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(54) **ORGANIC ELECTROLUMINESCENT COMPOUNDS AND ORGANIC ELECTROLUMINESCENT DEVICE COMPRISING THE SAME**

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(57) **ABSTRACT**

The present invention relates to an organic electroluminescent compound and an organic electroluminescent device comprising the same. The organic electroluminescent compound according to the present invention can be comprised in a light-emitting layer or an electron buffer layer, and is effective to produce an organic electroluminescent device having low driving voltage, excellent current and power efficiencies, and significantly improved operational lifespan.

ORGANIC ELECTROLUMINESCENT COMPOUNDS AND ORGANIC ELECTROLUMINESCENT DEVICE COMPRISING THE SAME

TECHNICAL FIELD

[0001] The present invention relates to organic electroluminescent compounds and organic electroluminescent device comprising the same.

BACKGROUND ART

[0002] An electroluminescent device (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. The first organic EL device was developed by Eastman Kodak, by using small aromatic diamine molecules, and aluminum complexes as materials for forming a light-emitting layer [Appl. Phys. Lett. 51, 913, 1987].

[0003] An organic electroluminescent device is a device changing electrical energy to light by applying electricity to an organic electroluminescent material, and generally has a structure comprising an anode, a cathode, and an organic layer between the anode and the cathode. The organic layer of an organic EL device may be comprised of a hole injection layer, a hole transport layer, an electron blocking layer, a light-emitting layer (which comprises host and dopant materials), an electron buffer layer, a hole blocking layer, an electron transport layer, an electron injection layer, etc., and the materials used for the organic layer are categorized by their functions in hole injection material, hole transport material, electron blocking material, light-emitting material, electron buffer material, hole blocking material, electron transport material, electron injection material, etc. In the organic EL device, due to an application of a voltage, holes are injected from the anode to the light-emitting layer, electrons are injected from the cathode to the light-emitting layer, and excitons of high energies are formed by a recombination of the holes and the electrons. By this energy, organic luminescent compounds reach an excited state, and light emission occurs by emitting light from energy due to the excited state of the organic luminescent compounds returning to a ground state.

[0004] The most important factor determining luminous efficiency in an organic EL device is light-emitting materials. A light-emitting material must have high quantum efficiency, high electron and hole mobility, and the formed light-emitting material layer must be uniform and stable. Light-emitting materials are categorized into blue, green, and red light-emitting materials dependent on the color of the light emission, and additionally yellow or orange light-emitting materials. In addition, light-emitting materials can also be categorized into host and dopant materials according to their functions. Recently, the development of an organic EL device providing high efficiency and long lifespan is an urgent issue. In particular, considering EL characteristic requirements for a middle or large-sized panel of OLED, materials showing better characteristics than conventional ones must be urgently developed. The host material, which acts as a solvent in a solid state and transfers energy, needs to have high purity and a molecular weight appropriate for vacuum deposition. Furthermore, the host material needs to have high glass transition temperature and high thermal degradation temperature to achieve thermal stability, high electro-chemical stability to achieve long lifespan, ease of forming an amorphous thin film, good adhesion to materials of adjacent layers, and non-migration to other layers.

[0005] Until now, fluorescent host materials have been widely used as a host material. For a blue fluorescent host material, a blue light-emitting material system of Idemitsu Kosan using 4,4'-bis(2,2'-diphenylvinyl)-1,1'-biphenyl (DPVBi), and a blue light-emitting material system of Eastman Kodak using dinaphthylanthracene and tetra(t-butyl)perylene, etc., are known. However, much research has been conducted until now in order to develop a blue fluorescent host material having improved characteristics in a device.

[0006] Korean Patent Application Laying-Open No. 2008-0047210 discloses a compound in which an aryl group is bonded to a benzocarbazole or dibenzocarbazole structure and an organic EL device comprising the same. Korean Patent Application Laying-Open No. 2013-0130747 discloses an aromatic heterocyclic ring derivative consisting of two or more carbazole derivative residual groups and a nitrogen-containing aromatic heterocyclic ring and an organic EL device comprising the same. In addition, Korean Patent Application Laying-Open No. 2010-0015581 discloses an organic electroluminescent compound in which a nitrogen-containing aromatic hydrocarbon group or an aromatic heterocyclic group is bonded to a pyrimidine ring or a triazine ring and an organic EL device comprising the same. However, necessity of compounds having superior luminous efficiency and lifespan characteristic to the compounds disclosed in the references above is continuously to the fore.

[0007] Accordingly, after working on obtaining a compound satisfactory to the necessity above, the present inventors found that a compound of a specific structure in which a dibenzocarbazole and a diaryltriazine are bonded via an aryl group more suitable for producing an organic EL device improved efficiency and lifespan compared to conventional organic electroluminescent compounds.

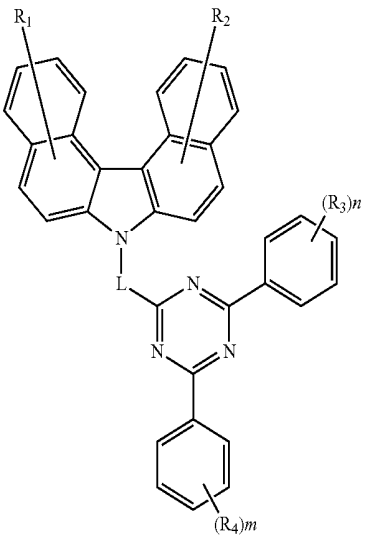
DISCLOSURE OF THE INVENTION

Problems to be Solved

[0008] The objective of the present invention is to provide an organic electroluminescent compound which can produce an organic electroluminescent device having excellent efficiency and improved lifespan.

Solution to Problems

[0009] The present inventors found that the above objective can be achieved by an organic electroluminescent compound represented by the following formula 1:



(1)

[0010] wherein

[0011] L represents a substituted or unsubstituted (C6-C30)arylene;

[0012] R_1 to R_4 each independently represent hydrogen, deuterium, a halogen, a cyano, 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 (C1-C30)alkoxy, a substituted or unsubstituted tri(C1-C30)alkylsilyl, a substituted or unsubstituted di(C1-C30)alkyl(C6-C30)arylsilyl, a substituted or unsubstituted (C1-C30)alkyldi(C6-C30)arylsilyl, a substituted or unsubstituted tri(C6-C30)arylsilyl, a substituted or unsubstituted mono- or di-(C1-C30)alkylamino, a substituted or unsubstituted mono- or di-(C6-C30)arylamino, or a substituted or unsubstituted (C1-C30)alkyl(C6-C30)arylamino; or are linked to an adjacent substituent(s) to form a substituted or unsubstituted, mono- or polycyclic, (C3-C30) alicyclic or aromatic ring, whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen, and sulfur;

[0013] the heteroaryl contains at least one hetero atom selected from B, N, O, S, Si, and P; and

[0014] n and m represent an integer of 0 to 3.

Effects of the Invention

[0015] By using the organic electroluminescent compound of the present invention as a host of the light-emitting layer, efficiency and lifespan are significantly improved compared to the conventional organic electroluminescent compounds. Specifically, by maintaining high efficiency and having significantly improved lifespan even at high luminance, the organic electroluminescent compound of the present invention shows more suitable characteristics in recent trends requiring increasing demands for high resolution.

EMBODIMENTS OF THE INVENTION

[0016] Hereinafter, the present invention will be described in detail. However, the following description is intended to explain the invention, and is not meant in any way to restrict the scope of the invention.

[0017] The present invention relates to an organic electroluminescent compound of formula 1, an organic electroluminescent material comprising the compound, and an organic electroluminescent device comprising the material.

[0018] In formula 1 above, preferably, L represents a substituted or unsubstituted (C6-C20)arylene, and R_1 to R_4 each independently represent hydrogen, or a substituted or unsubstituted (C6-C20)aryl, or are linked to an adjacent substituent(s) to form a substituted or unsubstituted, mono- or polycyclic, (C6-C20) alicyclic or aromatic ring, whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen, and sulfur.

[0019] In formula 1 above, more preferably, L represents a (C6-C12)arylene unsubstituted or substituted with a (C1-C6)alkyl or a (C6-C12)aryl, and R_1 to R_4 each independently represent hydrogen or an unsubstituted (C6-C12)aryl, or are linked to an adjacent substituent(s) to form a mono- or polycyclic, (C6-C15) alicyclic or aromatic ring unsubstituted or substituted with a (C1-C6)alkyl or a (C6-C12)aryl, whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen, and sulfur.

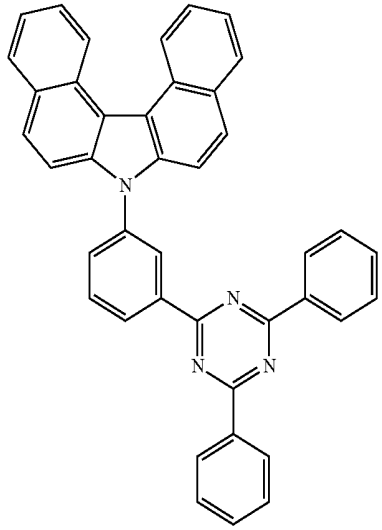
[0020] Herein, "(C1-C30)alkyl" is meant to be a linear or branched alkyl having 1 to 30 carbon atoms constituting the chain, in which the number of carbon atoms is preferably 1 to 20, more preferably 1 to 10, and includes methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, etc.; "(C2-C30)alkenyl" is meant to be a linear or branched alkenyl having 2 to 30 carbon atoms constituting the chain, in which the number of carbon atoms is preferably 2 to 20, more preferably 2 to 10, and includes vinyl, 1-propenyl, 2-propenyl, 1-butenyl, 2-butenyl, 3-butenyl, 2-methylbut-2-enyl, etc.; "(C2-C30)alkynyl" is meant to be a linear or branched alkynyl having 2 to 30 carbon atoms constituting the chain, in which the number of carbon atoms is preferably 2 to 20, more preferably 2 to 10, and includes ethynyl, 1-propynyl, 2-propynyl, 1-butynyl, 2-butynyl, 3-butynyl, 1-methylpent-2-ynyl, etc.; "(C1-C30)alkoxy" is meant to be a linear or branched alkoxy having 1 to 30 carbon atoms constituting the chain, in which the number of carbon atoms is preferably 1 to 20, more preferably 1 to 10, and includes methoxy, ethoxy, propoxy, isopropoxy, 1-ethylpropoxy, etc.; "(C3-C30)cycloalkyl" is a mono- or polycyclic hydrocarbon having 3 to 30 ring backbone carbon atoms, in which the number of carbon atoms is preferably 3 to 20, more preferably 3 to 7, and includes cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, etc.; "5- to 7-membered heterocycloalkyl" is a cycloalkyl having 5 to 7 ring backbone atoms, including at least one heteroatom selected from B, N, O, S, Si, and P, preferably O, S, and N, and includes pyrrolidine, thiolan, tetrahydropyran, etc.; "(C6-C30)aryl(ene)" is a monocyclic or fused ring derived from an aromatic hydrocarbon having 6 to 30 ring backbone carbon atoms, in which the number of carbon atoms is preferably 6 to 20, more

preferably 6 to 15, and includes phenyl, biphenyl, terphenyl, naphthyl, fluorenyl, phenanthrenyl, anthracenyl, indenyl, triphenylenyl, pyrenyl, tetracenyl, perylenyl, chrysenyl, naphthacenyl, fluoranthenyl, etc.; "3- to 30-membered heteroaryl(ene)" is an aryl having 3 to 30 ring backbone atoms, in which the number of atoms is preferably 3 to 20, more preferably 3 to 15, including at least one, preferably 1 to 4 heteroatoms selected from the group consisting of B, N, O, S, Si, and P; is 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 including 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 including benzofuranyl, benzothiophenyl, isobenzofuranyl, dibenzofuranyl, dibenzothiophenyl, benzoimidazolyl, benzothiazolyl, benzoisothiazolyl, benzoisoxazolyl, benzoxazolyl, isoindolyl, indolyl, indazolyl, benzothiadiazolyl, quinolyl, isoquinolyl, cinnolinyl, quinazolinyl, quinoxalinyl, carbazolyl, phenoxazinyl, phenanthridinyl, benzodioxolyl, etc. Further, "halogen" includes F, Cl, Br, and I.

[0021] 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 the present invention, the substituents of the substituted (C1-C30)alkyl, the substituted (C6-C30)aryl, the substituted 3- to 30-membered heteroaryl, the substituted (C3-C30)cycloalkyl, the substituted (C1-C30)alkoxy, the substituted tri(C1-C30)alkylsilyl, the substituted di(C1-C30)alkyl(C6-C30)arylsilyl, the substituted (C1-C30)alkyldi(C6-C30)arylsilyl, the substituted tri(C6-C30)arylsilyl, the substituted mono- or di-(C1-C30)alkylamino, the substituted mono- or di-(C6-C30)arylamino, the substituted (C1-C30)alkyl(C6-C30)arylamino, and the substituted mono- or polycyclic, (C3-C30) alicyclic or aromatic ring in R_1 to R_4 in formula 1 each independently are at least one selected from the group consisting of deuterium, a halogen, a cyano, a carboxyl, a nitro, a hydroxyl, 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 5- to 30-membered heteroaryl unsubstituted or substituted with a (C6-C30)aryl, a (C6-C30)aryl unsubstituted or substituted with a 5- 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.

