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# (54) Title: NOVEL ORGANIC ELECTROLUMINESCENT COMPOUND, AND MULTI-COMPONENT HOST MATERIAL AND ORGANIC ELECTROLUMINESCENT DEVICE COMPRISING THE SAME

**(57) Abstract**: The present disclosure relates to an organic electroluminescent compound, and a multi-component host material and an organic electroluminescent device comprising the same. The organic electroluminescent compound of the present disclosure has good luminous efficiency and can be used as a host for a light-emitting layer. By using the organic electroluminescent compound according to the present disclosure, an organic electroluminescent device can have high color purity, low driving voltage, long lifespan, and improved current and power efficiencies.

**WO 2015/099507 A1**

# Description

# Title of Invention: NOVEL ORGANIC ELECTROLUMINESCENT COMPOUND, AND MULTI-COMPONENT HOST MATERIAL AND ORGANIC ELECTROLUMINESCENT DEVICE COMPRISING THE SAME

## Technical Field

[1] The present disclosure relates to a novel organic electroluminescent compound, and a multi-component host material and an organic electroluminescent device comprising the same.

## Background Art

[2] An electroluminescent (EL) device is a self-light-emitting device which has advantages in that it provides a wider viewing angle, a greater contrast ratio, and a faster response time. An organic EL device was first developed by Eastman Kodak, by using small aromatic diamine molecules and aluminum complexes as materials to form a light-emitting layer [Appl. Phys. Lett. 51, 913, 1987].

[3] Generally, an organic EL device has a structure comprising an anode, a cathode, and an organic layer disposed between the anode and the cathode. Holes and electrons are injected from an anode and a cathode, respectively, to the organic layer; the compound is in an excited state by recombinations between the holes and the electrons, and the decay of the excited state results in a relaxation of the energy into a ground state, accompanied by light-emission. The organic layer of the organic EL device comprises a hole injection layer, a hole transport layer, an electron blocking layer, a light-emitting layer, a hole blocking layer, an electron transport layer, an electron injection layer, etc. A material for preparing the organic layers includes a hole injection material, a hole transport material, an electron blocking material, a light-emitting material, a hole blocking material, an electron transport material, an electron injection material, etc.

[4] The most important factor determining luminous efficiency in the organic EL device is light-emitting materials. The light-emitting material needs to have high quantum efficiency, high electron mobility, and high hole mobility. Furthermore, the light-emitting layer formed by the light-emitting material needs to be uniform and stable. Depending on colors visualized by light-emission, the light-emitting materials can be classified as a blue-, green-, or red-emitting material, and a yellow- or orange-emitting material can be additionally included therein. Furthermore, depending on the excited state, the light-emitting material can be classified as fluorescent materials (singlet state) and phosphorescent materials (triplet state). Fluorescent materials have been

widely used for the organic EL device. However, since phosphorescent materials enhance luminous efficiency for converting electricity to light by four (4) times compared to fluorescent materials and can reduce power consumption to have longer lifespan, development of phosphorescent light-emitting materials are widely being researched.

[5] Iridium(III) complexes have been widely known as phosphorescent materials, including bis(2-(2'-benzothienyl)-pyridinato-N,C3')iridium(acetylacetonate) ((acac)Ir(btp)$_2$), tris(2-phenylpyridine)iridium (Ir(ppy)$_3$) and bis(4,6-difluorophenylpyridinato-N,C2)picolinate iridium (Firpic) as red-, green- and blue-emitting materials, respectively.

[6] The light-emitting material can be prepared by combining a host material with a dopant to improve color purity, luminous efficiency, and stability. The host materials greatly influence the efficiency and performance of the EL device when using a host material/dopant system as the light emitting material, and thus their selection is important. At present, 4,4'-N,N'-dicarbazol-biphenyl (CBP) is the most widely known host material for phosphorescent materials. Recently, Pioneer (Japan) et al., developed a high performance organic EL device using bathocuproine (BCP) and aluminum(III) bis(2-methyl-8-quinolinate)(4-phenylphenolate) (BAlq) etc., as host materials, which were known as hole blocking materials.

[7] Although conventional phosphorescent host materials provide good light-emitting characteristics, they have the following disadvantages: (1) Due to their low glass transition temperature and poor thermal stability, their degradation may occur during a high-temperature deposition process in a vacuum. (2) The power efficiency of the organic EL device is given by [(π/voltage) × current efficiency], and the power efficiency is inversely proportional to the voltage. Although the organic EL device comprising phosphorescent host materials provides higher current efficiency (cd/A) than one comprising fluorescent materials, a significantly high driving voltage is necessary. Thus, there is no merit in terms of power efficiency (lm/W). (3) Furthermore, the operational lifespan of the organic EL device is short, and luminous efficiency is still required to be improved.

[8] Accordingly, in order to provide an organic EL device with good characteristics, materials for preparing an organic layer in an organic EL device, in particular, a host or a dopant for preparing a light-emitting layer, need to be properly selected.

[9] Korean Patent Appln. Laying-Open No. 10-2010-0105099 discloses, as a host material for a light-emitting layer, a heterocyclic compound having condensed 5 rings. However, an organic electroluminescent device using a compound of said reference is not satisfactory in power efficiency, luminous efficiency, lifespan, and color purity.

[10]

## Disclosure of Invention

## Technical Problem

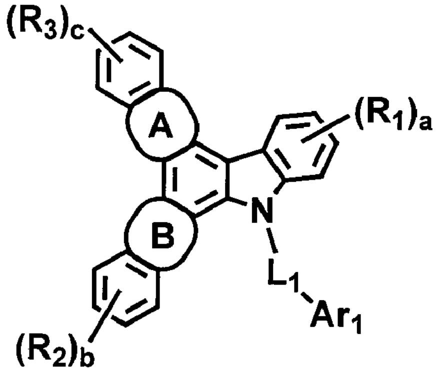
[11] The objective of the present disclosure is to provide an organic electroluminescent compound, which can provide an organic electroluminescent device showing low driving voltage, long lifespan, high color purity, and good current and power efficiencies, and a multi-component host material and an organic electroluminescent device comprising the same.

[12]

## Solution to Problem

[13] The present inventors found that the above objective can be achieved by an organic electroluminescent compound represented by the following formula 1.

[14]



(1)

[15] wherein Ar$_1$ represents a substituted or unsubstituted (3- to 30-membered)heteroaryl, or a substituted or unsubstituted (C6-C30)aryl;

[16] L$_1$ represents a single bond, a substituted or unsubstituted (C6-C30)arylene, or a substituted or unsubstituted (3- to 30-membered)heteroarylene;

[17] ring A represents ; ring B represents ;

[18] Y represents O, S, N(R$_6$) or C(R$_4$)(R$_5$); X represents O, S, N(R$_6$) or C(R$_7$)(R$_8$); provided that both X and Y cannot be simultaneously N(R$_6$);

[19] R$_1$ to R$_3$, each independently, represent hydrogen, deuterium, a halogen, a cyano, a carboxy, a nitro, a hydroxy, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C3-C30)cycloalkyl, a substituted or unsubstituted (C3-C30)cycloalkenyl, a substituted or unsubstituted (3- to 7-membered)heterocycloalkyl, a substituted or unsubstituted (C6-C30)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, -NR$_9$R$_{10}$ or -SiR$_{11}$R$_{12}$R$_{13}$, or may be linked to an adjacent substituent(s) to form a substituted or unsubstituted (C3-C30), mono- or polycyclic, alicyclic or aromatic ring;

[20] R$_4$ to R$_{13}$, each independently, represent hydrogen, deuterium, a halogen, a sub-

stituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted(C6-C30)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, a substituted or unsubstituted (C3-C30)cycloalkyl, a substituted or unsubstituted (5- to 7-membered)heterocycloalkyl, a substituted or unsubstituted (C6-C30)aryl(C1-C30)alkyl, -$NR_{14}R_{15}$, -$SiR_{16}R_{17}R_{18}$, a cyano, a nitro, or a hydroxy, or may be linked to an adjacent substituent(s) to form a substituted or unsubstituted (C3-C30), mono- or polycyclic, alicyclic or aromatic ring;

[21] $R_{14}$ to $R_{18}$ have the same definition as $R_4$ to $R_{13}$;

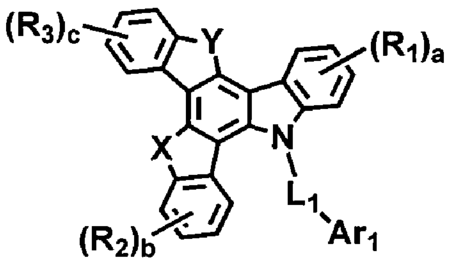
[22] a carbon atom(s) of the alicyclic or aromatic ring may be replaced with at least one hetero atom selected from nitrogen, oxygen, and sulfur;

[23] the heteroaryl(ene) and heterocycloalkyl contains at least one hetero atom selected from B, N, O, S, P(=O), Si and P;

[24] a, b and c, each independently, represent an integer of 1 to 4; where a, b, or c represents an integer of 2 or more, each of $R_1$, $R_2$, or $R_3$ may be the same or different;

[25] provided that where the compound of formula 1 above is represented by the following formula 2, a ring which may be formed between any one of $R_1$ to $R_3$ and an adjacent substituent(s) is not a substituted naphthalene ring.

[26]



(2)

[27]

## Advantageous Effects of Invention

[28] An organic electroluminescent compound of the present disclosure can provide higher color purity, longer lifespan, and better luminous efficiency than conventional compounds. Accordingly, an organic electroluminescent device using the compound of the present disclosure as a host material for a light-emitting layer can show higher color purity, lower driving voltage, longer lifespan, better luminous efficiency, in particular, better current efficiency, and improved power consumption.

[29]

## Mode for the Invention

[30] Hereinafter, the present disclosure will be described in detail. However, the following description is intended to explain the present disclosure, and is not meant in any way to restrict the scope of the present disclosure.

[31] The present disclosure provides the organic electroluminescent compound of formula

1 above, an organic electroluminescent material comprising the same, and an organic electroluminescent device comprising the material.

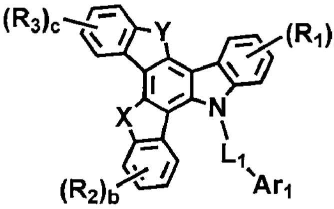
[32] Herein, "(C1-C30)alkyl(ene)" indicates a linear or branched alkyl(ene) having 1 to 30, preferably 1 to 20, and more preferably 1 to 10 carbon atoms, and includes methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, etc. "(C2-C30) alkenyl" indicates a linear or branched alkenyl having 2 to 30, preferably 2 to 20, and more preferably 2 to 10 carbon atoms and includes vinyl, 1-propenyl, 2-propenyl, 1-butenyl, 2-butenyl, 3-butenyl, 2-methylbut-2-enyl, etc. "(C2-C30)alkynyl" indicates a linear or branched alkynyl having 2 to 30, preferably 2 to 20, and more preferably 2 to 10 carbon atoms and includes ethynyl, 1-propynyl, 2-propynyl, 1-butynyl, 2-butynyl, 3-butynyl, 1-methylpent-2-ynyl, etc. "(C3-C30)cycloalkyl" indicates a mono- or polycyclic hydrocarbon having 3 to 30, preferably 3 to 20, and more preferably 3 to 7 carbon atoms and includes cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, etc. "(3- to 7-membered) heterocycloalkyl" indicates a cycloalkyl having 3 to 7, preferably 5 to 7 ring backbone atoms including at least one hetero atom selected from B, N, O, S, P(=O), Si, and P, preferably O, S, and N, and includes tetrahydrofuran, pyrrolidine, thiolan, tetrahydropyran, etc. Furthermore, "(C6-C30)aryl(ene)" indicates a monocyclic or fused ring derived from an aromatic hydrocarbon and having 6 to 30, preferably 6 to 20, and more preferably 6 to 15 ring backbone carbon atoms, and includes phenyl, biphenyl, terphenyl, naphthyl, fluorenyl, phenanthrenyl, anthracenyl, indenyl, triphenylenyl, pyrenyl, tetracenyl, perylenyl, chrysenyl, naphthacenyl, fluoranthenyl, etc. "(3- to 30-membered) heteroaryl(ene)" indicates an aryl group having 3 to 30, preferably 3 to 20, and more preferably 3 to 15 ring backbone atoms including at least one, preferably 1 to 4, hetero atom selected from the group consisting of B, N, O, S, P(=O), Si, and P; may be a monocyclic ring, or a fused ring condensed with at least one benzene ring; may be partially saturated; may be one formed by linking at least one heteroaryl or aryl group to a heteroaryl group via a single bond(s); and includes a monocyclic ring-type heteroaryl such as furyl, thiophenyl, pyrrolyl, imidazolyl, pyrazolyl, thiazolyl, thiadiazolyl, isothiazolyl, isoxazolyl, oxazolyl, oxadiazolyl, triazinyl, tetrazinyl, triazolyl, tetrazolyl, furazanyl, pyridyl, pyrazinyl, pyrimidinyl, pyridazinyl, etc., and a fused ring-type heteroaryl such as benzofuranyl, benzothiophenyl, isobenzofuranyl, dibenzofuranyl, dibenzothiophenyl, benzonaphthofuranyl, benzonaphthothiophenyl, benzoimidazolyl, benzothiazolyl, benzoisothiazolyl, benzoisoxazolyl, benzoxazolyl, isoindolyl, indolyl, indazolyl, benzothiadiazolyl, quinolyl, isoquinolyl, cinnolinyl, quinazolinyl, quinoxalinyl, carbazolyl, benzocarbazolyl, naphthyridinyl, phenoxazinyl, phenanthridinyl, benzodioxolyl, etc. Furthermore, "halogen" includes F, Cl, Br, and I.

[33] Herein, "substituted" in the expression, "substituted or unsubstituted," means that a

hydrogen atom in a certain functional group is replaced with another atom or group, i.e. a substituent. In formula 1 of the present disclosure, the substituents of the substituted (C1-C30)alkyl, the substituted (C3-C30)cycloalkyl, the substituted (C3-C30)cycloalkenyl, the substituted (3- to 7-membered)heterocycloalkyl, the substituted (C6-C30)aryl(ene), the substituted (3- to 30-membered)heteroaryl(ene), the substituted (C6-C30)aryl(C1-C30)alkyl, or the substituted (C3-C30), mono- or polycyclic, alicyclic or aromatic ring in $Ar_1$, $L_1$, X, Y, and $R_1$ to $R_3$, each independently, are at least one selected from the group consisting of deuterium, a halogen, a cyano, a carboxy, a nitro, a hydroxy, a (C1-C30)alkyl, a halo(C1-C30)alkyl, a (C2-C30)alkenyl, a (C2-C30)alkynyl, a (C1-C30)alkoxy, a (C1-C30)alkylthio, a (C3-C30)cycloalkyl, a (C3-C30)cycloalkenyl, a (3- to 7-membered)heterocycloalkyl, a (C6-C30)aryloxy, a (C6-C30)arylthio, a (3- to 30-membered)heteroaryl unsubstituted or substituted with a (C6-C30)aryl, a (C6-C30)aryl unsubstituted or substituted with a (3- to 30-membered)heteroaryl, a tri(C1-C30)alkylsilyl, a tri(C6-C30)arylsilyl, a di(C1-C30)alkyl(C6-C30)arylsilyl, a (C1-C30)alkyldi(C6-C30)arylsilyl, an amino, a mono- or di-(C1-C30)alkylamino, a mono- or di-(C6-C30)arylamino, a (C1-C30)alkyl(C6-C30)arylamino, a (C1-C30)alkylcarbonyl, a (C1-C30)alkoxycarbonyl, a (C6-C30)arylcarbonyl, a di(C6-C30)arylboronyl, a di(C1-C30)alkylboronyl, a (C1-C30)alkyl(C6-C30)arylboronyl, a (C6-C30)aryl(C1-C30)alkyl and a (C1-C30)alkyl(C6-C30)aryl.

[34] Preferably, the compound of formula 1 may be represented by any one of the following formulae 2 to 5:

[35]



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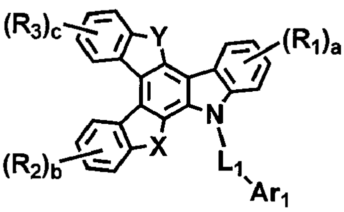
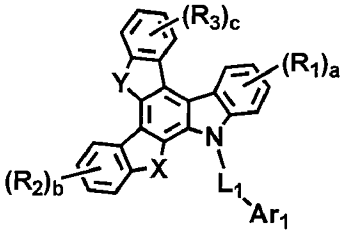


(3)

[36]



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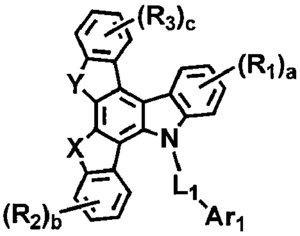


(5)

[37] wherein $Ar_1$, $L_1$, X, Y, $R_1$ to $R_3$, a, b, and c are as defined in formula 1 above.

[38] $Ar_1$ may represent preferably, a substituted or unsubstituted (5- to 20-membered)heteroaryl, or a substituted or unsubstituted (C6-C20)aryl. The substituent for the substituted group of $Ar_1$ may be a (C6-C20)aryl, a (6- to 20-membered)heteroaryl or a mono- or di-(C6-C20)arylamino. According to one em-

bodiment of the present disclosure, $Ar_1$ may represent a substituted or unsubstituted, nitrogen-containing (5- to 20-membered) heteroaryl; and specifically, may be selected from the group consisting of a substituted or unsubstituted triazinyl, a substituted or unsubstituted pyrimidinyl, a substituted or unsubstituted pyridyl, a substituted or unsubstituted pyrazinyl, a substituted or unsubstituted quinolyl, a substituted or unsubstituted isoquinolyl, a substituted or unsubstituted quinazolinyl, a substituted or unsubstituted naphthyridinyl, and a substituted or unsubstituted quinoxalinyl. In the embodiment above, the substituent for the substituted group of $Ar_1$ may be preferably, a (C6-C20)aryl or a (5- to 20-membered)heteroaryl, and specifically, may be at least one selected from phenyl, naphthyl, biphenyl, benzofuranyl, benzothiophenyl, dibenzofuranyl, and dibenzothiophenyl.

[39] $L_1$ may represent preferably, a single bond, a substituted or unsubstituted (C6-C20)arylene, or a substituted or unsubstituted (5- to 20-membered)heteroarylene; and more preferably, a single bond, or a substituted or unsubstituted (C6-C20)arylene. Specifically, $L_1$ may represent a single bond, a substituted or unsubstituted phenylene, a substituted or unsubstituted biphenylene, or a substituted or unsubstituted naphthylene.

[40] Preferably, X and Y, each independently, may be selected from O, S, and $N(R_6)$; provided that both X and Y cannot be simultaneously $N(R_6)$. According to one embodiment of the present disclosure, X and Y, each independently, may be selected from O and S. According to another embodiment of the present disclosure, X and Y, each independently, may be selected from O and S, and at least one of X and Y may be S. $R_6$ may represent preferably, a substituted or unsubstituted (C6-C30)aryl, and specifically a substituted or unsubstituted phenyl, a substituted or unsubstituted naphthyl, or a substituted or unsubstituted biphenyl.

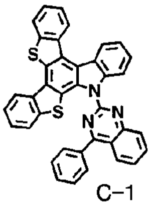
[41] $R_1$ to $R_3$, each independently, may represent preferably, hydrogen, deuterium, a substituted or unsubstituted (C1-C20)alkyl, a substituted or unsubstituted (C3-C20)cycloalkyl, a substituted or unsubstituted (C6-C30)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, $-NR_9R_{10}$ or $-SiR_{11}R_{12}R_{13}$, or may be linked to an adjacent substituent(s) to form a substituted or unsubstituted (C3-C30), mono- or polycyclic, alicyclic or aromatic ring. More preferably, the mono- or polycyclic aromatic ring in the definition of $R_1$ to $R_3$ is not naphthalene ring and phenanthrene ring. $R_9$ to $R_{13}$, may represent preferably, a substituted or unsubstituted (C6-C30)aryl. Specifically, $R_1$ to $R_3$ may represent hydrogen.

[42] According to one embodiment of the present disclosure, $Ar_1$ represents a substituted or unsubstituted (5- to 20-membered)heteroaryl, or a substituted or unsubstituted (C6-C20)aryl; $L_1$ represents a single bond, a substituted or unsubstituted (C6-C20)arylene, or a substituted or unsubstituted (5- to 20-membered)heteroarylene;

$R_1$ to $R_3$, each independently, represent hydrogen, deuterium, a substituted or unsubstituted (C1-C20)alkyl, a substituted or unsubstituted (C3-C20)cycloalkyl, a substituted or unsubstituted (C6-C30)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, $-NR_9R_{10}$ or $-SiR_{11}R_{12}R_{13}$, or may be linked to an adjacent substituent(s) to form a substituted or unsubstituted (C3-C30), mono- or polycyclic, alicyclic or aromatic ring.

[43] The compound represented by formula 1 includes the following, but is not limited thereto.

[44]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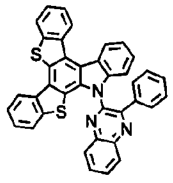
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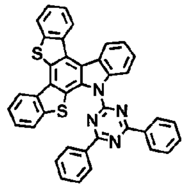
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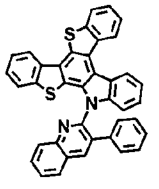
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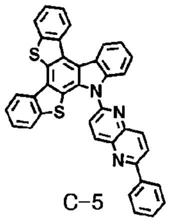
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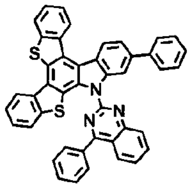
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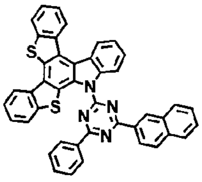
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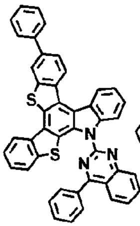
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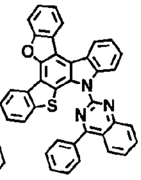
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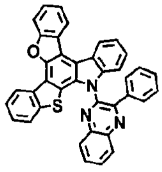
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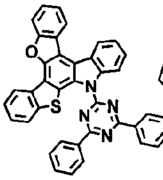
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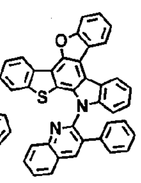
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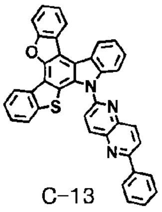
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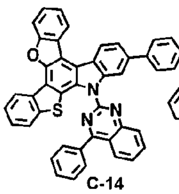
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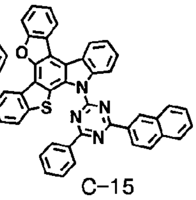
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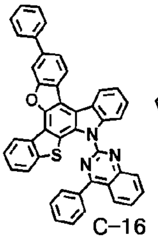
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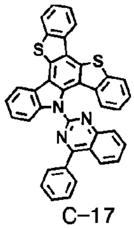
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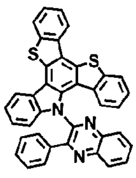
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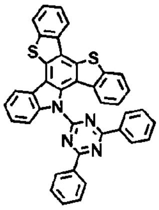
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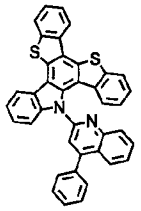
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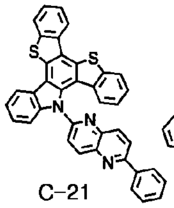
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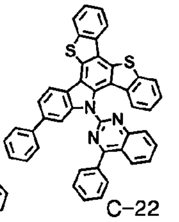
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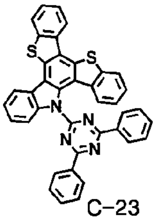
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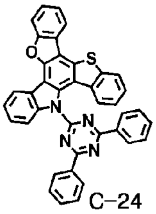
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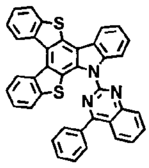
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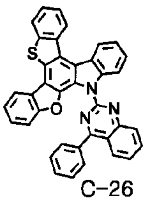
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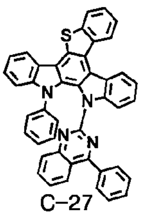
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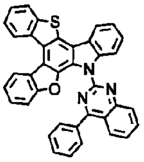
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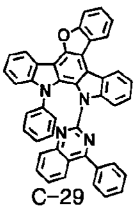
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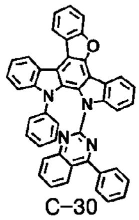
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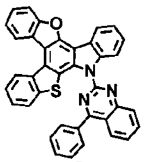
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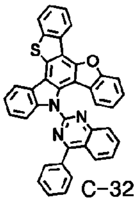
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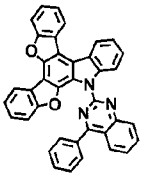
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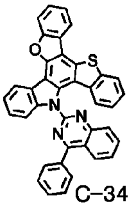
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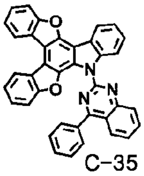
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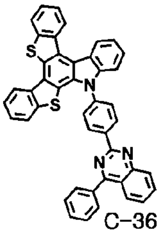
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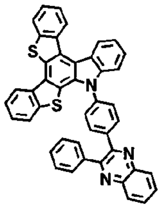
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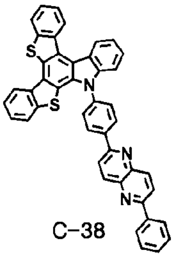
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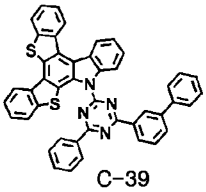
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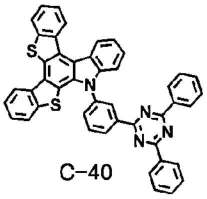
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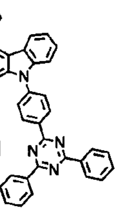
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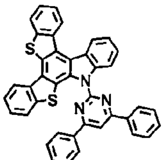
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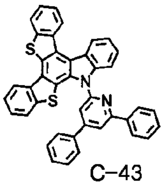
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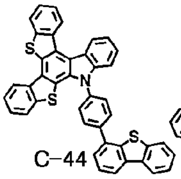
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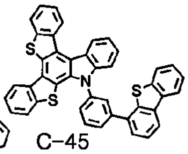
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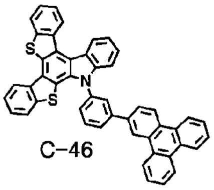
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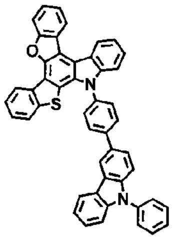
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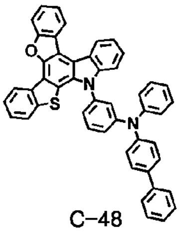
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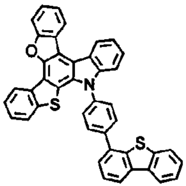
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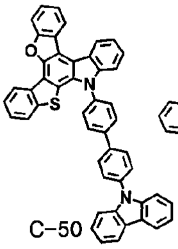
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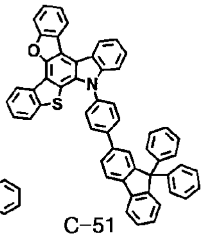
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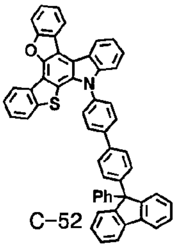
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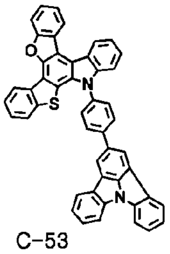
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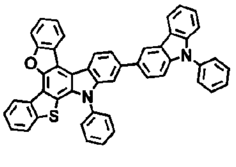
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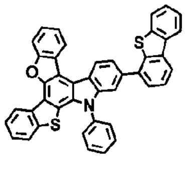
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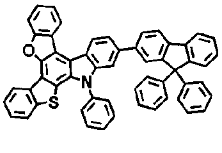
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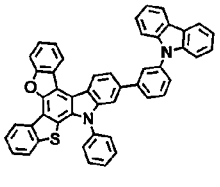
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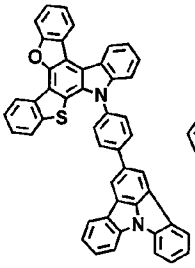
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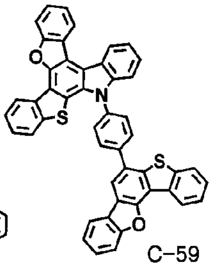
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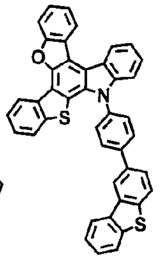
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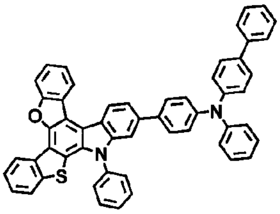
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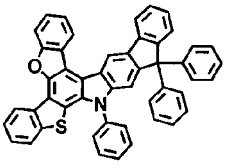
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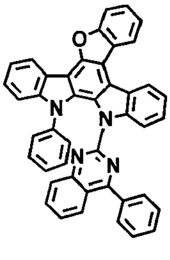
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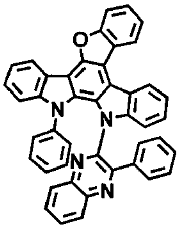
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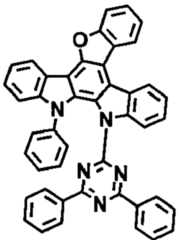
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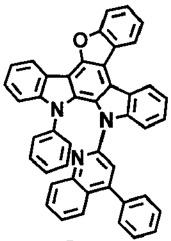
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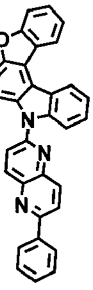
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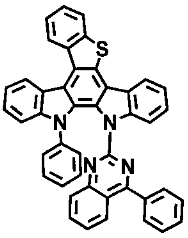

