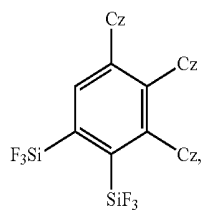
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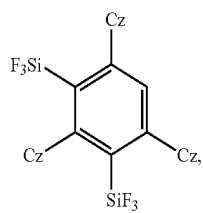
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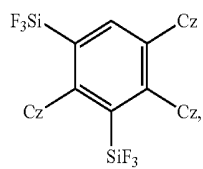
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Compound 160

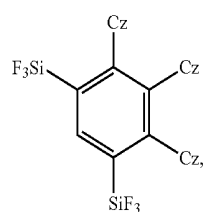


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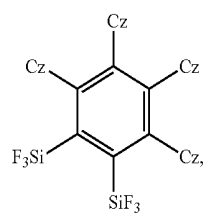


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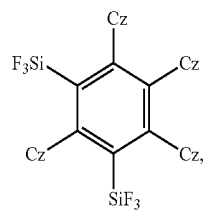
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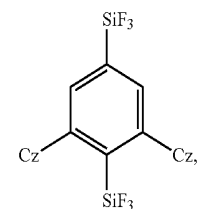
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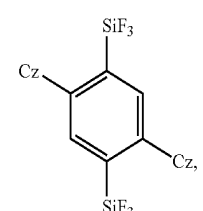
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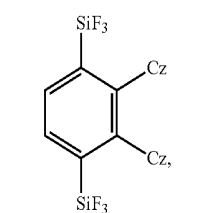
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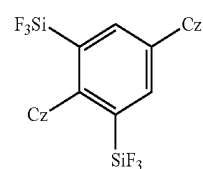
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Compound 167

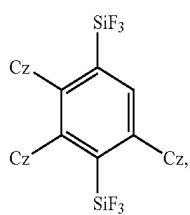


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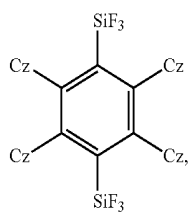


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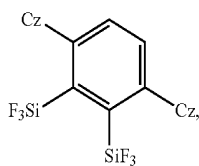
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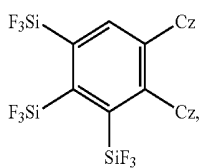
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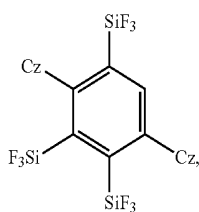
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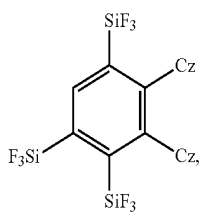
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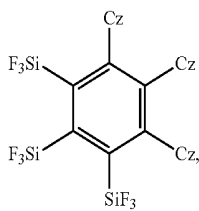
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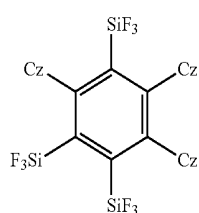
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Compound 175

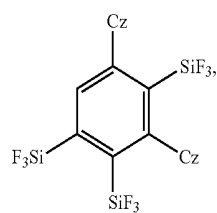


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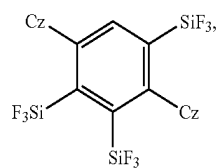


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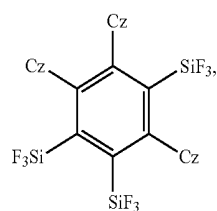
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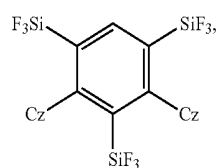
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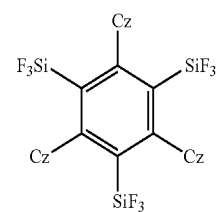
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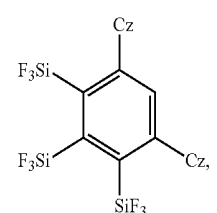
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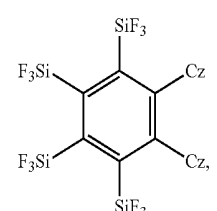
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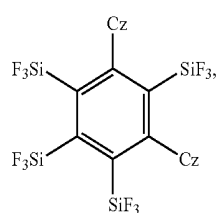
Compound 182



Compound 183

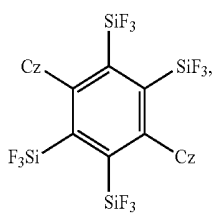


Compound 184

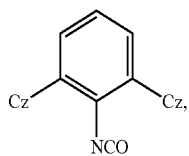


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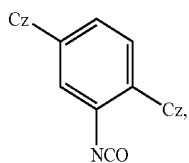
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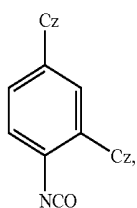
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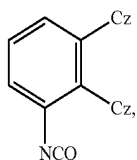
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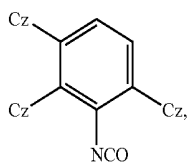
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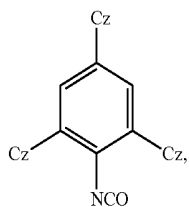
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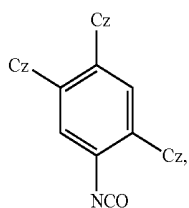
Compound 190



Compound 191

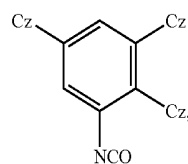


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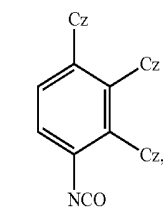


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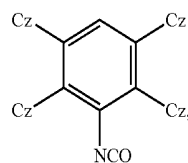
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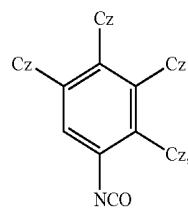
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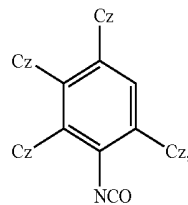
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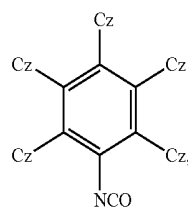
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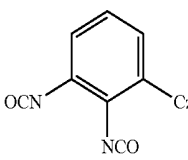
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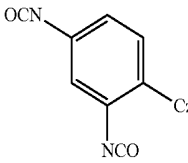
Compound 199



Compound 200

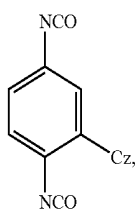


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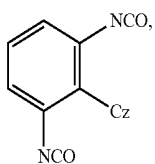


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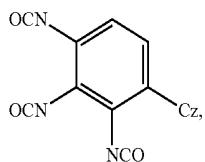
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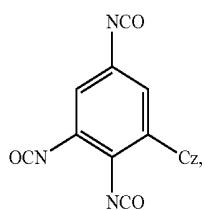
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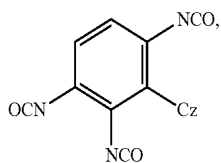
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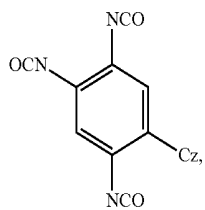
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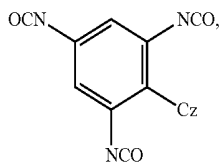
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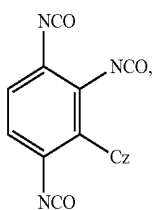
Compound 207



Compound 208

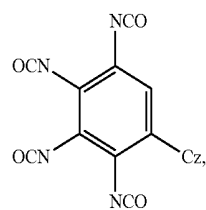


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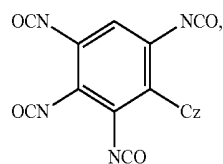


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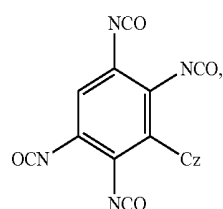
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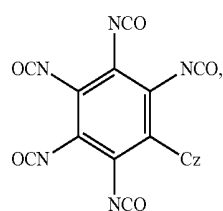
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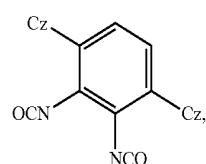
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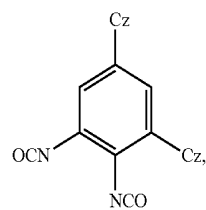
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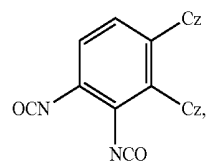
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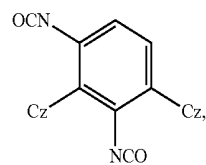
Compound 215



Compound 216

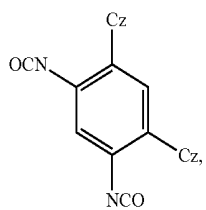


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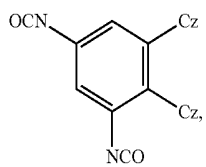


Compound 218

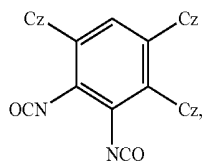
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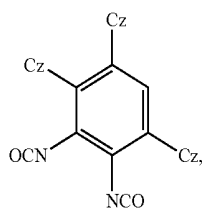
Compound 219



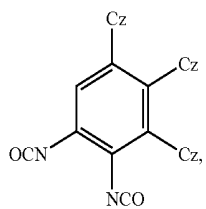
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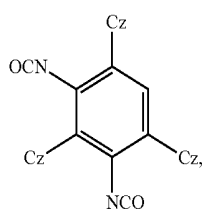
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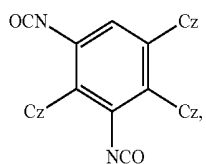
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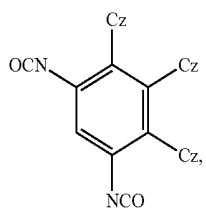
Compound 223



Compound 224

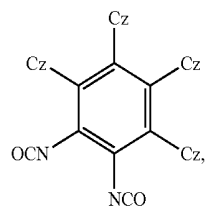


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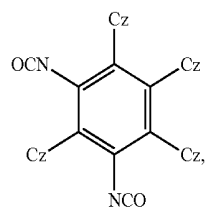


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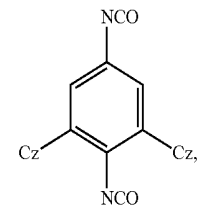
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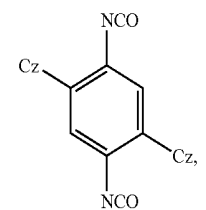
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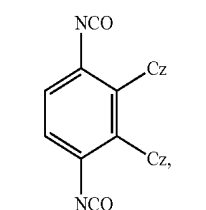
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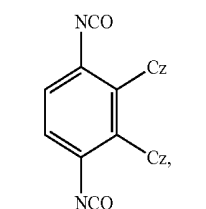
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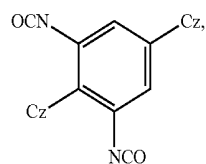
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Compound 231

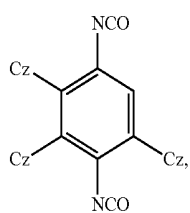


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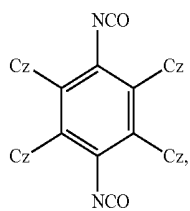


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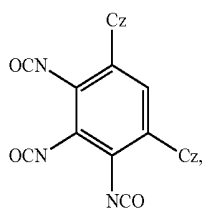
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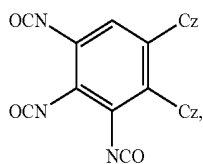
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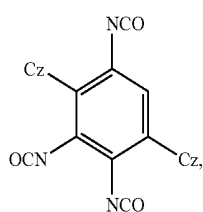
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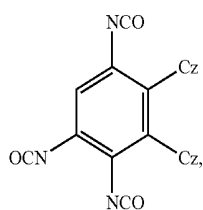
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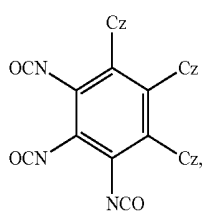
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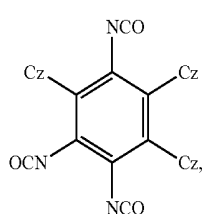
Compound 237



Compound 238

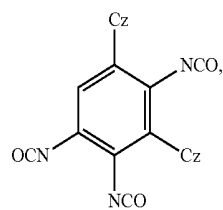


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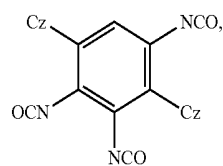


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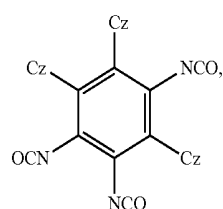
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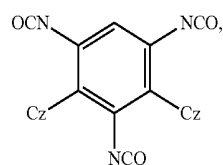
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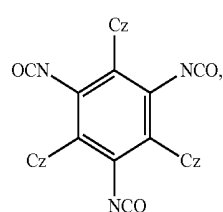
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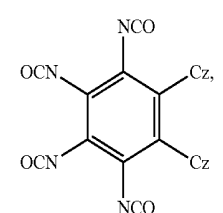
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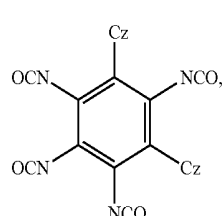
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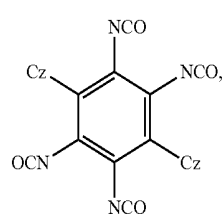
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Compound 246