[0022] The organic electroluminescent compound represented by formula 1 includes the following compounds, but is not limited thereto:

C-1



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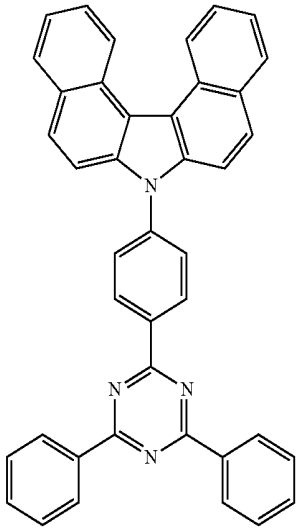

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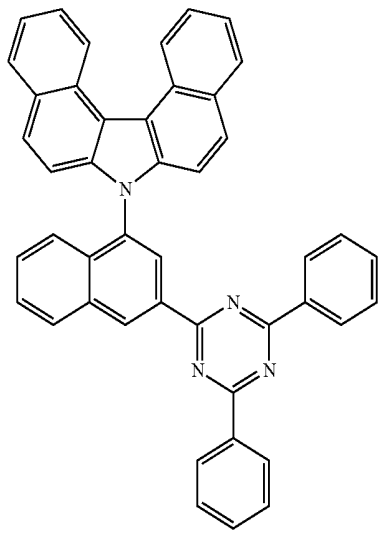

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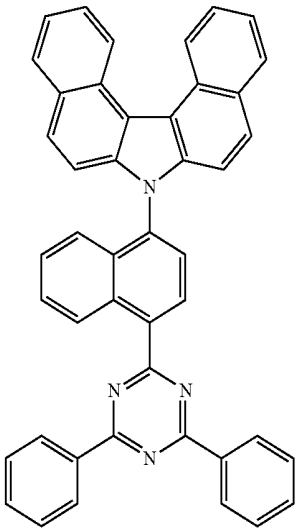

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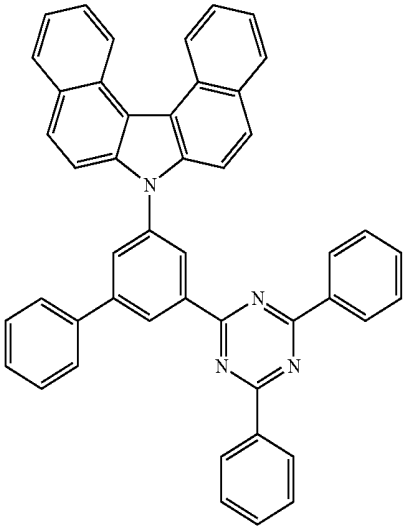

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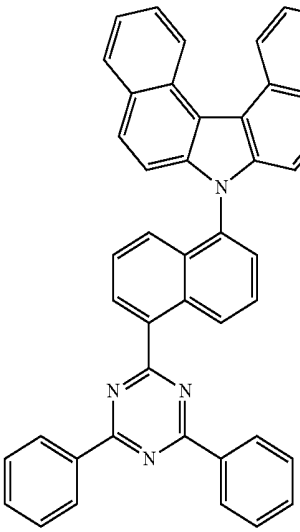

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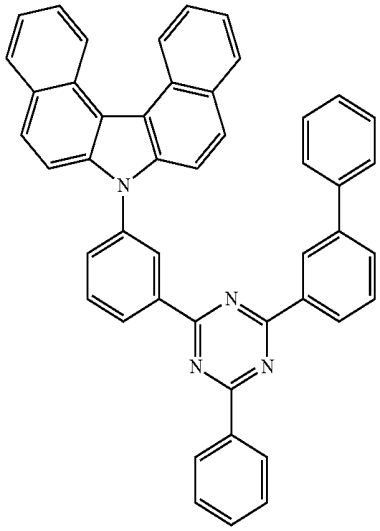

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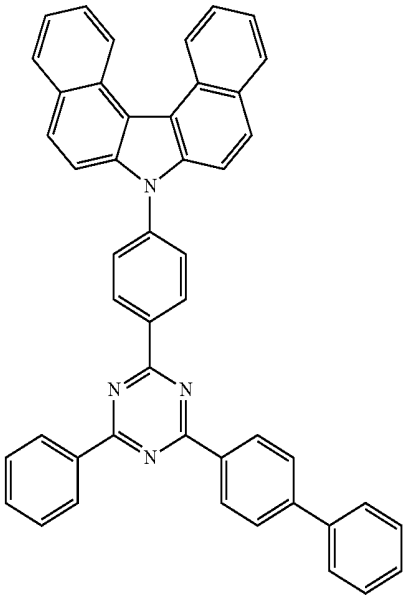

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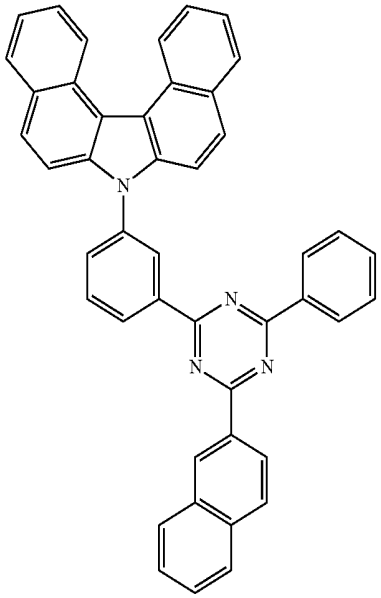

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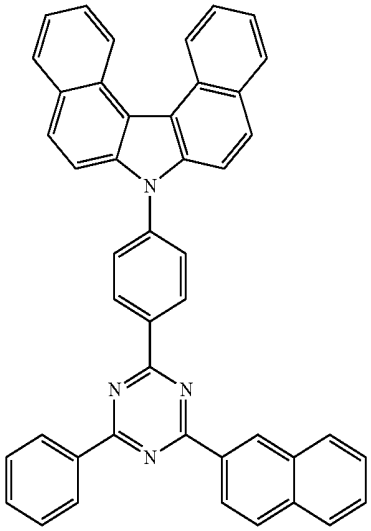

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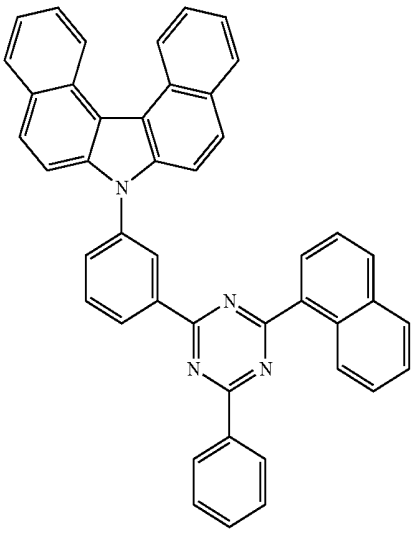

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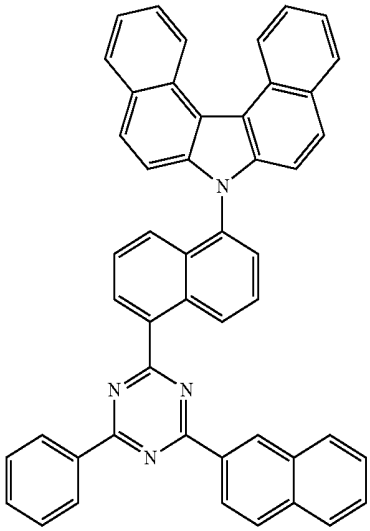

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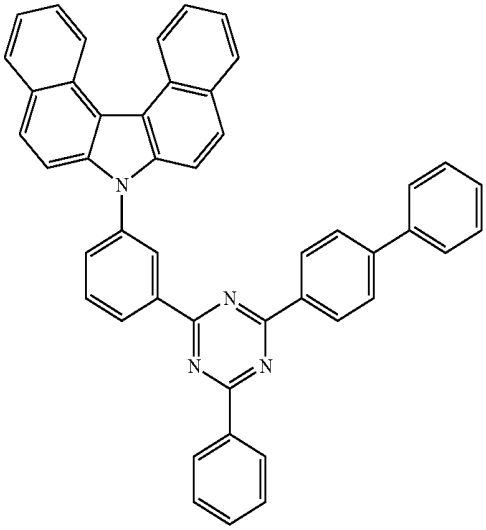

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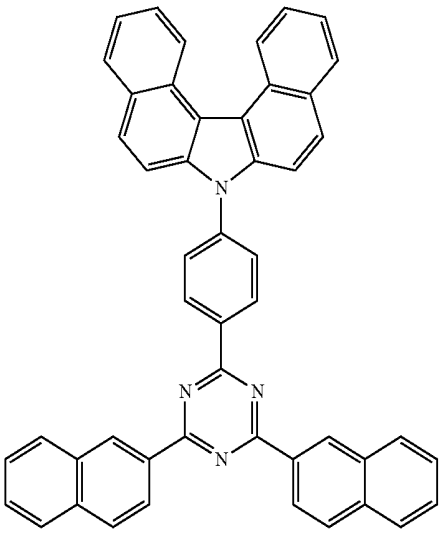

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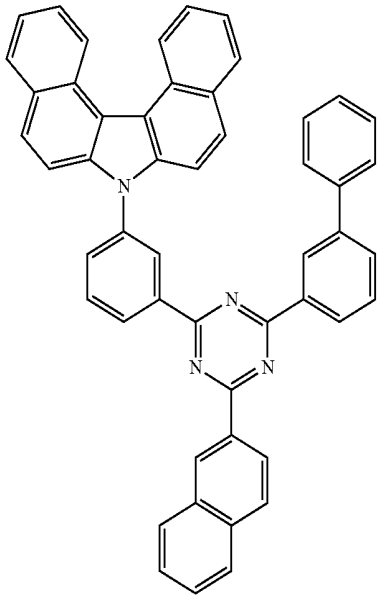

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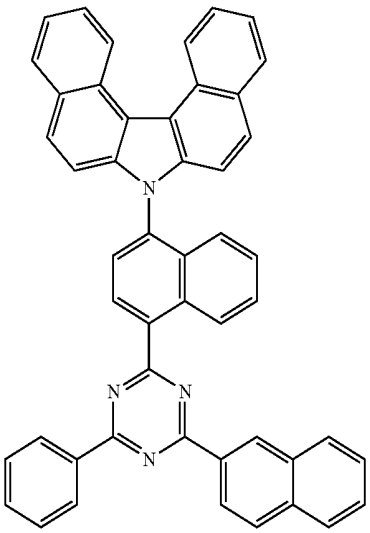

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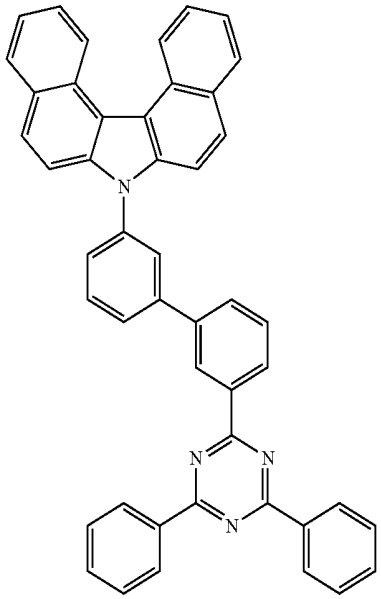

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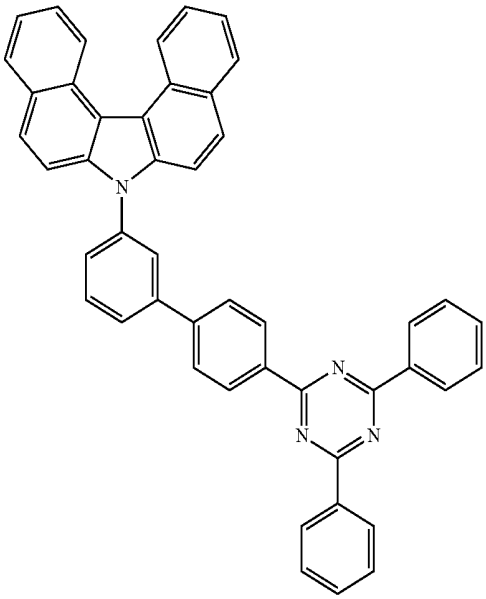

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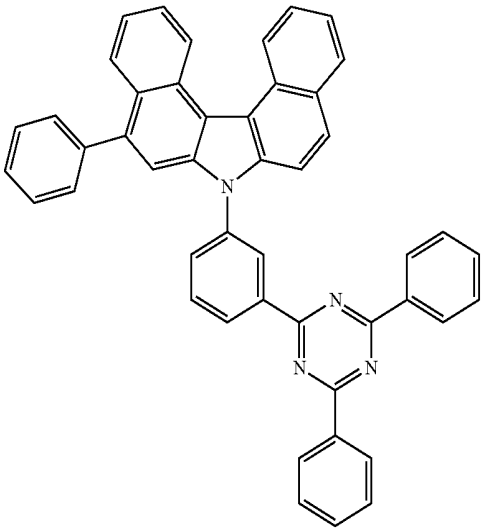

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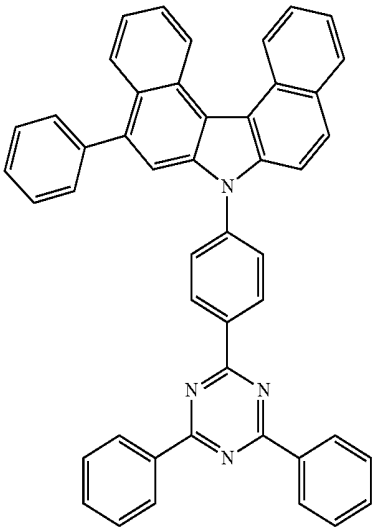