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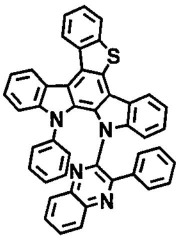

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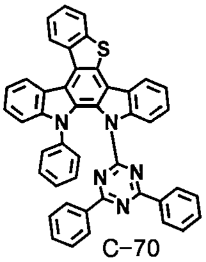

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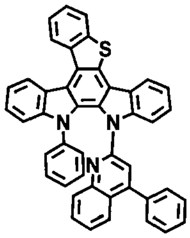

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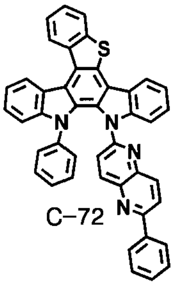

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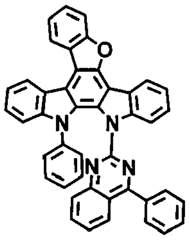

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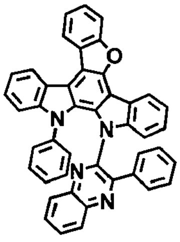

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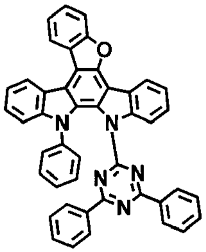
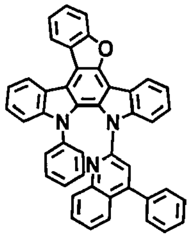


C-75



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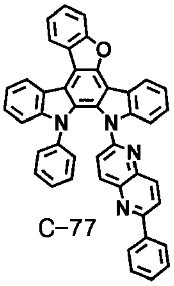

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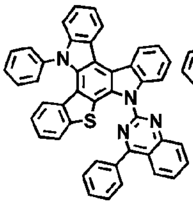

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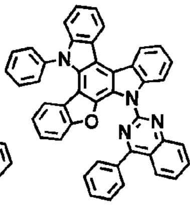

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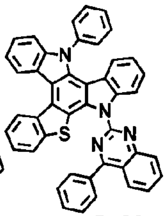

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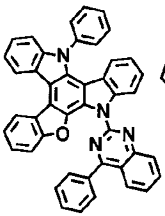

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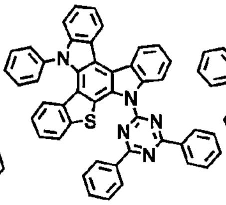

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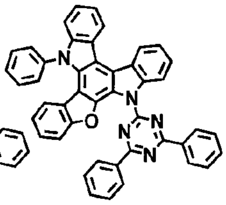

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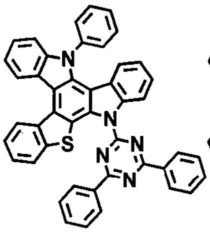
[58]



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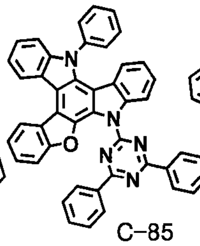

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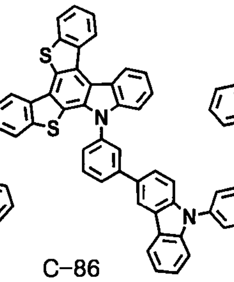

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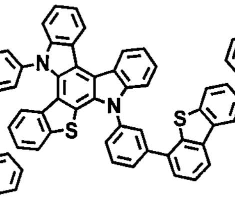

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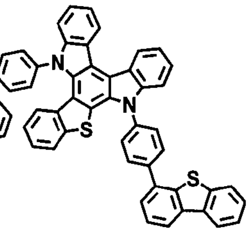

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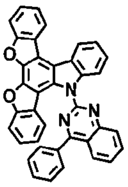

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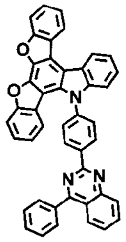

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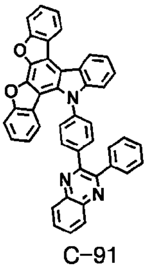

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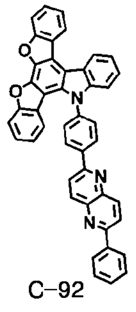

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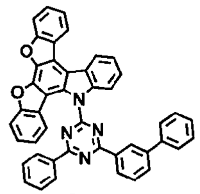

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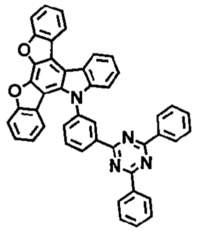
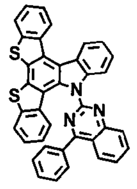
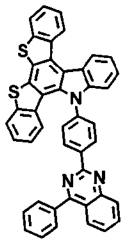


C-94

[60]



C-95



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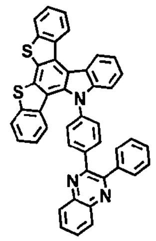

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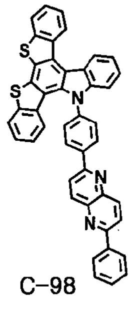

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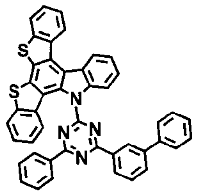
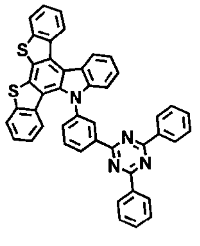
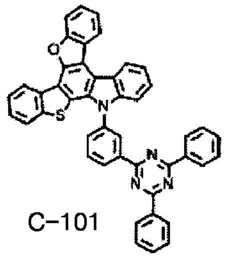


C-99



C-100

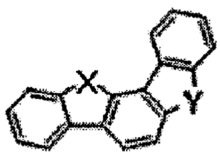
[61]



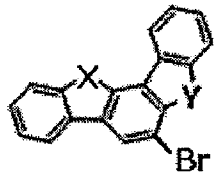
C-101

[62] The organic electroluminescent compound of the present disclosure can be prepared by a synthetic method known to one skilled in the art, e.g., bromination, Suzuki reaction, Buchwald-Hartwig reaction, Ullmann reaction, etc. For example, the compound of formula 1 can be prepared as follows: After preparing a five(5) ring-condensed compound represented by formula A, the compound of formula A is subjected to bromination to obtain a compound represented by formula B; the compound of formula B is fused with an indene ring, an indole ring, a benzofuran ring, or a benzothiophene ring to obtain a mother nucleus structure of formula 1; and *-$L_1$ -$Ar_1$ is then connected to the prepared mother nucleus structure, thereby the compound of formula 1 is obtained.

[63]



(A)



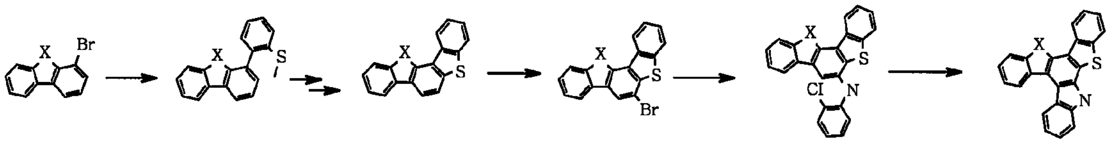
(B)

[64] In formulae A and B, X and Y, each independently, may be selected from O, S, N($R_6$ ), C($R_4$)($R_5$), and C($R_7$)($R_8$).

[65] The method for preparing the compound of the present disclosure described above can be illustrated in the following reaction schemes 1 to 4.

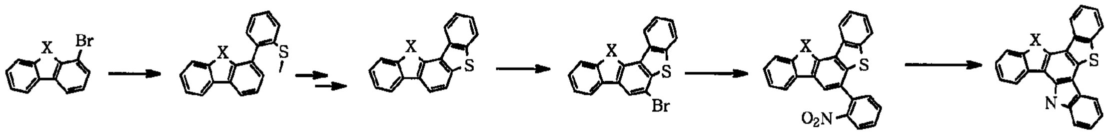
[66] [Reaction Scheme 1]

[67]



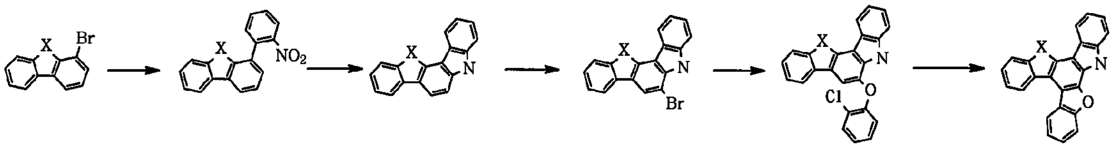
[68] [Reaction Scheme 2]

[69]



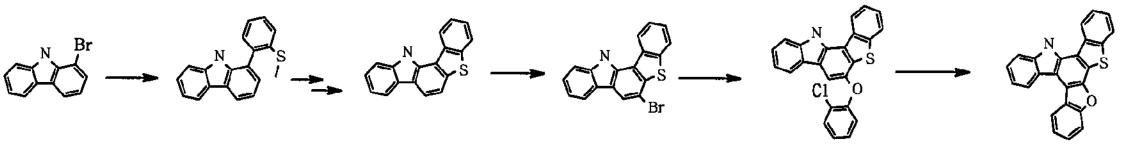
[70] [Reaction Scheme 3]

[71]



[72] [Reaction Scheme 4]

[73]



[74] In reaction schemes 1 to 4 above, X can be selected from O, S, N($R_6$), and C($R_7$)($R_8$).

[75] According to another aspect of the present disclosure, an organic electroluminescent material comprising the organic electroluminescent compound of formula 1, and an organic electroluminescent device comprising the material are provided.

[76] The material may comprise one or more compounds selected from the organic electroluminescent compound of formula 1. The material may further comprise a conventional compound(s) which has been comprised for an organic electroluminescent material. The organic electroluminescent material may be preferably a host material. When the organic electroluminescent material is used as a host material, it may further comprise a second host material other than the compound of formula 1 of the present disclosure, whose details are provided below.

[77] The organic electroluminescent device of the present disclosure may comprise a first electrode, a second electrode, and at least one organic layer disposed between the first and second electrodes, wherein the organic layer may comprise at least one compound of formula 1.

[78] One of the first and second electrodes may be an anode, and the other may be a cathode. The organic layer may comprise a light-emitting layer, and may further comprise at least one layer selected from a hole injection layer, a hole transport layer, an electron blocking layer, an electron transport layer, an electron injection layer, an interlayer, an electron buffer layer, and a hole blocking layer.

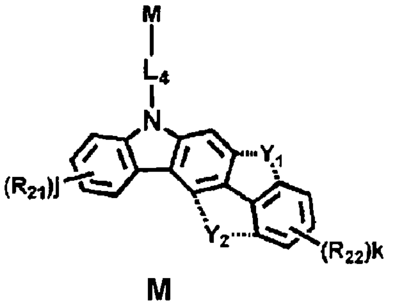
[79] The organic electroluminescent compound of formula 1 of the present disclosure may be comprised as a host material in the light-emitting layer. Preferably, the light-emitting layer may further comprise at least one dopant. Preferably, the light-emitting layer may comprise, in addition to an organic electroluminescent compound of formula 1 of the present disclosure (a first host material), a second host material. The weight

ratio between the first host material and the second host material is in the range of 1:99 to 99:1, and preferably 30:70 to 70:30 in view of driving voltage, lifespan, and luminous efficiency.

[80] According to another aspect of the present disclosure, a material for preparing an organic electroluminescent device is provided. The material comprises the compound of the present disclosure. The material may be a material for preparing a light-emitting layer of an organic electroluminescent device. When the compound of the present disclosure is comprised in the material for preparing a light-emitting layer of an organic electroluminescent device, the compound of the present disclosure may be comprised as a host material. When the compound of the present disclosure is comprised as a host material, the material may further comprise a second host material. The weight ratio between the compound of the present disclosure and the second host material is in the range of 1:99 to 99:1, and preferably 30:70 to 70:30 in view of driving voltage, lifespan, and luminous efficiency. The material may be a composition or a mixture.

[81] A phosphorescent host material known in the art may be used as the second host material. The compound selected from the group consisting of the compounds of formulae 6 to 10 below is preferable as the second host material in view of driving voltage, lifespan, and luminous efficiency.

[82] $\text{H-(Cz-L}_4)_h\text{-M}$ (6) $\text{H-(Cz)}_i\text{-L}_4\text{-M}$ (7)



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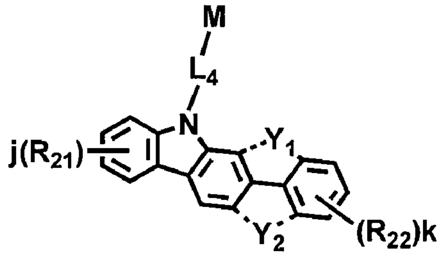

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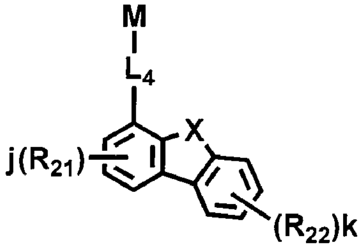
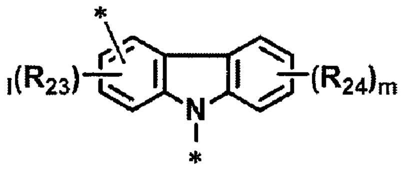


(10)

[83] wherein Cz represents the following structure:

[84]



[85] $L_4$ represents a single bond, a substituted or unsubstituted (C6-C30)arylene, or a sub-

stituted or unsubstituted (5- to 30-membered)heteroarylene; M represents a substituted or unsubstituted (C6-C30)aryl, or a substituted or unsubstituted (5- to 30-membered)heteroaryl; $Y_1$ and $Y_2$, each independently, represent -O-, -S-, -N($R_{31}$)- or -C($R_{32}$)($R_{33}$)-, provided that both $Y_1$ and $Y_2$ cannot be simultaneously present; X represents O or S; $R_{21}$ to $R_{24}$, each independently, represent hydrogen, deuterium, a halogen, a cyano, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C3-C30)cycloalkyl, a substituted or unsubstituted (C6-C30)aryl, a substituted or unsubstituted (5- to 30-membered)heteroaryl or $R_{25}R_{26}R_{27}$Si-; or may be linked to an adjacent substituent(s) to form a (C3-C30), mono- or polycyclic, alicyclic or aromatic ring whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen, and sulfur; provided that when h of formula 6 or i of formula 7 is 1, $R_{23}$ or $R_{24}$ does not form the ring containing $Y_1$ or $Y_2$ of formulae 8 and 9, and $R_{22}$ of formula 10 does not form the indole ring connected to $R_{21}$ of formulae 8 and 9; $R_{25}$ to $R_{27}$, each independently, represent a substituted or unsubstituted (C1-C30)alkyl, or a substituted or unsubstituted (C6-C30)aryl; $R_{31}$ to $R_{33}$, each independently, represent hydrogen, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C6-C30)aryl, or a substituted or unsubstituted (5- to 30-membered)heteroaryl; or may be linked to an adjacent substituent(s) to form a (C5-C30), mono- or polycyclic, alicyclic or aromatic ring whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen, and sulfur; $R_{32}$ and $R_{33}$ may be the same or different; the heteroaryl(ene) contains at least one hetero atom selected from B, N, O, S, P(=O), Si and P; h and i, each independently, represent an integer of 1 to 3; j, k, l and m, each independently, represent an integer of 0 to 4; and when h, i, j, k, l or m is an integer of 2 or more, each of (Cz-$L_4$), each of (Cz), each of $R_{21}$, each of $R_{22}$, each of $R_{23}$, or each of $R_{24}$ may be the same or different.

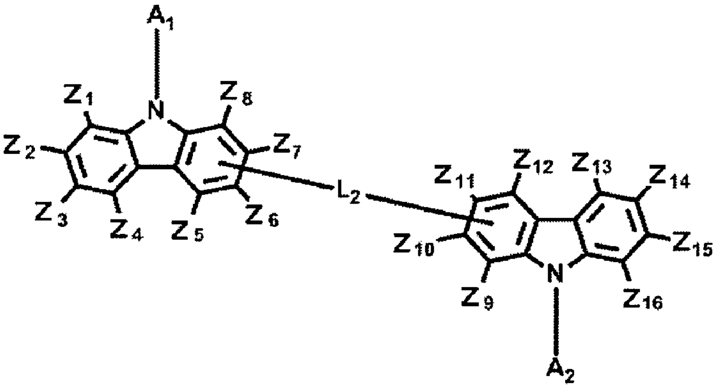
[86] Preferably, in formulae 6 to 10, M may represent a substituted or unsubstituted nitrogen-containing (6- to 20-membered) heteroaryl. Preferably, the substituent for the substituted group of M may be a (C1-C20)alkyl; a (C6-C24)aryl unsubstituted or substituted with a (C1-C10)alkyl, a tri(C6-C13)arylsilyl, or a (6- to 13-membered)heteroaryl; or a (6- to 20-membered)heteroaryl unsubstituted or substituted with a (C1-C10)alkyl, a tri(C6-C13)arylsilyl, or a (C6-C24)aryl; or a tri(C6-C20)arylsilyl. Specifically, M may represent a substituted or unsubstituted pyridyl, a substituted or unsubstituted pyrimidinyl, a substituted or unsubstituted triazinyl, a substituted or unsubstituted pyrazinyl, a substituted or unsubstituted quinolyl, a substituted or unsubstituted isoquinolyl, a substituted or unsubstituted quinazolinyl, a substituted or unsubstituted quinoxalinyl, a substituted or unsubstituted naphthyridinyl, or a substituted or unsubstituted phenanthrolinyl.

[87] Preferably, at least one of $R_{23}$ and $R_{24}$ of formulae 6 and 7, or at least one of $R_{21}$ and

$R_{22}$ of formulae 8 to 10 may represent a substituted or unsubstituted carbazolyl, a substituted or unsubstituted benzocarbazolyl, a substituted or unsubstituted dibenzothiophenyl, a substituted or unsubstituted benzonaphthothiophenyl, a substituted or unsubstituted dibenzofuranyl, a substituted or unsubstituted benzonaphthofuranyl, a (C6-C18)aryl substituted with a substituted or unsubstituted carbazolyl, a (C6-C18)aryl substituted with a substituted or unsubstituted benzocarbazolyl, a (C6-C18)aryl substituted with a substituted or unsubstituted dibenzothiophenyl, a (C6-C18)aryl substituted with a substituted or unsubstituted benzonaphthothiophenyl, a (C6-C18)aryl substituted with a substituted or unsubstituted dibenzofuranyl, or a (C6-C18)aryl substituted with a substituted or unsubstituted benzonaphthofuranyl. When M is aryl, at least one of $R_{23}$ and $R_{24}$, or at least one of $R_{21}$ and $R_{22}$ may represent a substituted or unsubstituted nitrogen-containing (6- to 20-membered)heteroaryl; or may have, as a substituent, a substituted or unsubstituted nitrogen-containing (6- to 20-membered)heteroaryl. Specifically, the substituted or unsubstituted nitrogen-containing heteroaryl may represent a substituted or unsubstituted pyridyl, a substituted or unsubstituted pyrimidinyl, a substituted or unsubstituted triazinyl, a substituted or unsubstituted pyrazinyl, a substituted or unsubstituted quinolyl, a substituted or unsubstituted isoquinolyl, a substituted or unsubstituted quinazolinyl, a substituted or unsubstituted quinoxalinyl, a substituted or unsubstituted naphthyridinyl, or a substituted or unsubstituted phenanthrolinyl.

[88] Specifically, the second host material may be represented by formula 6 above, and more specifically, the following formula 11.

[89]



(11)

[90] wherein $A_1$ and $A_2$, each independently, represent a substituted or unsubstituted (C6-C30)aryl; provided that the substituent of the substituted group of $A_1$ and $A_2$ is not a nitrogen-containing heteroaryl;

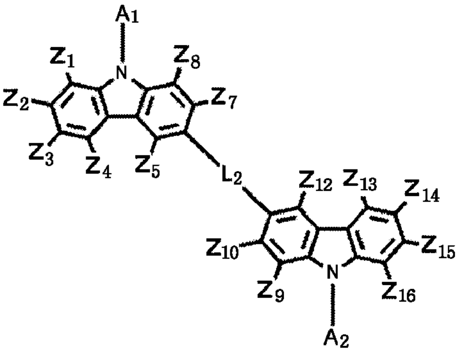
[91] $L_2$ represents a single bond or a substituted or unsubstituted (C6-C30)arylene; and

[92] $Z_1$ to $Z_{16}$, each independently, represent hydrogen, deuterium, a halogen, a cyano, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C2-C30)alkenyl, a substituted or unsubstituted (C2-C30)alkynyl, a substituted or un-

substituted (C3-C30)cycloalkyl, a substituted or unsubstituted (C6-C60)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, a substituted or unsubstituted tri(C1-C30)alkylsilyl, a substituted or unsubstituted tri(C6-C30)arylsilyl, a substituted or unsubstituted di(C1-C30)alkyl(C6-C30)arylsilyl, a substituted or unsubstituted (C1-C30)alkyldi(C6-C30)arylsilyl, or a substituted or unsubstituted mono- or di-(C6-C30)arylamino; or may be linked to an adjacent substituent(s) to form a substituted or unsubstituted (C3-C30), mono- or polycyclic, alicyclic or aromatic ring.

[93] According to one embodiment of the present disclosure, the compound of formula 11 may be represented by any one of the following formulae 12, 13, 14, and 15.

[94]



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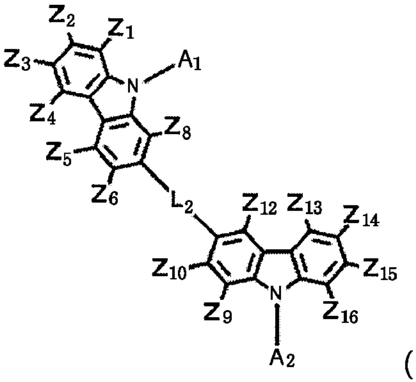
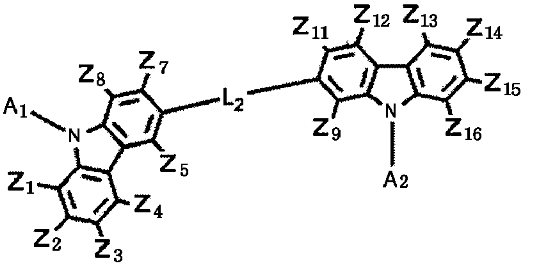


(13)

[95]



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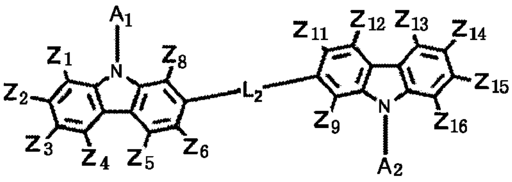


(15)

[96] wherein $A_1$, $A_2$, $L_2$, and $Z_1$ to $Z_{16}$ are as defined in formula 11 above.

[97] $A_1$ and $A_2$, each independently, represent preferably, a substituted or unsubstituted (C6-C18)aryl, and more preferably, a (C6-C18)aryl unsubstituted or substituted with a cyano, a halogen, a (C1-C6)alkyl, a (C6-C12)aryl or tri(C6-C12)arylsilyl. Specifically, $A_1$ and $A_2$, each independently, may be selected from the group consisting of a substituted or unsubstituted phenyl, a substituted or unsubstituted biphenyl, a substituted or unsubstituted terphenyl, a substituted or unsubstituted naphthyl, a substituted or unsubstituted fluorenyl, a substituted or unsubstituted benzofluorenyl, a substituted or unsubstituted phenanthrenyl, a substituted or unsubstituted anthracenyl, a substituted or unsubstituted indenyl, a substituted or unsubstituted triphenylenyl, a substituted or unsubstituted pyrenyl, a substituted or unsubstituted tetracenyl, a substituted or unsubstituted perylenyl, a substituted or unsubstituted chrysenyl, a substituted or unsubstituted phenylnaphthyl, a substituted or unsubstituted naphthylphenyl, and a sub-

stituted or unsubstituted fluoranthenyl. The substituent of the substituted group such as the substituted phenyl of $A_1$ and $A_2$ may be a cyano, a halogen, a (C1-C6)alkyl, a (C6-C12)aryl, or tri(C6-C12)arylsilyl.