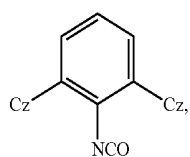


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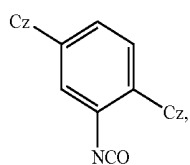


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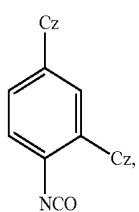
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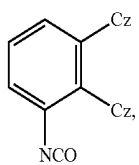
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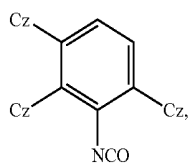
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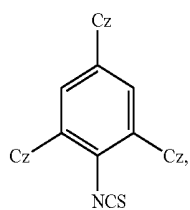
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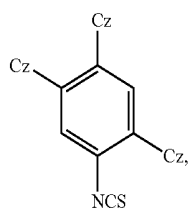
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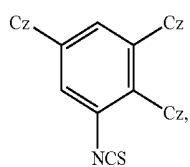
Compound 253



Compound 254

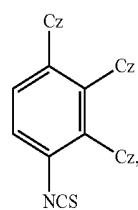


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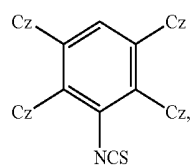


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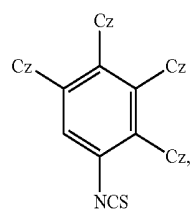
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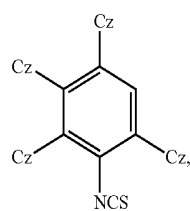
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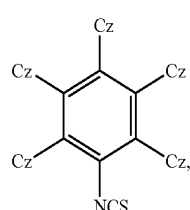
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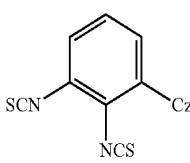
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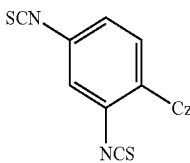
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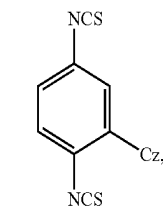
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Compound 262



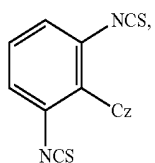
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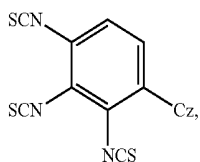
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Compound 265

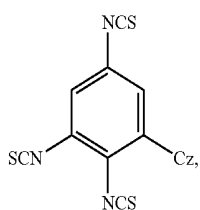
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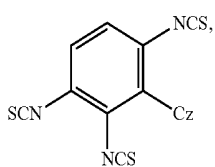
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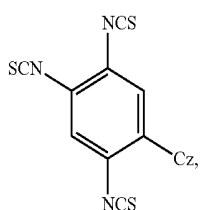
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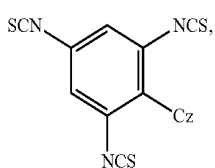
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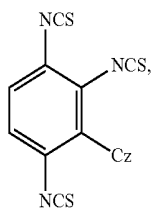
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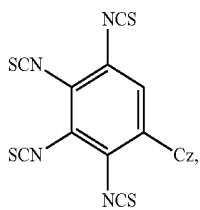
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Compound 271

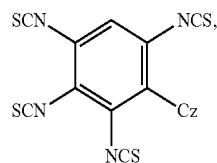


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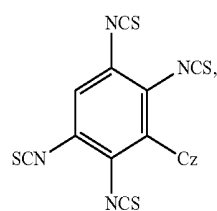


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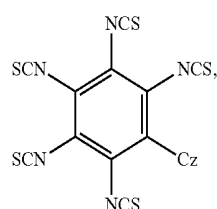
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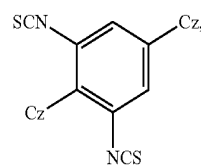
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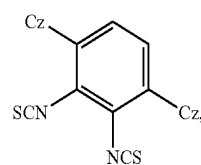
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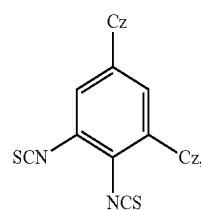
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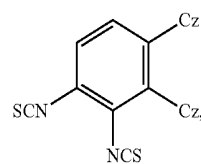
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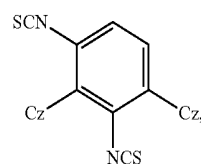
Compound 278



Compound 279

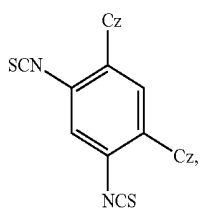


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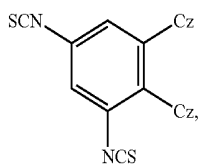


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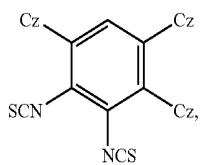
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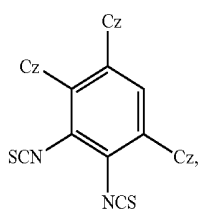
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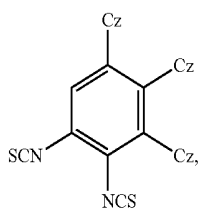
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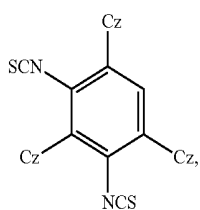
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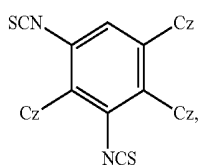
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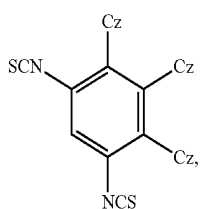
Compound 286



Compound 287

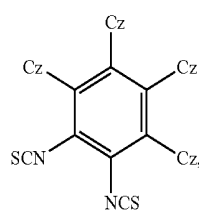


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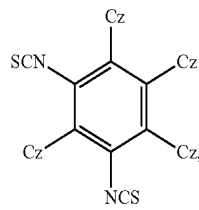


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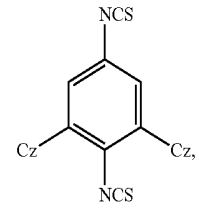
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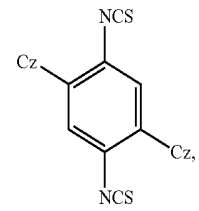
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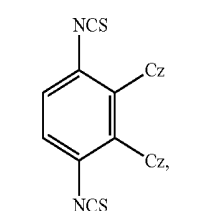
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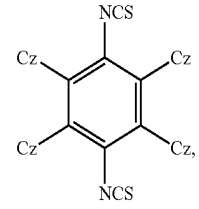
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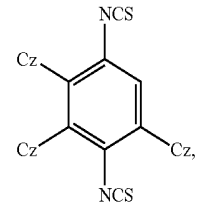
Compound 293



Compound 294

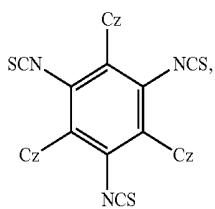


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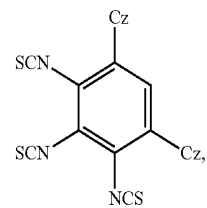


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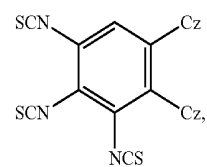
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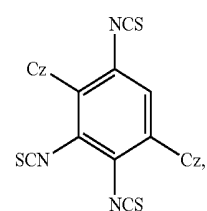
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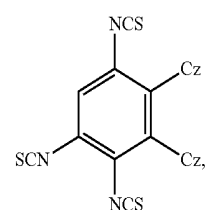
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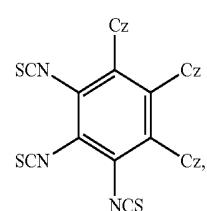
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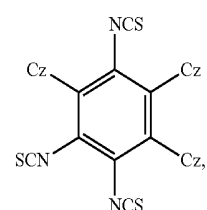
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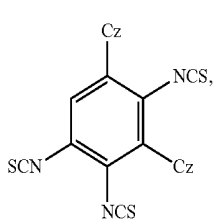
Compound 301



Compound 302

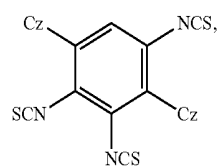


Compound 303

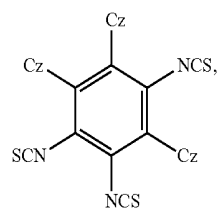


Compound 304

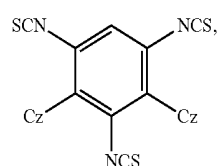
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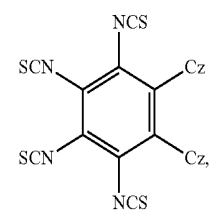
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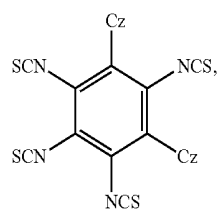
Compound 306



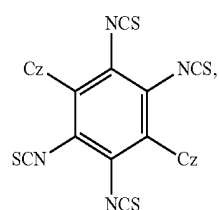
Compound 307



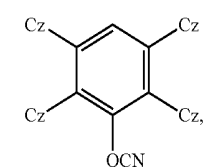
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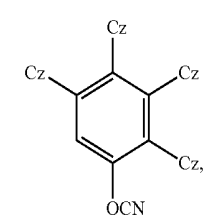
Compound 309



Compound 310

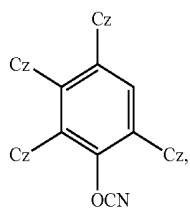


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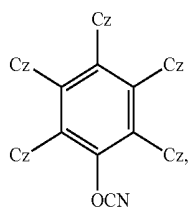


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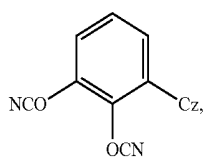
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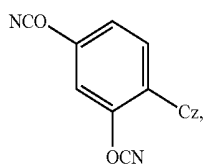
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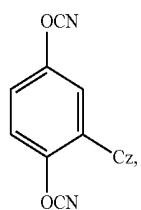
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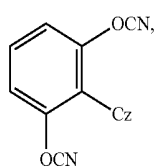
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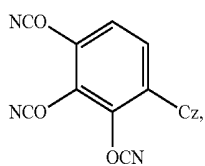
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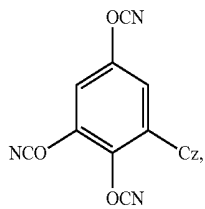
Compound 317



Compound 318

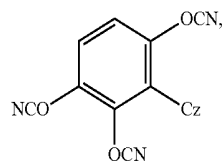


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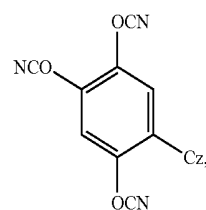


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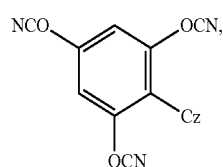
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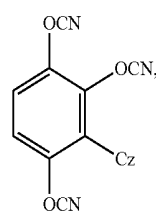
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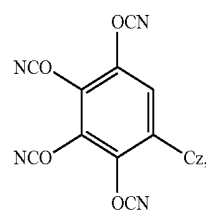
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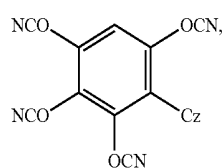
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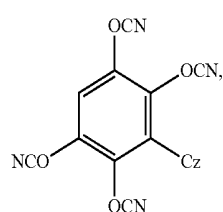
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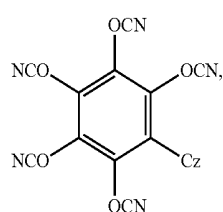
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Compound 326

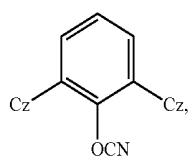


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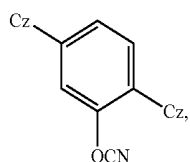


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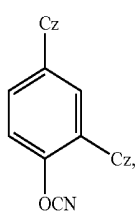
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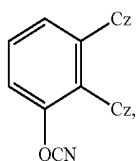
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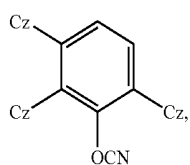
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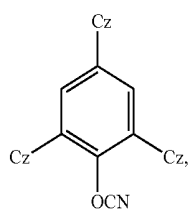
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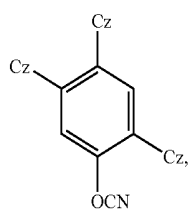
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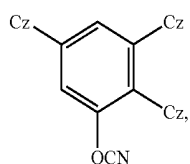
Compound 333



Compound 334

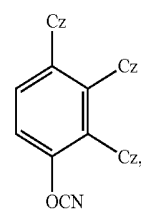


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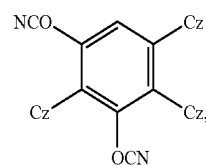