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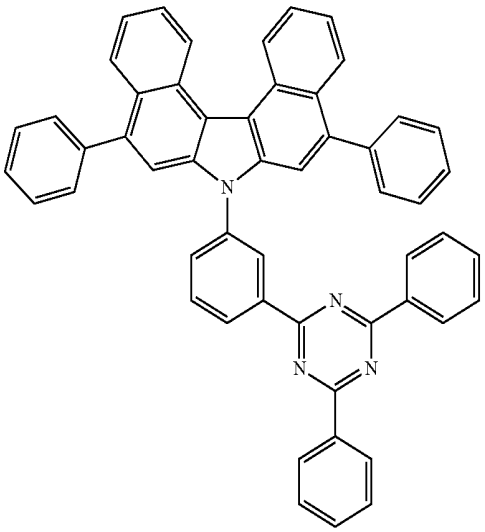

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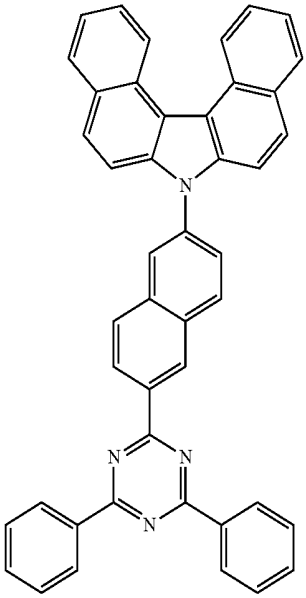

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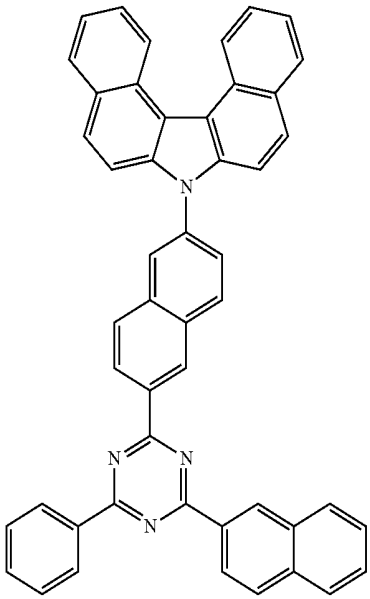

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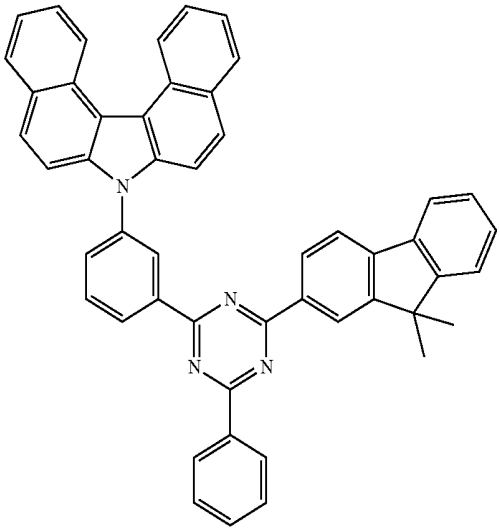

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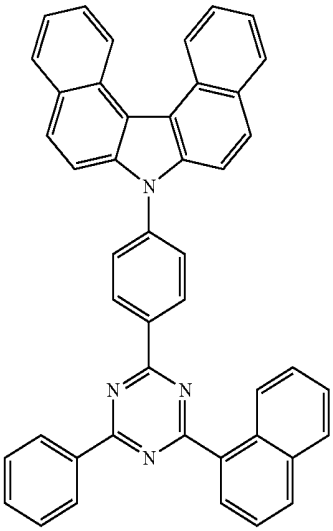

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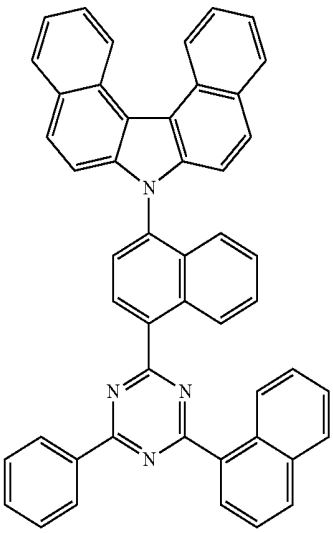

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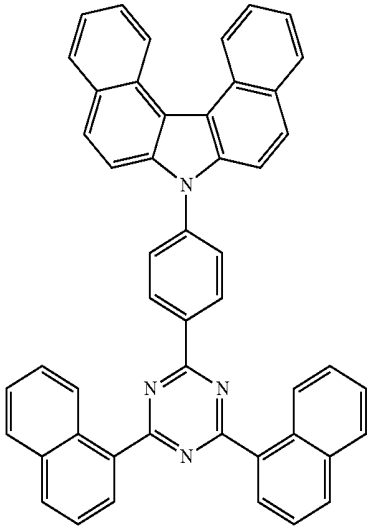
C-27



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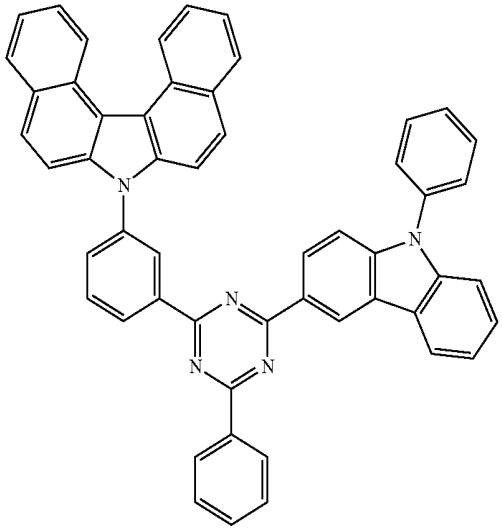

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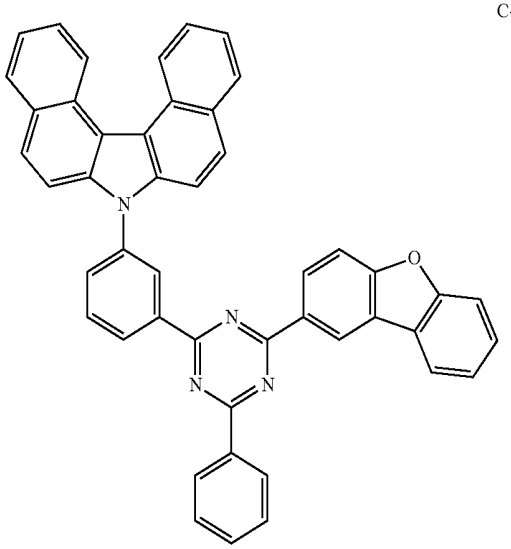

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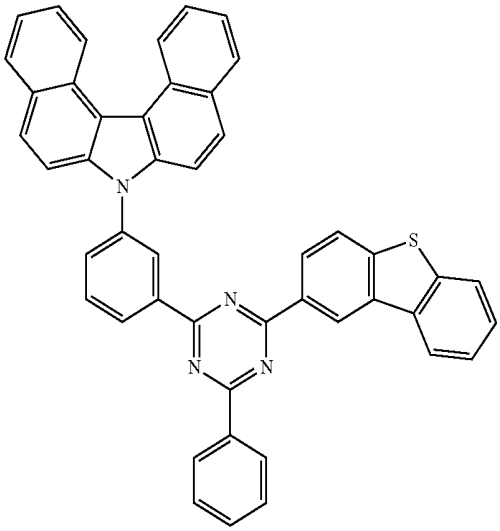

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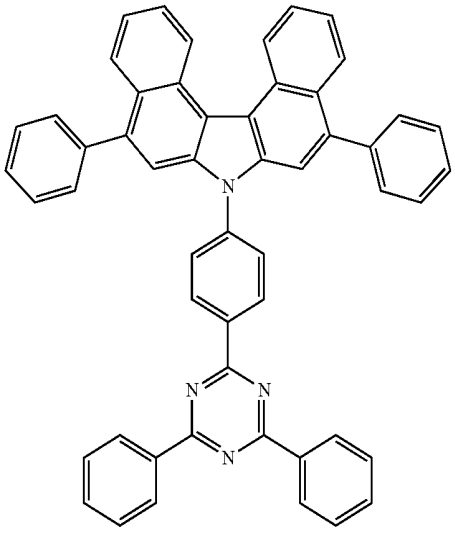

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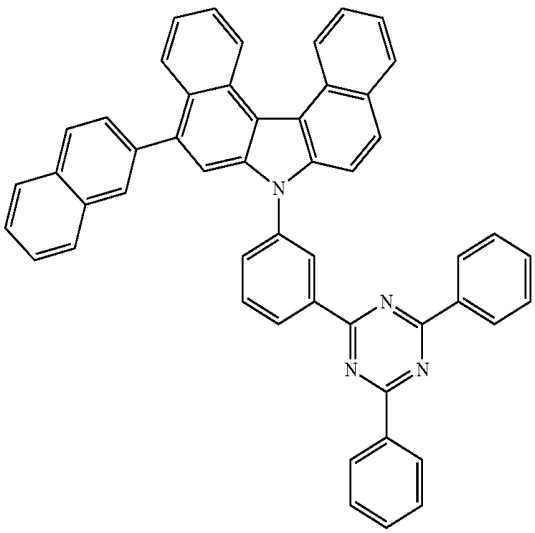

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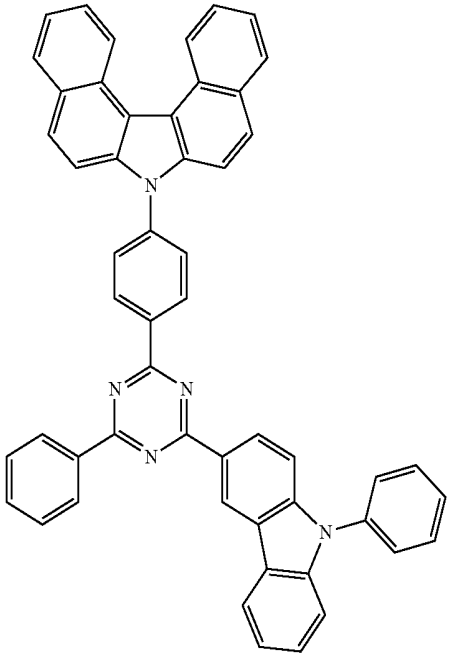

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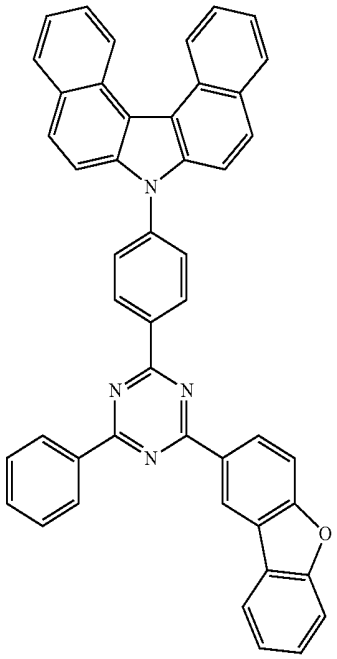

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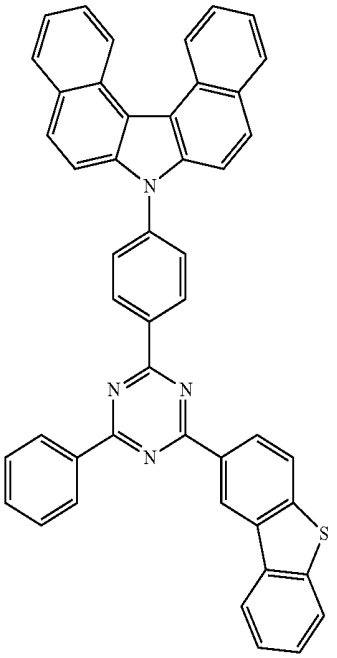

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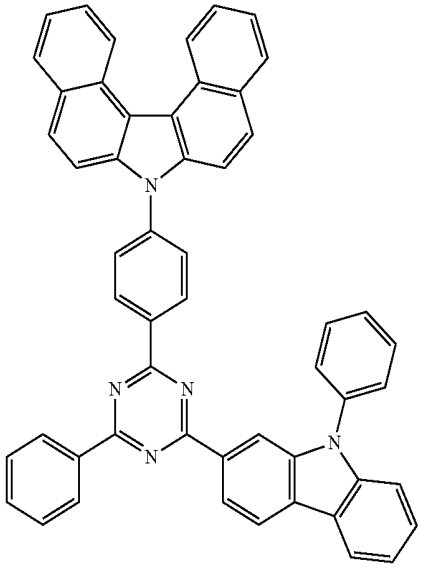