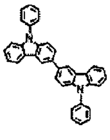
[98] $Z_1$ to $Z_{16}$, each independently, represent preferably, hydrogen, a cyano, a substituted or unsubstituted (C1-C10)alkyl, a substituted or unsubstituted (C6-C20)aryl, a substituted or unsubstituted (5- to 20-membered)heteroaryl, or a substituted or unsubstituted tri(C6-C12)arylsilyl. $Z_1$ to $Z_{16}$, each independently, represent more preferably, hydrogen; a cyano; a (C1-C10)alkyl; a (C6-C20)aryl unsubstituted or substituted with a cyano, a (C1-C10)alkyl or tri(C6-C12)arylsilyl; a (5- to 20-membered)heteroaryl unsubstituted or substituted with a (C1-C10)alkyl, a (C6-C15)aryl or tri(C6-C12)arylsilyl; or tri(C6-C12)arylsilyl unsubstituted or substituted with a (C1-C10)alkyl. Specifically, $Z_1$ to $Z_{16}$, each independently, may represent hydrogen; a cyano; a (C1-C6)alkyl; phenyl, biphenyl, terphenyl, or naphthyl, unsubstituted or substituted with a cyano, a (C1-C6)alkyl or triphenylsilyl; dibenzothiophenyl or dibenzofuranyl, unsubstituted or substituted with a (C1-C6)alkyl, phenyl, biphenyl, naphthyl, or triphenylsilyl; or triphenylsilyl unsubstituted or substituted with a (C1-C6)alkyl.

[99] $L_2$ represents preferably, a single bond, or a substituted or unsubstituted (C6-C15)arylene. Specifically, $L_2$ may represent a single bond, a substituted or unsubstituted phenylene, a substituted or unsubstituted naphthylene, or a substituted or unsubstituted biphenylene.

[100] According to one embodiment of the present disclosure, $A_1$ and $A_2$, each independently, may represent a substituted or unsubstituted (C6-C18)aryl; $Z_1$ to $Z_{16}$, each independently, may represent hydrogen, a cyano, a substituted or unsubstituted (C1-C10)alkyl, a substituted or unsubstituted (C6-C20)aryl, a substituted or unsubstituted (5- to 20-membered)heteroaryl, or a substituted or unsubstituted tri(C6-C12)arylsilyl; and $L_2$ may represent a single bond, or a substituted or unsubstituted (C6-C15)arylene.

[101] Specifically, the preferable example of the second host material represented by formulae 6 to 10 includes the following, but is not limited thereto:

[102]



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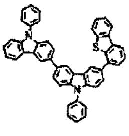

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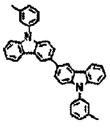

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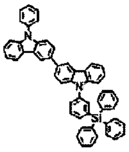

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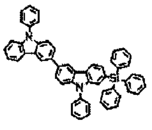

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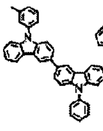

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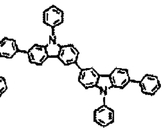

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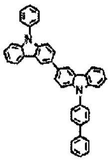

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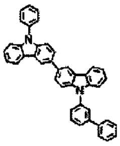
[103]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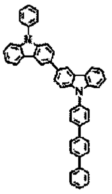
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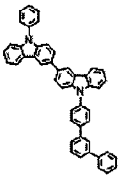
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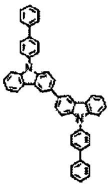
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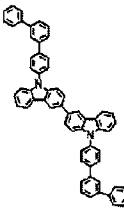
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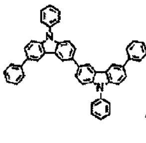
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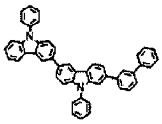
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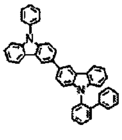
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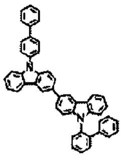
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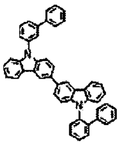
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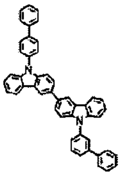
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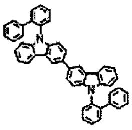
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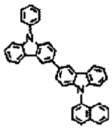
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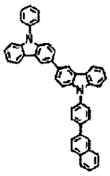
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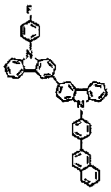
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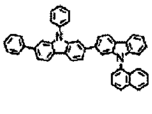
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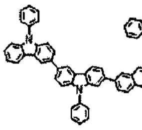
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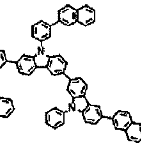
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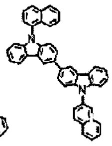
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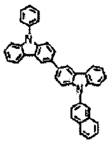
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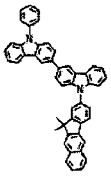
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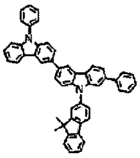
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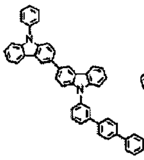
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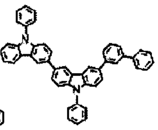
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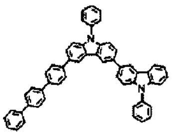
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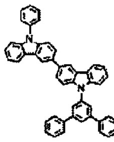
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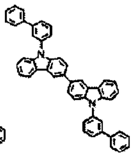
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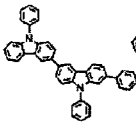
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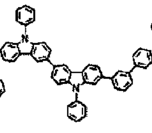
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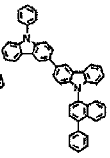
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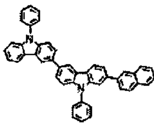
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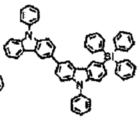
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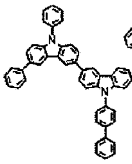
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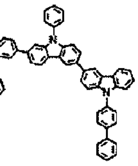
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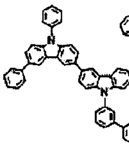
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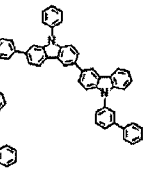
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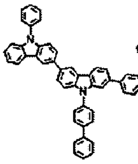
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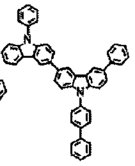
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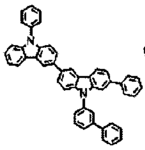
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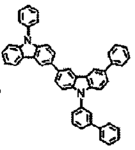
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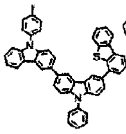
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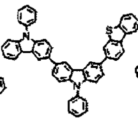
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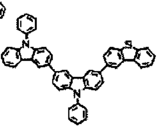
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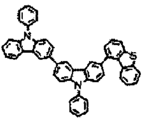
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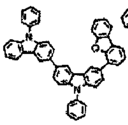
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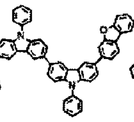
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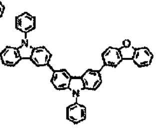
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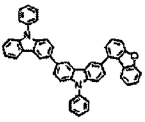
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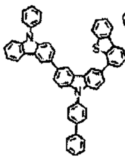
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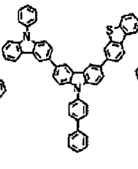
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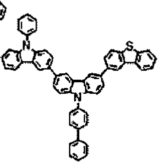
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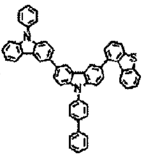
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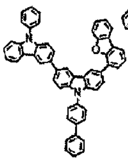
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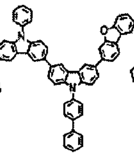
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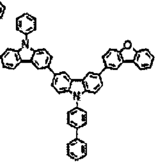
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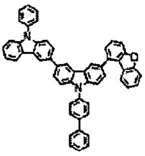
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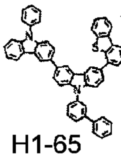
[110]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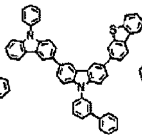
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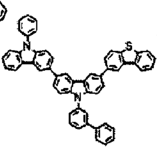
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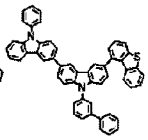
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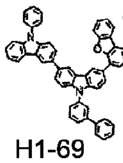
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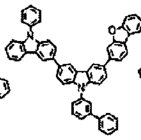
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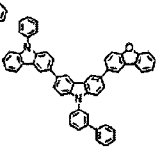
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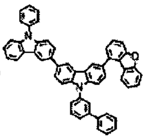
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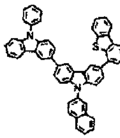
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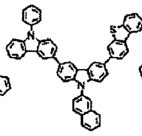
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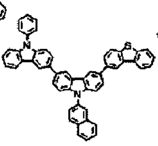
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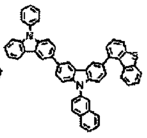
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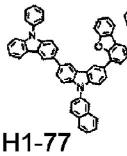
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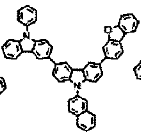
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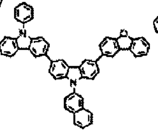
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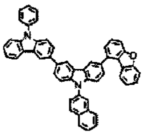
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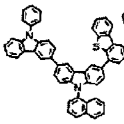
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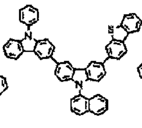
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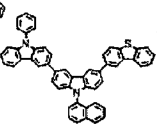
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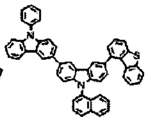
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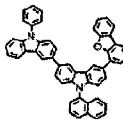
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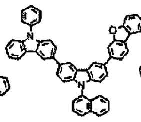
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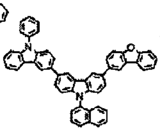
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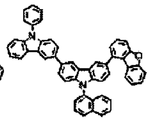
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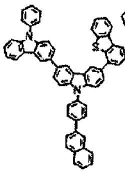
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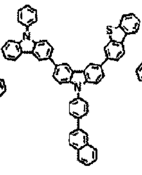
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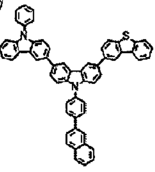
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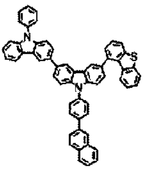
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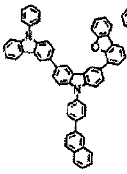
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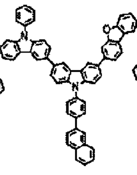
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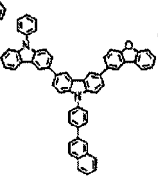
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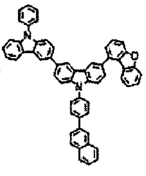
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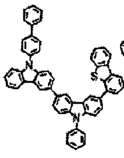
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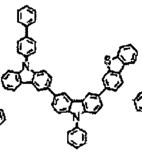
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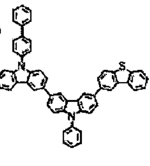
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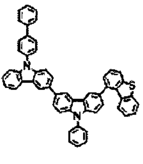
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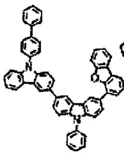
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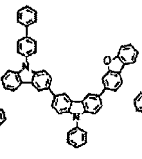
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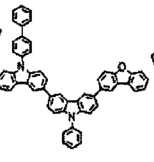
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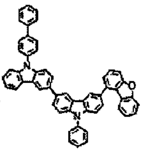
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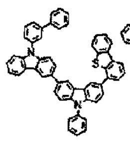
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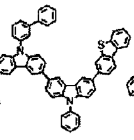
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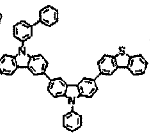
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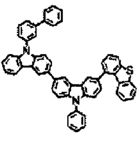
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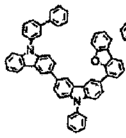
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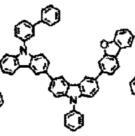
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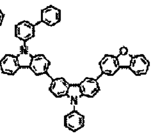
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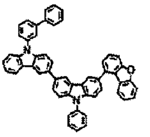
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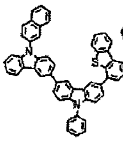
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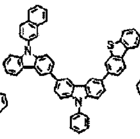
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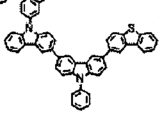
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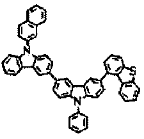
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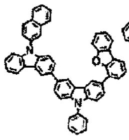
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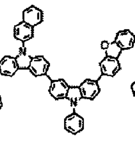
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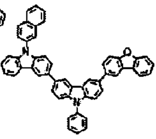
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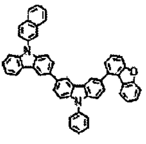
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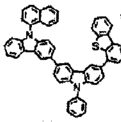
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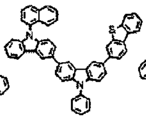
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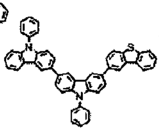
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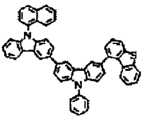
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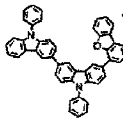
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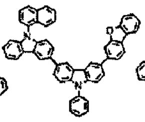
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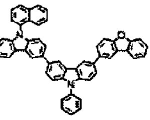
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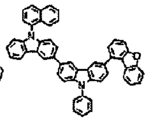
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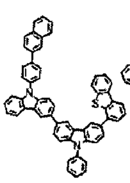
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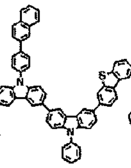
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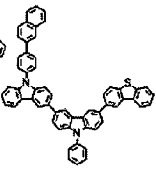
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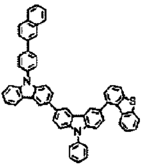
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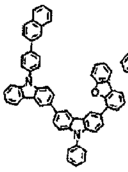
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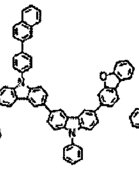
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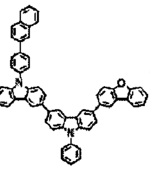
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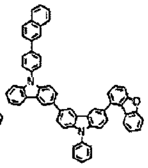
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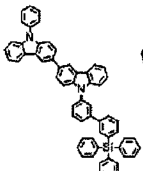
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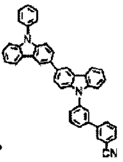
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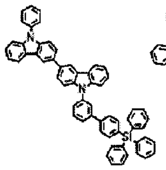
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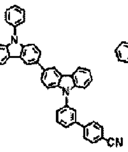
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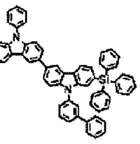
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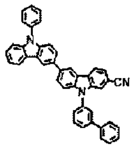
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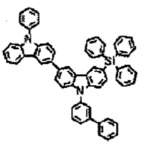
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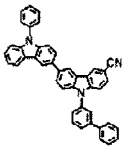
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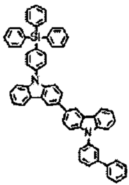
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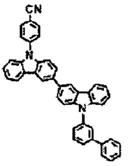
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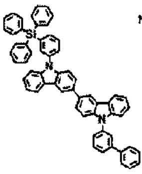
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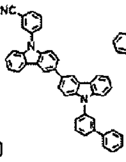
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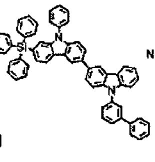
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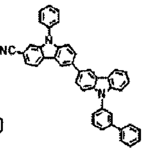
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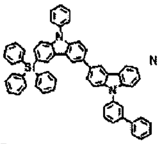
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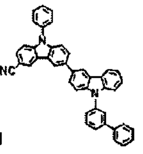
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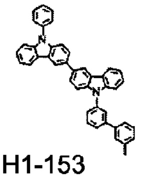
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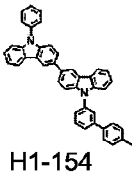
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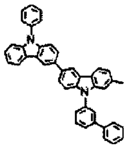
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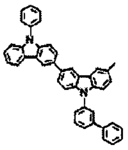
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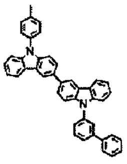
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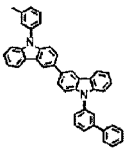
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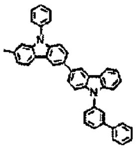
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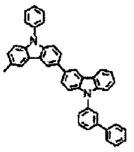
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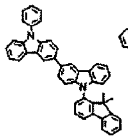
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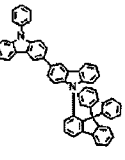
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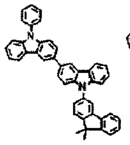
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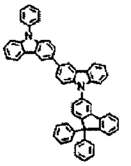
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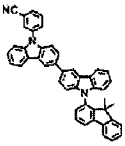
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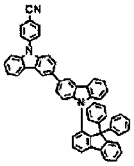
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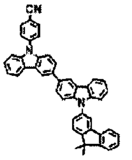
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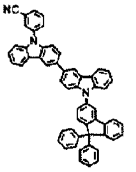
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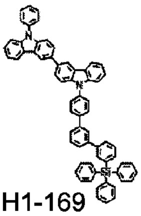
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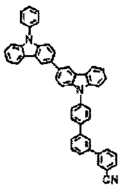
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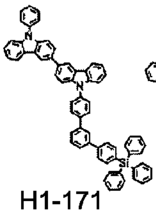
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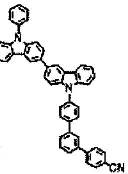
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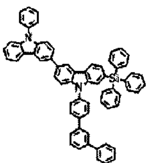
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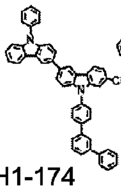
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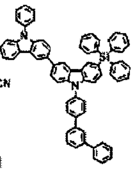
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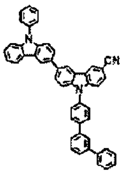
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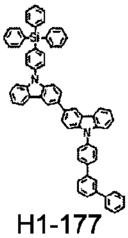
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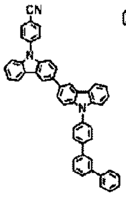
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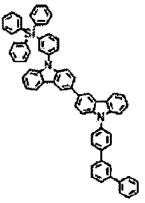
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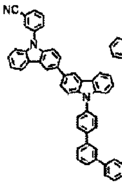
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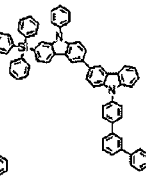
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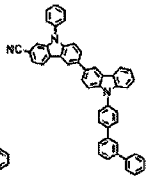
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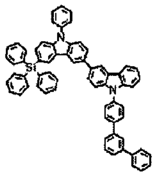
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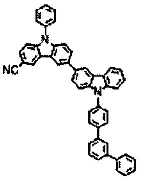
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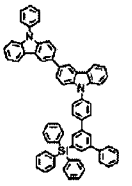
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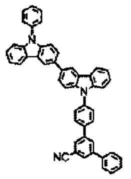
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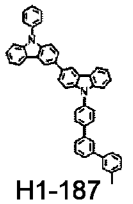
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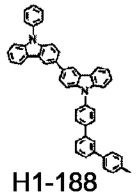
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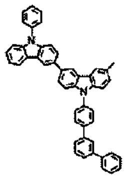
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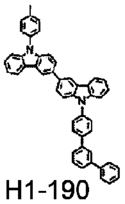
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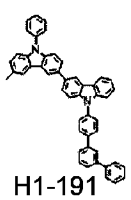
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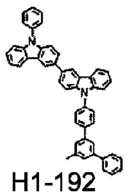
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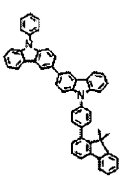
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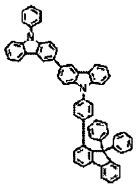
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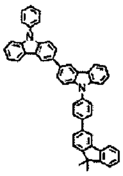
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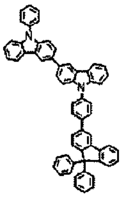
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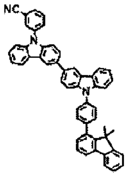
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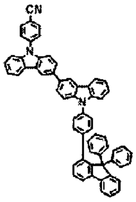
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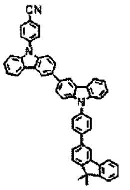
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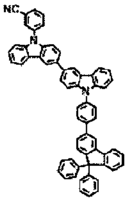
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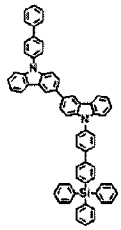
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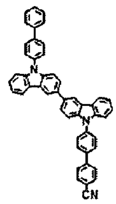
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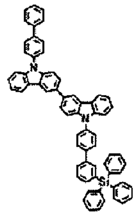
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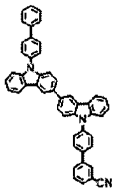
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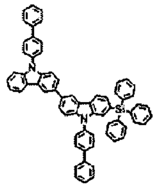
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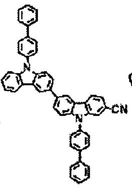
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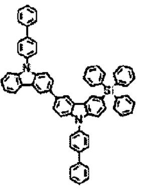
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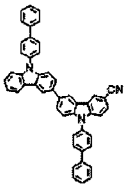
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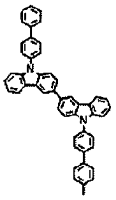
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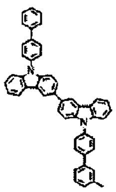
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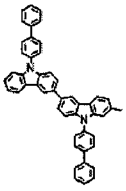
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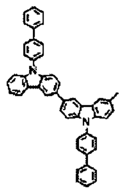
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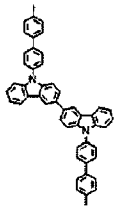
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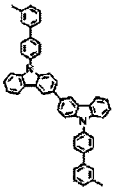
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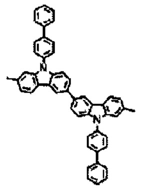
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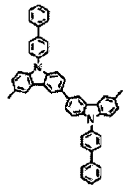
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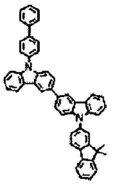
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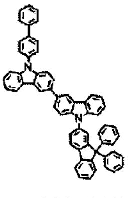
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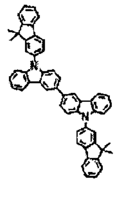
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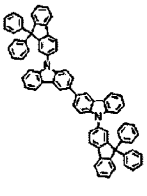
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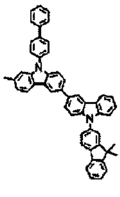
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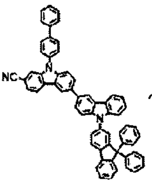
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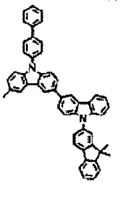
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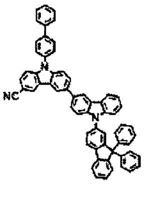
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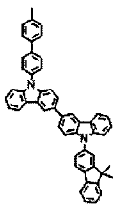
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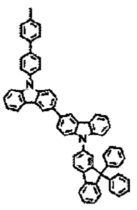
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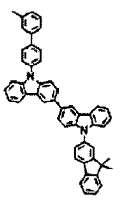
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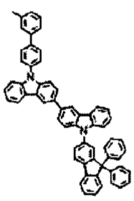
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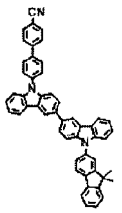
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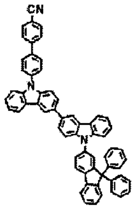
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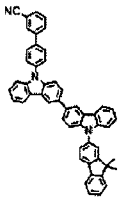
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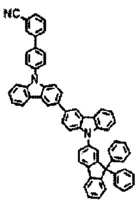
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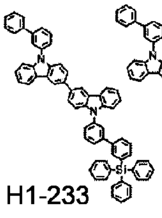
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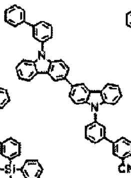
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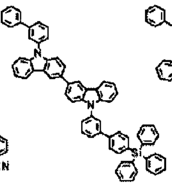
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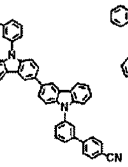
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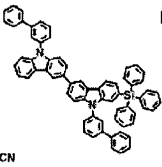
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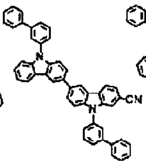
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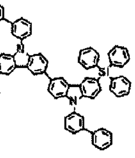
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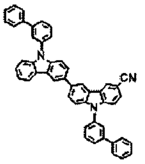
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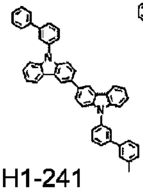
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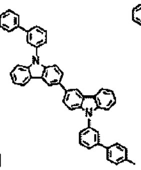
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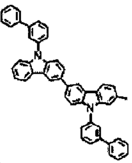
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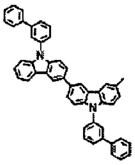
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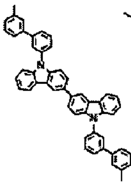
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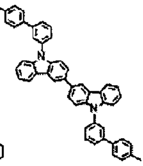
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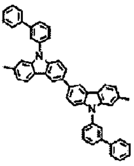
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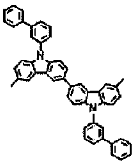
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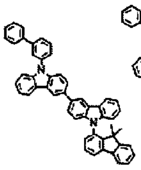
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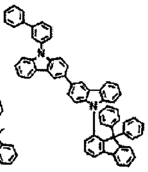
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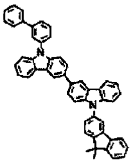
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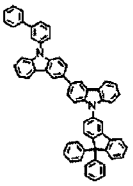
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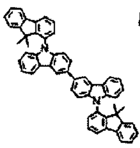
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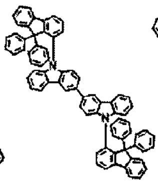
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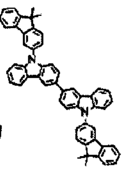
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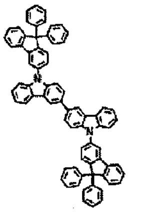
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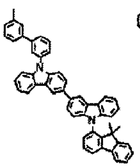
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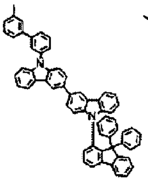
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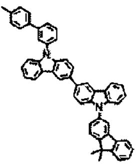
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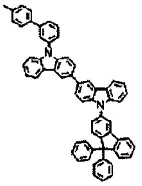
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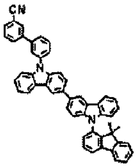
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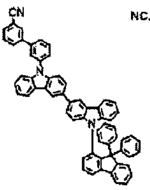
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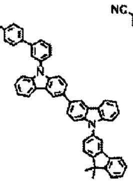
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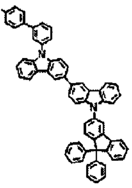
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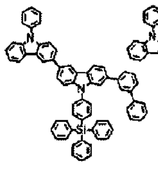
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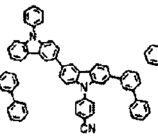
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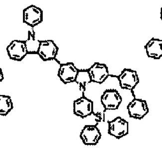
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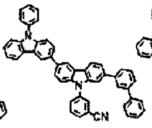
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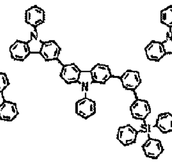
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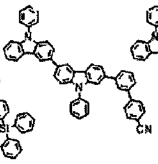
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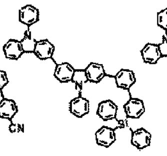
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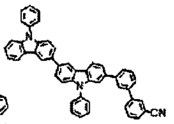
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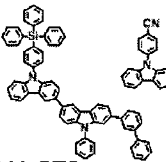
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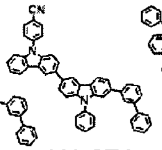
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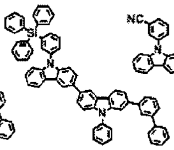
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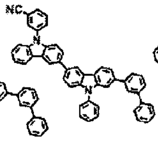
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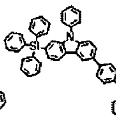
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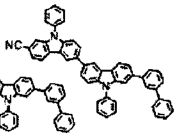
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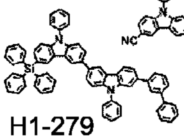
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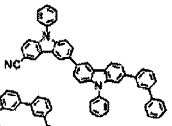
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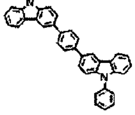
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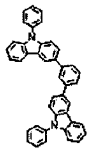
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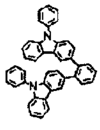
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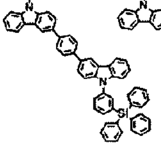
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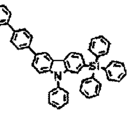
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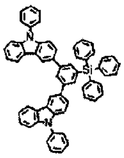
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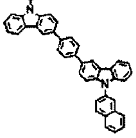
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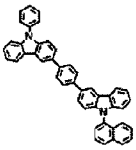
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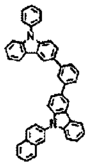
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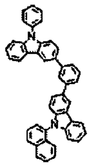
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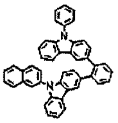
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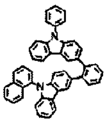
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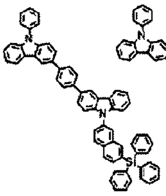
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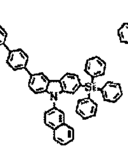
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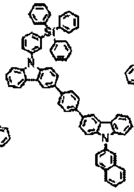
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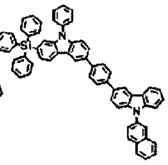
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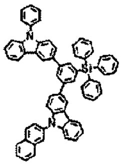
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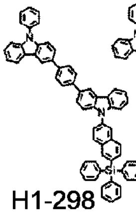
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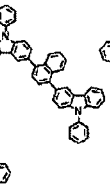
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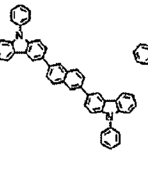
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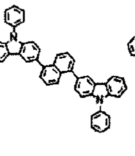
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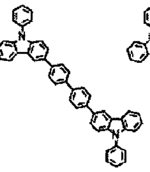
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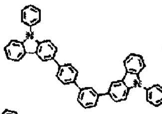
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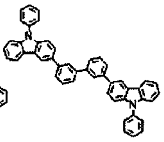
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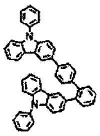
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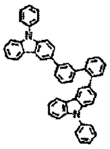
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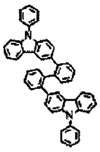
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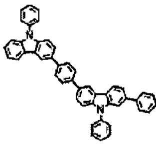
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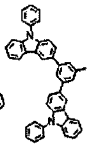
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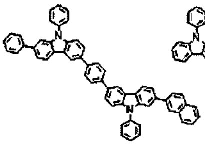
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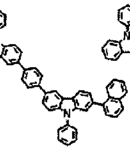
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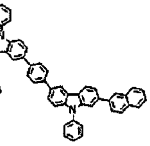
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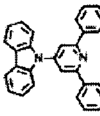
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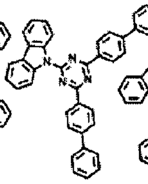
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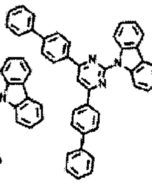
H1-315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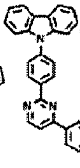
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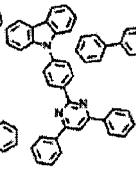
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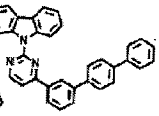
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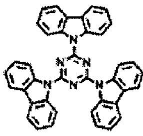
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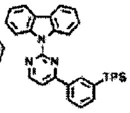
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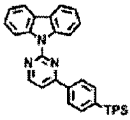
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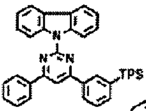
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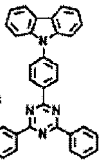
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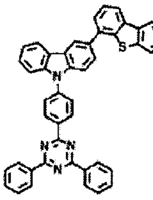
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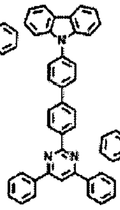
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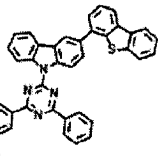
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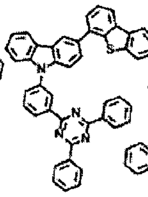
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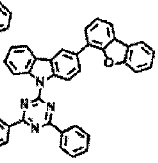
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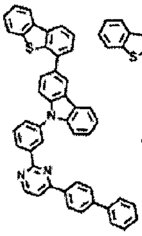
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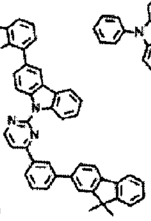
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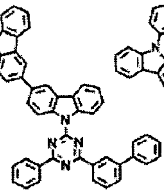
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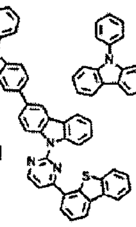
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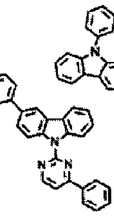
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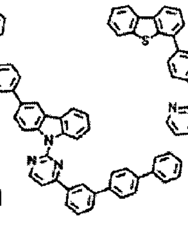
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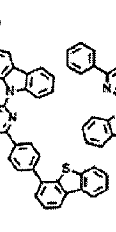
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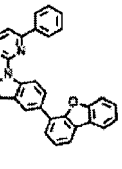
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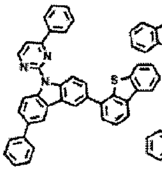
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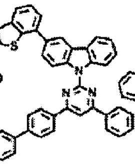
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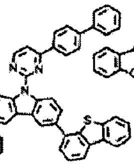
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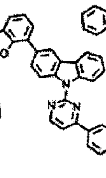
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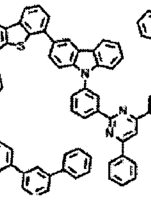
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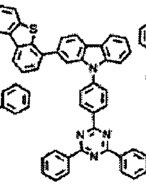
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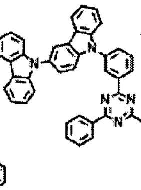
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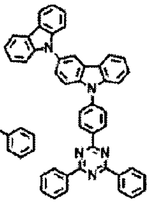
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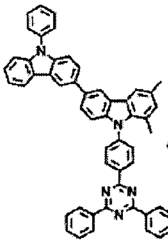
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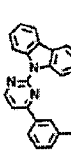
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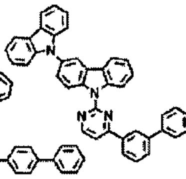
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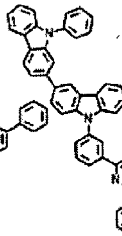
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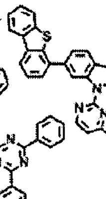
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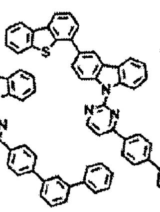
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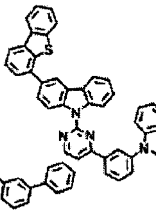
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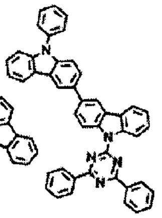
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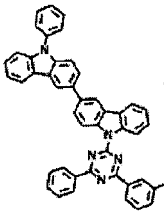
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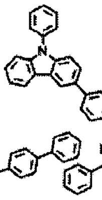
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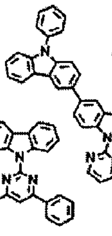
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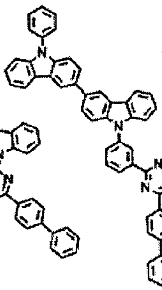
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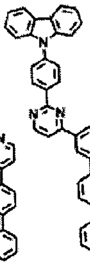
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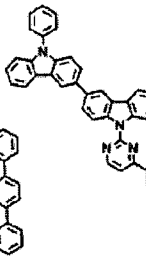
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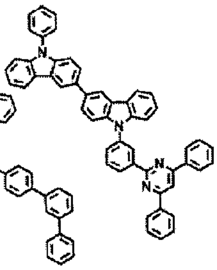
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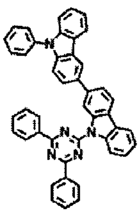
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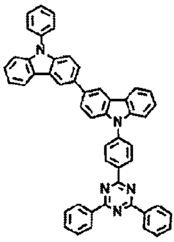
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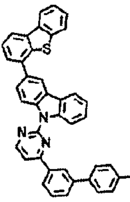
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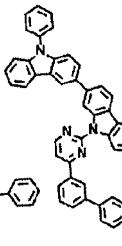
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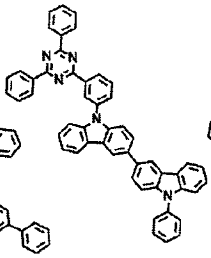
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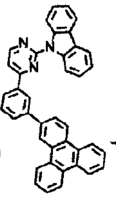
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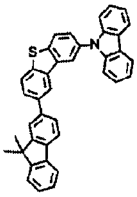
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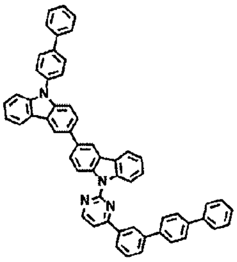
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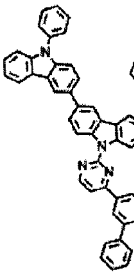
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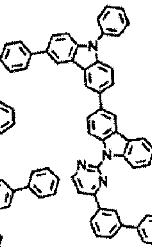
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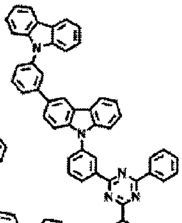
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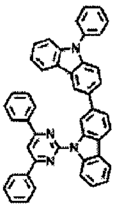
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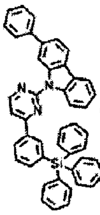
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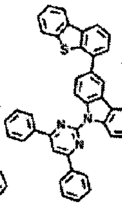
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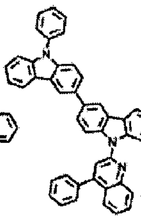
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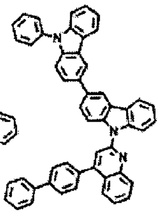
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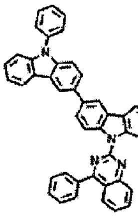