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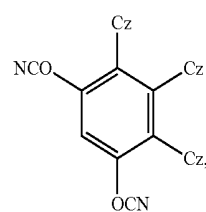
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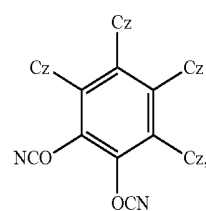
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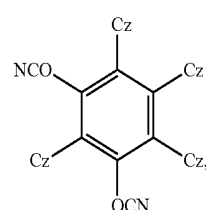
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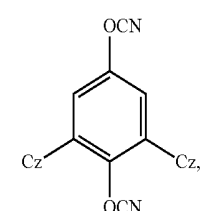
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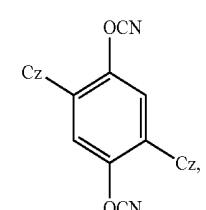
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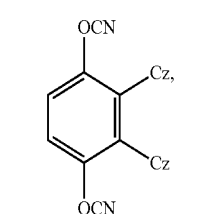
Compound 342



Compound 343

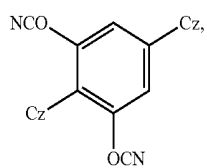


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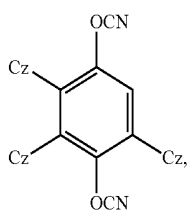


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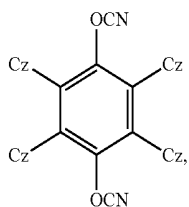
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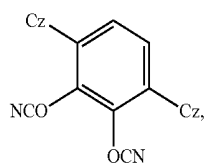
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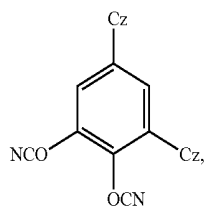
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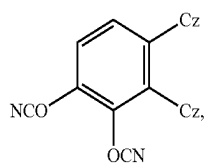
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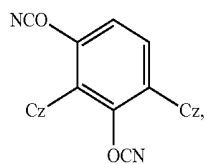
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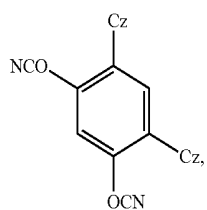
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Compound 351

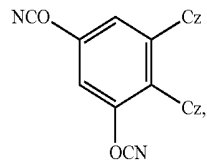


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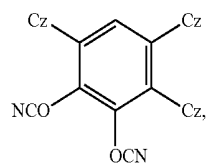


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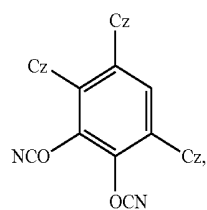
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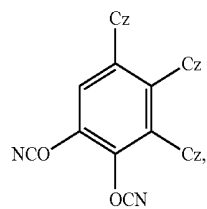
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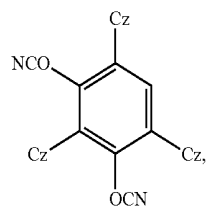
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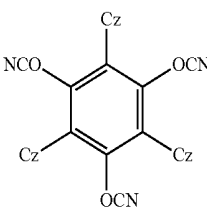
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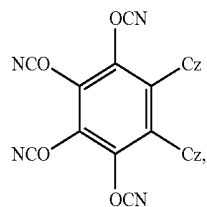
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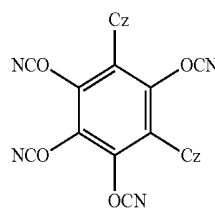
Compound 358



Compound 359

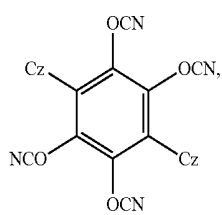


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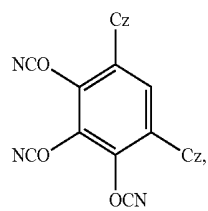


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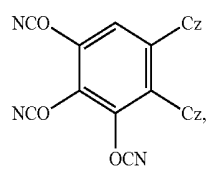
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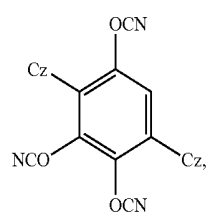
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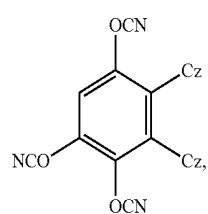
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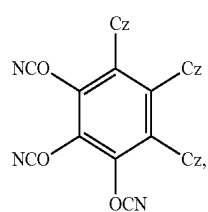
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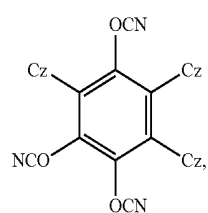
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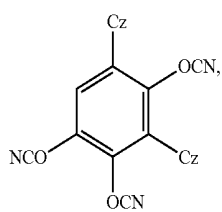
Compound 366



Compound 367

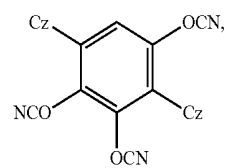


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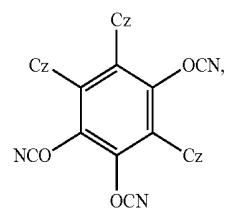


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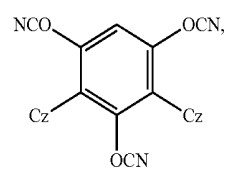
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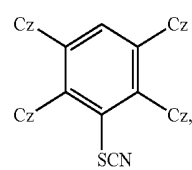
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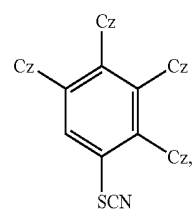
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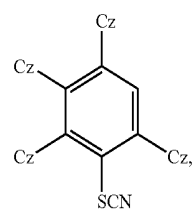
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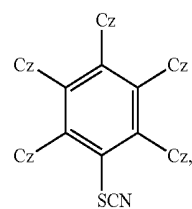
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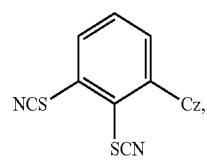
Compound 374



Compound 375

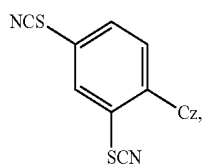


Compound 376

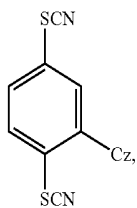


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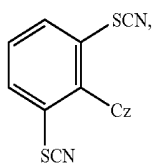
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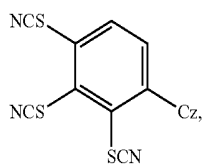
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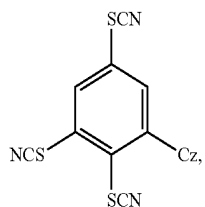
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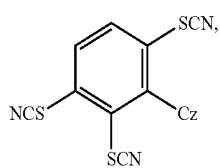
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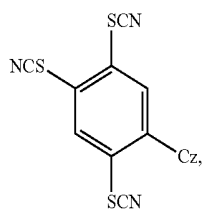
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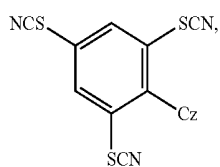
Compound 382



Compound 383

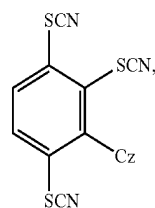


Compound 384

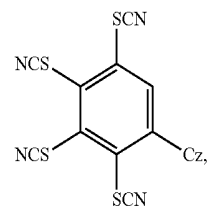


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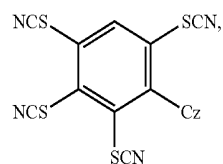
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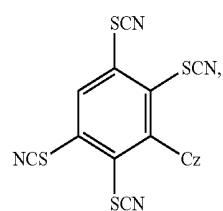
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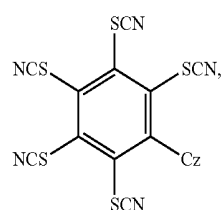
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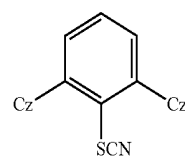
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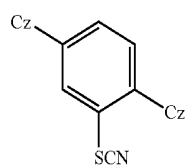
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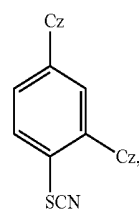
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Compound 391

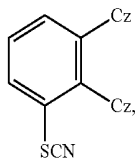


Compound 392

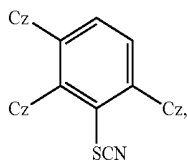


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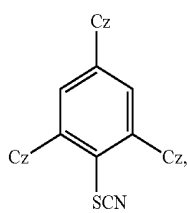
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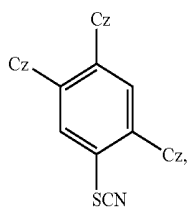
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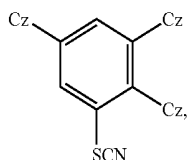
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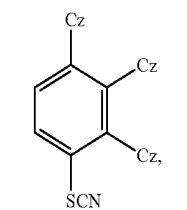
Compound 396



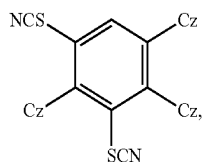
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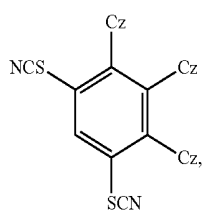
Compound 399



Compound 400

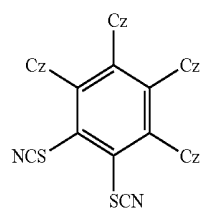


Compound 401

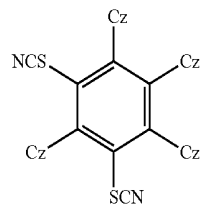


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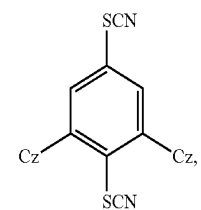
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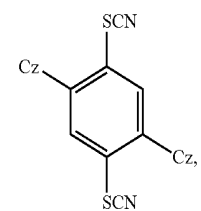
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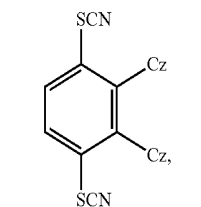
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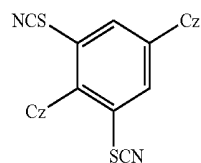
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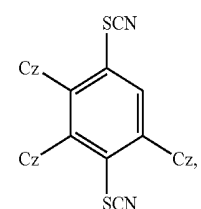
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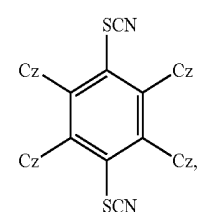
Compound 407



Compound 408

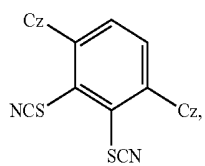


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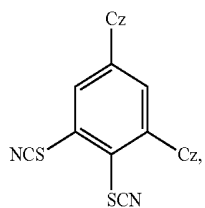


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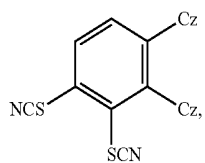
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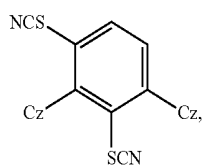
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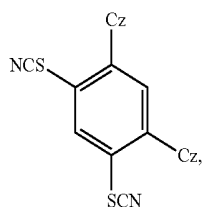
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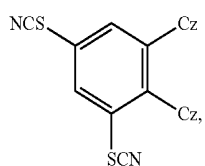
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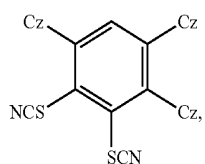
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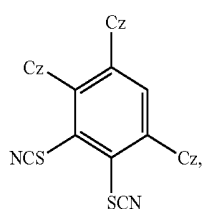
Compound 415



Compound 416

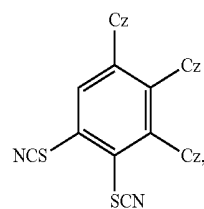


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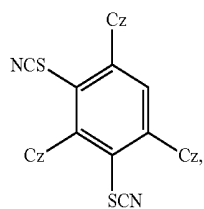


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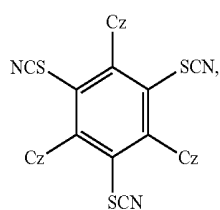
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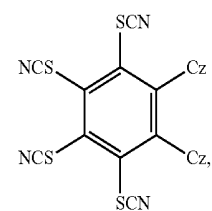
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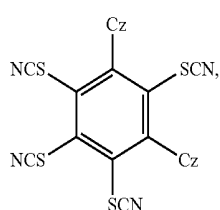
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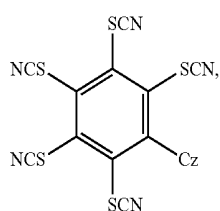
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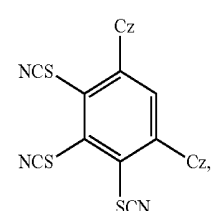
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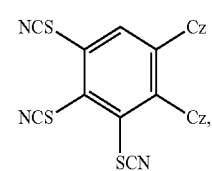
Compound 423



Compound 424

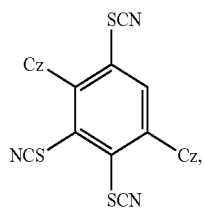


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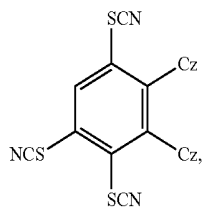