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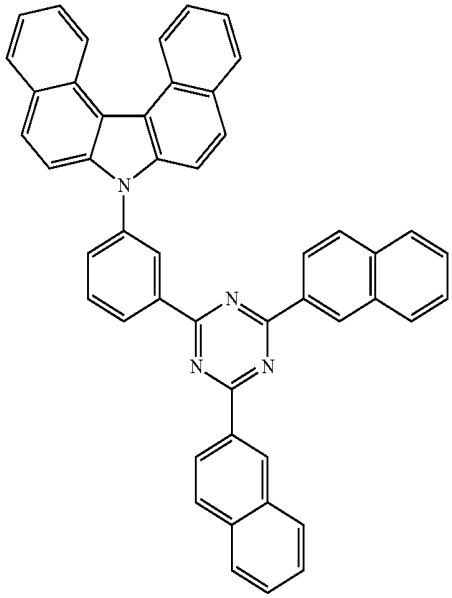

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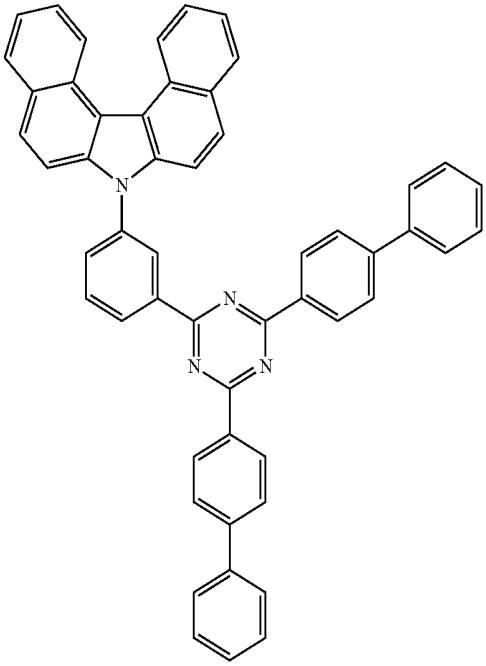

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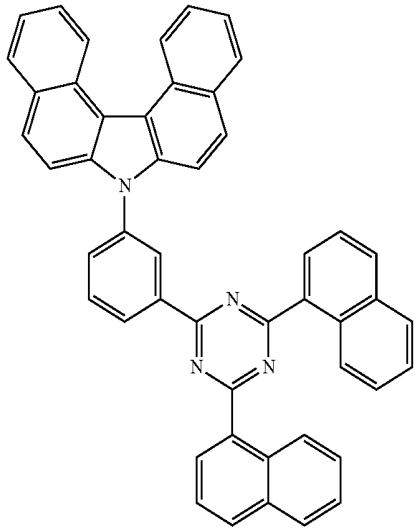

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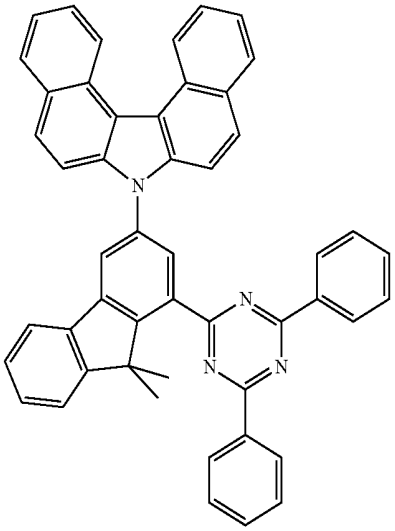

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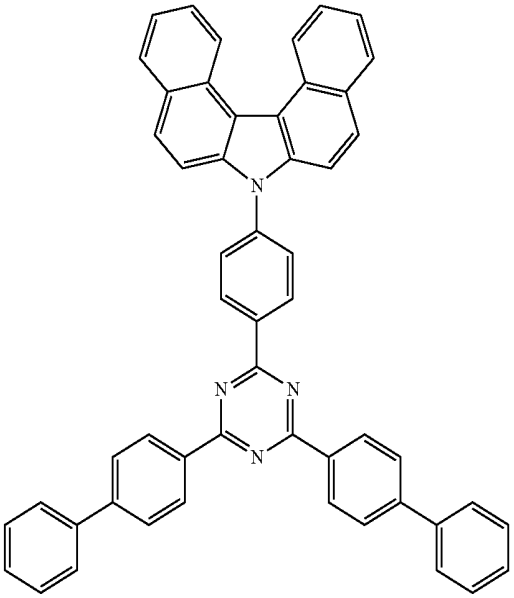

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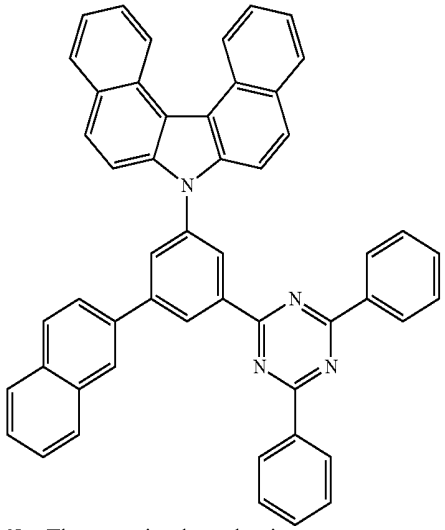
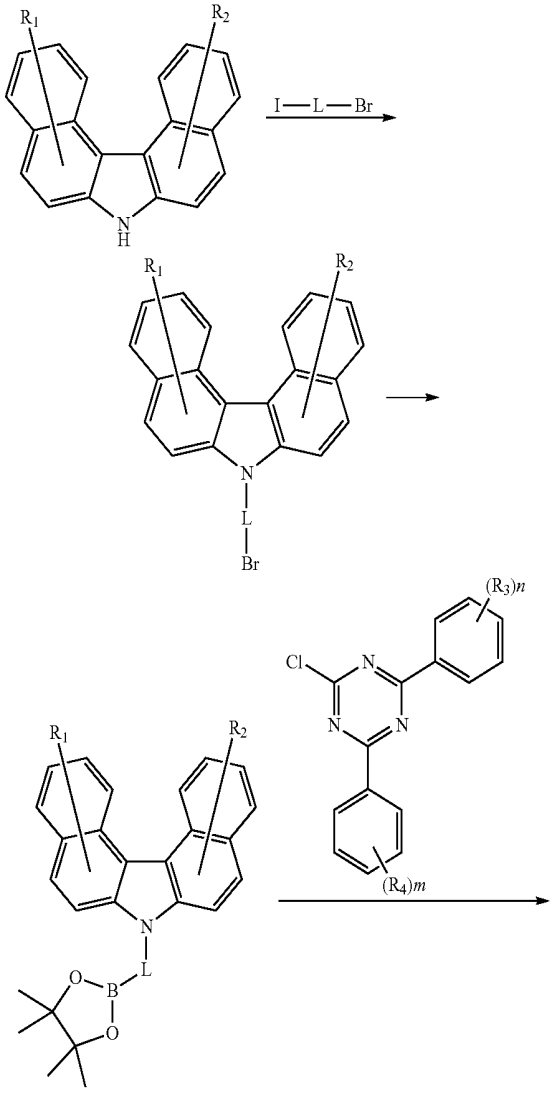
C-42



[0023] The organic electroluminescent compound of the present invention can be prepared by a synthetic method known to a person skilled in the art. For example, it can be prepared according to the following reaction scheme.

[Reaction Scheme 1]



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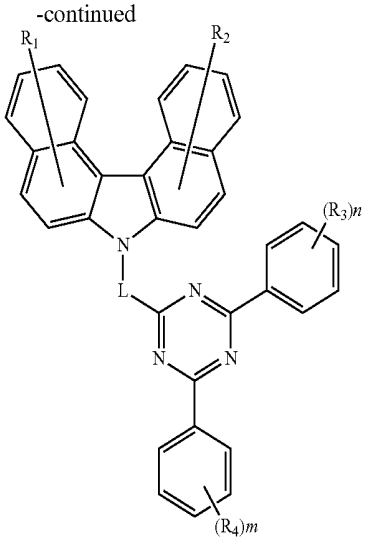


[0024] wherein L, R_1 to R_4, m, and n are as defined in formula 1.

[0025] The present invention provides an organic electroluminescent material comprising the organic electroluminescent compound of formula 1, and an organic electroluminescent device comprising the material.

[0026] The above material can be comprised of the organic electroluminescent compound according to the present invention alone, or can further include conventional materials generally used in organic electroluminescent materials.

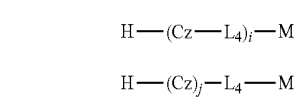
[0027] The organic electroluminescent device comprises a first electrode; a second electrode; and at least one organic layer between the first and second electrodes. The organic layer may comprise at least one organic electroluminescent compound of formula 1.

[0028] One of the first and second electrodes can be an anode, and the other can be a cathode. The organic layer comprises a light-emitting layer, and may further comprise at least one layer selected from the group consisting of a hole injection layer, a hole transport layer, an electron transport layer, an electron buffer layer, an electron injection layer, an interlayer, a hole blocking layer, and an electron blocking layer.

[0029] The organic electroluminescent compound of formula 1 of the present invention can be comprised in the light-emitting layer as a host material, or can be comprised in the electron buffer layer. Preferably, the light-emitting layer may comprise at least one dopant. If necessary, a compound besides the organic electroluminescent compound of formula 1 can be comprised as a second host material.

[0030] Another embodiment of the present invention provides a material for producing an organic electroluminescent device. The material comprises the first host material and the second host material, and the first host material comprises the organic electroluminescent compound of the present invention. Herein, the weight ratio of the first host material to the second host material is in the range of 1:99 to 99:1.

[0031] The second host material can be any of the known phosphorescent hosts. Preferably, the compound may be selected from the group consisting of the compounds of formulae 2 to 6 below.

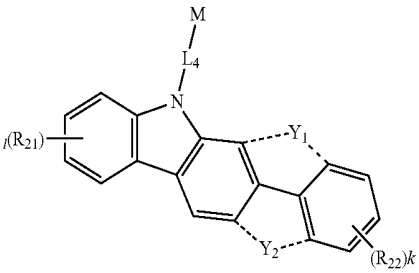


(2)

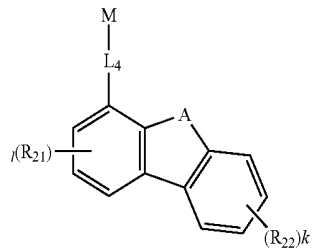
(3)

(4)

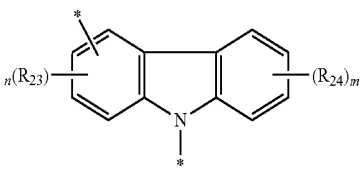
(5)



(6)



[0032] wherein Cz represents the following structure;



[0033] A represents —O— or —S—;

[0034] R_{21} to R_{24} each independently represent hydrogen, deuterium, a halogen, a substituted or unsubstituted (C1-C30)alkyl, a substituted of unsubstituted (C6-C30)aryl, a substituted or unsubstituted 5- to 30-membered heteroaryl, or —$SiR_{25}R_{26}R_{27}$, R_{25} to R_{27} each independently represent a substituted or unsubstituted (C1-C30)alkyl, or a substituted or unsubstituted (C6-C30)aryl;

[0035] L_4 represents a single bond, a substituted or unsubstituted (C6-C30)arylene, or a substituted or unsubstituted 5- to 30-membered heteroarylene;

[0036] M represents a substituted or unsubstituted (C6-C30)aryl, or a substituted or unsubstituted 5- to 30-membered heteroaryl;

[0037] Y_1 and Y_2 each independently represent —O—, —S—, —N(R_{41})—, or —C(R_{42})(R_{43})—, provided that Y_1 and Y_2 do not simultaneously exist;

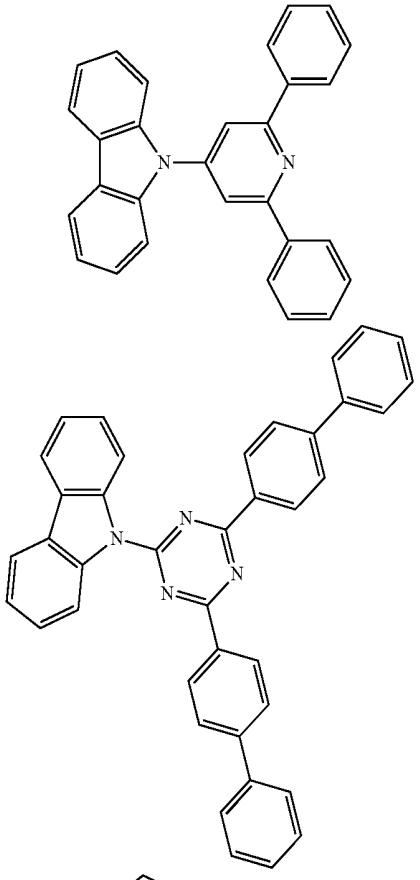
[0038] R_{41} to R_{43} each independently represent a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C6-C30)aryl, or a substituted or unsubstituted 5- to 30-membered heteroaryl, and R_{42} and R_{43} may be the same or different;

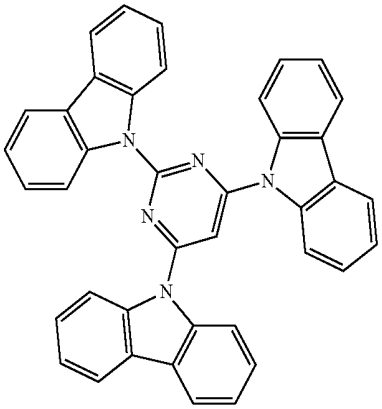
[0039] i and j each independently represent an integer of 1 to 3;

[0040] k, l, m, and n each independently represent an integer of 0 to 4; and

[0041] where i, j, k, l, m, or n 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.