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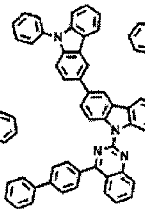

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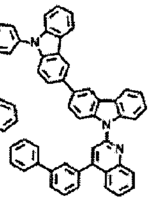

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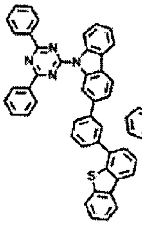

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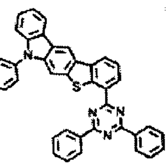

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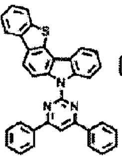

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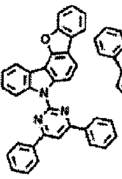

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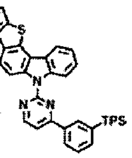

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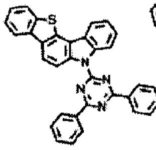

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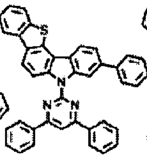

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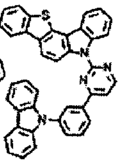

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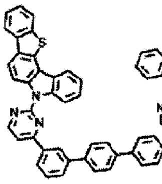

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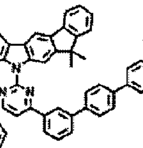

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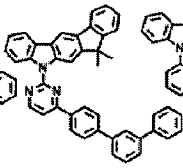

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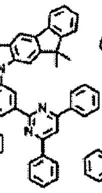

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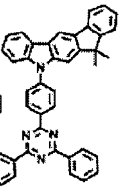

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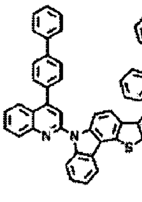

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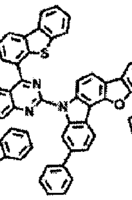

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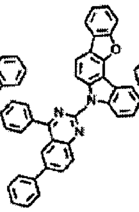

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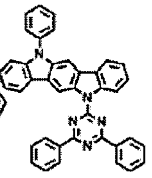

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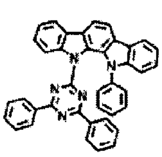

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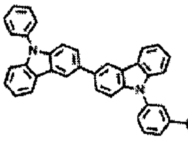

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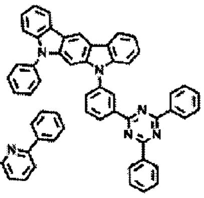

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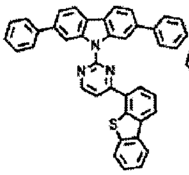

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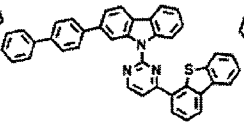

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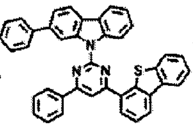

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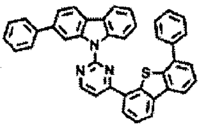

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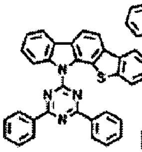

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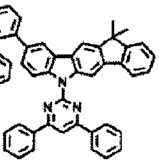

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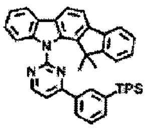

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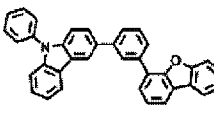

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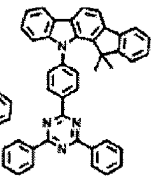

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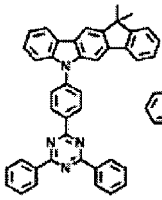

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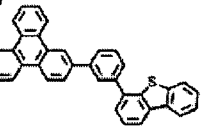

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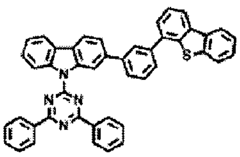

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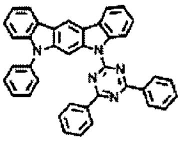

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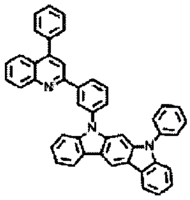

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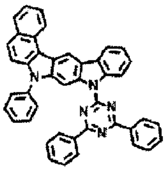

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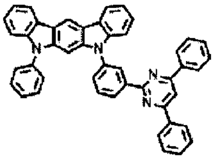

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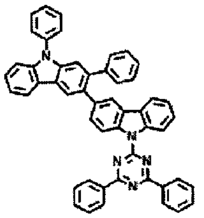

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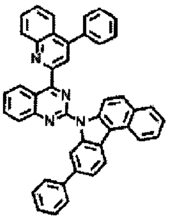
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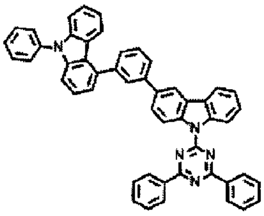
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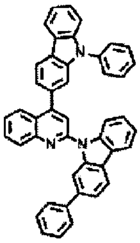
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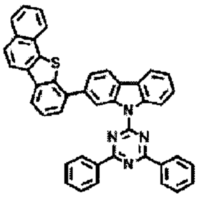
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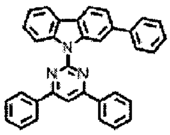
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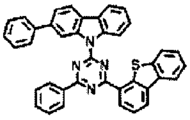
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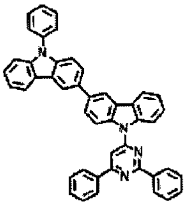
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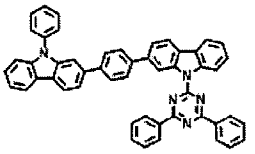
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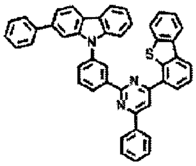
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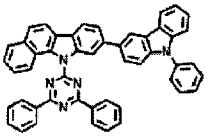
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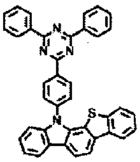
[157]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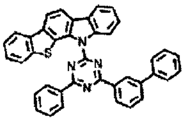
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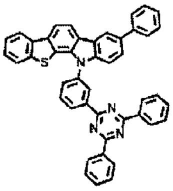
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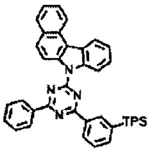

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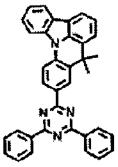
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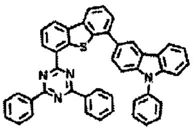
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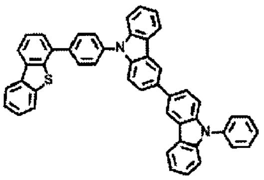
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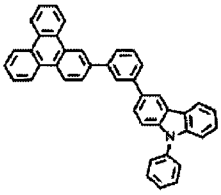
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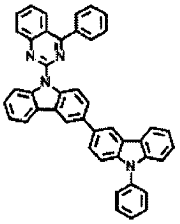
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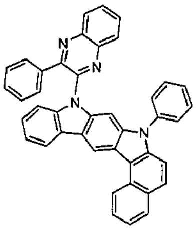
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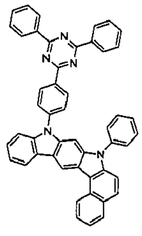
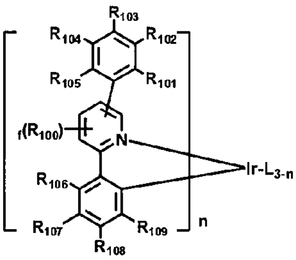

H1-437

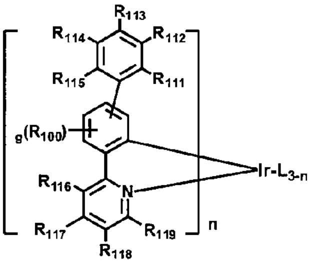
[159] (Wherein, TPS represents triphenylsilyl.)

[160] The dopant is preferably at least one phosphorescent dopant. The phosphorescent dopant material for the organic electroluminescent device of the present disclosure is not limited, but may be preferably selected from metallated complex compounds of iridium (Ir), osmium (Os), copper (Cu) or platinum (Pt), more preferably selected from ortho-metallated complex compounds of iridium (Ir), osmium (Os), copper (Cu) or platinum (Pt), and even more preferably ortho-metallated iridium complex compounds.

[161] The dopant to be comprised in the organic electroluminescent device of the present disclosure may be selected from the group consisting of compounds represented by the following formulae 16 to 18.

[162]


(16)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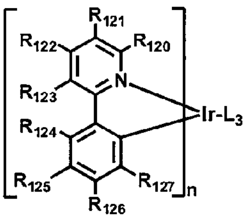
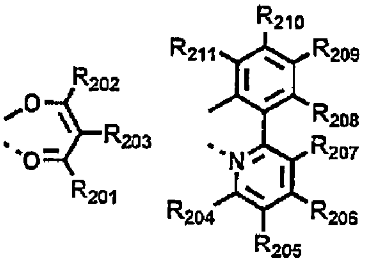

(18)

[163] wherein L is selected from the following structures:

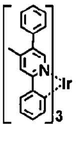
[164]



[165] $R_{100}$ represents hydrogen, a substituted or unsubstituted (C1-C30)alkyl, or a substituted or unsubstituted (C3-C30)cycloalkyl; $R_{101}$ to $R_{109}$, and $R_{111}$ to $R_{123}$, each independently, represent hydrogen, deuterium, a halogen, a (C1-C30)alkyl unsubstituted or substituted with a halogen, a substituted or unsubstituted (C3-C30)cycloalkyl, a cyano, a substituted or unsubstituted (C6-C30)aryl, or a substituted or unsubstituted (C1-C30)alkoxy; $R_{106}$ to $R_{109}$ may be linked to an adjacent substituent(s) to form a substituted or unsubstituted fused ring, for example, a substituted or unsubstituted fluorene, a substituted or unsubstituted dibenzothiophene, or a substituted or unsubstituted dibenzofuran; $R_{120}$ to $R_{123}$ may be linked to an adjacent substituent(s) to form a substituted or unsubstituted fused ring, for example, a substituted or unsubstituted quinoline; $R_{124}$ to $R_{127}$, each independently, represent hydrogen, deuterium, a halogen, a substituted or unsubstituted (C1-C30)alkyl, or a substituted or unsubstituted (C6-C30)aryl; $R_{124}$ to $R_{127}$ may be linked to an adjacent substituent(s) to form a substituted or unsubstituted fused ring, for example, a substituted or unsubstituted fluorene, a substituted or unsubstituted dibenzothiophene, or a substituted or unsubstituted dibenzofuran; $R_{201}$ to $R_{211}$, each independently, represent hydrogen, deuterium, a halogen, a (C1-C30)alkyl unsubstituted or substituted with a halogen, a substituted or unsubstituted (C3-C30)cycloalkyl, or a substituted or unsubstituted (C6-30)aryl, $R_{208}$ to $R_{211}$ may be linked to an adjacent substituent(s) to form a substituted or unsubstituted fused ring, for example, a substituted or unsubstituted fluorene, a substituted or unsubstituted dibenzothiophene, or a substituted or unsubstituted dibenzofuran; f and g, each independently, represent an integer of 1 to 3; when f or g is an integer of 2 or more, each of $R_{100}$ may be the same or different; and n represents an integer of 1 to 3.

[166] Specifically, the phosphorescent dopant material includes the following:

[167]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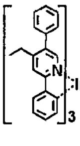
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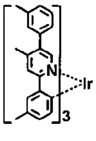
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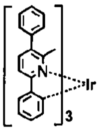
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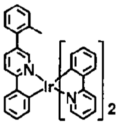
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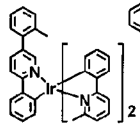
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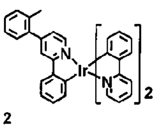
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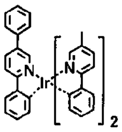
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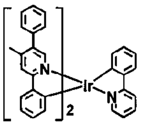
[168]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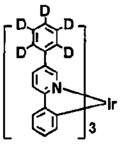
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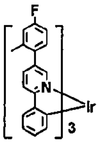
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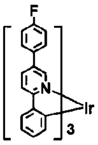
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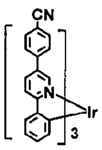
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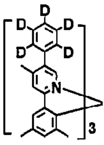
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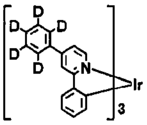
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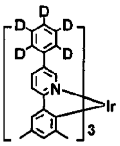
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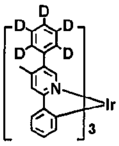
[169]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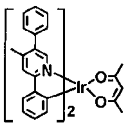
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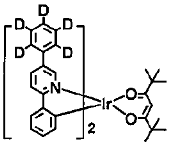
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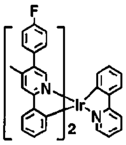
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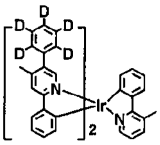
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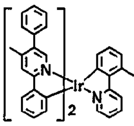
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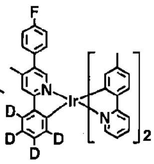
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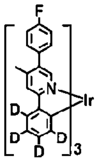
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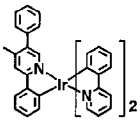
[170]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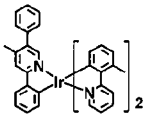
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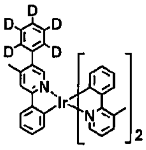
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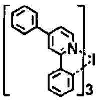
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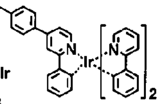
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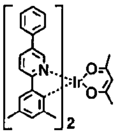
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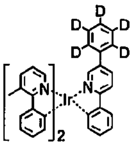
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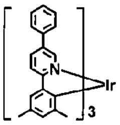
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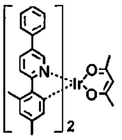
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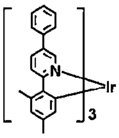
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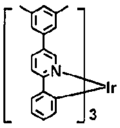
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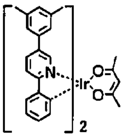
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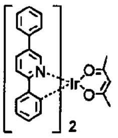
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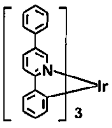
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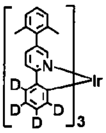
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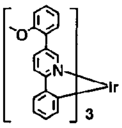
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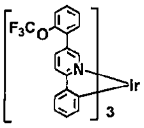
[172]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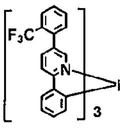
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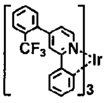
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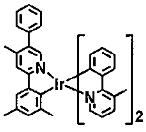
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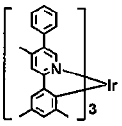
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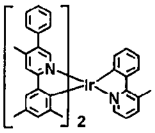
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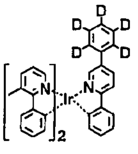
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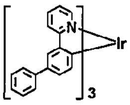
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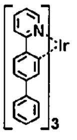
[173]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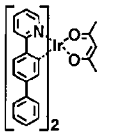
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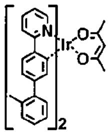
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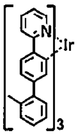
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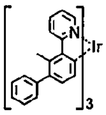
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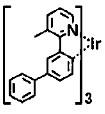
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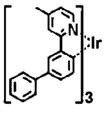
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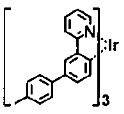
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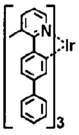
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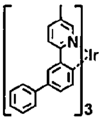
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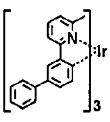
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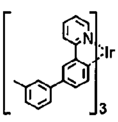
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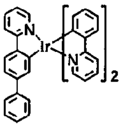
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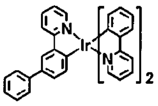
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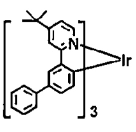
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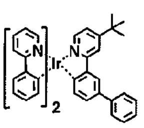
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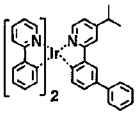
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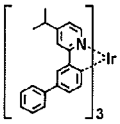
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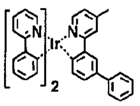
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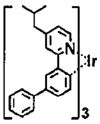
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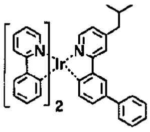
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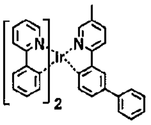
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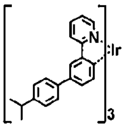
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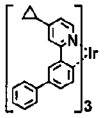
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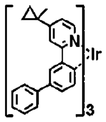
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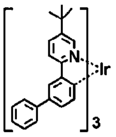
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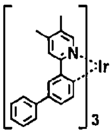
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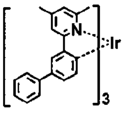
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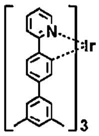
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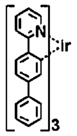
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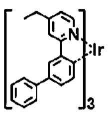
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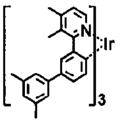
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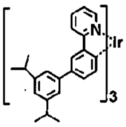
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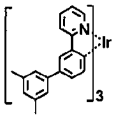
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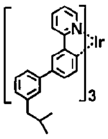
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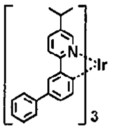
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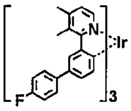
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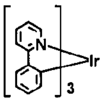
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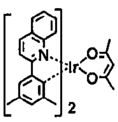
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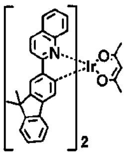
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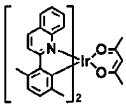
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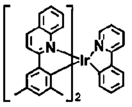
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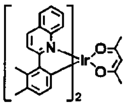
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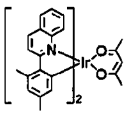
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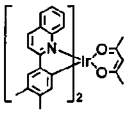
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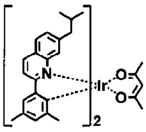
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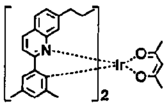
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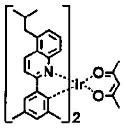
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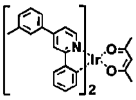
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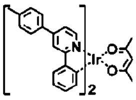
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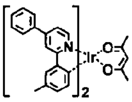
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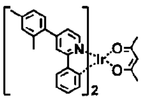
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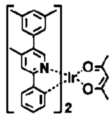
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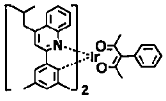
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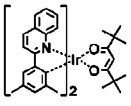
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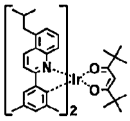
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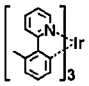
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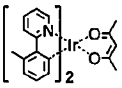
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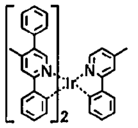
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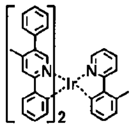
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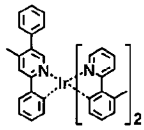
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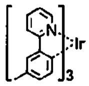
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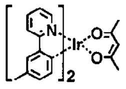
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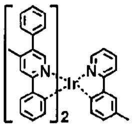
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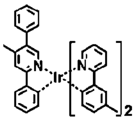
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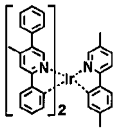
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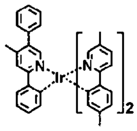
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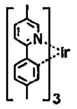
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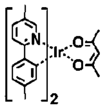
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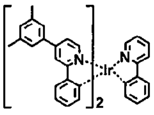
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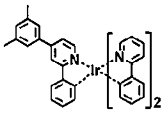
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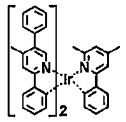
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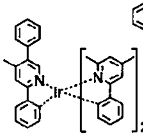
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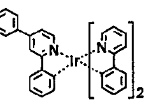
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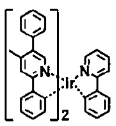
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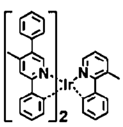
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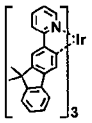
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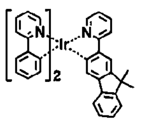
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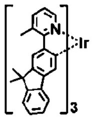
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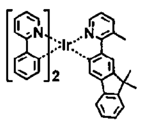
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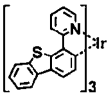
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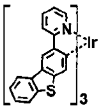
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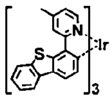
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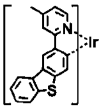
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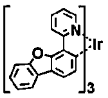
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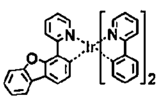
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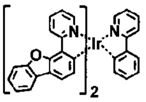
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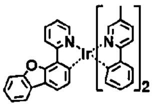
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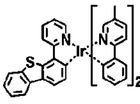
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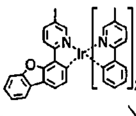
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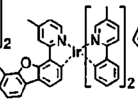
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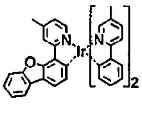
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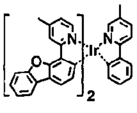
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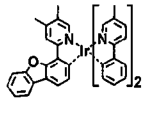
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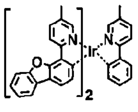
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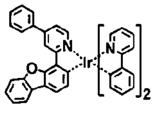
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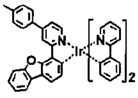
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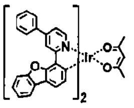
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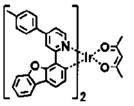
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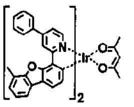
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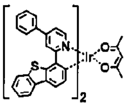
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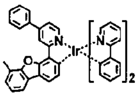
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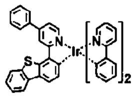
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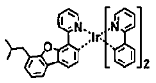
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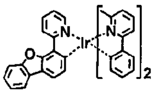
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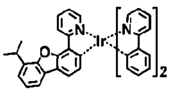
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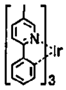
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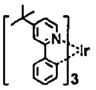
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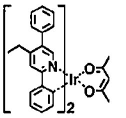
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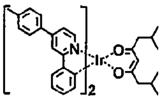
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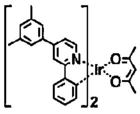
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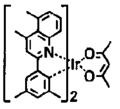
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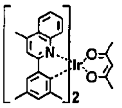
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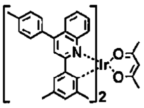
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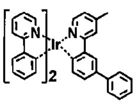
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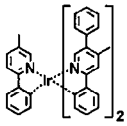
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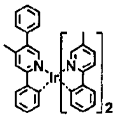
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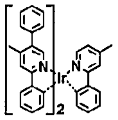
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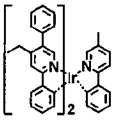
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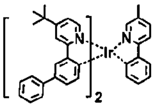
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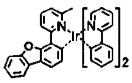
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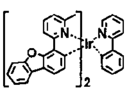
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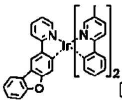
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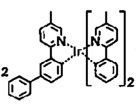
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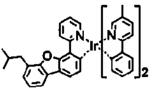
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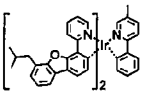
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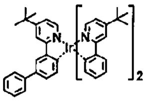
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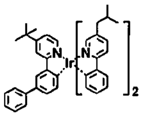
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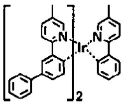
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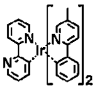
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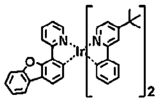
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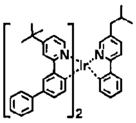
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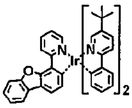
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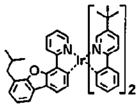
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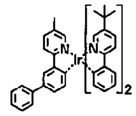
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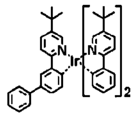
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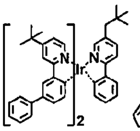
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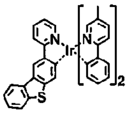
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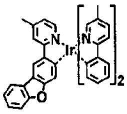
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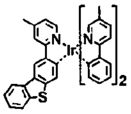
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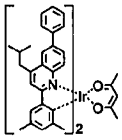
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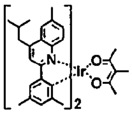
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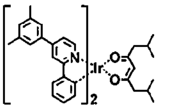
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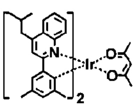
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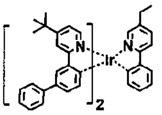
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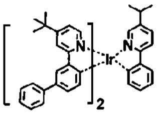
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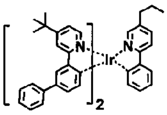
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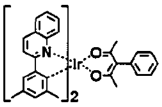
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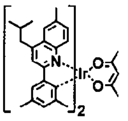
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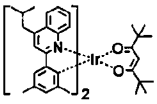
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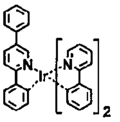
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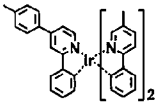
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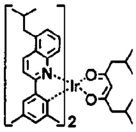
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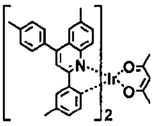
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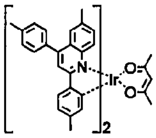
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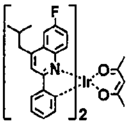
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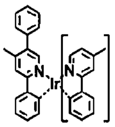
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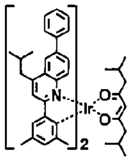
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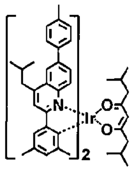

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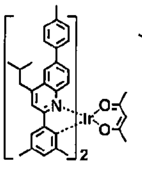

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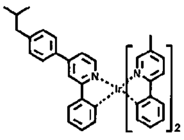

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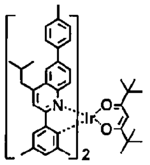

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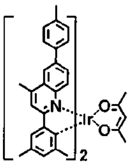

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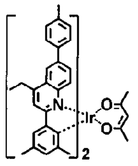

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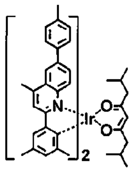


D-213

[194] According to another aspect of the present disclosure, an organic electroluminescent device comprising an anode, a cathode, and an organic layer disposed between the anode and cathode, wherein the organic layer comprises one or more light-emitting layers; at least one light-emitting layer comprises one or more dopant compounds and two or more host compounds; and a first host compound of the two or more host compounds is the organic electroluminescent compound represented by formula 1 is provided.

[195] When the organic electroluminescent device comprises two host compounds, the weight ratio between the first host material and the second host material is in the range of 1:99 to 99:1, and preferably 30:70 to 70:30 in view of driving voltage, lifespan, and luminous efficiency.

[196] According to one embodiment of the present disclosure, in the organic electroluminescent device, a first host compound of the two or more host compounds may be the organic electroluminescent compound represented by formula 1, and a second host compound may be selected from the compound represented by formulae 6 to 10.

[197] According to another embodiment of the present disclosure, in the organic electroluminescent device, a first host compound of the two or more host compounds may be the organic electroluminescent compound represented by formula 1, and a second host compound may be the compound represented by formula 11.

[198] According to another embodiment of the present disclosure, in the organic electroluminescent device, the one or more dopant compounds may be selected from the compound represented by formulae 12 to 15.

[199] The organic electroluminescent device of the present disclosure comprises the compound of formula 1 in the organic layer. The organic electroluminescent device of the present disclosure may further comprise at least one compound selected from the group consisting of arylamine-based compounds and styrylarylamine-based compounds.

[200] In the organic electroluminescent device of the present disclosure, the organic layer may further comprise, in addition to the compound of formula 1, at least one metal selected from the group consisting of metals of Group 1, metals of Group 2, transition metals of the 4th period, transition metals of the 5th period, lanthanides and organic metals of the d-transition elements of the Periodic Table, or at least one complex compound comprising the metal.

[201] In addition, the organic electroluminescent device of the present disclosure may emit white light by further comprising at least one light-emitting layer, which comprises a blue electroluminescent compound, a red electroluminescent compound or a green electroluminescent compound known in the field, besides the compound of the present disclosure. If necessary, it may further comprise an orange light-emitting layer or a yellow light-emitting layer.

[202] In the organic electroluminescent device of the present disclosure, preferably, at least one layer (hereinafter, "a surface layer”) may be placed on an inner surface(s) of one or both electrode(s), selected from a chalcogenide layer, a metal halide layer and a metal oxide layer. Specifically, a chalcogenide (includes oxides) layer of silicon or aluminum is preferably placed on an anode surface of an electroluminescent medium layer, and a metal halide layer or a metal oxide layer is preferably placed on a cathode surface of an electroluminescent medium layer. Such a surface layer provides operation stability for the organic electroluminescent device. Preferably, the chalcogenide includes $SiO_X$ ($1\leq X\leq 2$), $AlO_X$ ($1\leq X\leq 1.5$), SiON, SiAlON, etc.; the metal halide includes LiF, $MgF_2$, $CaF_2$, a rare earth metal fluoride, etc.; and the metal oxide includes $Cs_2O$, $Li_2O$, MgO, SrO, BaO, CaO, etc.

[203] In the organic electroluminescent device of the present disclosure, a mixed region of an electron transport compound and a reductive dopant, or a mixed region of a hole transport compound and an oxidative dopant may be placed on at least one surface of a pair of electrodes. In this case, the electron transport compound is reduced to an anion, and thus it becomes easier to inject and transport electrons from the mixed region to an electroluminescent medium. Furthermore, the hole transport compound is oxidized to a cation, and thus it becomes easier to inject and transport holes from the mixed region to the electroluminescent medium. Preferably, the oxidative dopant includes various Lewis acids and acceptor compounds, and the reductive dopant includes alkali metals, alkali metal compounds, alkaline earth metals, rare-earth metals, and mixtures thereof. A reductive dopant layer may be employed as a charge generating layer to prepare an electroluminescent device having two or more light-emitting layers and emitting white light.

[204] In order to form each layer of the organic electroluminescent device of the present disclosure, dry film-forming methods such as vacuum evaporation, sputtering, plasma and ion plating methods, or wet film-forming methods such as inkjet printing, nozzle printing, slot coating, spin coating, dip coating, and flow coating methods can be used.

[205] When using a wet film-forming method, a thin film can be formed by dissolving or diffusing materials forming each layer into any suitable solvent such as ethanol, chloroform, tetrahydrofuran, dioxane, etc. The solvent can be any solvent where the materials forming each layer can be dissolved or diffused, and where there are no

problems in film-formation capability.

[206] In the organic electroluminescent device of the present disclosure, two or more host compounds for a light-emitting layer may be co-evaporated or mixture-evaporated. Herein, a co-evaporation indicates a process for two or more materials to be deposited as a mixture, by introducing each of the two or more materials into respective crucible cells, and applying electric current to the cells for each of the materials to be evaporated. Herein, a mixture-evaporation indicates a process for two or more materials to be deposited as a mixture, by mixing the two or more materials in one crucible cell before the deposition, and applying electric current to the cell for the mixture to be evaporated.

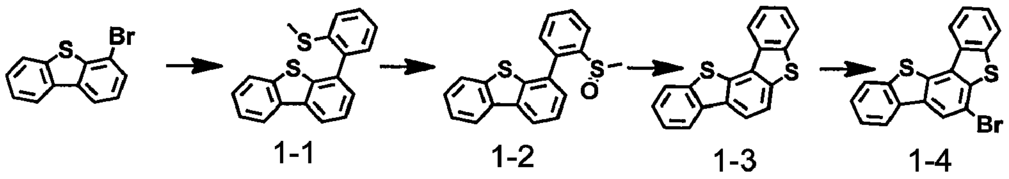
[207] By using the organic electroluminescent device of the present disclosure, a display system or a lighting system can be produced.

[208] Hereinafter, the organic electroluminescent compound of the present disclosure, the preparation method of the compound, and the luminescent properties of the device will be explained in detail with reference to the following examples.

[209]

[210] **Example 1: Preparation of compounds C-1 and C-3**

[211]



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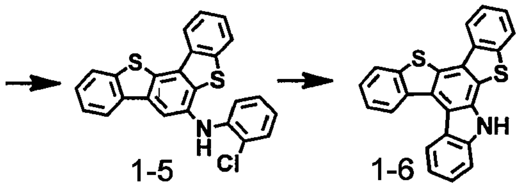

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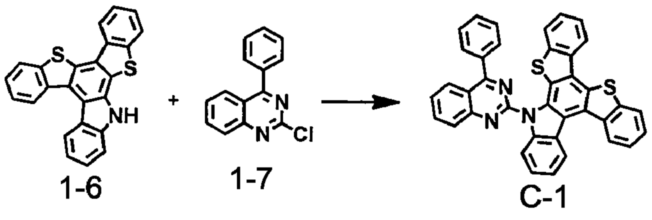

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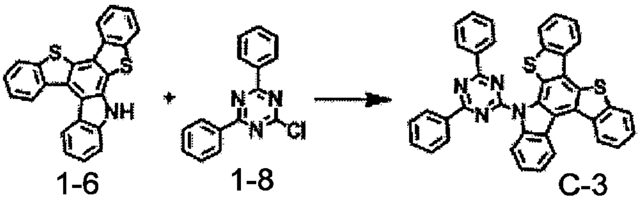


[215] Preparation of compound **1-1**

[216] After introducing compound 4-bromodibenzothiophene (50g, 189.98mmol),

2-methylthiophenylboronic acid (31.9g, 189.89mmol), tetrakis(triphenylphosphine)palladium (11g, 9.499mmol), sodium carbonate (60g, 569.94mmol), toluene (900mL), ethanol (280mL) and distilled water (280mL) into a reaction vessel, the mixture was stirred at 120°C for 3 hours. After the reaction, the mixture was washed with distilled water, and extracted with ethyl acetate. The obtained organic layer was dried with magnesium sulfate, and the solvent was removed therefrom by a rotary evaporator. The products were purified by column chromatography to obtain compound **1-1** (58g, 99%).

[217] Preparation of compound **1-2**

[218] After dissolving compound 1-1 (58g, 189.98mmol) in tetrahydrofuran(THF) (500mL) and acetic acid (580mL), hydrogen peroxide(35%) (23mL) was slowly added dropwise to the mixture. The mixture was stirred at room temperature for 10 hours. After the reaction, the mixture was concentrated to remove the solvent, and extracted with dichloromethane and purified water. The remaining moisture was removed from the obtained organic layer with magnesium sulfate, and then the organic layer was dried, concentrated, and directly used for the next reaction.

[219] Preparation of compound **1-3**

[220] After dissolving compound 1-2 (58g) in trifluoromethane sulfonic acid (300mL), the mixture was stirred at room temperature for 2 days, and then added dropwise to a solution of pyridine (600mL)/purified water (1.5mL). The mixture was warmed, and was under reflux at 120°C for 4 hours. After the reaction, the mixture was extracted with dichloromethane. The obtained organic layer was purified by column chromatography to obtain compound **1-3** (15.4g, 28%).

[221] Preparation of compound **1-4**

[222] After dissolving compound 1-3 (15.4g, 53.03mmol) in chloroform (550mL), the mixture was cooled to 0°C. Bromine (2.7mL, 53.03mmol) was slowly added dropwise to the mixture. After the reaction, the mixture was warmed slowly to room temperature, and stirred for 8 hours. After the reaction, bromine was removed from the mixture by using aqueous sodium thiosulfate solution. The product was filtered to obtain compound **1-4** (12.8g, 65.4%).

[223] Preparation of compound **1-5**

[224] After introducing compound 1-4 (12.8g, 34.66mmol), chloroaniline (4.7mL, 45.06mmol), palladium acetate (0.31g, 45.06mmol), t-butylphosphine (50%) (1.4mL, 2.77mmol) and sodium t-butoxide (8.3g, 86.65mmol) into toluene (170mL), the mixture was stirred under reflux for 1 day. After the reaction, the mixture was cooled to room temperature, and extracted with distilled water and ethyl acetate. The obtained organic layer was distilled under reduced pressure, and purified by column chromatography to obtain compound **1-5** (13.7g, 77%).

[225] Preparation of compound **1-6**

[226] After introducing compound 1-5 (13.7g, 32.94mmol), palladium acetate (0.4g, 1.646mmol), tricyclohexylphosphonium tetrafluoroborate ($C_{18}H_{34}P.BF_4$) (1.21g, 3.29mmol), cesium carbonate (32.1g, 98.82mmol) and dimethylacetamide (DMA) (250mL) into a reaction vessel, the mixture was stirred at 180°C for 7 hours. After the reaction, the mixture was extracted with ethyl acetate. The obtained organic layer was dried with magnesium sulfate, distilled under reduced pressure, and purified by column chromatography to obtain compound **1-6** (5.6g, 45%).

[227] Preparation of compound **C-1**

[228] After dissolving compound 1-6 (5g, 13.17mmol), compound 1-7 (4.6g, 15.81mmol), palladium acetate (1.2g, 5.27mmol), 50% t-butylphosphine (5mL, 10.54mmol) and cesium carbonate (13g, 39.5mmol) in toluene (65mL), the mixture was under reflux at 130°C for 3 hours. After the reaction, the mixture was extracted with dichloromethane/ purified water, and purified by column chromatography to obtain compound C-1 (4.4g, 57%).

[229] UV: 319 nm, PL: 525 nm, Melting point: 261°C, MS/EIMS Found 584; Calculated 583

[230] Preparation of compound **C-3**

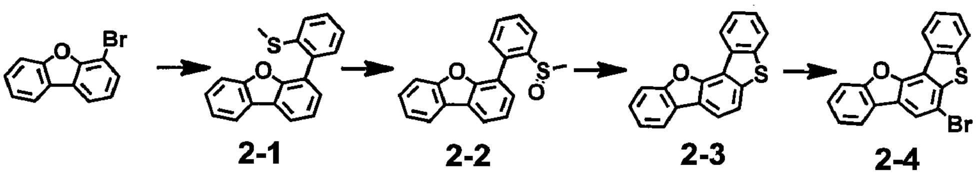
[231] After dissolving compound 1-6 (1.6g, 4.21mmol) and compound 1-8 (1.7g, 6.32mmol) in dimethylformamide(DMF) (30 mL), NaH (0.5g, 12.63 mmol, 60% in mineral oil) was added to the mixture. The mixture was stirred at room temperature for 12 hours, and methanol and distilled water were added thereto. The obtained solid was filtered under reduced pressure, and purified by column chromatography to obtain compound **C-3** (1.4g, 54%).

[232] UV: 342 nm, PL: 528 nm, Melting point: 360°C, MS/EIMS Found 611; Calculated 610

[233]

[234] **Example 2: Preparation of compounds C-9 and C-11**

[235]



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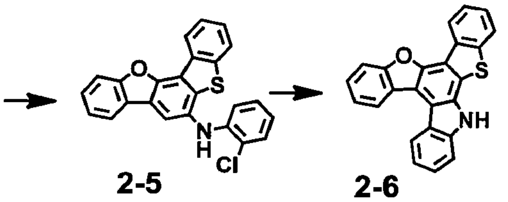

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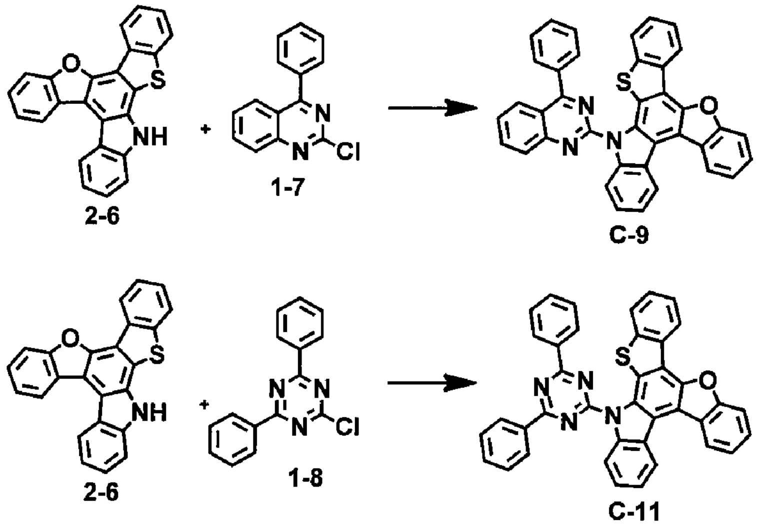


[238] Preparation of compound **2-1**

[239] After introducing compound 4-bromodibenzofuran (50g, 202.35mmol), 2-methylthiophenylboronic acid (34g, 202.35mmol), tetrakis(triphenylphosphine)palladium (11.7g, 10.117mmol), sodium carbonate (64g, 607.06mmol), toluene (1000mL), ethanol (300mL), and distilled water (300mL) into a reaction vessel, the mixture was stirred at 120°C for 3 hours. After the reaction, the mixture was washed with distilled water, and extracted with ethyl acetate. The extracted organic layer was dried with magnesium sulfate, and the solvent was removed therefrom by a rotary evaporator. The products were purified by column chromatography to obtain compound **2-1** (58g, 99%).

[240] Preparation of compound **2-2**

[241] After dissolving compound 2-1 (58g, 202.35mmol) in THF (580mL) and acetic acid (580mL), hydrogen peroxide (35%) (26mL) was slowly added dropwise to the mixture. The mixture was stirred at room temperature for 10 hours, concentrated to remove the solvent, and then extracted with dichloromethane and purified water. The remaining moisture was removed from the obtained organic layer with magnesium sulfate, concentrated, and directly used for the next reaction.

[242] Preparation of compound **2-3**

[243] While stirring compound 2-2, a solution of pyridine (600mL)/purified water (1.5mL) was added dropwise thereto. The mixture was then warmed, and was under reflux at 120°C for 4 hours. After the reaction, the mixture was extracted with dichloromethane, and the obtained organic layer was subjected to column chromatography to obtain compound 2-3 (48.6g, 93%).

[244] Preparation of compound **2-4**

[245] After dissolving compound 2-3 (43.6g, 158.9mmol) in chloroform (800mL), the mixture was cooled to 0°C. Bromine (8.55mL, 166.87mmol) was slowly added

dropwise to the mixture. After the addition, the mixture was slowly warmed to room temperature, and stirred for 8 hours. After the reaction, bromine was removed from the mixture by using aqueous sodium thiosulfate solution. The product was filtered to obtain compound 2-4 (44g, 70%).

[246] Preparation of compound **2-5**

[247] After introducing compound 2-4 (20g, 56.62mmol), chloroaniline (7.7mL, 73.61mmol), palladium acetate (0.5g, 2.26mmol), t-butylphosphine(50%) (2.2mL, 4.53mmol) and sodium t-butoxide (13.6g, 141.55mmol) into toluene (280mL), the mixture was stirred under reflux for 1 day. After the reaction, the mixture was cooled to room temperature, and extracted with distilled water and ethyl acetate. The obtained organic layer was distilled under reduced pressure, and purified by column chromatography to obtain compound **2-5** (11g, 48.6%).

[248] Preparation of compound **2-6**

[249] After introducing compound 2-5 (11g, 27.5mmol), palladium acetate (0.3g, 1.37mmol), $C_{18}H_{34}P.BF_4$ (1g, 2.75mmol), cesium carbonate (26g, 82.5mmol) and DMA (135mL) into a reaction vessel, the mixture was stirred at 180°C for 7 hours. After the reaction, the mixture was extracted with ethyl acetate. The obtained organic layer was dried with magnesium sulfate, distilled under reduced pressure, and purified by column chromatography to obtain compound **2-6** (4g, 40%).

[250] Preparation of compound **C-9**

[251] After dissolving compound 2-6 (3.5g, 9.63mmol), compound 1-7 (2.78g, 11.55mmol), palladium acetate (0.86g, 3.85mmol), 50% t-butylphosphine (3.7mL, 7.704mmol) and cesium carbonate (9.4g, 28.8mmol) in toluene (100mL), the mixture was under reflux at 130°C for 3 hours. After the reaction, the mixture was extracted with dichloromethane/purified water, and purified by column chromatography to obtain compound **C-9** (2.5g, 46%).