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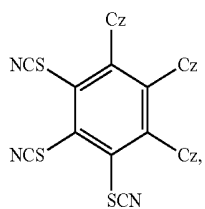
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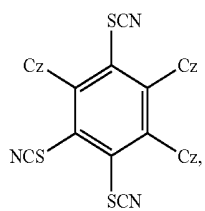
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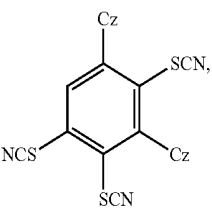
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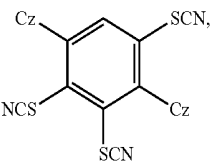
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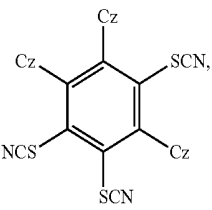
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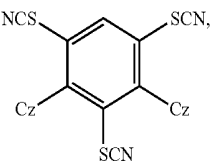
Compound 431



Compound 432

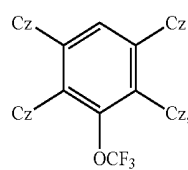


Compound 433

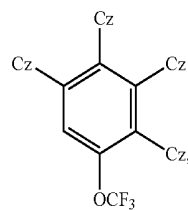


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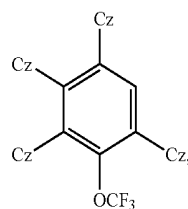
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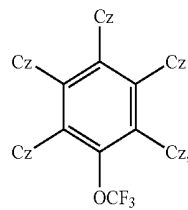
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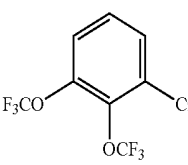
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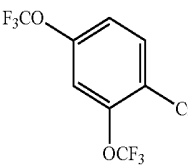
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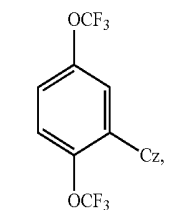
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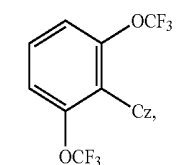
Compound 439



Compound 440

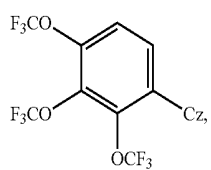


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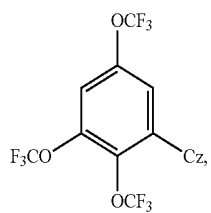


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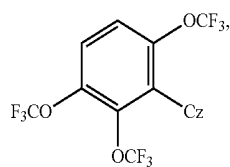
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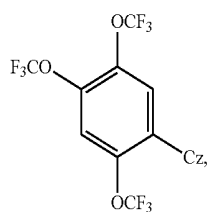
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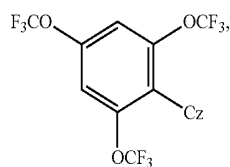
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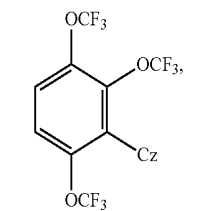
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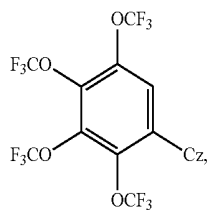
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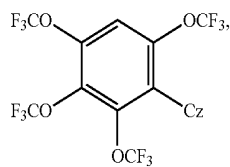
Compound 447



Compound 448

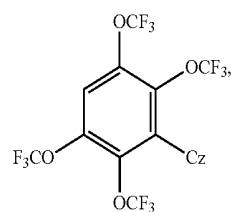


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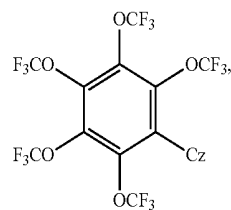


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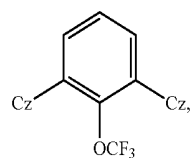
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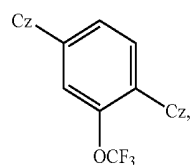
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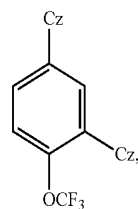
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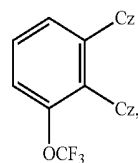
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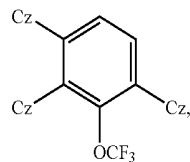
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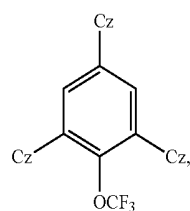
Compound 455



Compound 456

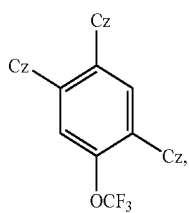


Compound 457

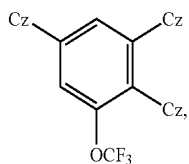


Compound 458

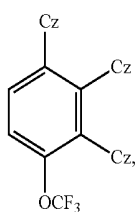
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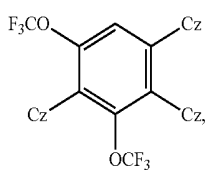
Compound 460



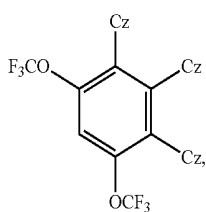
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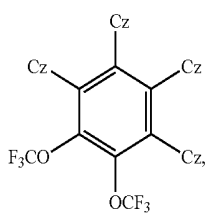
Compound 462



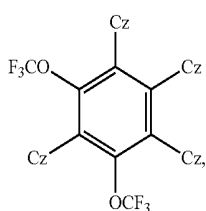
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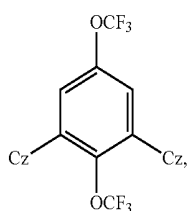
Compound 464



Compound 465

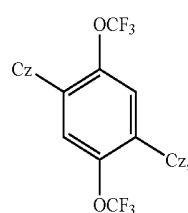


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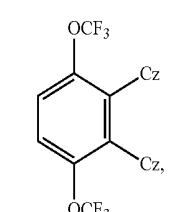


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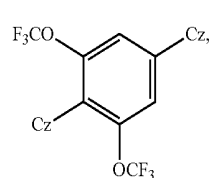
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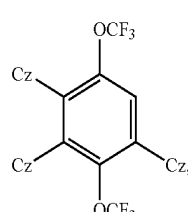
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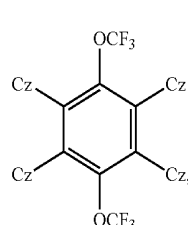
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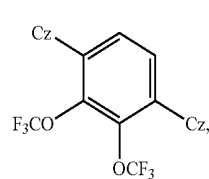
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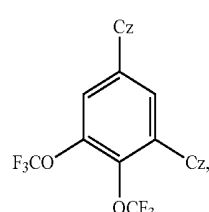
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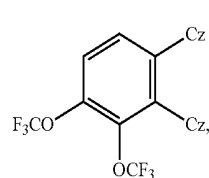
Compound 472



Compound 473

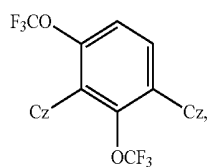


Compound 474

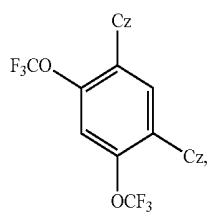


Compound 475

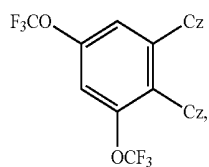
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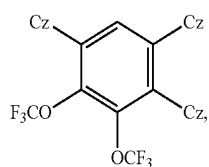
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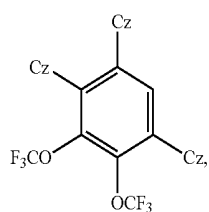
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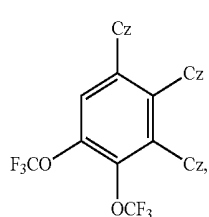
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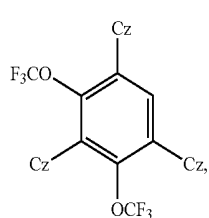
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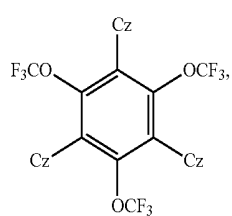
Compound 480



Compound 481

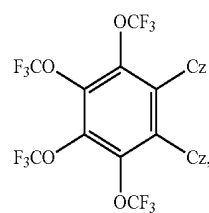


Compound 482

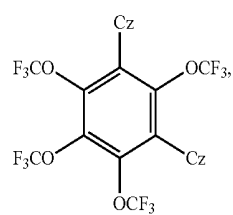


Compound 483

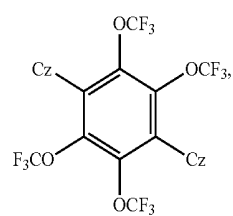
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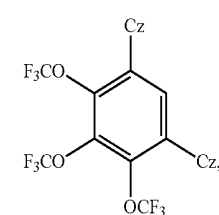
Compound 484



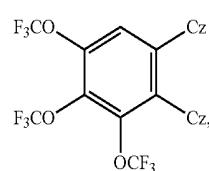
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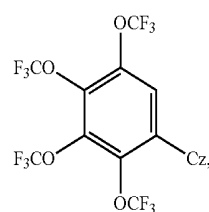
Compound 486



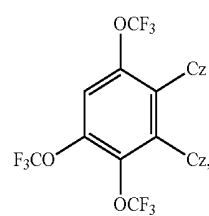
Compound 487



Compound 488

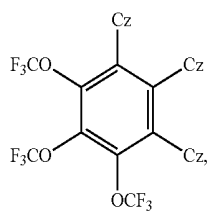


Compound 489

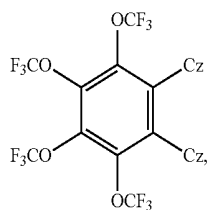


Compound 490

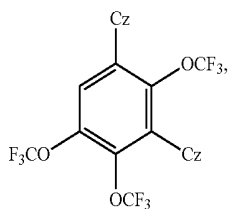
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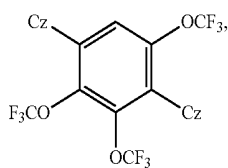
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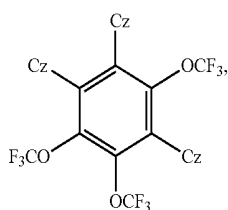
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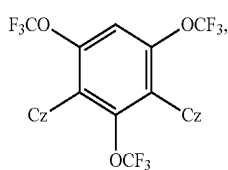
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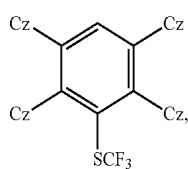
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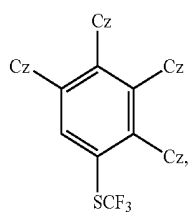
Compound 495



Compound 496

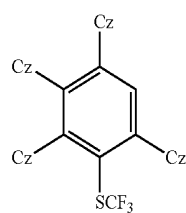


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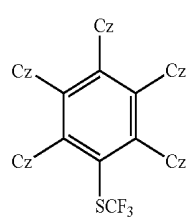


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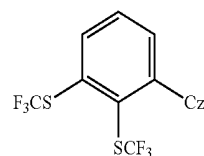
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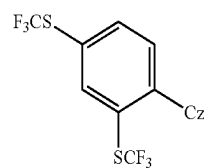
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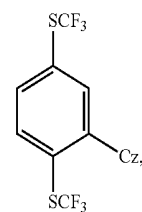
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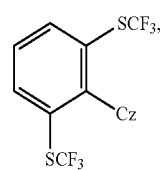
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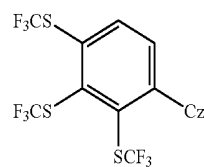
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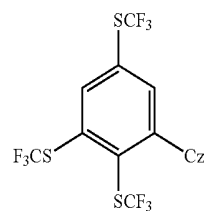
Compound 503



Compound 504

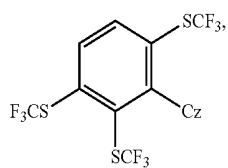


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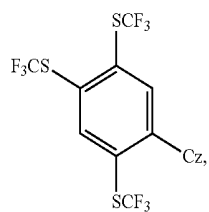


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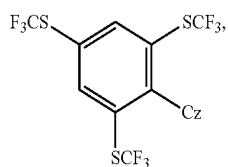
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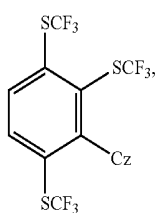
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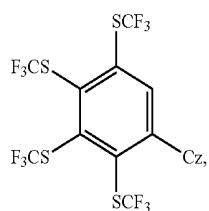
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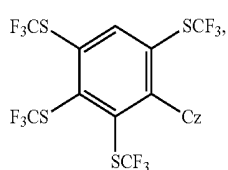
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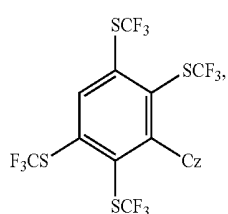
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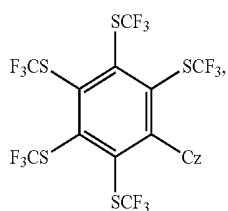
Compound 511