[0042] Specifically, preferable examples of the second host material are as follows:





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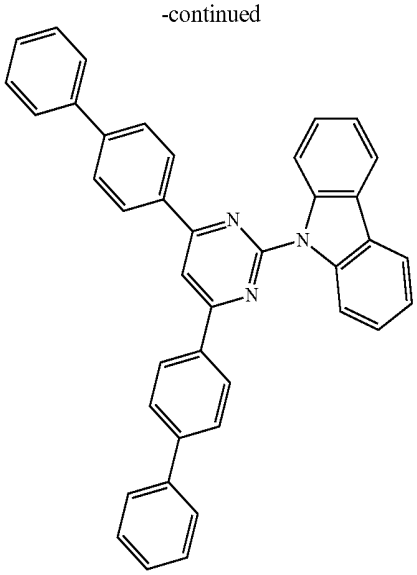

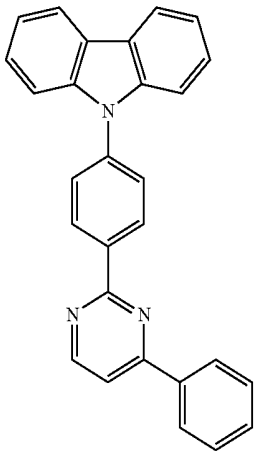

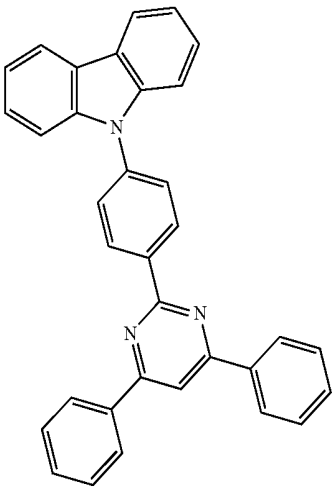

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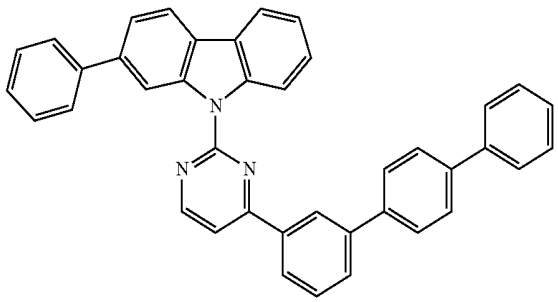

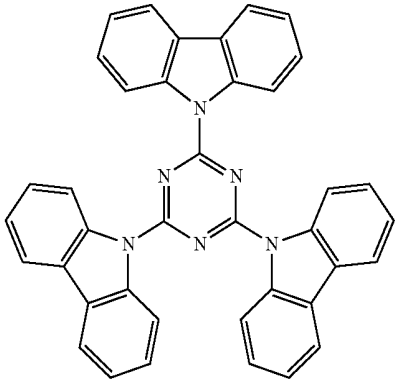

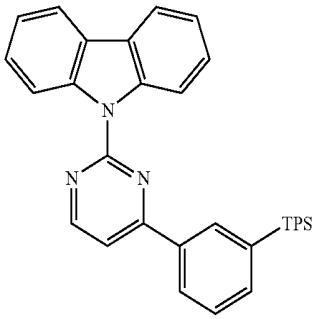

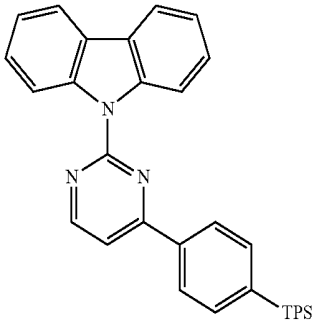

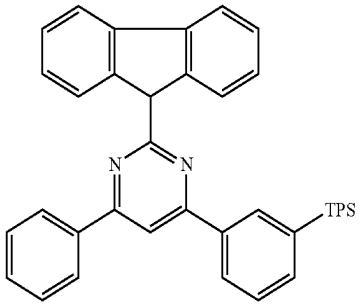

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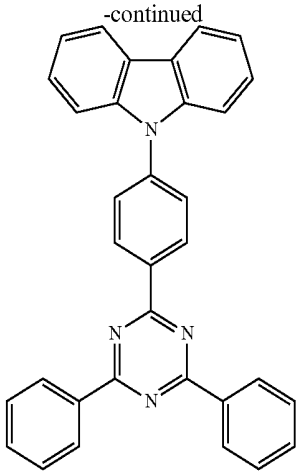

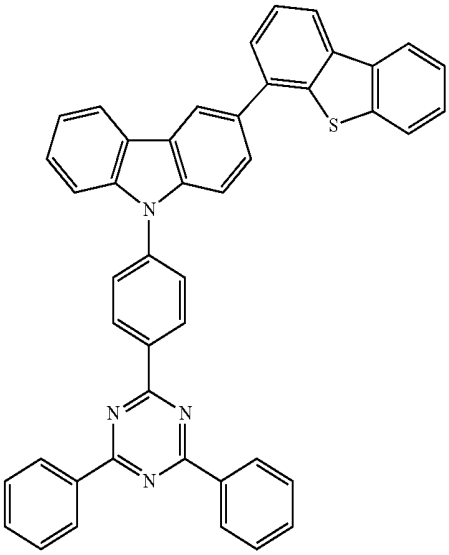

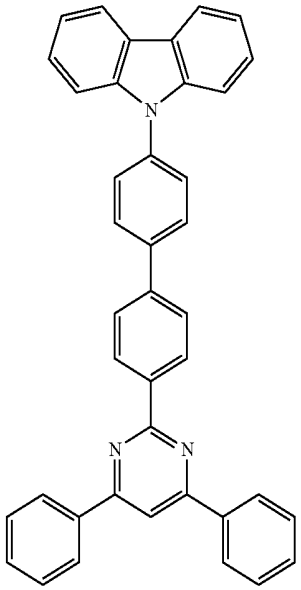

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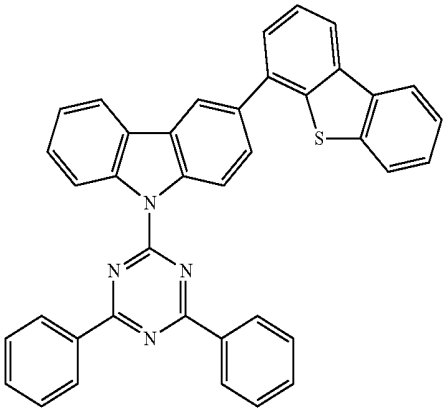

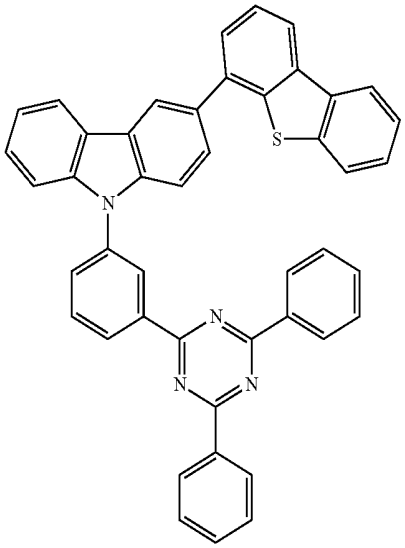

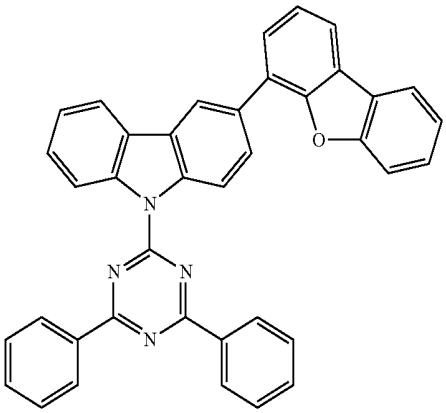

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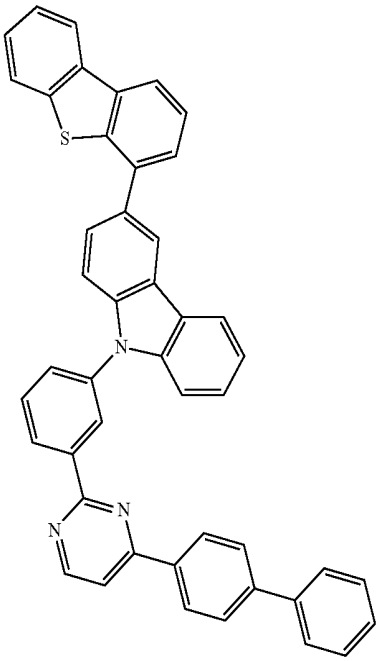

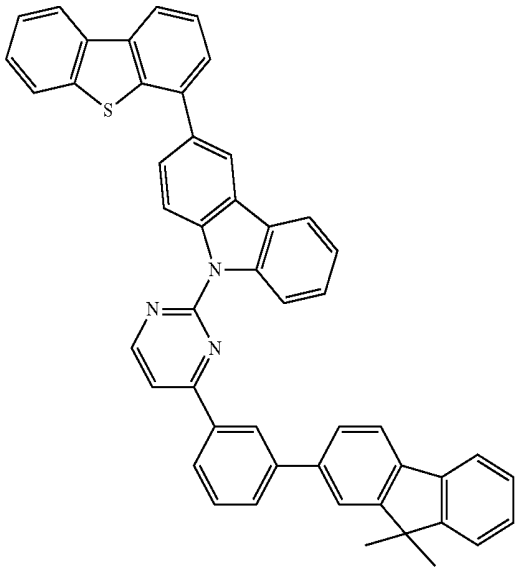

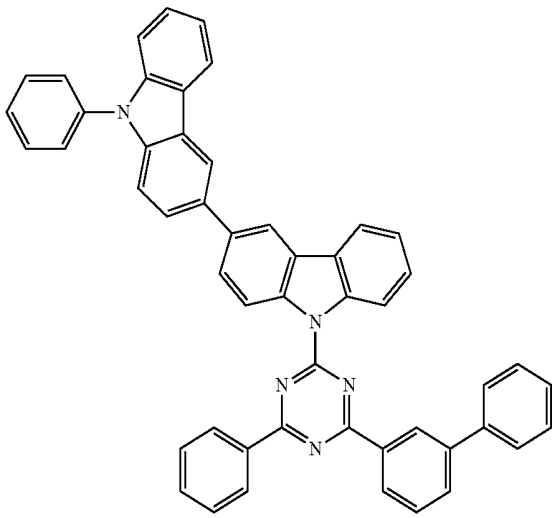

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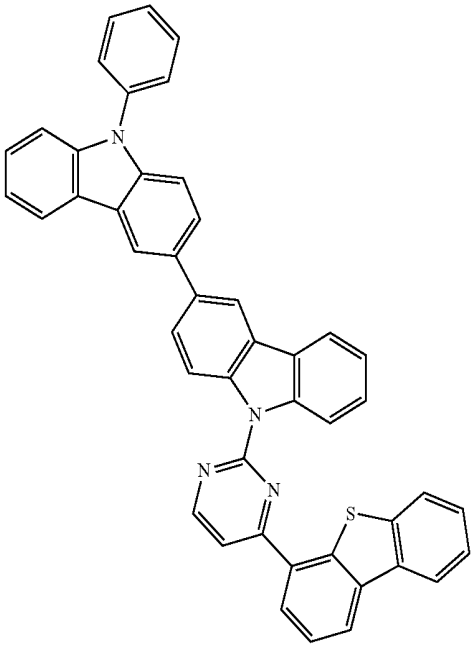

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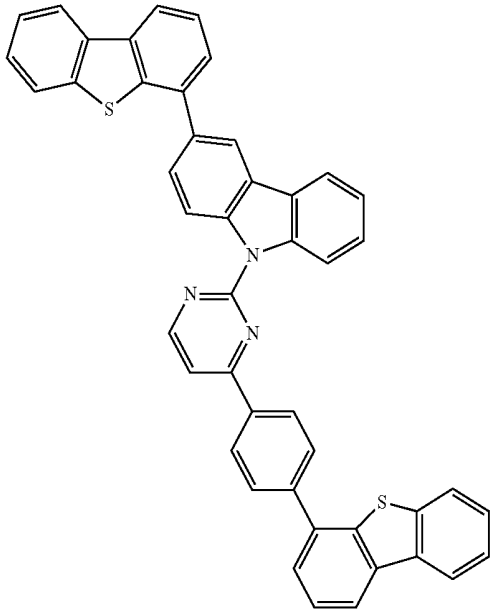