[252] UV: 296 nm, PL: 535 nm, Melting point: 290°C, MS/EIMS Found 568; Calculated 567

[253] Preparation of compound **C-11**

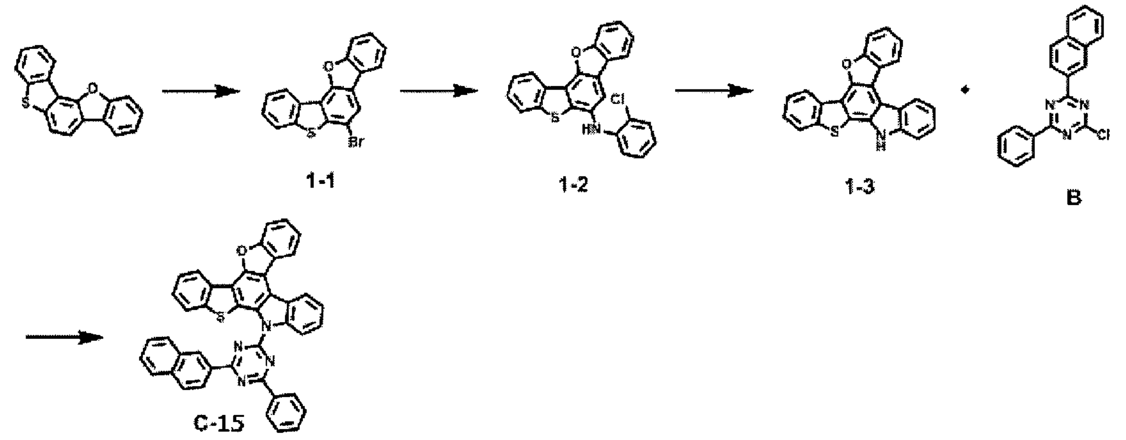
[254] After dissolving compound 2-6 (3g, 8.2mmol) and compound 1-8 (2.65g, 9.9mmol) in dimethylformamide(DMF) (40 mL), NaH (1g, 24.76mmol, 60% in mineral oil) was added thereto. The mixture was stirred at room temperature for 12 hours, and methanol and distilled water were added to the mixture. The obtained solid was filtered under reduced pressure, and purified by column chromatography to obtain compound **C-11** (3.1g, 63%).

[255] UV: 342 nm, PL: 532 nm, Melting point: 353°C, MS/EIMS Found 595; Calculated 594

[256]

[257] **Example 3: Preparation of compound C-15**

[258]



[259] Preparation of compound **1-1**

[260] After introducing benzo[b][1]benzocyano[2,3-g]benzofuran (30g, 109mmol) and chloroform (540mL) into a flask, the mixture was cooled to 0°C. Bromine (5.8mL, 114mmol) was slowly added dropwise to the mixture. The mixture was then stirred for 3 hours. After the reaction, the mixture was extracted with ethyl acetate, dried with magnesium sulfate, and distilled under reduced pressure. The product was separated from the mixture by column chromatography to obtain compound **1-1** (23g, yield: 60%).

[261] Preparation of compound **1-2**

[262] After introducing compound 1-1 (18g, 52.1 mmol), 2-chloroaniline (8.2mL, 78.1 mmol), palladiumacetate (1.1g, 5.21 mmol), tri-tert-butylphosphine (5mL) (50%), 10.4 mmol), sodium tert-butoxide (15 g, 156 mmol) and toluene (260 mL) into a flask, the mixture was stirred under reflux for 4 hours. After the reaction, the mixture was extracted with methylene chloride (MC), dried with magnesium sulfate, and distilled under reduced pressure. The product was separated from the mixture by column chromatography to obtain compound **1-2** (18g, yield: 90%).

[263] Preparation of compound **1-3**

[264] After introducing compound **1-2** (18g, 47.0 mmol), palladium acetate (1.0g, 4.70 mmol), tricyclohexylphosphonium tetrafluoroborate (3.4g, 9.40 mmol), cesium carbonate (46 g, 141 mmol), and dimethylacetamide (240 mL) into a flask, the mixture was stirred under reflux for 4 hours. After the reaction, the mixture was extracted with methylene chloride (MC), dried with magnesium sulfate, and distilled under reduced pressure. The product was separated from the mixture by column chromatography to obtain compound **1-3** (6.7g, yield: 40%).

[265] Preparation of compound **C-15**

[266] After dissolving compound **1-3** (3 g, 8.25 mmol) and compound **B** (3.4g, 10.7 mmol) in dimethylformamide(DMF) (40 mL) in a flask, NaH (1g, 24.76mmol, 60% in mineral

oil) was added to the mixture. The mixture was then stirred at room temperature for 12 hours, and methanol and distilled water were added thereto. The obtained solid was filtered under reduced pressure, and purified by column chromatography to obtain compound **C-15** (3.6g, 67%).

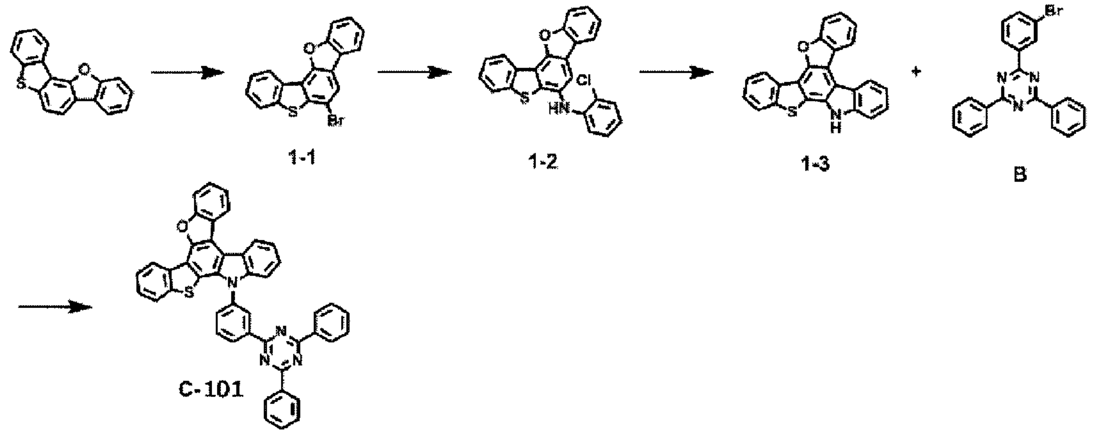
[267]

| | Molecular Weight (MW) | UV | PL | Melting point (MP) |
|---|---|---|---|---|
| C-15 | 644.74 | 344 nm | 535 nm | 378 ℃ |

[268]

[269] Example 4: Preparation of compound C-101

[270]



[271] Preparation of compound **1-1**

[272] After introducing benzo[b][1]benzocyano[2,3-g]benzofuran (30g, 109 mmol) and chloroform (540 mL) into a flask, the mixture was cooled to 0°C. Bromine (5.8mL, 114 mmol) was slowly added dropwise to the mixture. The mixture was then stirred for 3 hours. After the reaction, the mixture was extracted with ethyl acetate. The obtained organic layer was dried with magnesium sulfate, and distilled under reduced pressure. The product was separated from the mixture by column chromatography to obtain compound **1-1** (23g, yield: 60%).

[273] Preparation of compound **1-2**

[274] After introducing compound **1-1** (18g, 52.1 mmol), 2-chloroaniline (8.2mL, 78.1 mmol), palladiumacetate (1.1g, 5.21 mmol), tri-tert-butylphosphine (5mL)(50%), 10.4 mmol), sodium tert-butoxide (15 g, 156 mmol) and toluene (260mL) into a flask, the mixture was stirred under reflux for 4 hours. After the reaction, the mixture was extracted with methylene chloride(MC), dried with magnesium sulfate, and distilled under reduced pressure. The product was separated from the mixture by column chromatography to obtain compound **1-2** (18g, yield: 90%).

[275] Preparation of compound **1-3**

[276] After introducing compound **1-2** (18g, 47.0 mmol), palladium acetate (1.0g, 4.70 mmol), tricyclohexylphosphonium tetrafluoroborate (3.4g, 9.40 mmol), cesium

carbonate (46 g, 141 mmol) and dimethylacetamide (240mL) into a flask, the mixture was stirred under reflux for 4 hours. After the reaction, the mixture was extracted with methylene chloride(MC), dried with magnesium sulfate, and then distilled under reduced pressure. The product was separated from the mixture by column chromatography to obtain compound **1-3** (6.7g, yield: 40%).

[277] Preparation of compound **C-101**

[278] After introducing compound **1-3** (6.7g, 18.4 mmol), 2-(3-bromophenyl)-4,6-diphenyl-1,3,5-triazine (7.8g, 20.2 mmol), tris(dibenzylindeneacetone) dipalladium (0.8g, 0.92 mmol), tri-tert-butylphosphine (0.9 mL)(50%), 1.84 mmol), sodium tert-butoxide (4.4 g, 46.1 mmol), and toluene (100mL) into a flask, the mixture was stirred under reflux for 3 hours. After the reaction, the mixture was extracted with methylene chloride(MC), dried with magnesium sulfate, and distilled under reduced pressure. The product was separated from the mixture by column chromatography to obtain compound **C-101** (8.3g, yield: 67%).

[279]

| | MW | UV | PL | M.P |
|---|---|---|---|---|
| C-101 | 670.78 | 390 nm | 541 nm | 382 ℃ |

[280]

[281] **[Device Example 1] OLED using the compound of the present disclosure**

[282] OLED was produced using the organic electroluminescent compound of the present disclosure as follows. A transparent electrode indium tin oxide (ITO) thin film (15 Ω/sq) on a glass substrate for an organic light-emitting diode (OLED) (Geomatec) was subjected to an ultrasonic washing with trichloroethylene, acetone, ethanol, and distilled water sequentially, and was then stored in isopropanol. The ITO substrate was then mounted on a substrate holder of a vacuum vapor depositing apparatus. $N^1$,$N^{1'}$-([1,1'-biphenyl]-4,4'-diyl)bis($N^1$-(naphthalene-1-yl)-$N^4$,$N^4$-diphenylbenzene-1,4-diamine) was introduced into a cell of said vacuum vapor depositing apparatus, and then the pressure in the chamber of said apparatus was controlled to $10^{-6}$ torr. Thereafter, an electric current was applied to the cell to evaporate the above introduced material, thereby forming a hole injection layer having a thickness of 60 nm on the ITO substrate. N,N'-di(4-biphenyl)-N,N'-di(4-biphenyl)-4,4'-diaminobiphenyl was then introduced into another cell of said vacuum vapor depositing apparatus, and evaporated by applying electric current to the cell, thereby forming a hole transport layer having a thickness of 20 nm on the hole injection layer. Thereafter, compound **C-1** was introduced into one cell of the vacuum vapor depositing apparatus as a host, and compound **D-87** was introduced into another cell as a dopant. The two materials were evaporated at different rates, so that the dopant was deposited in a doping amount of 4

wt% based on the total amount of the host and dopant to form a light-emitting layer having a thickness of 30 nm on the hole transport layer. 2-(4-(9,10-di(naphthalene-2-yl)anthracen-2-yl)phenyl)-1-phenyl-1H-benzo[d]imidazole was then introduced into one cell, and lithium quinolate was introduced into another cell. The two materials were evaporated at the same rate, so that they were respectively deposited in a doping amount of 50 wt% to form an electron transport layer having a thickness of 30 nm on the light-emitting layer. After depositing lithium quinolate as an electron injection layer having a thickness of 2 nm on the electron transport layer, an Al cathode having a thickness of 150 nm was then deposited by another vacuum vapor deposition apparatus on the electron injection layer. Accordingly, an OLED was produced. All the materials used for producing the OLED were those purified by vacuum sublimation at $10^{-6}$ torr. The produced OLED showed a red emission having a luminance of 1,050 cd/$m^2$ and a current density of 8.1 mA/$cm^2$ at a driving voltage of 3.6 V. The minimum time taken to be reduced to 90% of the luminance at 5,000 nit was 200 hours.

[283]

[284] **[Comparative Example 1] OLED using a conventional organic**

[285] **electroluminescent compound**

[286] OLED was produced in the same manner as in Device Example 1, except that compound **A-1** shown below and compound **D-88** were used as a host and a dopant. The produced OLED showed a red emission having a luminance of 980 cd/$m^2$ and a current density of 16.4 mA/$cm^2$ at a driving voltage of 3.8 V. The minimum time taken to be reduced to 90% of the luminance at 5,000 nit was 12 hours.

[287]

[288] **[Comparative Example 2] OLED using a conventional organic**

[289] **electroluminescent compound**

[290] OLED was produced in the same manner as in Device Example 1, except that compound **A-2** shown below and compound **D-88** were used as a host and a dopant. The produced OLED showed a red emission having a luminance of 1,020 cd/$m^2$ and a current density of 13.1 mA/$cm^2$ at a driving voltage of 4.1 V. The minimum time taken to be reduced to 90% of the luminance at 5,000 nit was 10 hours.

[291]

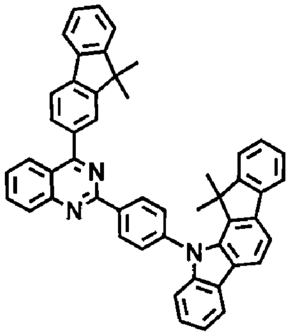
[292] **[Comparative Example 3] OLED using a conventional organic**

[293] **electroluminescent compound**

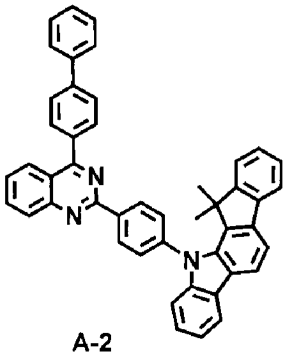
[294] OLED was produced in the same manner as in Device Example 1, except that compound **A-3** shown below and compound **D-87** were used as a host and a dopant. The produced OLED showed a red emission having a luminance of 1,110 cd/$m^2$ and a current density of 9.8 mA/$cm^2$ at a driving voltage of 4.2 V. The minimum time taken

to be reduced to 90% of the luminance at 5,000 nit was 10 hours.

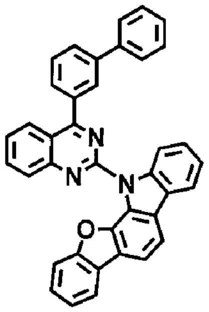
[295]



A-1



A-2



A-3

[296] As confirmed above, the organic electroluminescent compounds of the present disclosure provide lower driving voltage, longer lifespan, and better current efficiency than conventional organic electroluminescent compounds. The organic electroluminescent device using the organic electroluminescent compounds of the present disclosure shows excellence in driving voltage, lifespan, and luminous characteristics, in particular, current and power efficiencies.

[297]

[298] **[Device Examples 1-1 to 1-7] OLED produced by using a co-evaporation of**

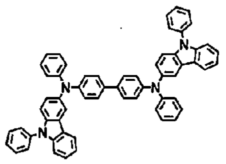
[299] **a first host compound and a second host compound of the present disclosure**

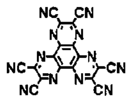
[300] OLED was produced using the light-emitting material of the present disclosure as follows. A transparent electrode indium tin oxide (ITO) thin film (10 Ω/sq) on a glass substrate for an organic light-emitting diode (OLED) (Geomatec) was subjected to an ultrasonic washing with trichloroethylene, acetone, ethanol, and distilled water sequentially, and was then stored in isopropanol. The ITO substrate was then mounted on a substrate holder of a vacuum vapor depositing apparatus. N$^4$,N$^{4'}$-diphenyl-N$^4$,N$^{4'}$-bis(9-phenyl-9H-carbazol-3-yl)-[1,1'-biphenyl]-4,4'-diamine (**HI-1**) was introduced into a cell of the vacuum vapor depositing apparatus, and then the pressure in the chamber of the apparatus was controlled to $10^{-6}$ torr. Thereafter, an electric current was applied to the cell to evaporate the above introduced material, thereby forming a first hole injection layer having a thickness of 80 nm on the ITO substrate. 1,4,5,8,9,12-hexaazatriphenylene-hexacarbonitrile (**HI-2**) was then introduced into another cell of the vacuum vapor depositing apparatus, and evaporated by applying electric current to the cell, thereby forming a second hole injection layer having a thickness of 5 nm on the first hole injection layer. N-([1,1'-biphenyl]-4-yl)-9,9-dimethyl-N-(4-(9-phenyl-9H-carbazol-3-yl)phenyl)-9H-fluorene-2-amine (**HT-1**) was introduced into one cell of the vacuum vapor depositing apparatus, and evaporated by applying electric current to the cell, thereby forming a first hole transport layer having a thickness of 10 nm on the second hole injection

layer. N,N-di([1,1'-biphenyl]-4-yl)-4'-(9H- carbazol-9-yl)-[1,1'-biphenyl]-4-amine ( **HT-2**) was then introduced into another cell of the vacuum vapor depositing apparatus, and evaporated by applying electric current to the cell, thereby forming a second hole transport layer having a thickness of 60 nm on the first hole transport layer. As a host material, the two compounds shown in Table 1 below were introduced into two cells of the vacuum vapor depositing apparatus, respectively, as a first host compound and a second host compound. A dopant compound shown in Table 1 was introduced into another cell. The two host compounds were evaporated at the same rate of 1:1, while the dopant was evaporated at a different rate from the host compounds, so that the dopant was deposited in a doping amount of 3 wt% based on the total amount of the host and dopant to form a light-emitting layer having a thickness of 40 nm on the hole transport layer.

2,4-bis(9,9-dimethyl-9H-fluoren-2-yl)-6-(naphthalen-2-yl)-1,3,5-triazine (**ET-1**) and lithium quinolate (**EI-1**) were introduced into two cells of the vacuum vapor depositing apparatus, respectively, and evaporated at the same rate of 1:1, thereby forming an electron transport layer having a thickness of 30 nm on the light-emitting layer. After depositing lithium quinolate (**EI-1**) as an electron injection layer having a thickness of 2 nm on the electron transport layer, an Al cathode having a thickness of 80 nm was then deposited by another vacuum vapor deposition apparatus on the electron injection layer.

[301]


HI-1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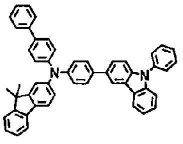
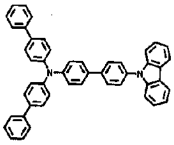
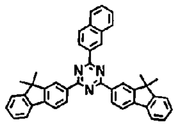
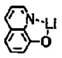

HT-1


HT-2


ET-1


EI-1

[302]

[303] **[Comparative Examples 1-1 to 1-4] OLED using a second host compound as**
[304] **a sole host**

[305] OLED was produced in the same manner as in Device Examples 1-1 to 1-7, except that only a second host compound shown in Table 1 below was used as a host for a light-emitting layer.

[306]

[307] **[Comparative Examples 2-1 to 2-2] OLED using a first host compound as**
[308] **a sole host**

[309] OLED was produced in the same manner as in Device Examples 1-1 to 1-7, except that only a first host compound shown in Table 1 below was used as a host for a light-emitting layer.

[310]

[311] The characteristics of the organic electroluminescent device produced in device examples 1-1 to 1-7, comparative examples 1-1 to 1-4, and comparative examples 2-1 to 2-2 are shown in Table 1 below.

[312] [Table 1]

| Device Example No. | Host | Dopant | Voltage (V) | Current Efficiency (cd/A) | Color coordinate (x, y) | | Minimum time taken for luminance to be reduced from 100% to 85% |
|---|---|---|---|---|---|---|---|
| 1-1 | H1-28:C-3 (1:1) | D-96 | 3.6 | 26.5 | 665 | 335 | 410 hours |
| 1-2 | H1-287:C-3 (1:1) | D-96 | 3.7 | 26.3 | 666 | 334 | 410 hours |
| 1-3 | H1-35:C-9 (1:1) | D-96 | 4.2 | 24.7 | 655 | 344 | 1290 hours |
| 1-4 | H1-28:C-9 (1:1) | D-96 | 42 | 24.5 | 655 | 344 | 1230 hours |
| 1-5 | H1-287:C-9 (1:1) | D-96 | 4.3 | 25.4 | 658 | 341 | 1290 hours |
| 1-6 | H1-287:C-15 (1:1) | D-96 | 4.1 | 28.7 | 668 | 332 | 520 hours |
| 1-7 | H1-287:C-101 (1:1) | D-96 | 4.1 | 28.0 | 668 | 332 | 60 hours |

[313]

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Comparative Example 1-1 | C-3 | D-96 | 3.7 | 26.2 | 670 | 330 | 130 hours |
| Comparative Example 1-2 | C-9 | D-96 | 4.1 | 24.3 | 664 | 336 | 800 hours |
| Comparative Example 1-3 | C-15 | D-96 | 3.8 | 25.7 | 671 | 329 | 95 hours |
| Comparative Example 1-4 | C-101 | D-96 | 4 | 24.8 | 671 | 329 | 7 hours |
| Comparative Example 2-1 | H1-28 | D-96 | 8.5 | 2.4 | 640 | 342 | X |
| Comparative Example 2-2 | H1-287 | D-96 | 8.8 | 2.4 | 642 | 341 | X |

* X indicates that lifespan of a device cannot be measured since current efficiency is too low.

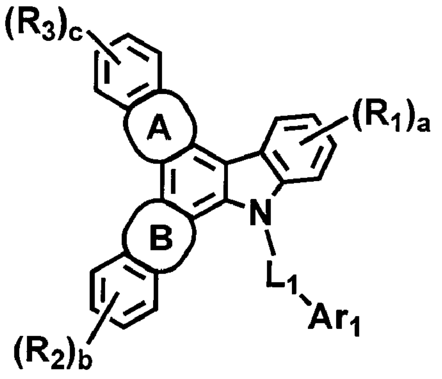
[314] When comparing devices of comparative examples 1-1 to 1-4 with devices of comparative examples 2-2 to 2-2, the organic electroluminescent device using one organic electroluminescent compound of the present disclosure as a host material showed improvement in driving voltage, current efficiency, color purity, and lifespan. However, when comparing device examples 1-1 to 1-7 with comparative examples 1-1 to 1-4, 2-1 and 2-2, the organic electroluminescent device showed remarkability in the performance, in particular, lifespan of the organic electroluminescent device, by using a multi-component host material comprising the organic electroluminescent compound of the present disclosure. That is, the organic electroluminescent device using a multi-

component host material can show longer lifespan than one using one host compound.

[315]

# Claims

[Claim 1] An organic electroluminescent compound represented by the following formula 1:



(1)

wherein $Ar_1$ represents a substituted or unsubstituted (3- to 30-membered)heteroaryl, or a substituted or unsubstituted (C6-C30)aryl;

$L_1$ represents a single bond, a substituted or unsubstituted (C6-C30)arylene, or a substituted or unsubstituted (3- to 30-membered)heteroarylene;

ring A represents 

; ring B represents 

;

Y represents O, S, $N(R_6)$ or $C(R_4)(R_5)$; X represents O, S, $N(R_6)$ or $C(R_7)(R_8)$; provided that both X and Y cannot be simultaneously $N(R_6)$;

$R_1$ to $R_3$, each independently, represent hydrogen, deuterium, a halogen, a cyano, a carboxy, a nitro, a hydroxy, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C3-C30)cycloalkyl, a substituted or unsubstituted (C3-C30)cycloalkenyl, a substituted or unsubstituted (3- to 7-membered)heterocycloalkyl, a substituted or unsubstituted (C6-C30)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, $-NR_9R_{10}$ or $-SiR_{11}R_{12}R_{13}$, or may be linked to an adjacent substituent(s) to form a substituted or unsubstituted (C3-C30), mono- or polycyclic, alicyclic or aromatic ring;

$R_4$ to $R_{13}$, each independently, represent hydrogen, deuterium, a halogen, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted(C6-C30)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, a substituted or unsubstituted (C3-C30)cycloalkyl, a substituted or unsubstituted (5- to 7-membered)heterocycloalkyl, a substituted or unsubstituted

(C6-C30)aryl(C1-C30)alkyl, $-NR_{14}R_{15}$, $-SiR_{16}R_{17}R_{18}$, a cyano, a nitro, or a hydroxy, or may be linked to an adjacent substituent(s) to form a substituted or unsubstituted (C3-C30), mono- or polycyclic, alicyclic or aromatic ring;

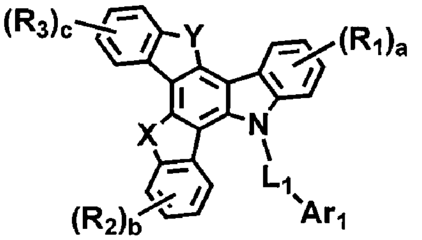
$R_{14}$ to $R_{18}$ have the same definition as $R_4$ to $R_{13}$;

a carbon atom(s) of the alicyclic or aromatic ring may be replaced with at least one hetero atom selected from nitrogen, oxygen, and sulfur;

the heteroaryl(ene) and heterocycloalkyl contains at least one hetero atom selected from B, N, O, S, P(=O), Si and P;

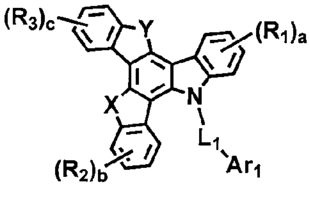
a, b and c, each independently, represent an integer of 1 to 4; where a, b, or c represents an integer of 2 or more, each of $R_1$, $R_2$, or $R_3$ may be the same or different; and

provided that where the compound of formula 1 above is represented by the following formula 2, a ring which may be formed between any one of $R_1$ to $R_3$ and an adjacent substituent(s) is not a substituted naphthalene ring.

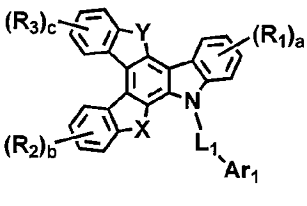


(2)

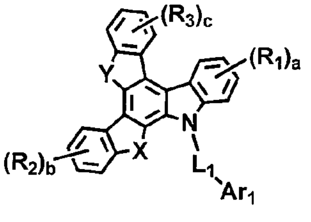
[Claim 2] The organic electroluminescent compound according to claim 1, wherein the compound of formula 1 is represented by any one of the following formulae 2 to 5:



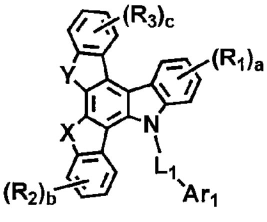
(2)



(3)



(4)



(5)

wherein $Ar_1$, $L_1$, X, Y, $R_1$ to $R_3$, a, b, and c are as defined in claim 1.

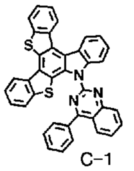
[Claim 3] The organic electroluminescent compound according to claim 1, wherein

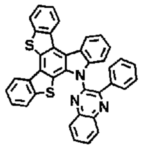
$Ar_1$ represents a substituted or unsubstituted (5- to 20-membered)heteroaryl, or a substituted or unsubstituted (C6-C20)aryl;

$L_1$ represents a single bond, a substituted or unsubstituted (C6-C20)arylene, or a substituted or unsubstituted (5- to 20-membered)heteroarylene; and

$R_1$ to $R_3$, each independently, represent hydrogen, deuterium, a substituted or unsubstituted (C1-C20)alkyl, a substituted or unsubstituted (C3-C20)cycloalkyl, a substituted or unsubstituted (C6-C30)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, $-NR_9R_{10}$ or $-SiR_{11}R_{12}R_{13}$, or may be linked to an adjacent substituent(s) to form a (C3-C20), mono- or polycyclic, alicyclic or aromatic ring.