Compound 512

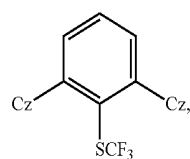


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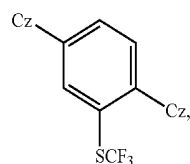


Compound 514

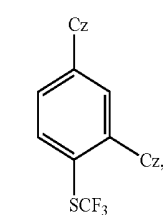
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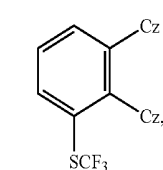
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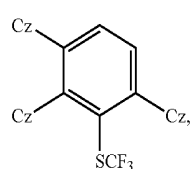
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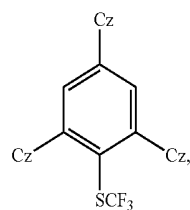
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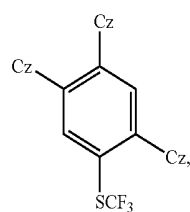
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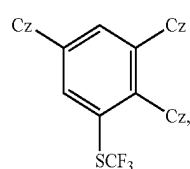
Compound 519



Compound 520

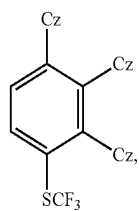


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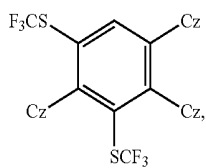


Compound 523

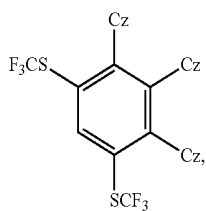
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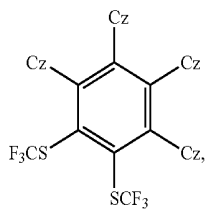
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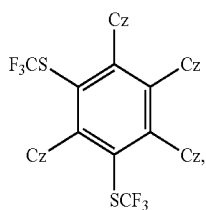
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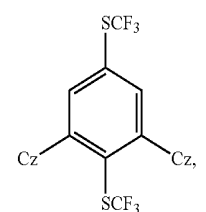
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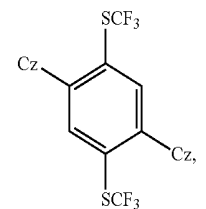
Compound 527



Compound 528

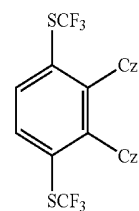


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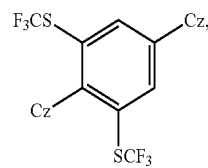


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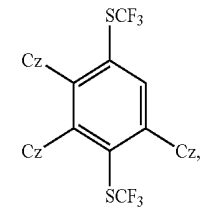
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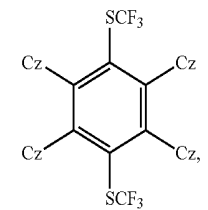
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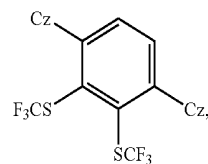
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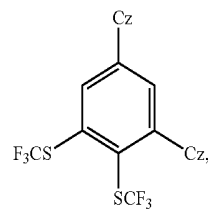
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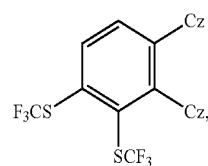
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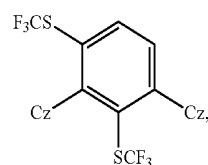
Compound 535



Compound 536

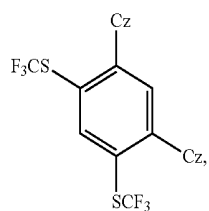


Compound 537

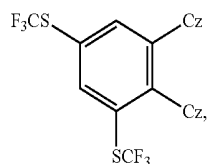


Compound 538

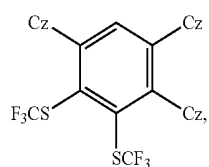
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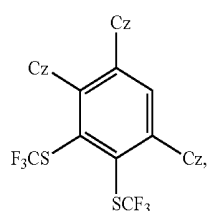
Compound 539



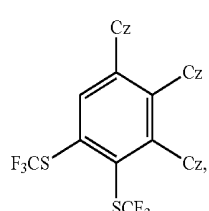
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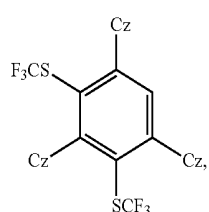
Compound 541



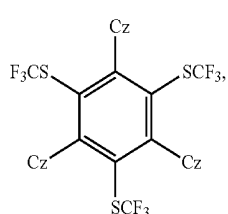
Compound 542



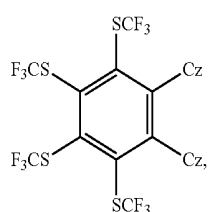
Compound 543



Compound 544

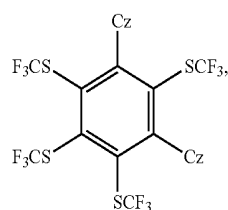


Compound 545

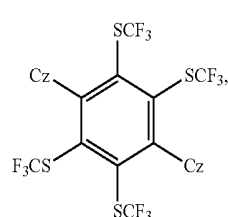


Compound 546

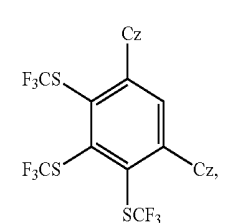
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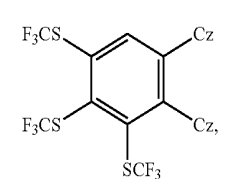
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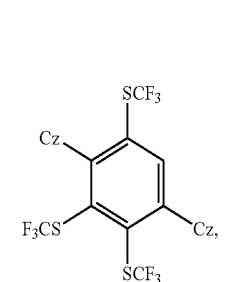
Compound 548



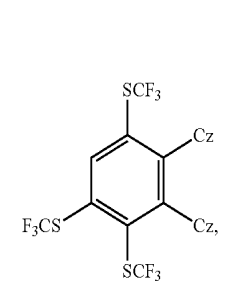
Compound 549



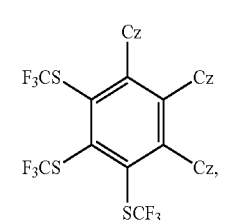
Compound 550



Compound 551

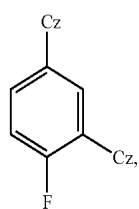
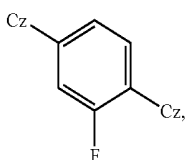
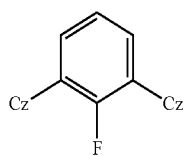
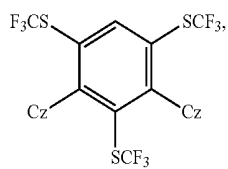
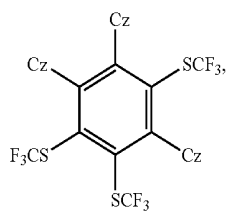
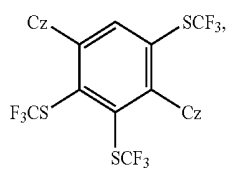
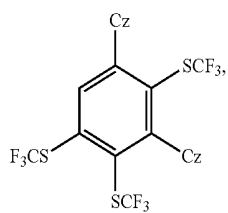
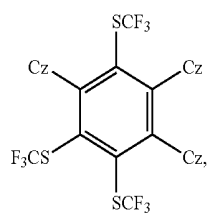


Compound 552



Compound 553

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Compound 554

Compound 555

Compound 556

Compound 557

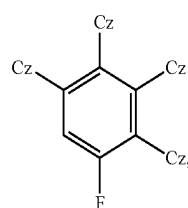
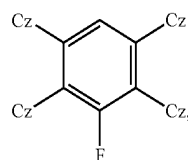
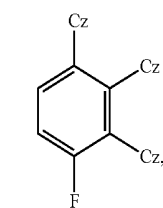
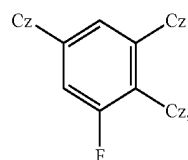
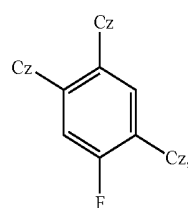
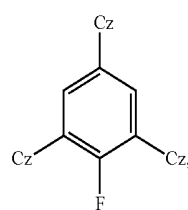
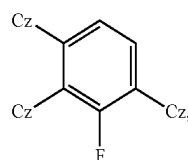
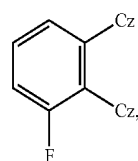
Compound 558

Compound 559

Compound 560

Compound 561

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Compound 562

Compound 563

Compound 564

Compound 566

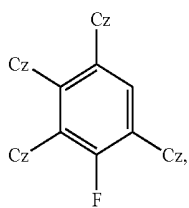
Compound 567

Compound 568

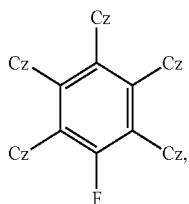
Compound 569

Compound 570

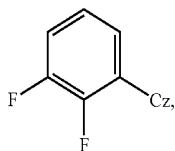
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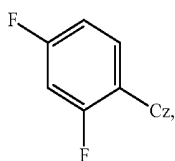
Compound 571



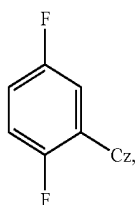
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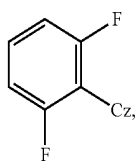
Compound 573



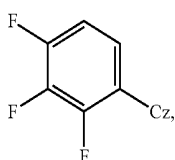
Compound 574



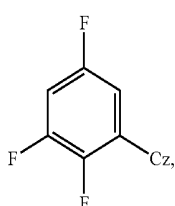
Compound 575



Compound 576

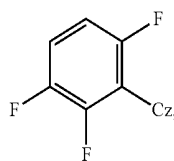


Compound 577

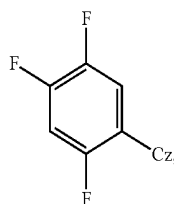


Compound 578

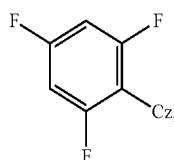
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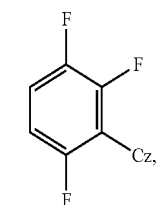
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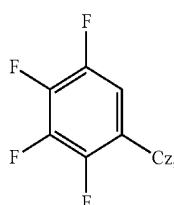
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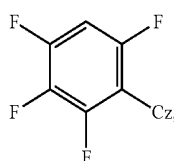
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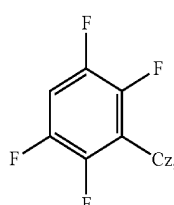
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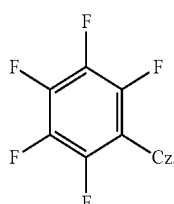
Compound 583



Compound 584

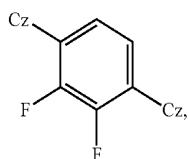


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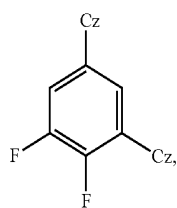


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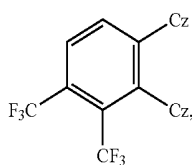
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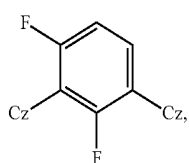
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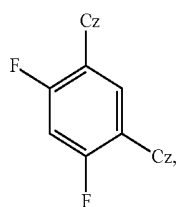
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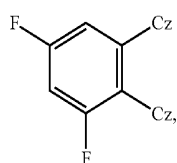
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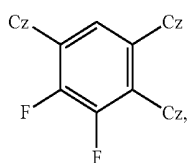
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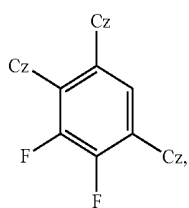
Compound 591



Compound 592

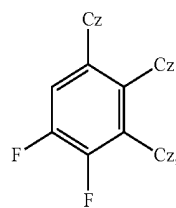


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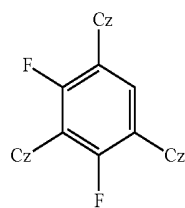


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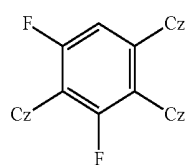
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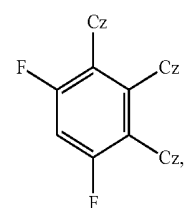
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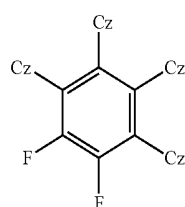
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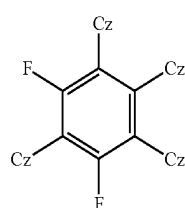
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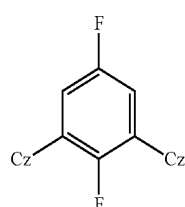
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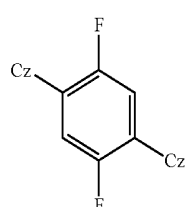
Compound 599