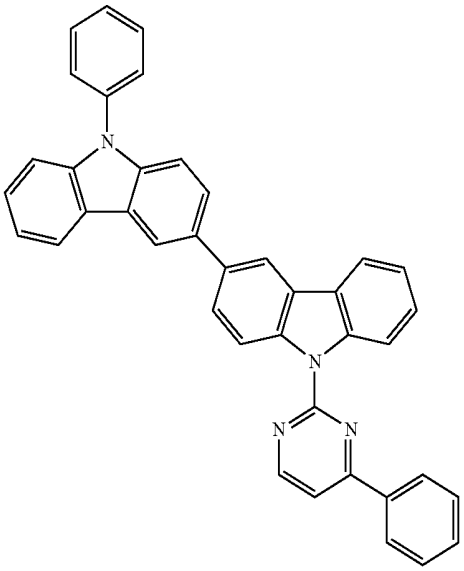

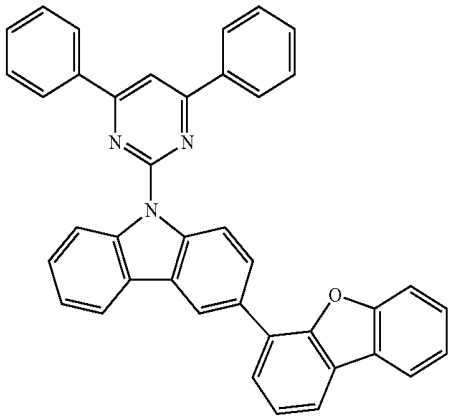

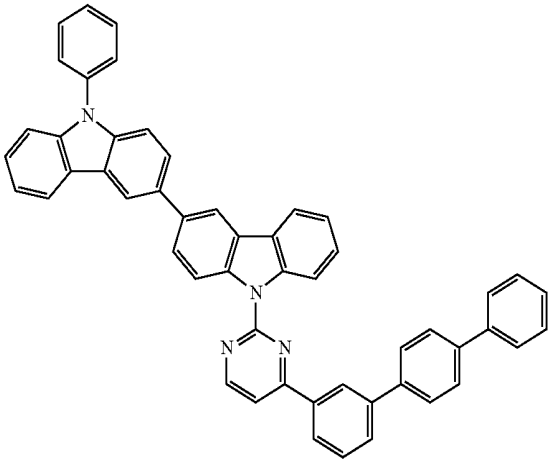

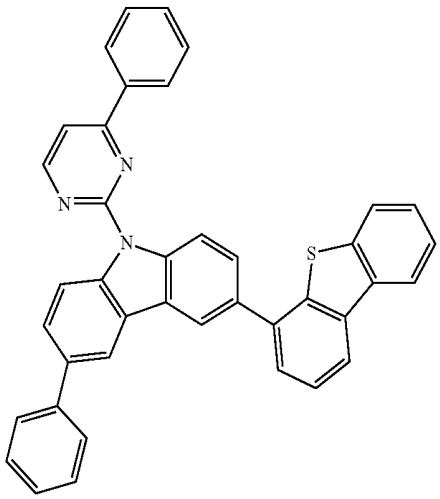

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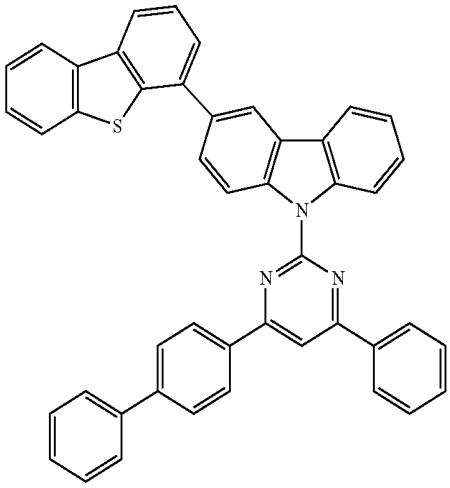

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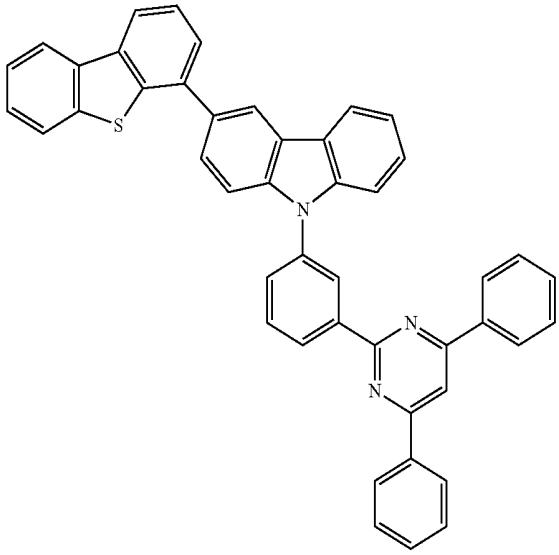

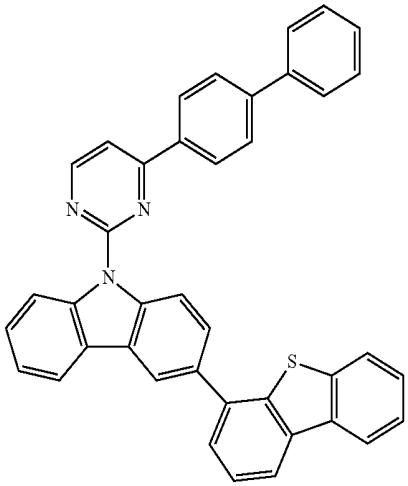

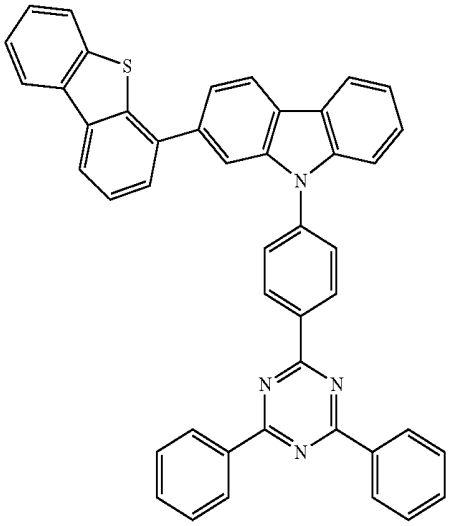

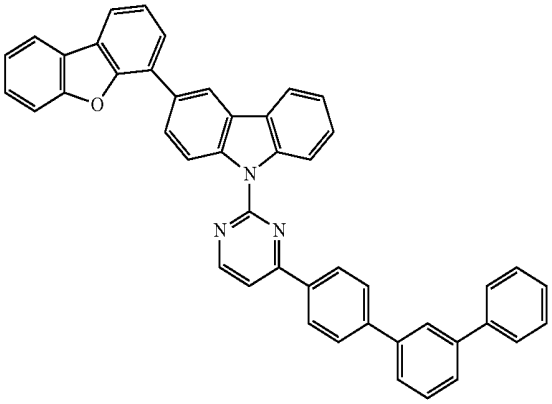

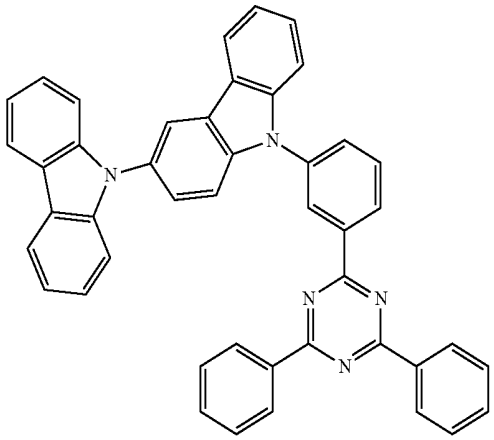

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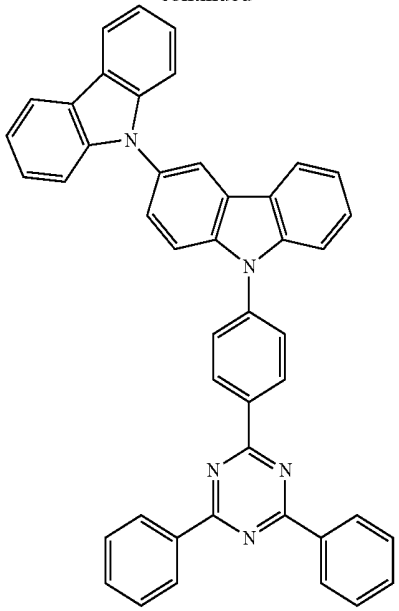

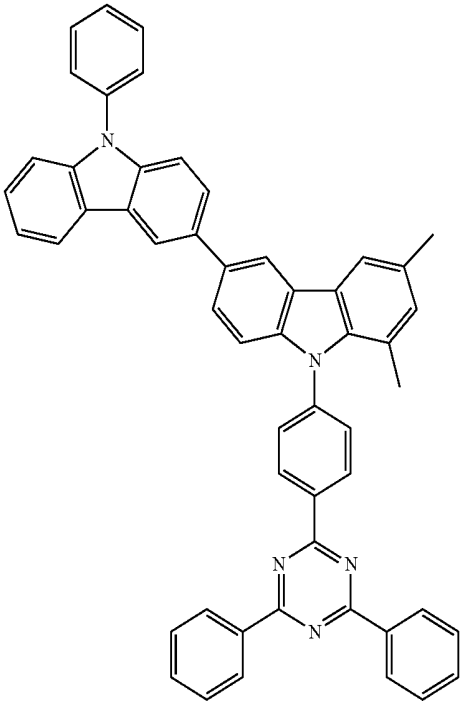

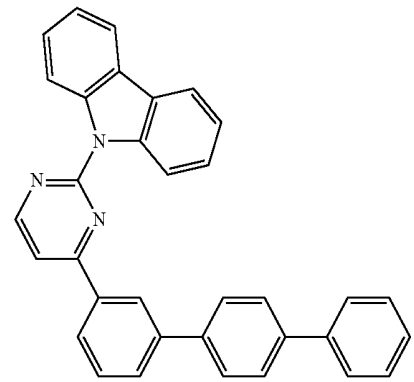

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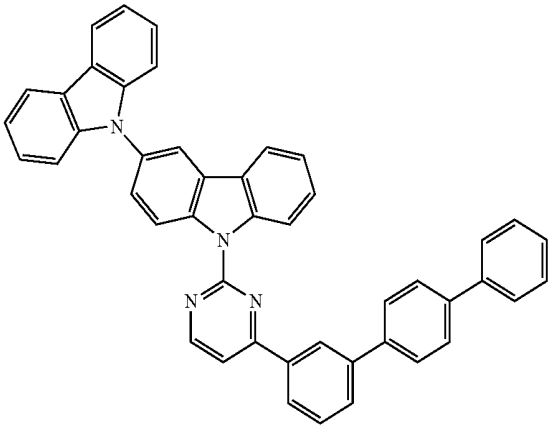

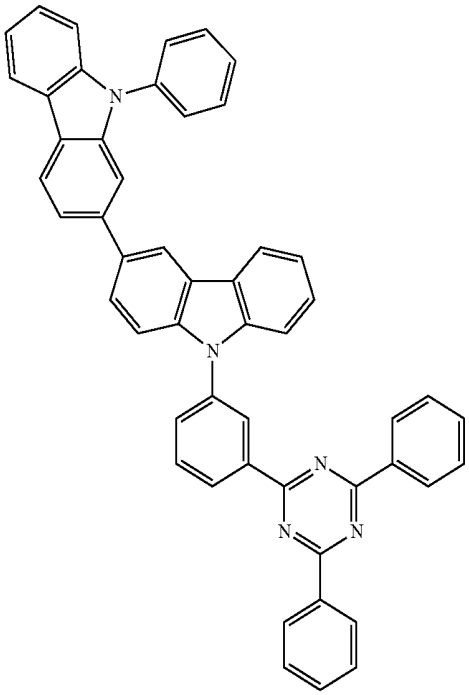

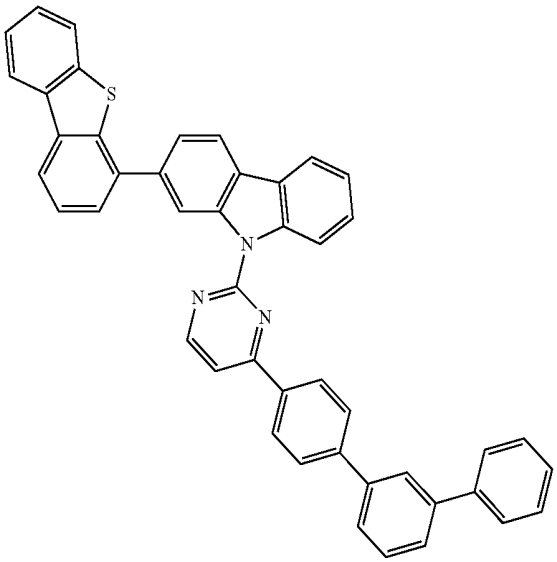

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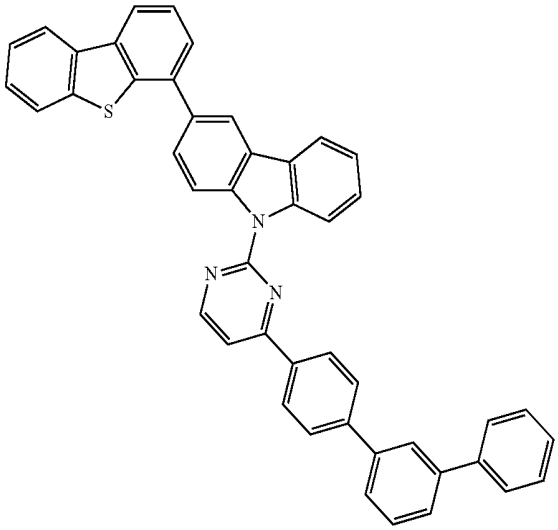