[Claim 4] The organic electroluminescent compound according to claim 1, wherein the compound of formula 1 is selected from the group consisting of:


C-1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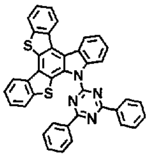
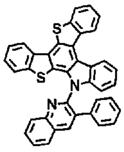
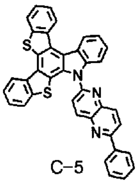

C-3


C-4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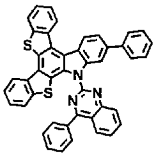
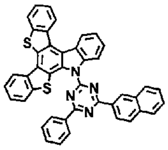
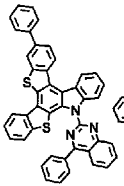
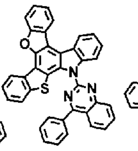

C-6


C-7


C-8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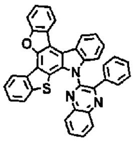
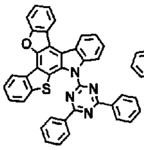
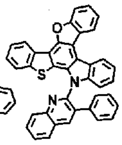

C-10


C-11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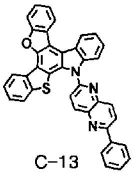
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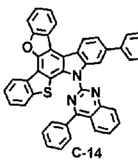
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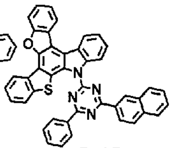
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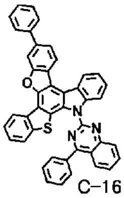
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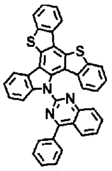
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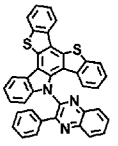
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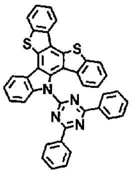
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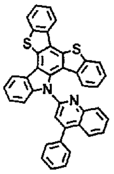
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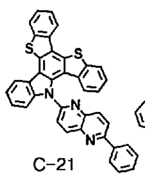
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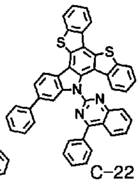
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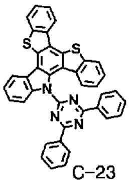
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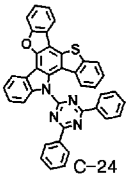
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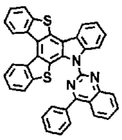
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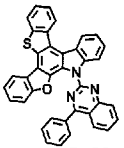
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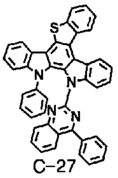
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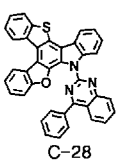
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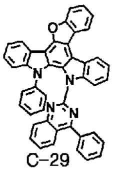
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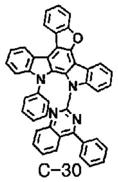
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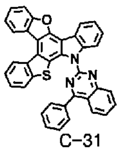
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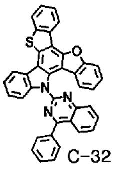
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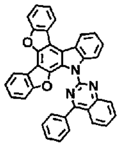
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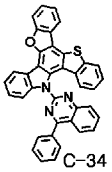
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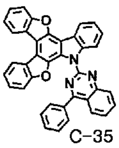
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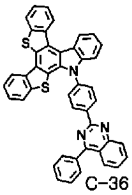
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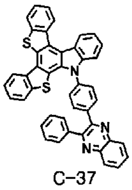
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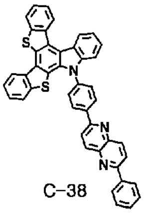
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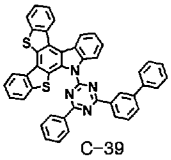
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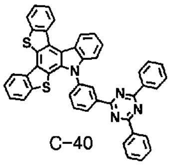
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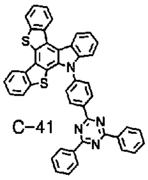
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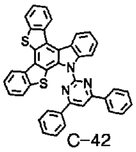
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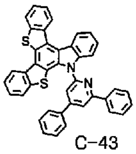
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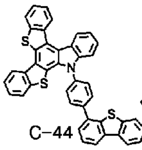
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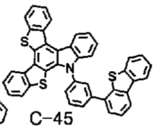
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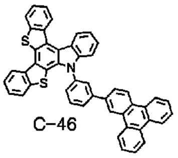
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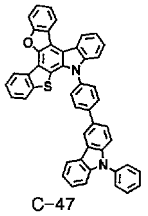
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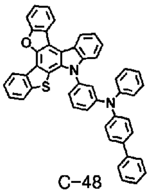
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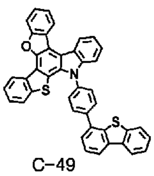
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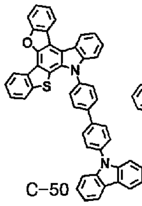
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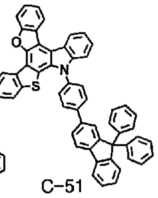
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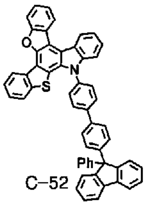
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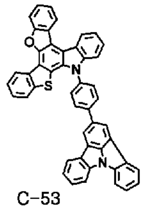
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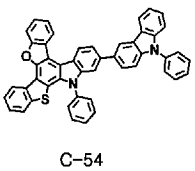
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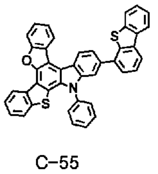
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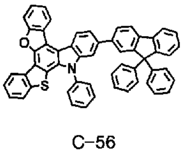
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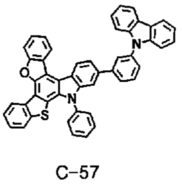
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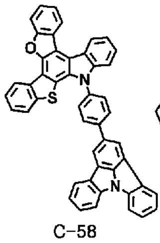
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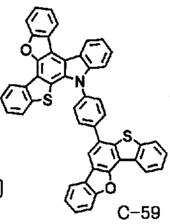
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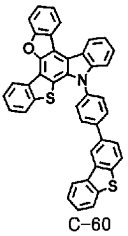
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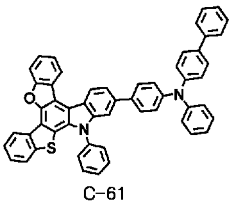
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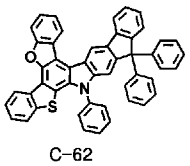
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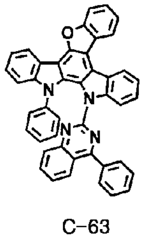
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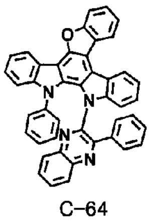
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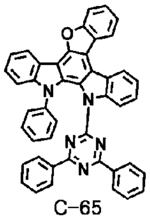
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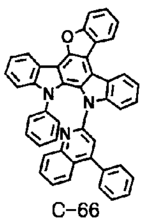
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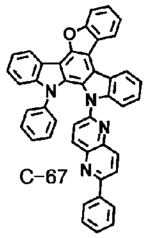
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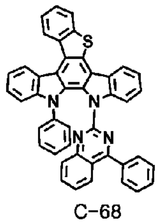
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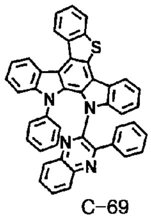
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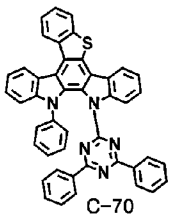
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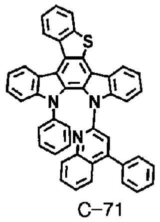
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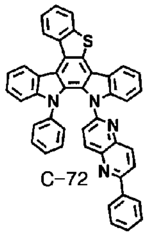
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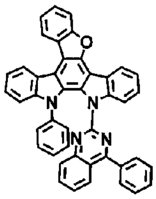
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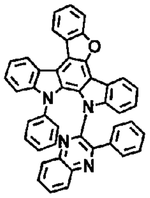
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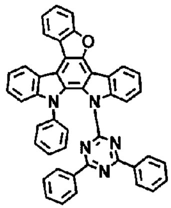
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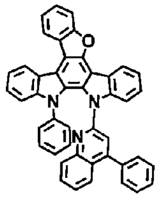
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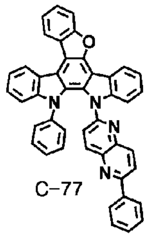
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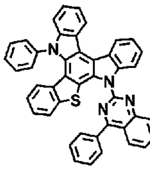
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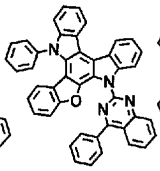
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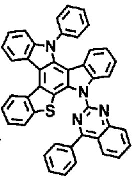
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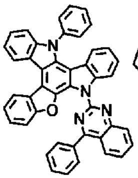
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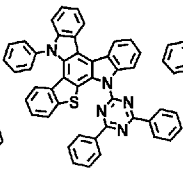
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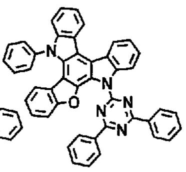
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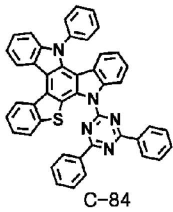
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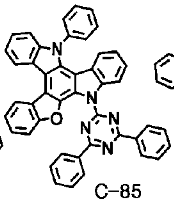
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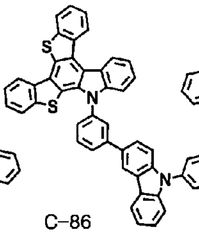
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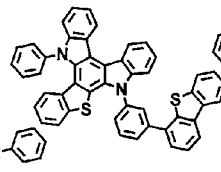
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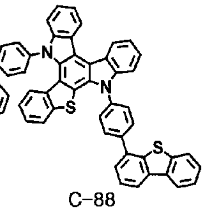
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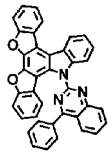
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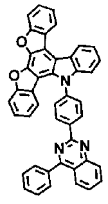
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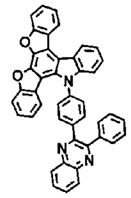
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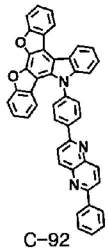
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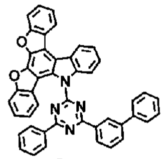
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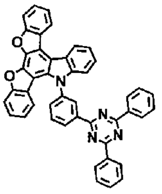
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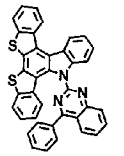
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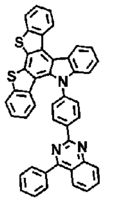
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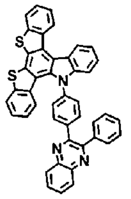
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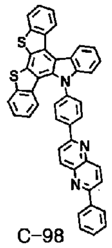
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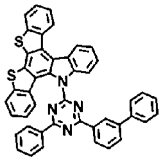
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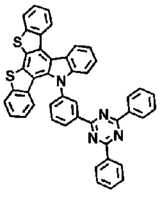
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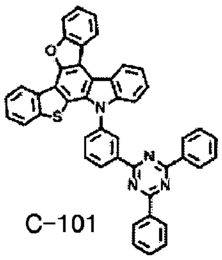

C-101

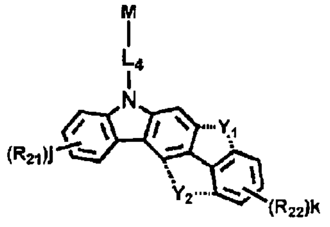
[Claim 5] An organic electroluminescent device comprising the organic electroluminescent compound according to claim 1.

[Claim 6] An organic electroluminescent device comprising an anode, a cathode, and an organic layer disposed between the anode and cathode, wherein the organic layer comprises one or more light-emitting layers; at least one light-emitting layer comprises one or more dopant compounds and two or more host compounds; and a first host compound of the two or more host compounds is the organic electroluminescent compound represented by formula 1 according to claim 1.

[Claim 7] The organic electroluminescent device according to claim 6, wherein a first host compound of the two or more host compounds is the organic electroluminescent compound represented by formula 1, and a second host compound is selected from the compound represented by the following formulae 6 to 10.

$H\text{-}(Cz\text{-}L_4)_h\text{-}M$ (6)

$H\text{-}(Cz)_i\text{-}L_4\text{-}M$ (7)



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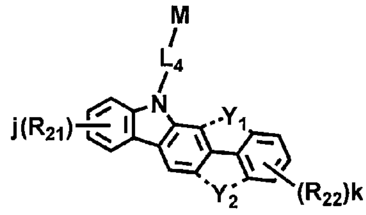
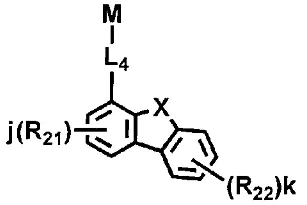
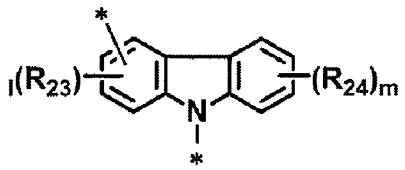


(9)



(10)

wherein Cz represents the following structure:



$L_4$ represents a single bond, a substituted or unsubstituted (C6-C30)arylene, or a substituted or unsubstituted (5- to 30-membered)heteroarylene;

M represents a substituted or unsubstituted (C6-C30)aryl, or a substituted or unsubstituted (5- to 30-membered)heteroaryl;

$Y_1$ and $Y_2$, each independently, represent -O-, -S-, $-N(R_{31})-$ or $-C(R_{32})(R_{33})-$, provided that both $Y_1$ and $Y_2$ cannot be simultaneously present;

X represents O or S;

$R_{21}$ to $R_{24}$, each independently, represent hydrogen, deuterium, a halogen, a cyano, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C3-C30)cycloalkyl, a substituted or unsubstituted (C6-C30)aryl, a substituted or unsubstituted (5- to 30-membered)heteroaryl or $R_{25}R_{26}R_{27}Si$-; or may be linked to an adjacent substituent(s) to form a (C3-C30), mono- or polycyclic, alicyclic or aromatic ring whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen, and sulfur; provided that when h of formula 6 or i of formula 7 is 1, $R_{23}$ or $R_{24}$ does not form the ring containing $Y_1$ or $Y_2$ of formulae 8 and 9, and $R_{22}$ of formula 10 does not form the indole ring connected to $R_{21}$ of formulae 8 and 9;

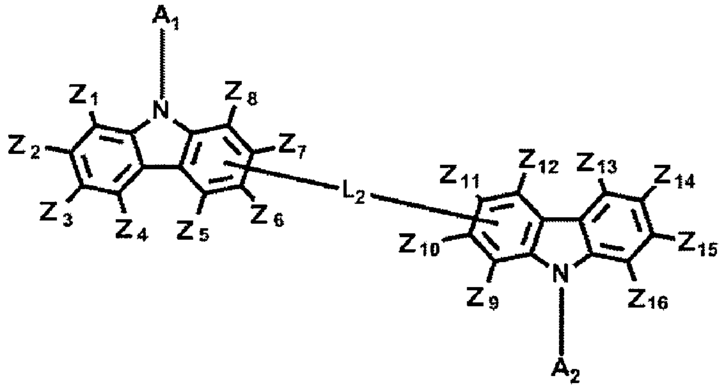
$R_{25}$ to $R_{27}$, each independently, represent a substituted or unsubstituted (C1-C30)alkyl, or a substituted or unsubstituted (C6-C30)aryl;

$R_{31}$ to $R_{33}$, each independently, represent hydrogen, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C6-C30)aryl, or a substituted or unsubstituted (5- to 30-membered)heteroaryl; or may be linked to an adjacent substituent(s) to form a (C5-C30), mono- or polycyclic, alicyclic or aromatic ring whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen, and sulfur; $R_{32}$ and $R_{33}$ may be the same or different;

the heteroaryl(ene) contains at least one hetero atom selected from B, N, O, S, P(=O), Si and P;

h and i, each independently, represent an integer of 1 to 3; j, k, l and m, each independently, represent an integer of 0 to 4; and when h, i, j, k, l or m is an integer of 2 or more, each of (Cz-$L_4$), each of (Cz), each of $R_{21}$, each of $R_{22}$, each of $R_{23}$, or each of $R_{24}$ may be the same or different.

[Claim 8] The organic electroluminescent device according to claim 7, wherein the second host compound is represented by the following formula 11.



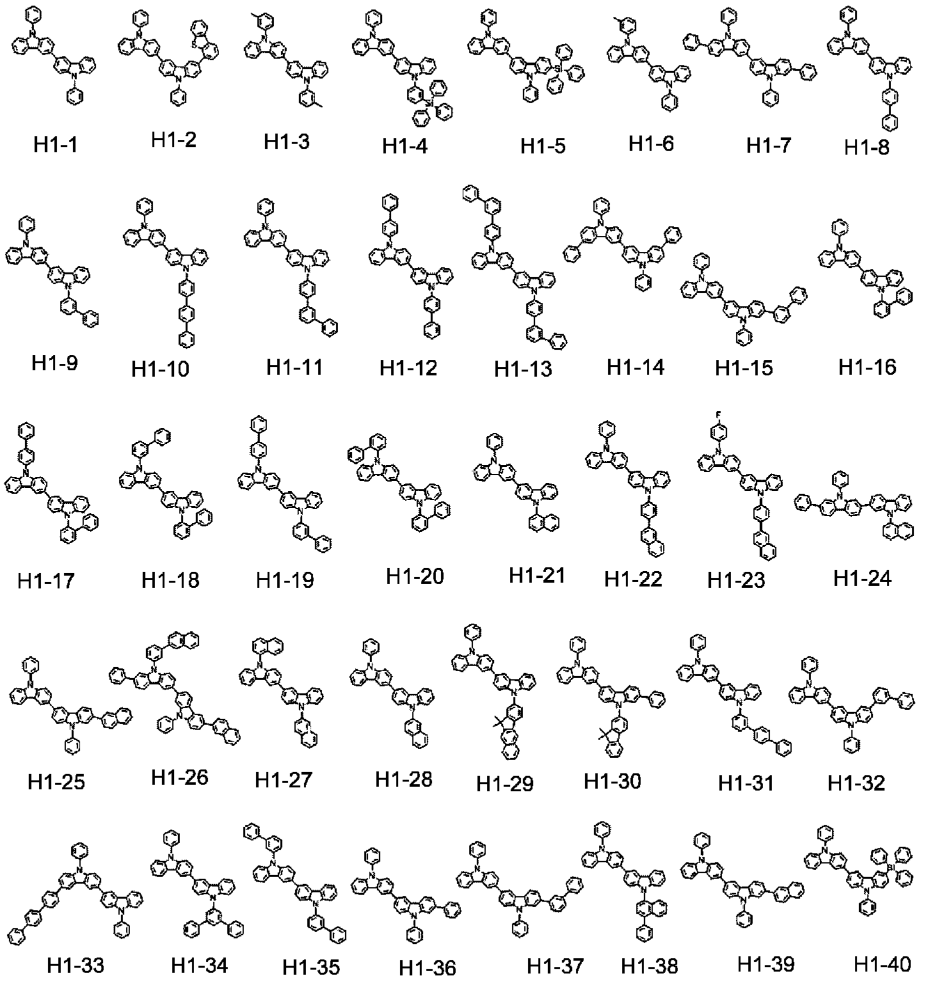
(11)

wherein $A_1$ and $A_2$, each independently, represent a substituted or unsubstituted (C6-C30)aryl; provided that the substituent of the substituted group of $A_1$ and $A_2$ is not a nitrogen-containing heteroaryl;

$L_2$ represents a single bond or a substituted or unsubstituted (C6-C30)arylene; and

$Z_1$ to $Z_{16}$, each independently, represent hydrogen, deuterium, a halogen, a cyano, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C2-C30)alkenyl, a substituted or unsubstituted (C2-C30)alkynyl, a substituted or unsubstituted (C3-C30)cycloalkyl, a substituted or unsubstituted (C6-C60)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, a substituted or unsubstituted tri(C1-C30)alkylsilyl, a substituted or unsubstituted tri(C6-C30)arylsilyl, a substituted or unsubstituted di(C1-C30)alkyl(C6-C30)arylsilyl, a substituted or unsubstituted (C1-C30)alkyldi(C6-C30)arylsilyl, or a substituted or unsubstituted mono- or di-(C6-C30)arylamino; or may be linked to an adjacent substituent(s) to form a substituted or unsubstituted (C3-C30), mono- or polycyclic, alicyclic or aromatic ring.

[Claim 9] The organic electroluminescent device according to claim 7, wherein the compound represented by formulae 6 to 10 is selected from the group consisting of:



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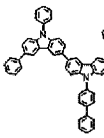
H1-9 H1-10 H1-11 H1-12 H1-13 H1-14 H1-15 H1-16