Compound 600

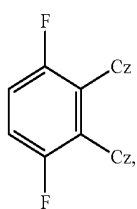


Compound 601

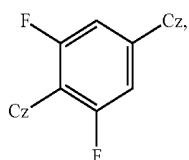


Compound 602

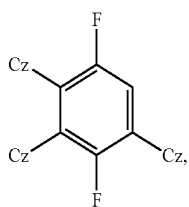
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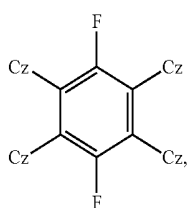
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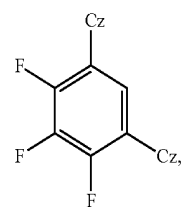
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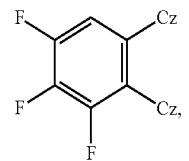
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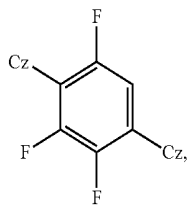
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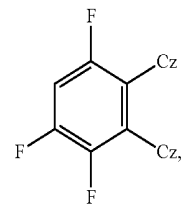
Compound 607



Compound 608

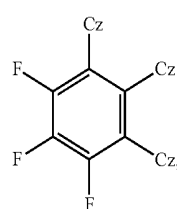


Compound 609

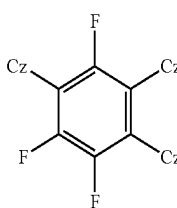


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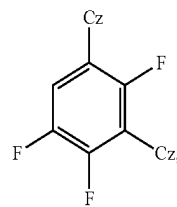
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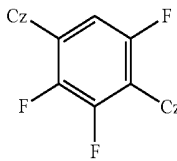
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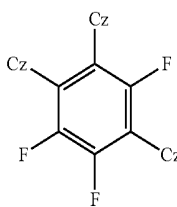
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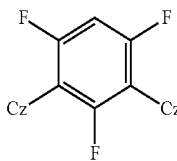
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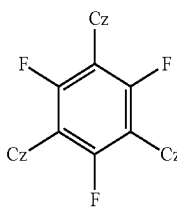
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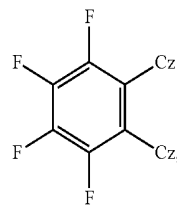
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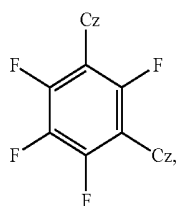


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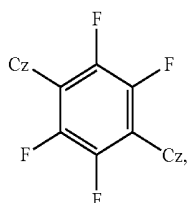


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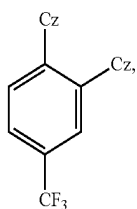
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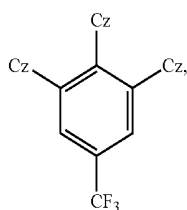
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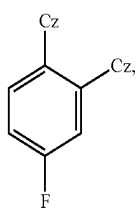
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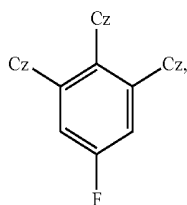
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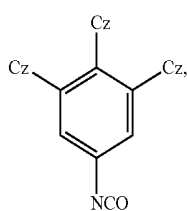
Compound 622



Compound 623

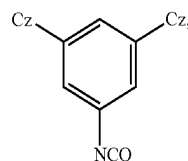


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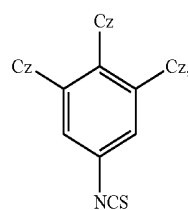


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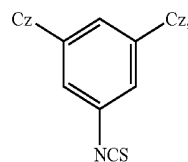
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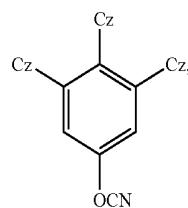
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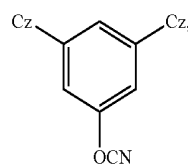
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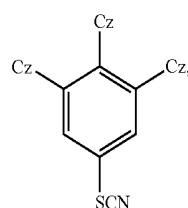
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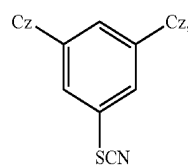
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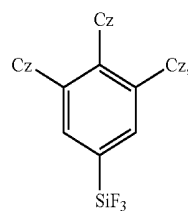
Compound 630



Compound 631

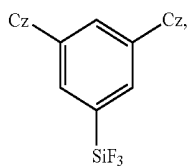


Compound 632



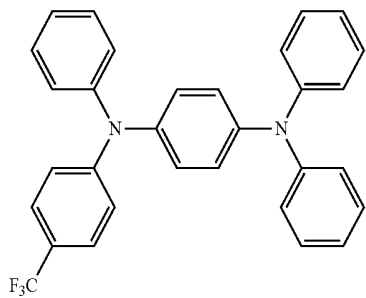
Compound 633

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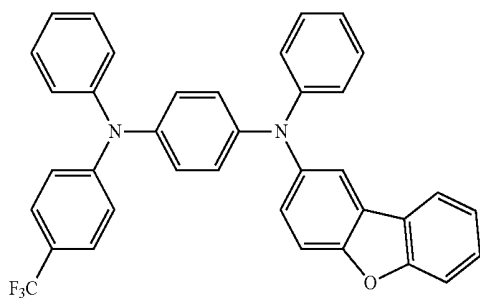


Compound 634

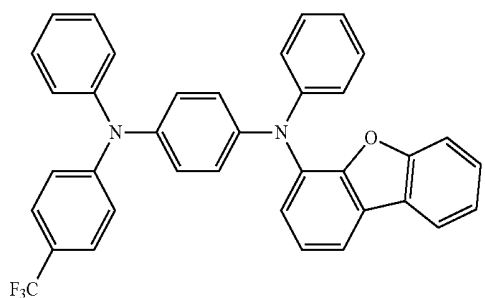
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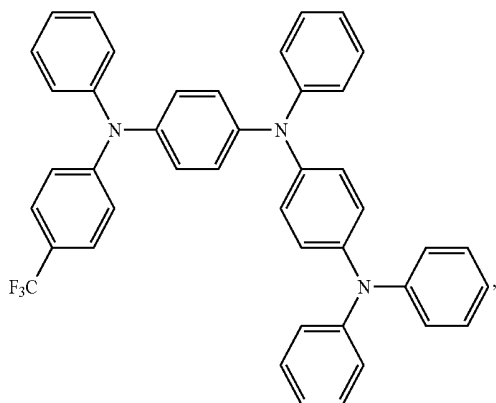
Compound 636



Compound 637

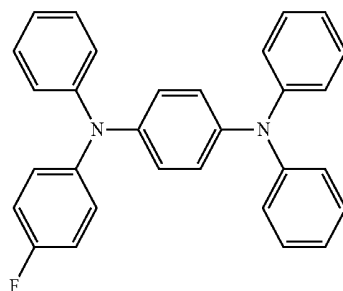


Compound 638

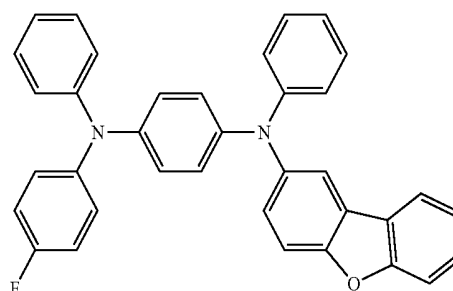


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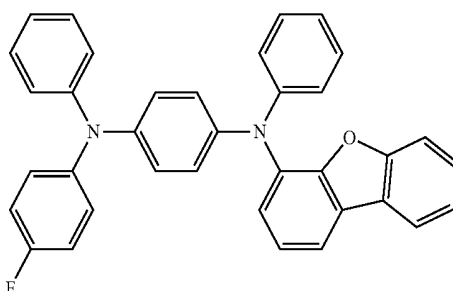
Compound 639



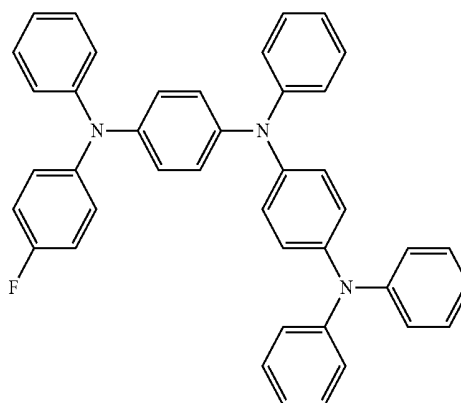
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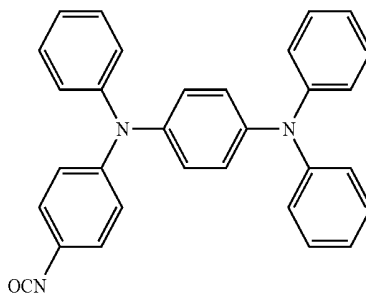
Compound 641



Compound 642

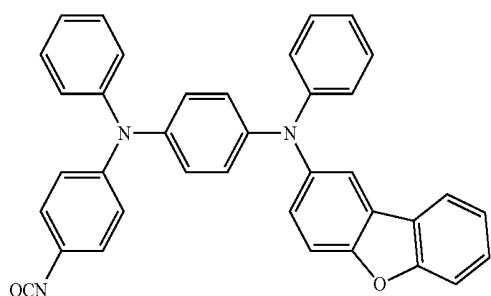


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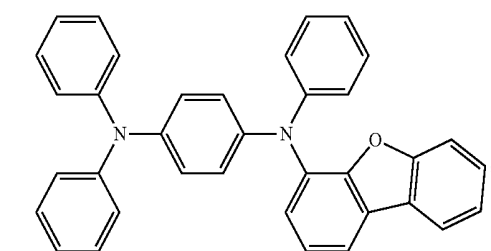


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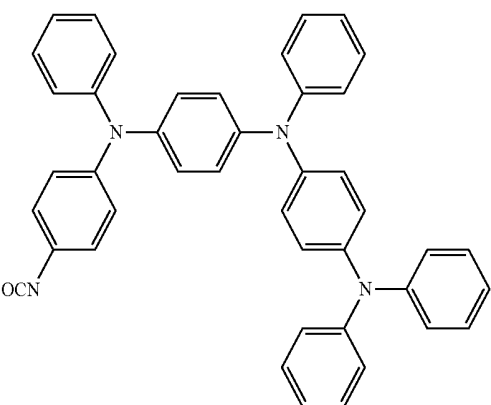
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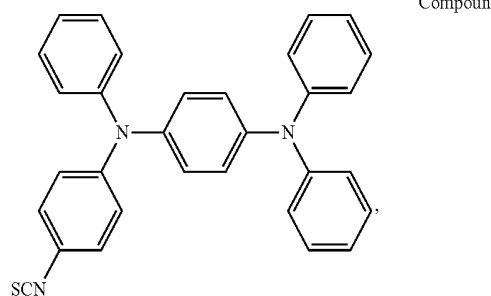
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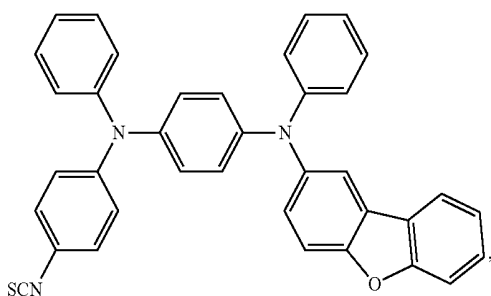
Compound 646



Compound 647

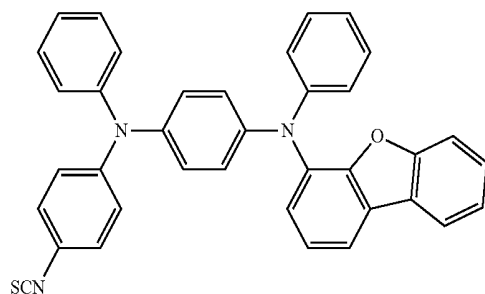


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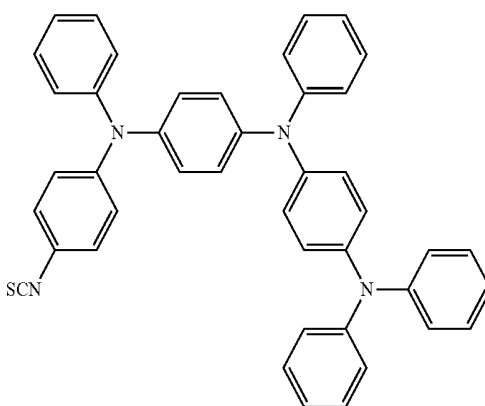


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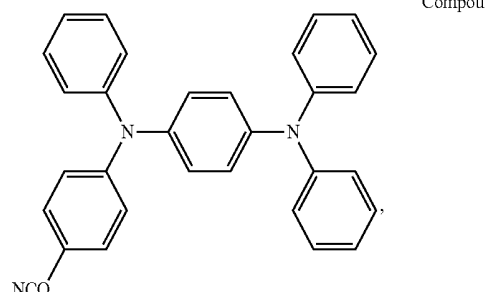
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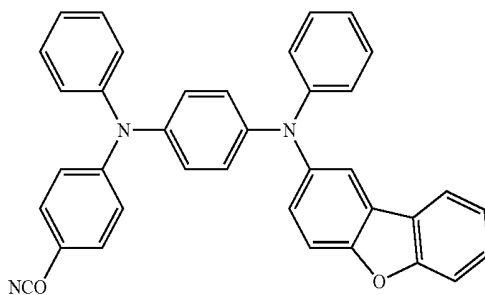
Compound 650