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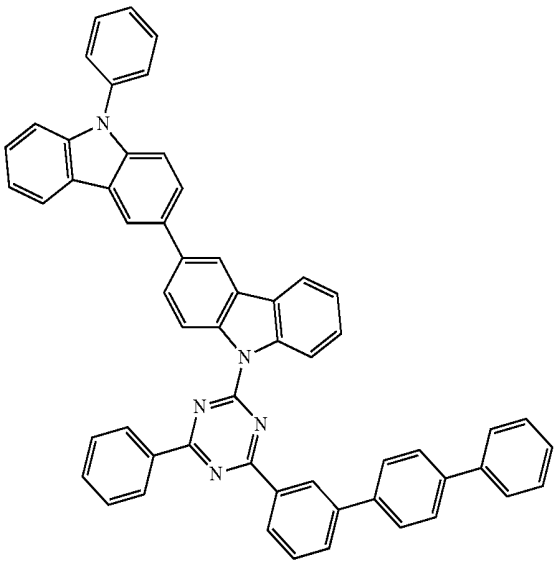

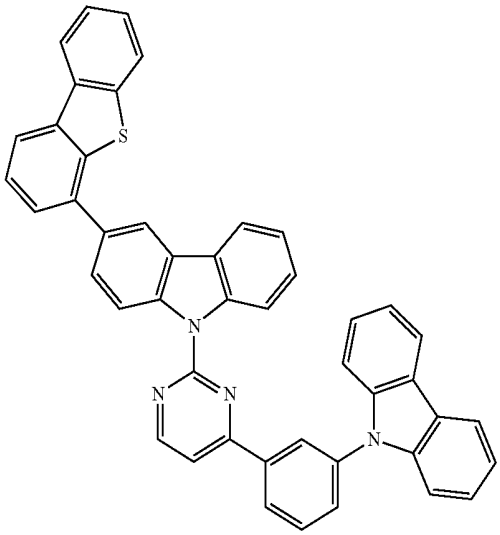

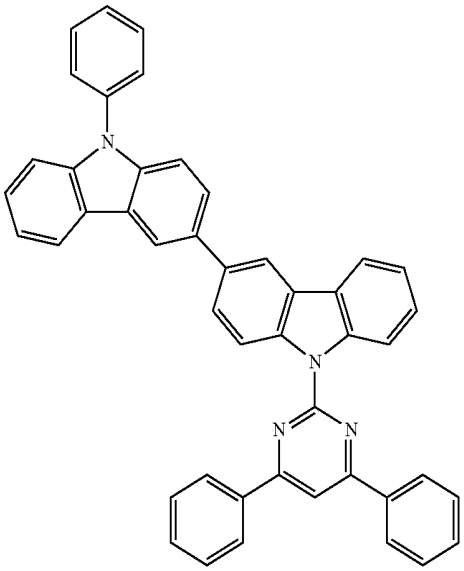

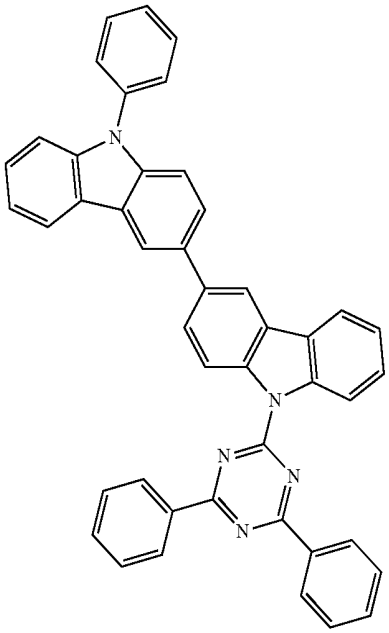

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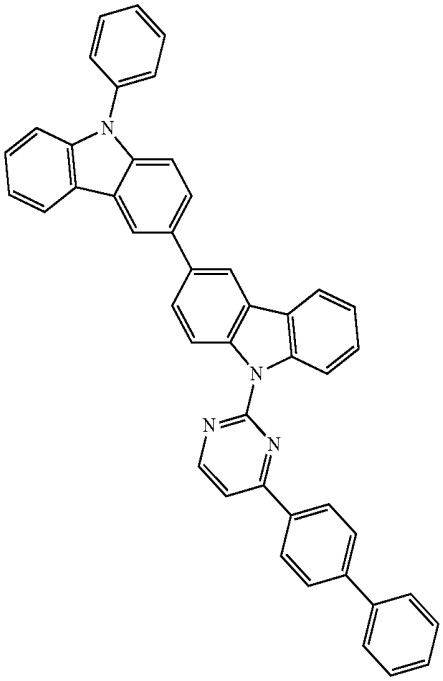

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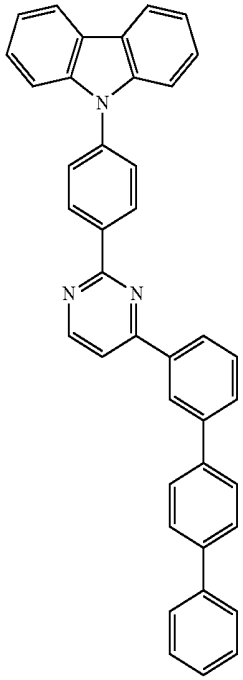

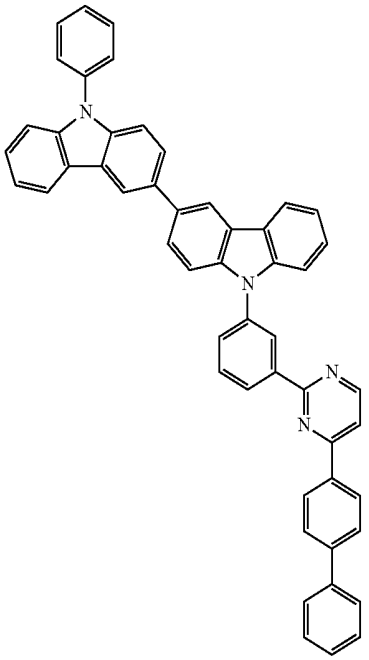

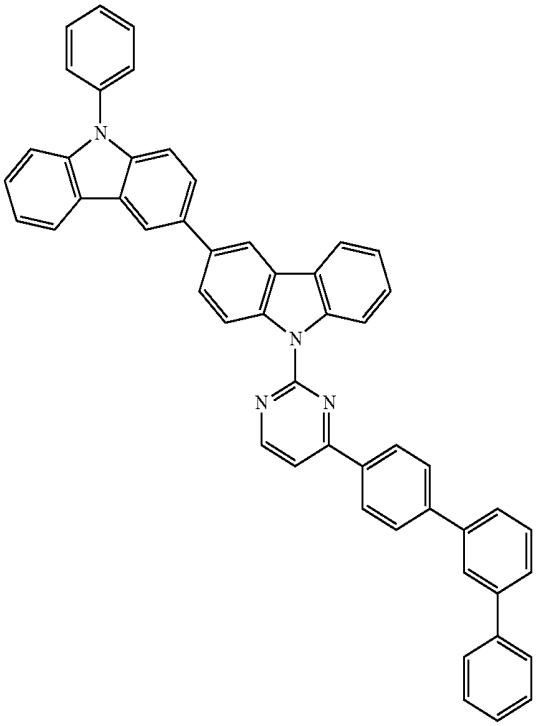

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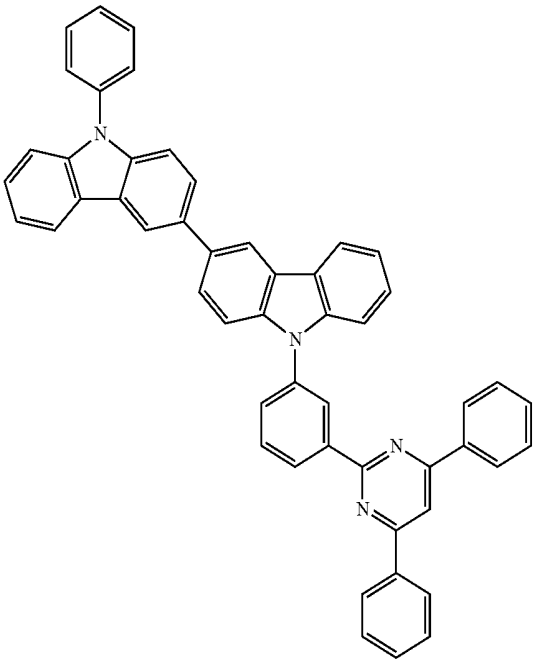

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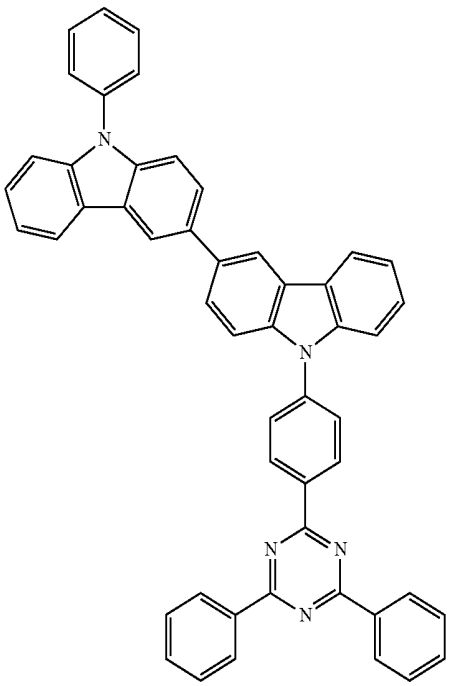

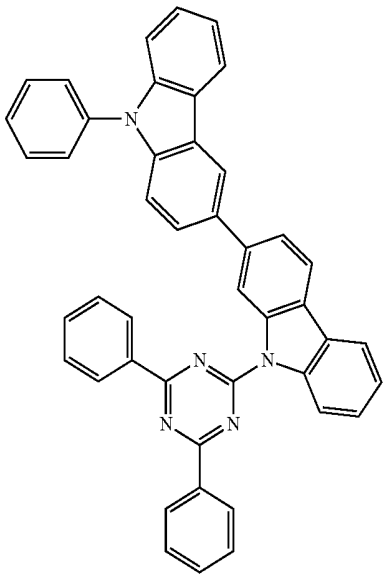

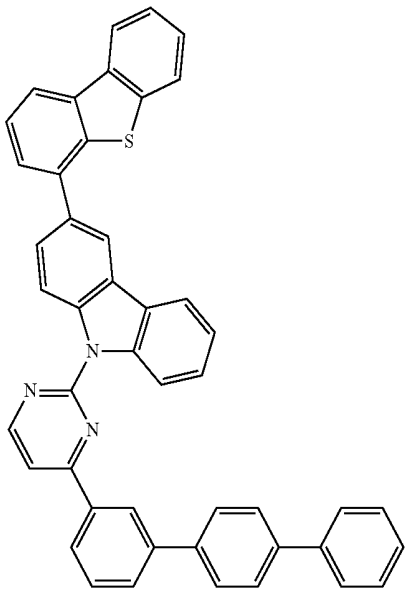

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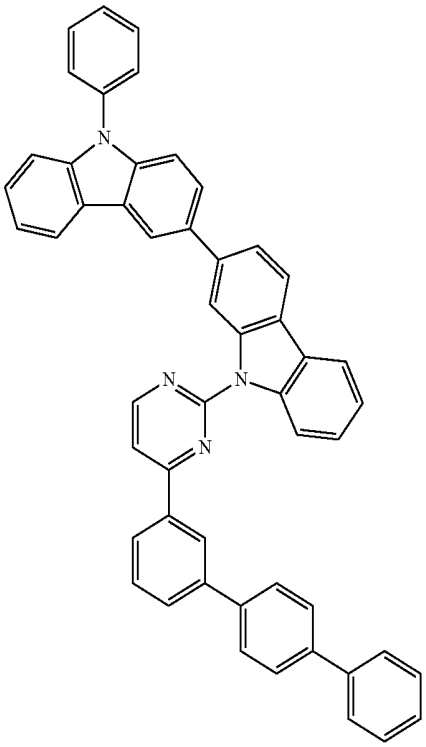

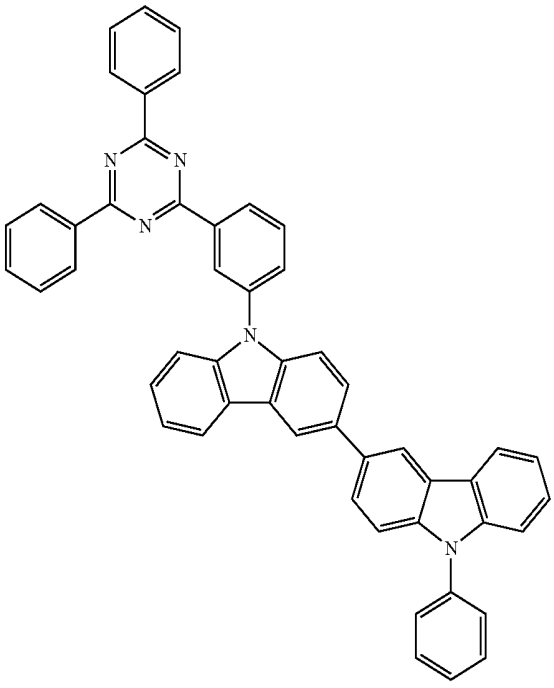

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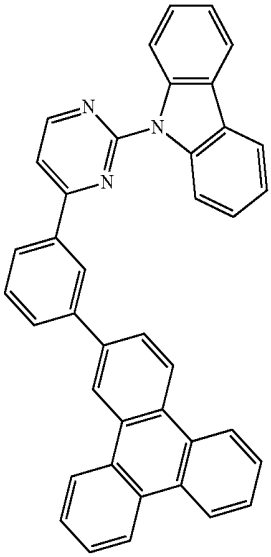