H1-17 H1-18 H1-19 H1-20 H1-21 H1-22 H1-23 H1-24

H1-25 H1-26 H1-27 H1-28 H1-29 H1-30 H1-31 H1-32

H1-33 H1-34 H1-35 H1-36 H1-37 H1-38 H1-39 H1-40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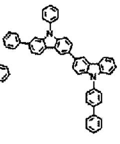
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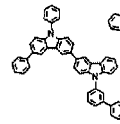
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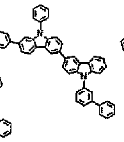
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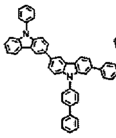
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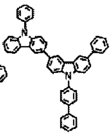
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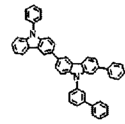
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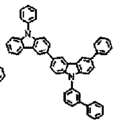
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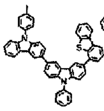
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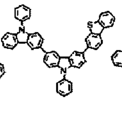
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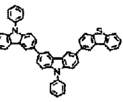
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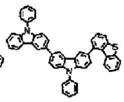
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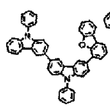
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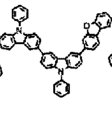
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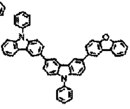
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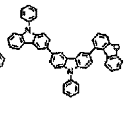
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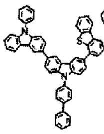
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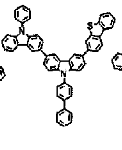
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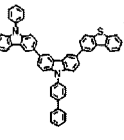
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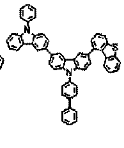
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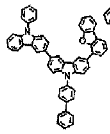
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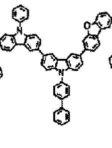
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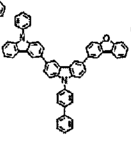
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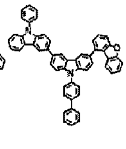
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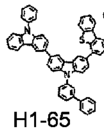
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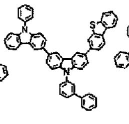
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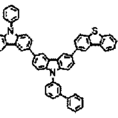
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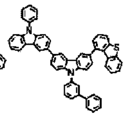
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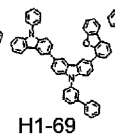
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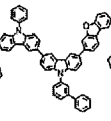
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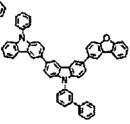
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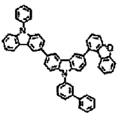
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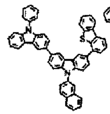
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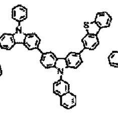
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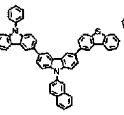
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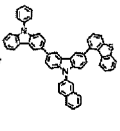
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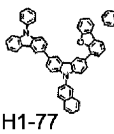
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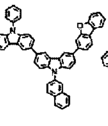
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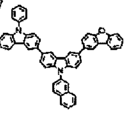
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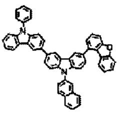
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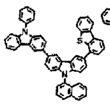
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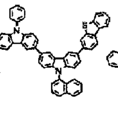
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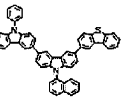
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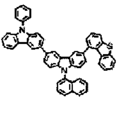
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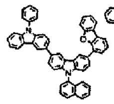
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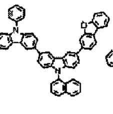
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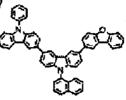
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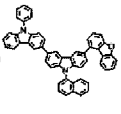
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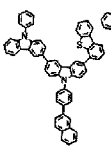
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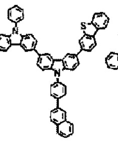
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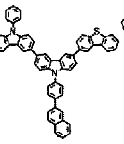
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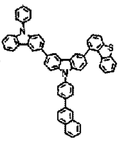
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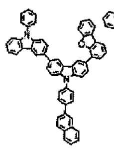
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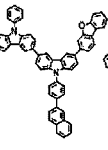
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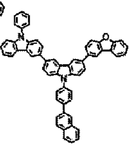
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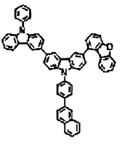
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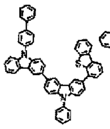
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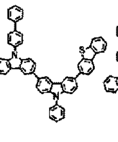
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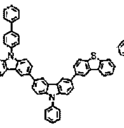
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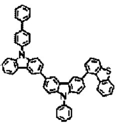
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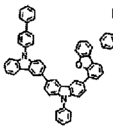
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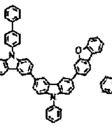
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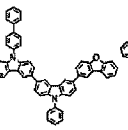
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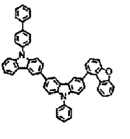
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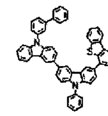
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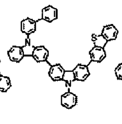
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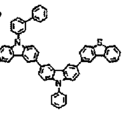
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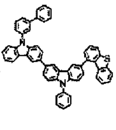
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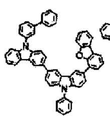
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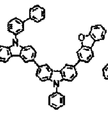
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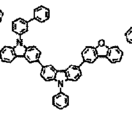
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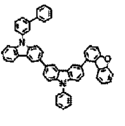
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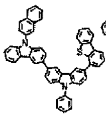
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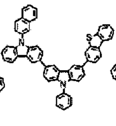
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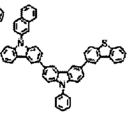
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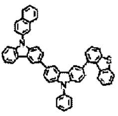
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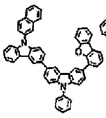
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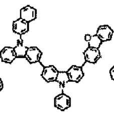
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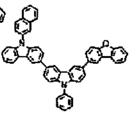
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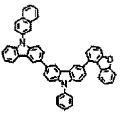
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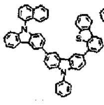
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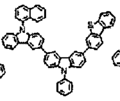
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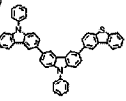
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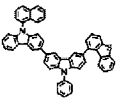
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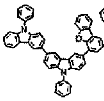
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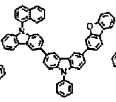
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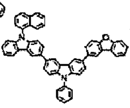
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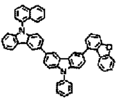
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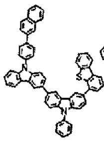
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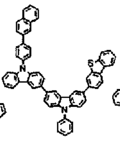
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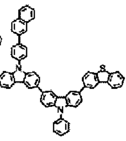
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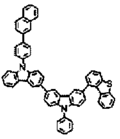
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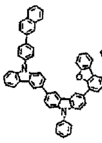
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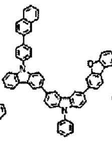
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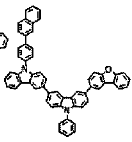
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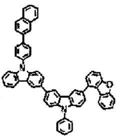
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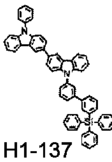
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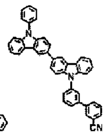
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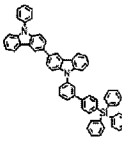
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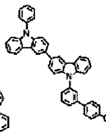
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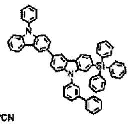
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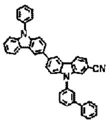
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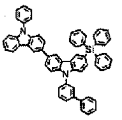
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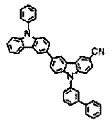
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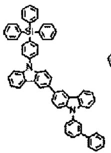
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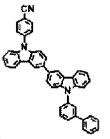
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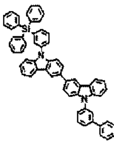
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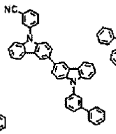
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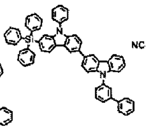
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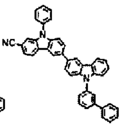
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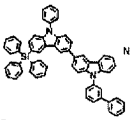
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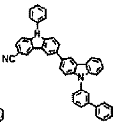
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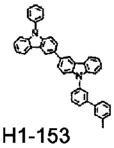
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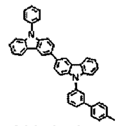
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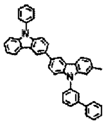
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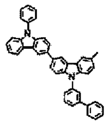
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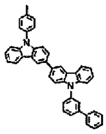
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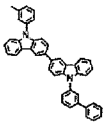
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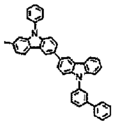
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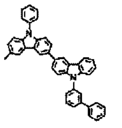
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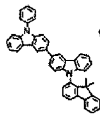
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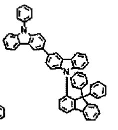
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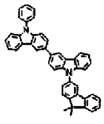
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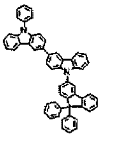
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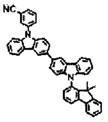
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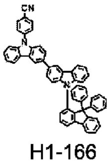
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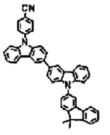
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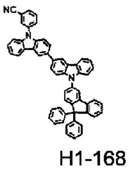
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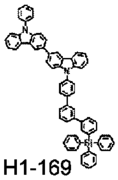
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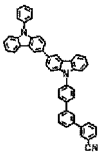
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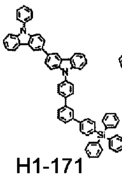
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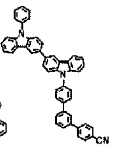
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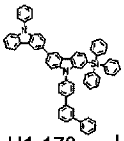
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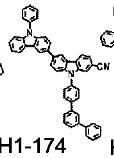
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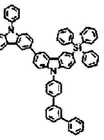
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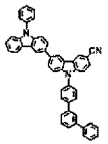
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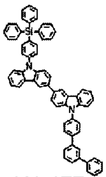
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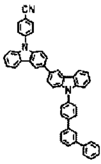
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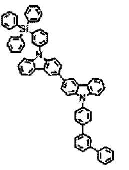
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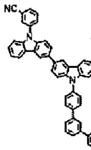
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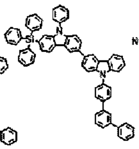
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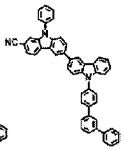
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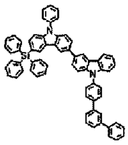
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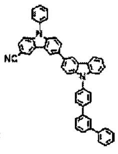
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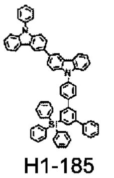
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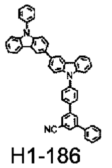
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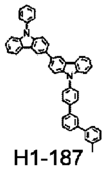
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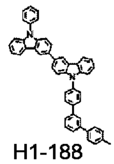
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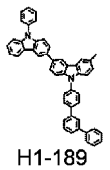
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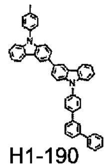
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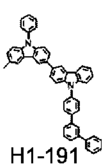
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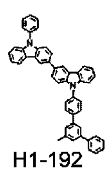
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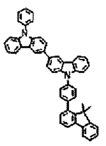
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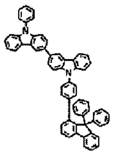
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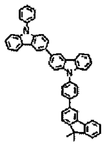
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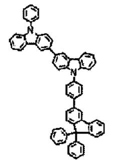
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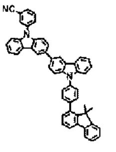
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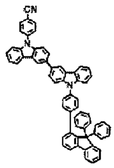
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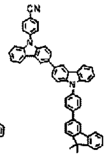
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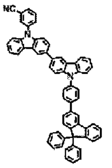
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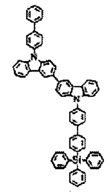
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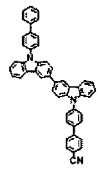
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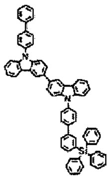
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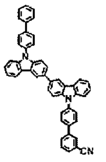
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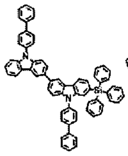
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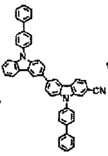
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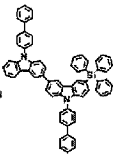
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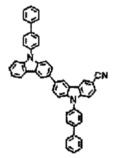
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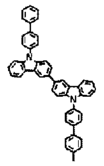
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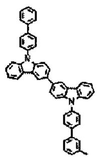
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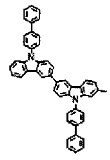
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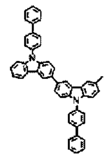
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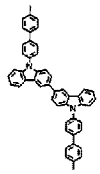
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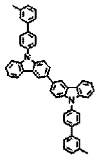
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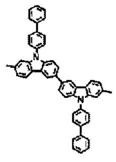
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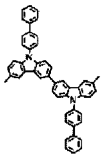
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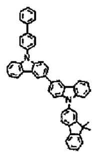
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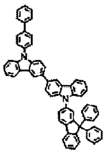
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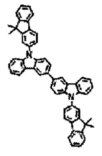
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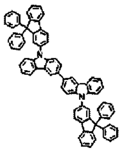
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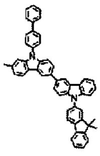
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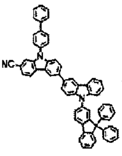
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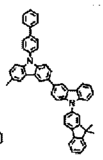
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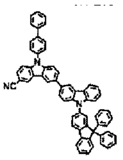
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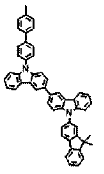
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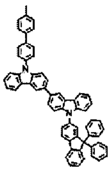
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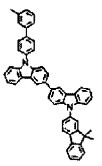
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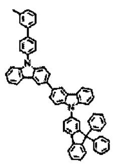
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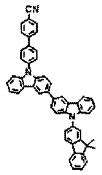
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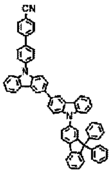
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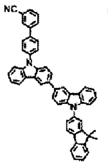
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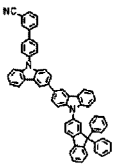
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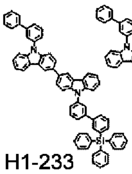
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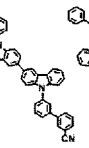
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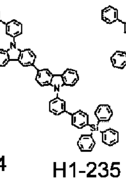
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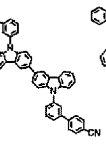
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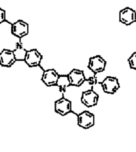
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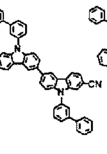
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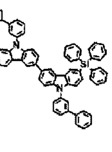
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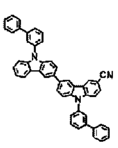
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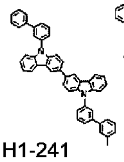
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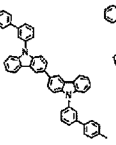
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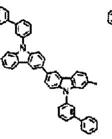
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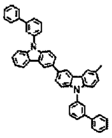
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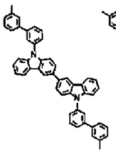
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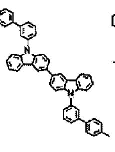
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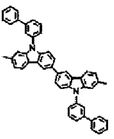
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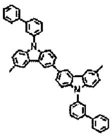
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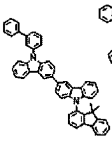
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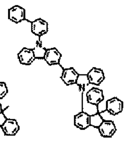
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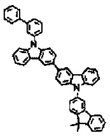
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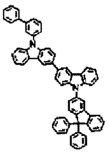
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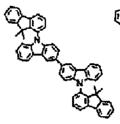
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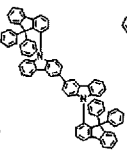
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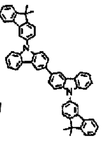
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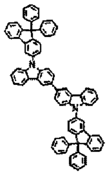
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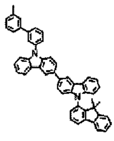
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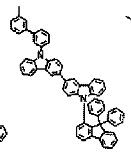
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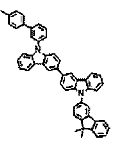
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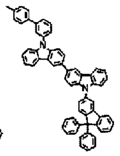
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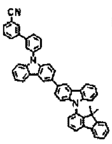
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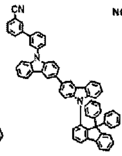
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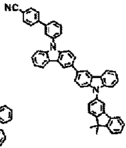
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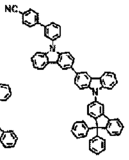
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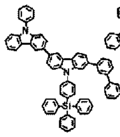
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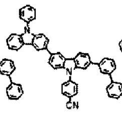
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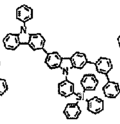
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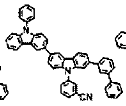
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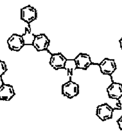
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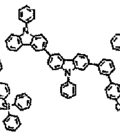
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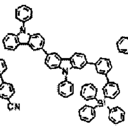
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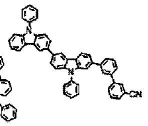
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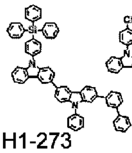
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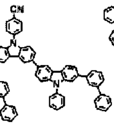
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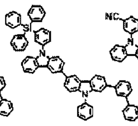
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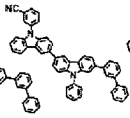
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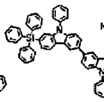
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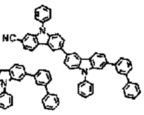
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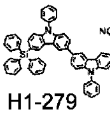
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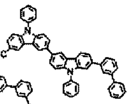
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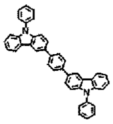
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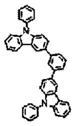
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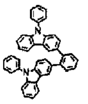
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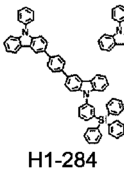
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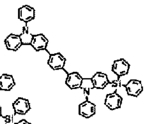
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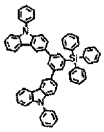
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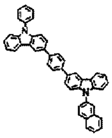
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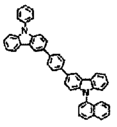
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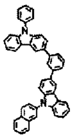
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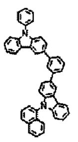
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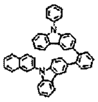
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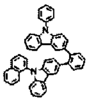
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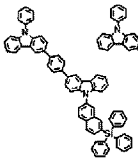
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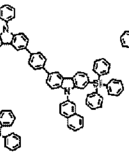
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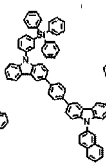
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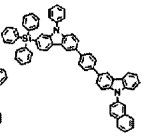
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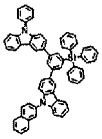
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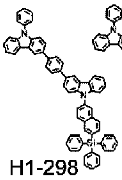
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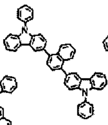
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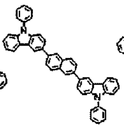
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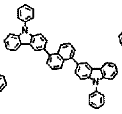
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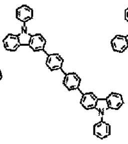
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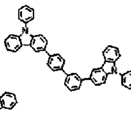
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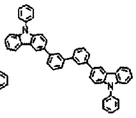
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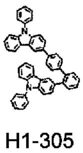
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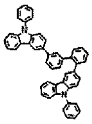
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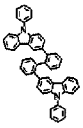
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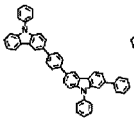
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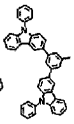
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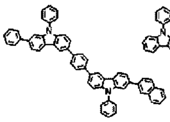
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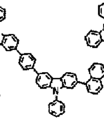
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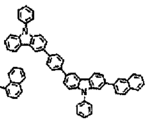
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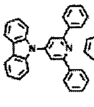
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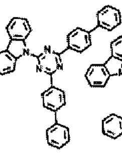
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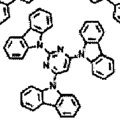
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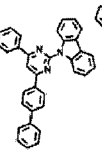
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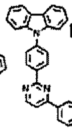
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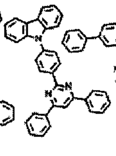
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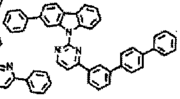
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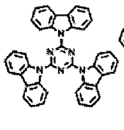
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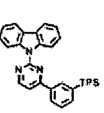

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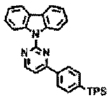

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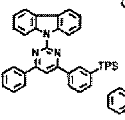

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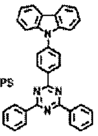

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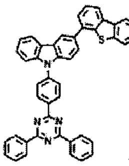

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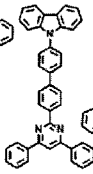

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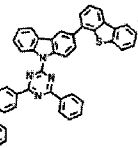

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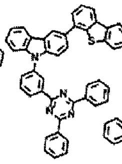

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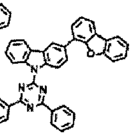

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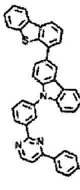

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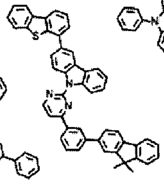

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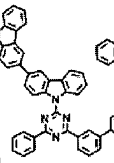

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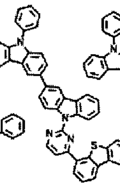

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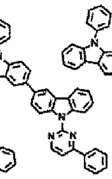

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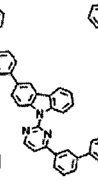

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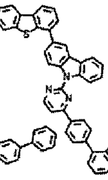

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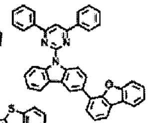

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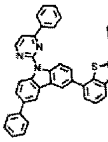

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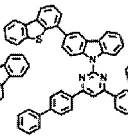

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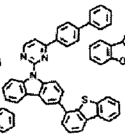

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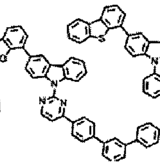

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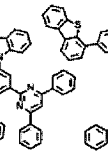

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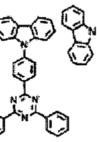

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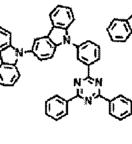

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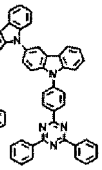

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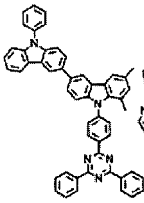

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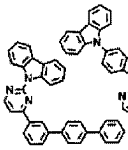

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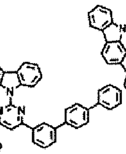

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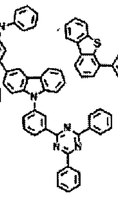

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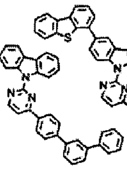

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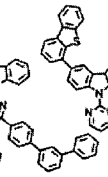

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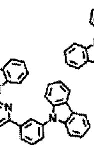

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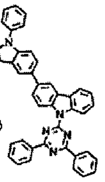

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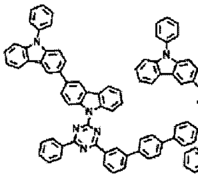

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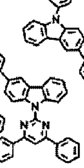

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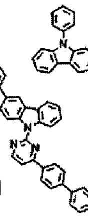

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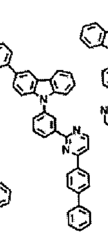

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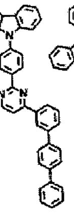

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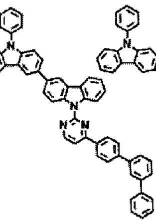

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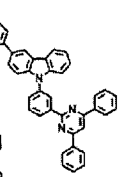

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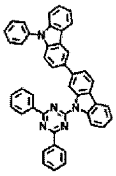

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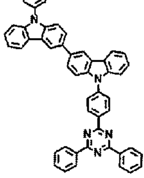

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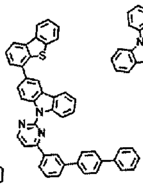

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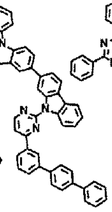

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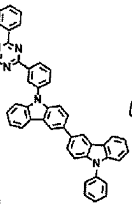

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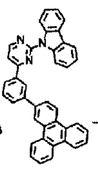

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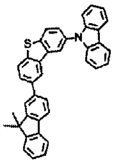

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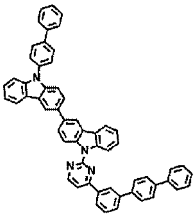

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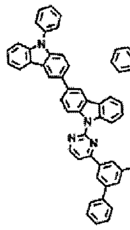
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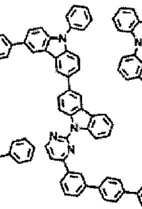
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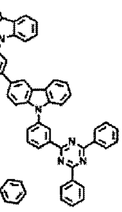
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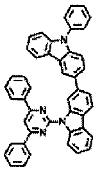
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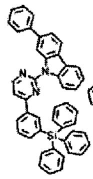
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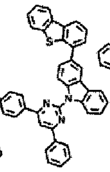
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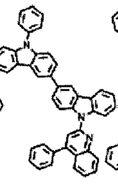
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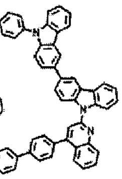
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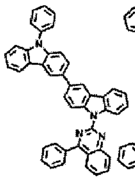
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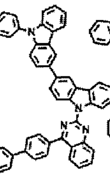
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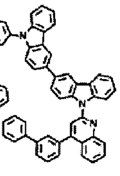
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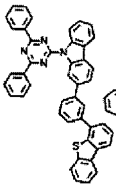
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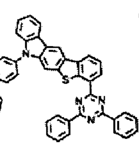
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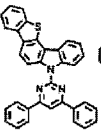
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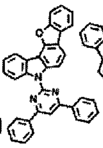
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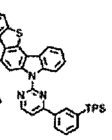
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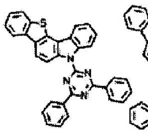
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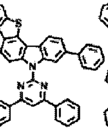
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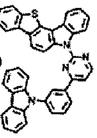
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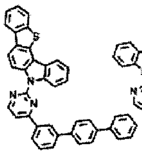
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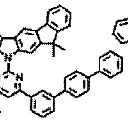
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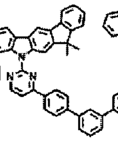
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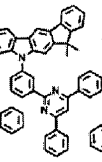
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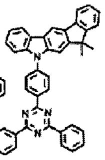
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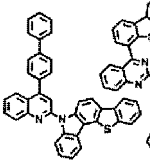
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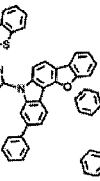
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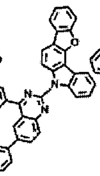
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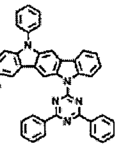
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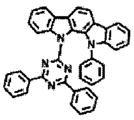
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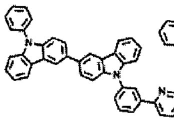
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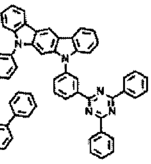
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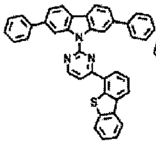
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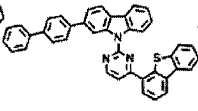
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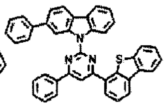
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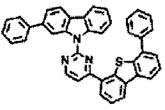
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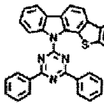
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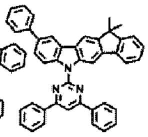
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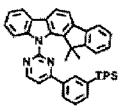
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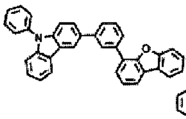
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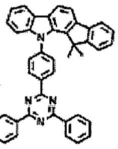
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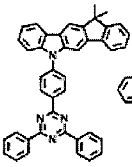
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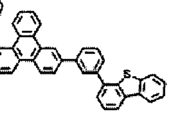
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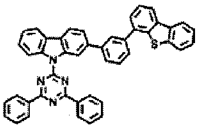
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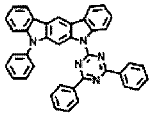
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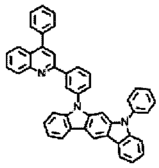
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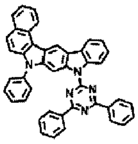
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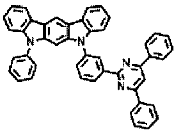
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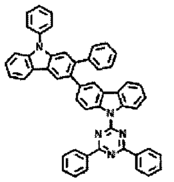
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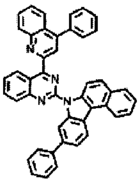
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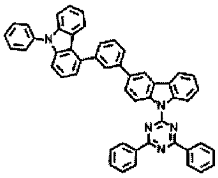
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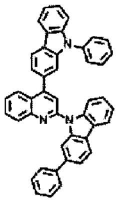
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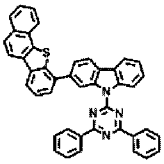
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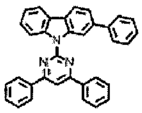
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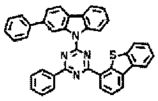
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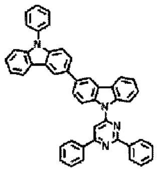
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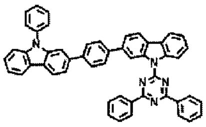
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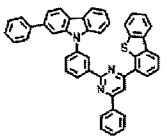
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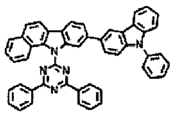
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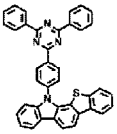
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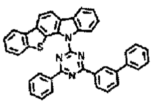
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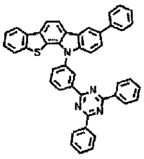
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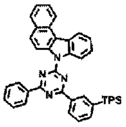
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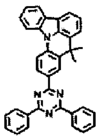
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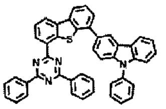
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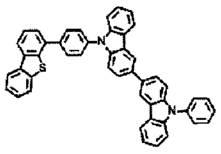
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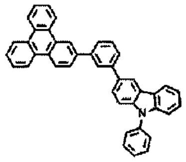
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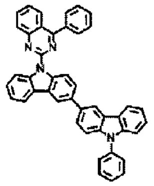
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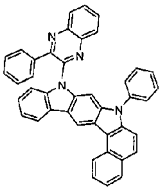
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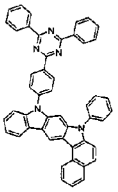
H1-437

wherein TPS represents triphenylsilyl.

**INTERNATIONAL SEARCH REPORT**

International application No.
**PCT/KR2014/012933**

A. CLASSIFICATION OF SUBJECT MATTER

***C07D 491/147 (2006.01) C07D 495/14 (2006.01) C07D 209/58 (2006.01) C07D 401/04 (2006.01) C07D 401/10 (2006.01) C07D 401/14 (2006.01) C07D 405/14 (2006.01) C07D 409/14 (2006.01) C07D 487/14 (2006.01) C07D 487/04 (2006.01) C07F 9/00 (2006.01) C07F 15/00 (2006.01) C09K 11/06 (2006.01) H01L 27/32 (2006.01) H01L 51/54 (2006.01)***

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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

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

STN Registry and CAplus: Substructure search based on compounds of Formula (1)

PatentScope and Espacenet: Inventor and Applicant Search

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| | Documents are listed in the continuation of Box C | |

☒ Further documents are listed in the continuation of Box C ☒ See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

| | |
|---|---|
| Date of the actual completion of the international search<br>16 March 2015 | Date of mailing of the international search report<br>16 March 2015 |

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| INTERNATIONAL SEARCH REPORT<br>C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT | International application No.<br>**PCT/KR2014/012933** |
|---|---|

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | WO 2010/151011 A1 (DOW ADVANCED DISPLAY MATERIALS, LTD.) 29 December 2010<br>Compound 2-3, paragraphs [88]-[94] | 1-3 |
| P,X | US 2014/0353640 A1 (HAKETA et al.) 04 December 2014<br>Compounds 1-24 and relevant intermediates thereof, examples 1-24, paragraphs [0241]-[0317] and relevant compounds of paragraphs [0100] particularly Page 37, left-hand column, 2nd compound, and Page 49, right-hand column, 3rd compound; paragraphs [0104]-[0133] and example 48 paragraphs [0331]-[0334] | 1-7 |
| P,X | WO 2014/157708 A1 (IDEMITSU KOSAN CO., LTD.) 02 October 2014<br>Compounds 1-12 and 14-16 and relevant intermediates thereof, examples 1-12 and 14-16, paragraphs [0260]-[0297] and relevant compounds of paragraphs [0057]-[0161] particularly Page 23, last row, 1st compound and Page 66, last row, 4th compound; paragraphs [0162]-[0168] and [0182]-[0184] | 1-7 |
| P,X | KR 10-2014-0039622 A (DOOSAN CORPORATION) 02 April 2014<br>Compounds 1-34, 45-46 and 56-60 paragraphs [0038]-[0043], particularly compound 26, and examples 1-12, 14 and 15 paragraphs [0056]-[0344]; paragraphs [0044]-[0054] and evaluation example 1 paragraphs [0345]-[0361] | 1-5 |
| P,X | KR 10-2014-0000611 A (PIENEICHITEKEU CO., LTD) 03 January 2014<br>Compounds 38-39 and 41-79 paragraphs [0035]-[0042], and manufacturing examples 10-14 paragraphs [0155]-[0197]); paragraphs [0043]-[0094] and device embodiment 1 paragraphs [0260]-[0272] | 1-3 and 5 |

| INTERNATIONAL SEARCH REPORT<br>Information on patent family members | International application No.<br>**PCT/KR2014/012933** |
|---|---|

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

| **Patent Document/s Cited in Search Report** | | **Patent Family Member/s** | |
|---|---|---|---|
| **Publication Number** | **Publication Date** | **Publication Number** | **Publication Date** |
| WO 2010/151011 A1 | 29 December 2010 | KR 20100137188 A | 30 Dec 2010 |
| | | TW 201109420 A | 16 Mar 2011 |
| US 2014/0353640 A1 | 04 December 2014 | JP 2015007036 A | 15 Jan 2015 |
| WO 2014/157708 A1 | 02 October 2014 | | |
| KR 10-2014-0039622 A | 02 April 2014 | None | |
| KR 10-2014-0000611 A | 03 January 2014 | None | |

**End of Annex**

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.