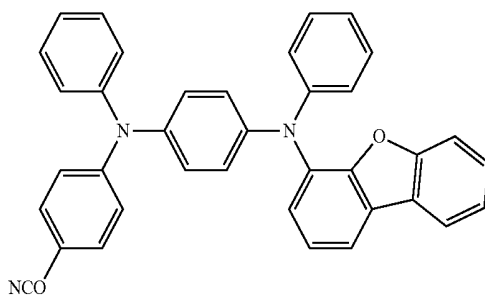
Compound 651



Compound 652

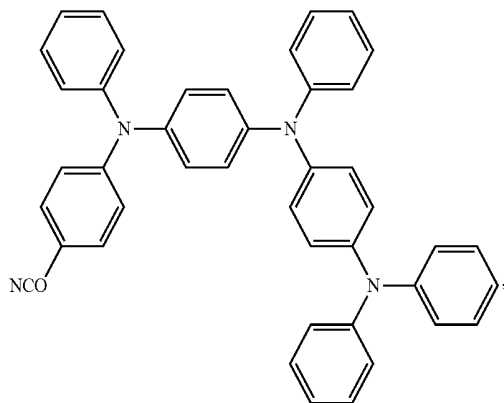


Compound 653



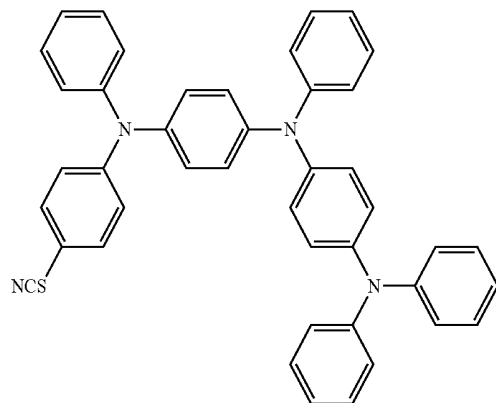
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Compound 654

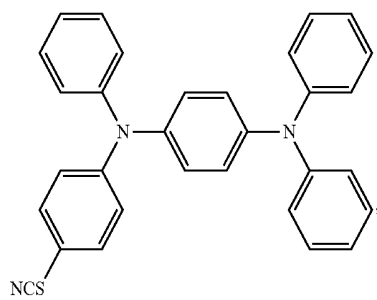


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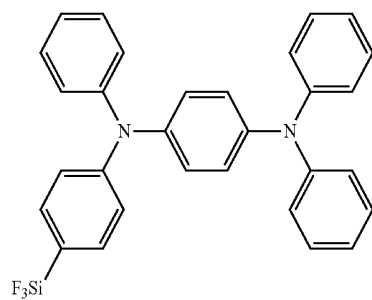
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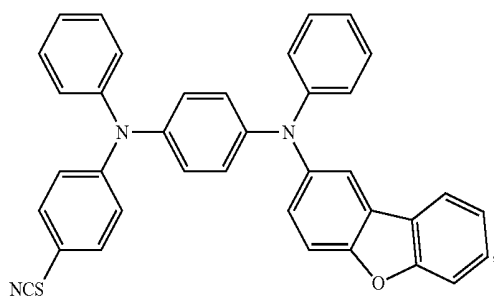
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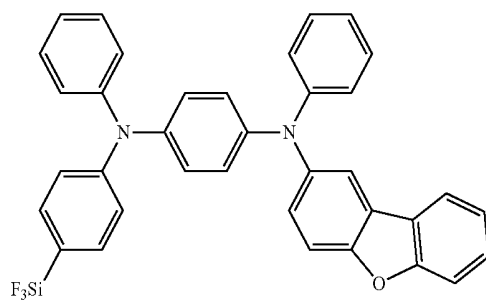
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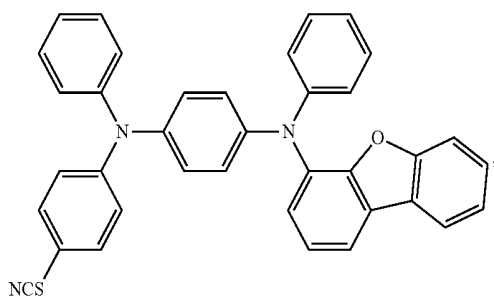
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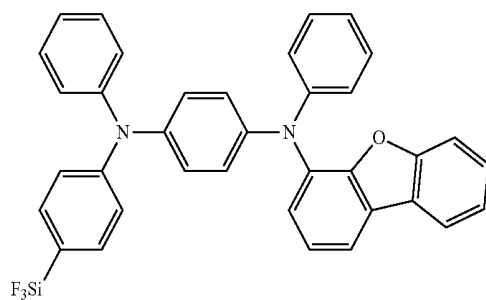
Compound 660



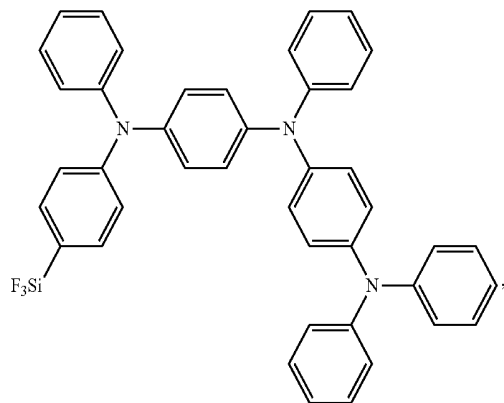
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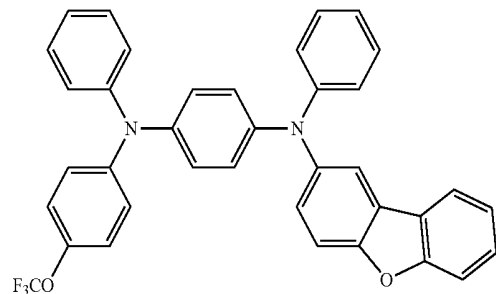
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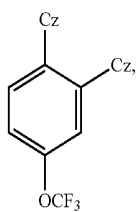
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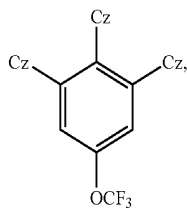
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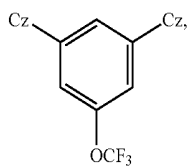
Compound 663



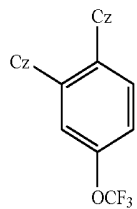
Compound 664



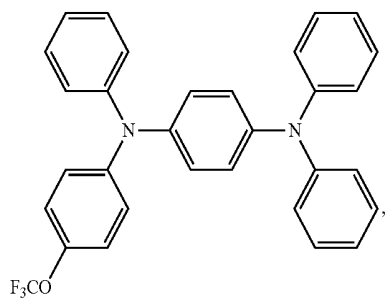
Compound 665



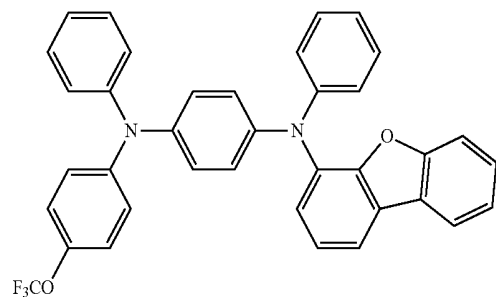
Compound 666



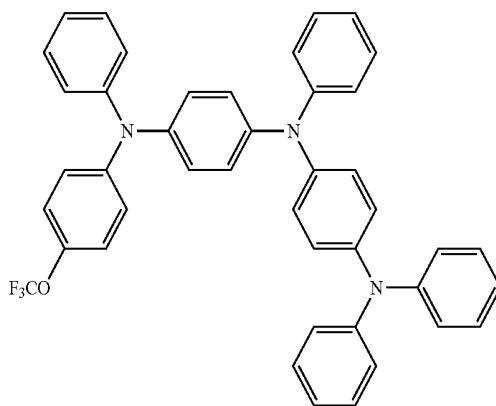
Compound 667



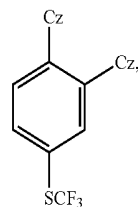
Compound 669



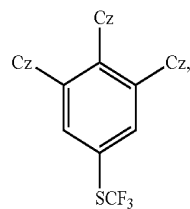
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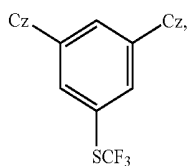
Compound 671



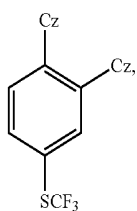
Compound 672



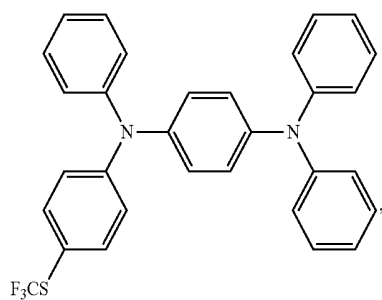
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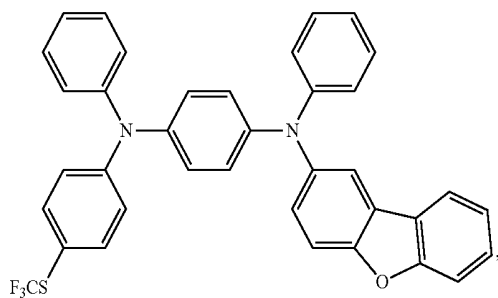
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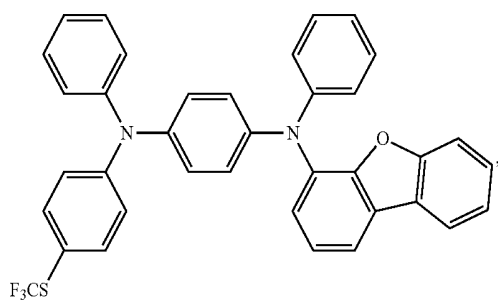
Compound 674



Compound 675

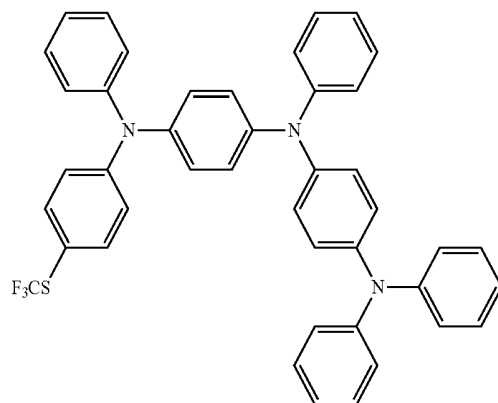


Compound 676

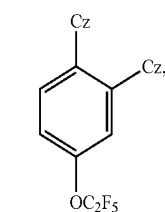


Compound 677

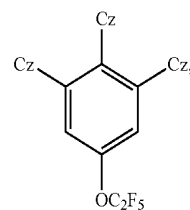
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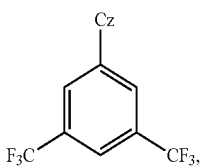
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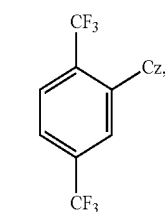
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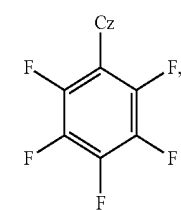
Compound 680



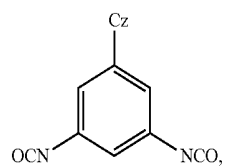
Compound 681



Compound 682

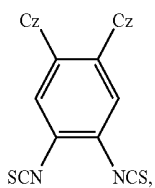


Compound 683

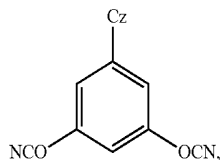


Compound 684

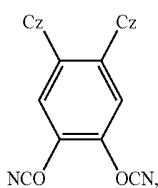
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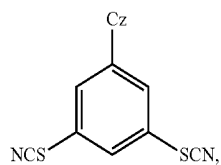
Compound 685



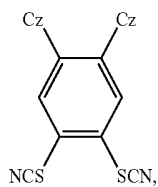
Compound 686



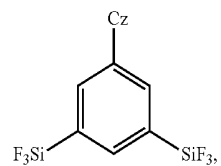
Compound 687



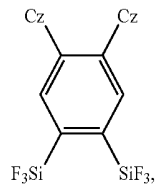
Compound 688



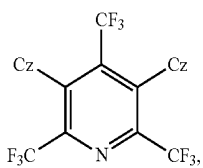
Compound 689



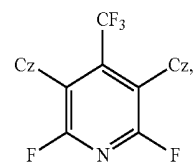
Compound 690



Compound 691

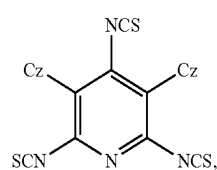


Compound 692

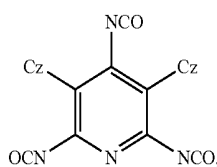


Compound 693

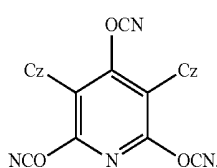
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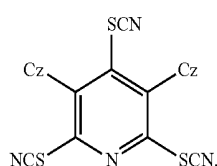
Compound 694



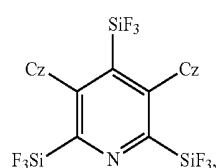
Compound 695



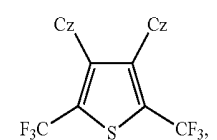
Compound 696



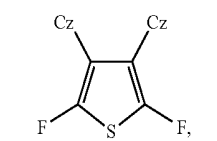
Compound 697



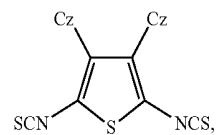
Compound 698



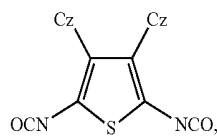
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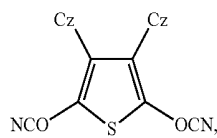
Compound 700



Compound 701

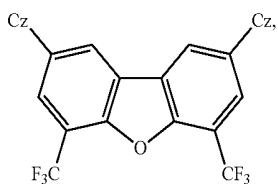
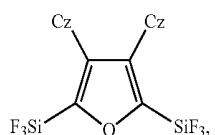
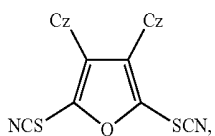
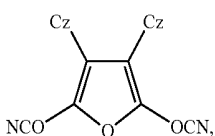
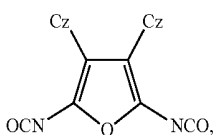
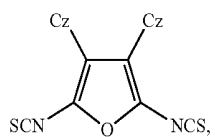
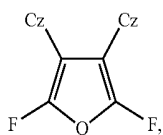
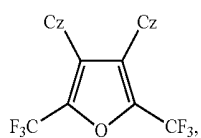
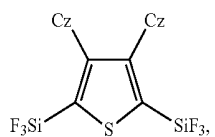
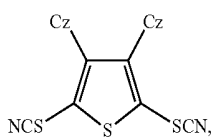


Compound 702

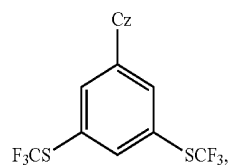
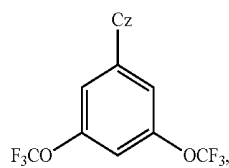
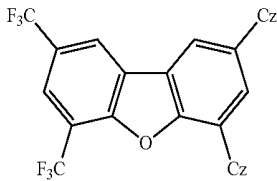
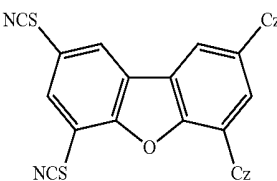
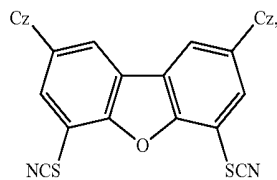
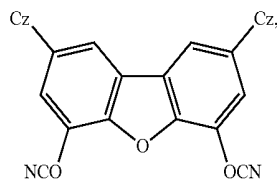
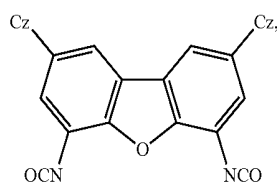
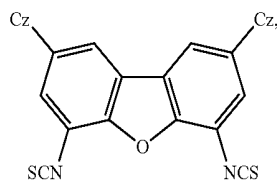
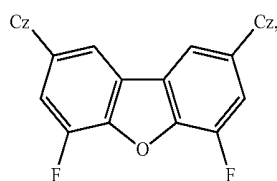


Compound 703

-continued



-continued



Compound 704

Compound 705

Compound 706

Compound 707

Compound 708

Compound 709

Compound 710

Compound 711

Compound 712

Compound 713

Compound 714

Compound 715

Compound 716

Compound 717

Compound 718

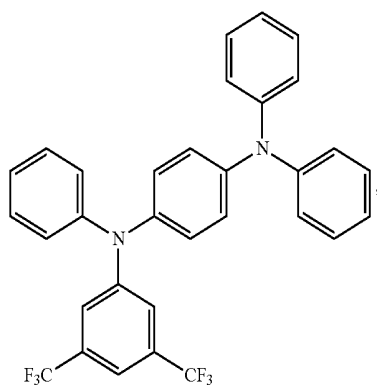
Compound 719

Compound 720

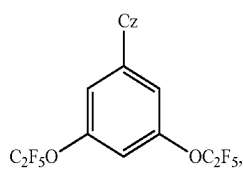
Compound 721

Compound 722

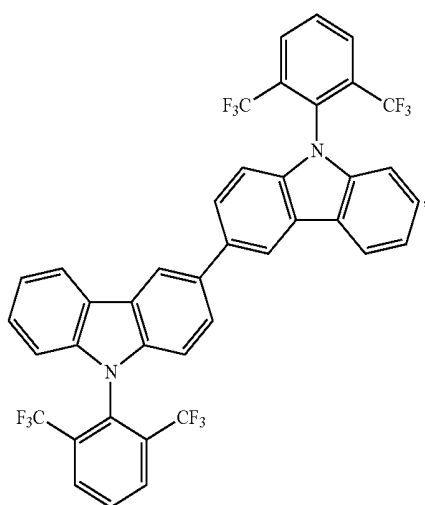
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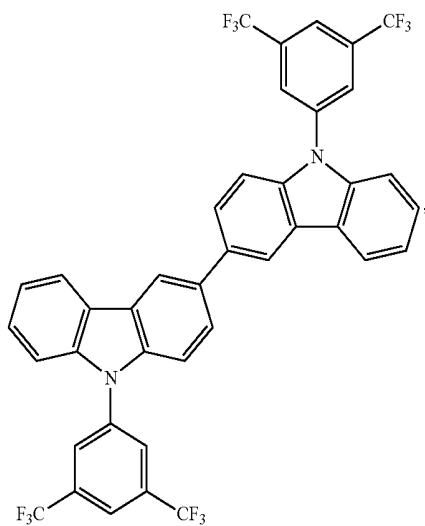
Compound 723



Compound 724

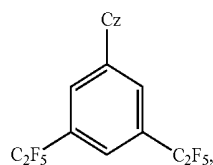


Compound 725

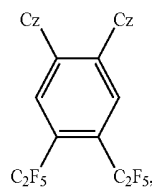


Compound 726

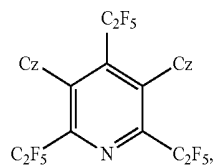
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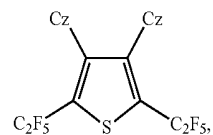
Compound 727



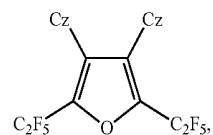
Compound 729



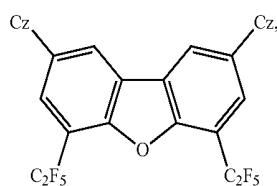
Compound 731



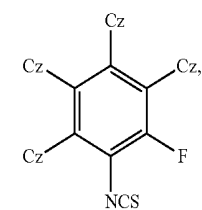
Compound 732



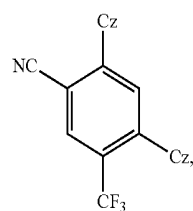
Compound 733



Compound 734

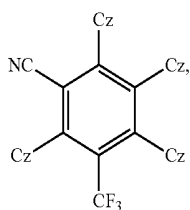


Compound 736

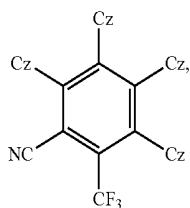


Compound 737

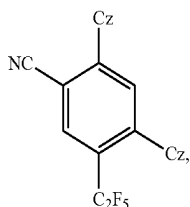
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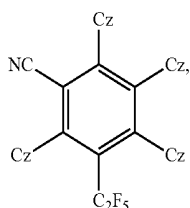
Compound 738



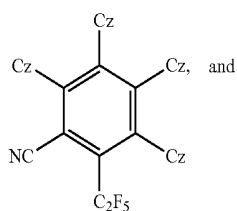
Compound 739



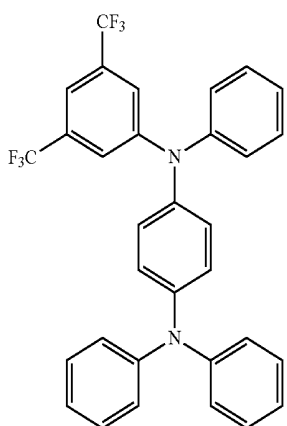
Compound 740



Compound 741

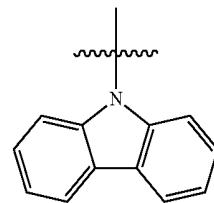


Compound 742



Compound 743

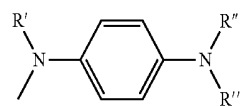
wherein Cz is



35. The first device of claim 26, wherein the compound comprises two structures according to Formula 2 bonded together.

36. (canceled)

37. A first device of claim 26, wherein at least one R group comprises the structure of Formula 3:



Formula 3

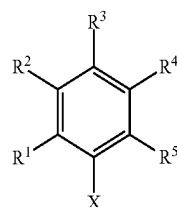
wherein R', R'', and R''' are independently aryl or heteroaryl.

38. (canceled)

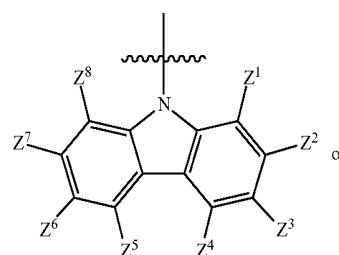
39. The first device of claim 26, wherein the first device emits a luminescent radiation at room temperature when a voltage is applied across the organic light emitting device, and wherein the luminescent radiation comprises a delayed fluorescence process.

40-45. (canceled)

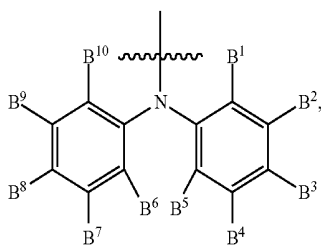
46. A formulation comprising a compound comprising a structure according to Formula 1:



Formula 1

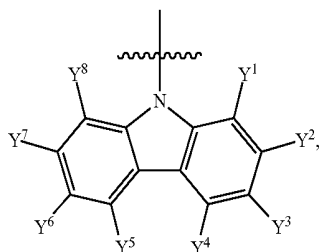
wherein R⁵ is

-continued

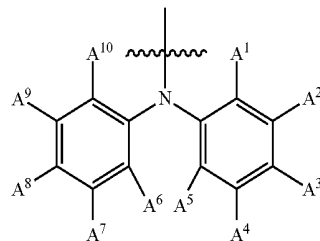


and

wherein (a) at least one of R¹-R⁴ is



or (b) R¹ is



wherein R¹, R², R³, R⁴, A¹, A², A³, A⁴, A⁵, A⁶, A⁷, A⁸, A⁹, A¹⁰, B¹, B², B³, B⁴, B⁵, B⁶, B⁷, B⁸, B⁹, B¹⁰, Y¹, Y², Y³, Y⁴, Y⁵, Y⁶, Y⁷, Y⁸, Z¹, Z², Z³, Z⁴, Z⁵, Z⁶, Z⁷, and Z⁸, are each independently selected from the group consisting of hydrogen, deuterium, halide, alkyl, haloalkyl, cycloalkyl, heteroalkyl, arylalkyl, alkoxy, thioalkoxy, aryloxy, thioaryloxy, amino, arylamino, diarylamino, carbazolyl, silyl, halosilyl, alkenyl, cycloalkenyl, heteroalkenyl, alkynyl, aryl, heteroaryl, acyl, carbonyl, carboxylic acids, ester, nitrile, isonitrile, sulfanyl, sulfinyl, sulfonyl, phosphino, —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCO, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, —SC_mF_{2m+1}, and combinations thereof;

wherein adjacent A, B, Y, and Z groups are, optionally, joined to form a fused ring structure; and

wherein X comprises an acceptor group selected from the group consisting of —C_mF_{2m+1}, —Si_mF_{2m+1}, —NCO, —NCS, —OCN, —SCN, —OC_mF_{2m+1}, and —SC_mF_{2m+1}.

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专利名称(译)	有机电致发光材料和器件		
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[标]发明人	KWONG RAYMOND LAM SIU TUNG LEE CHI HANG		
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摘要(译)

具有式1结构的化合物，以及第一装置和包括其的配方公开了。在公式1的结构中：R₅和(a)至少R₁-R₄中的一个或(b)R₁是此外，R₁，R₂，R₃，R₄，A₁，A₂，A₃，A₄，A₅，A₆，A₇，A₈，A₉，A₁₀，B₁，B₂，B₃，B₄，B₅，B₆，B₇，B₈，B₉，B₁₀，Y₁，Y₂，Y₃，Y₄，Y₅，Y₆，Y₇，Y₈，Z₁，Z₂，Z₃，Z₄，Z₅，Z₆，Z₇和Z₈每个取代基各自独立地选自各种取代基，其中相邻的A，B，Y和Z基团任选地连接形成稠环结构。最后，X包括选自-C_mF_{2m+1}，-Si_mF_{2m+1}的受体基团，-NCO，-NCS，-OCN，-SCN，-OC_mF_{2m+1}，-SC_mF_{2m+1}。