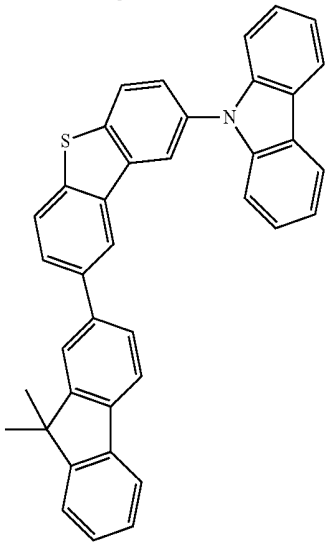

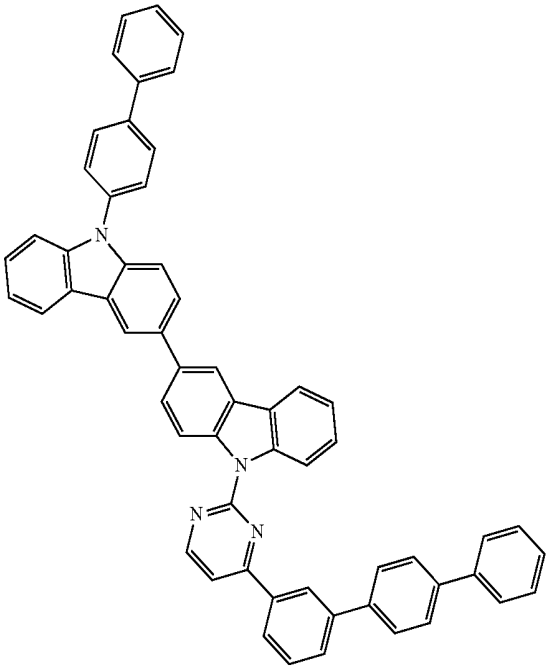

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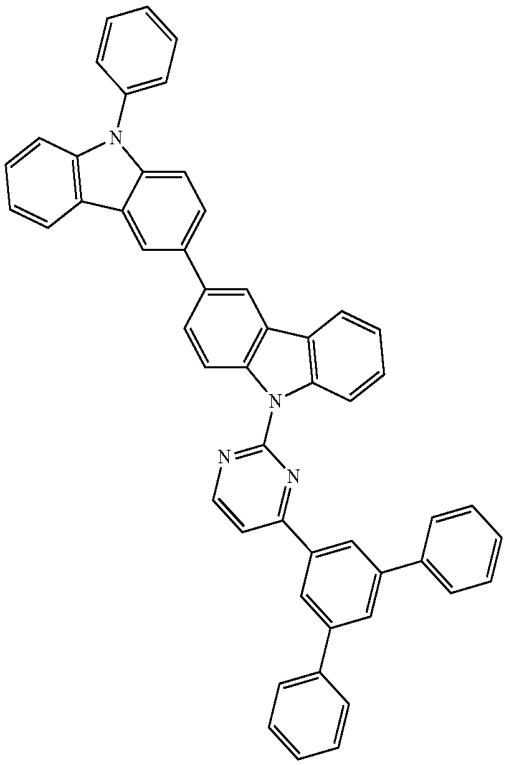

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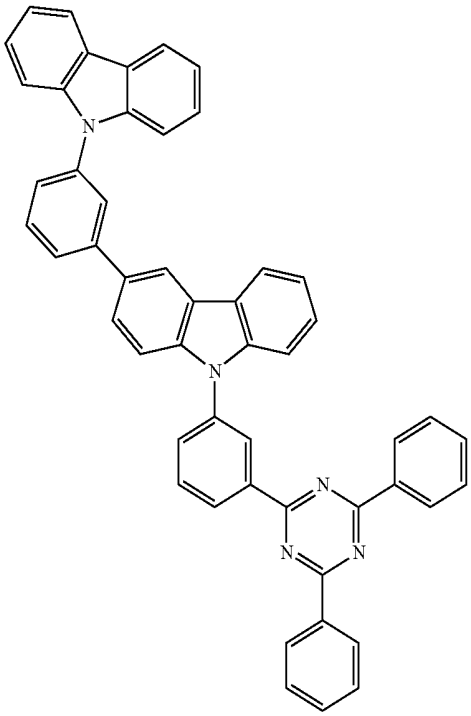

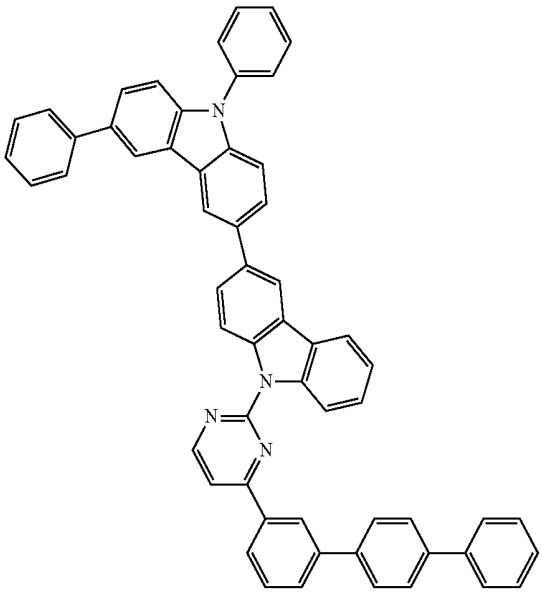

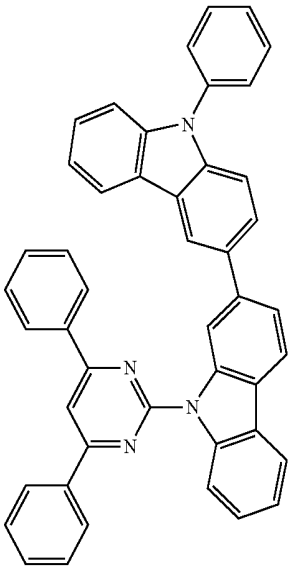

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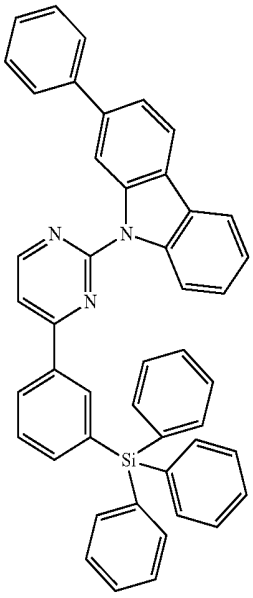

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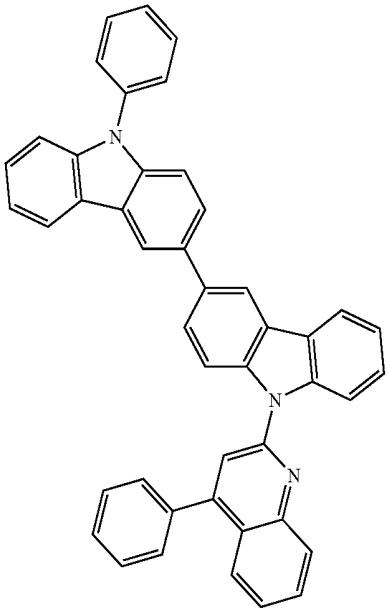

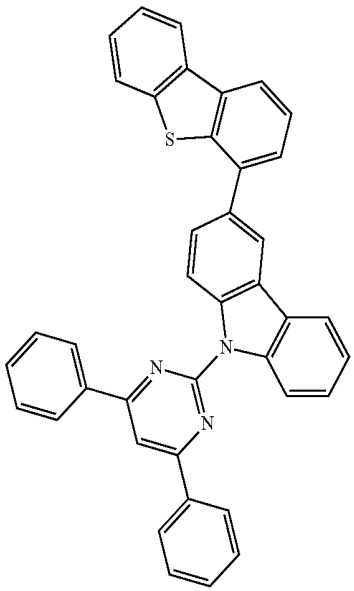

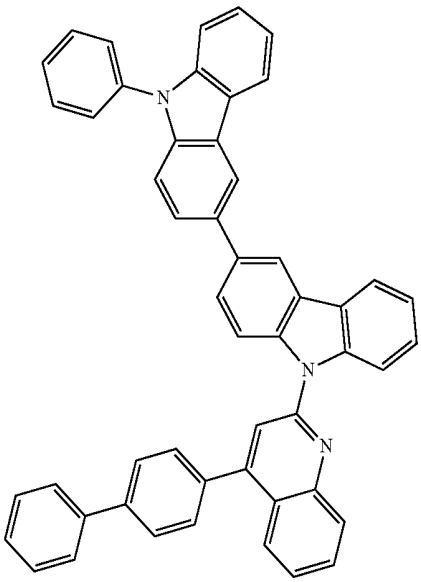

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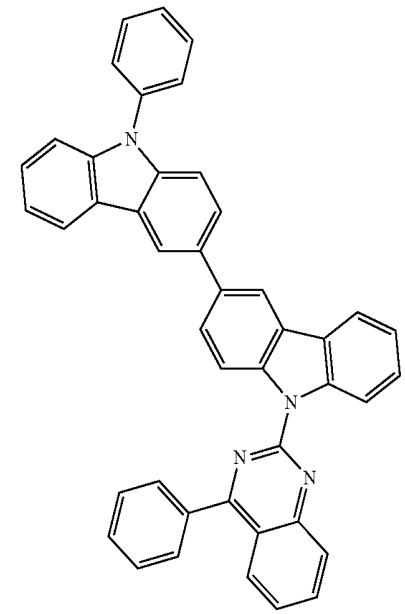

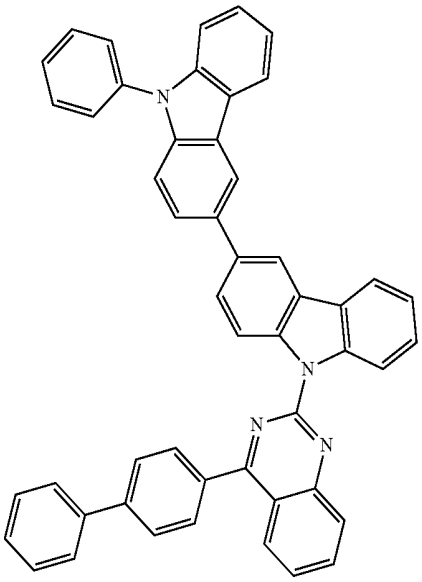

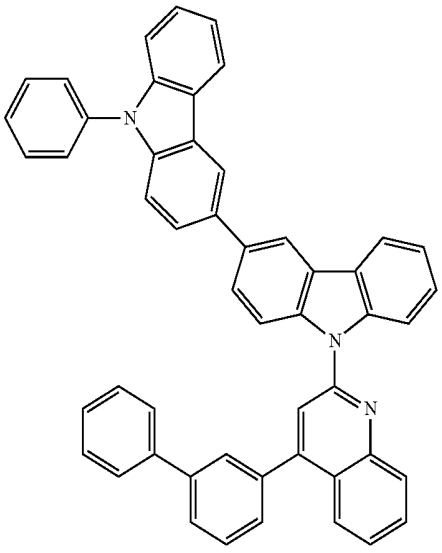

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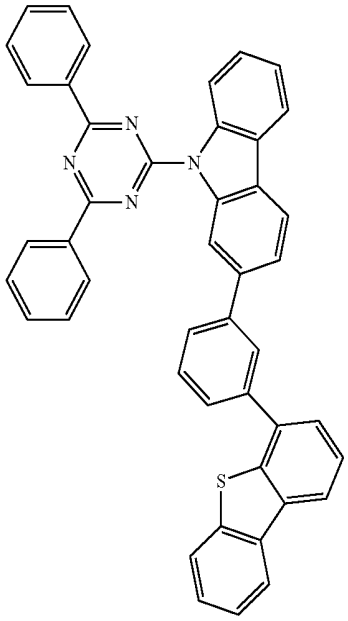

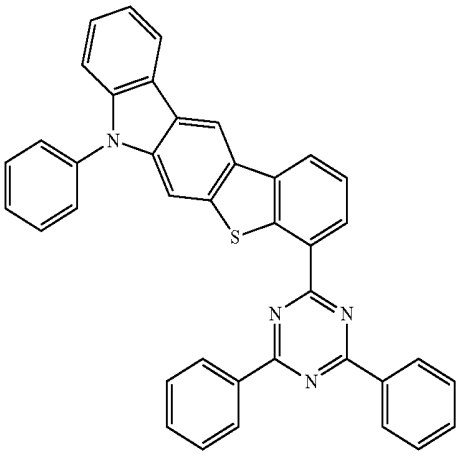

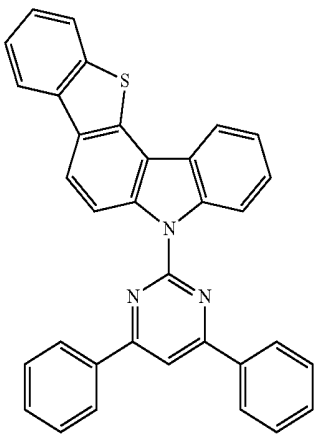

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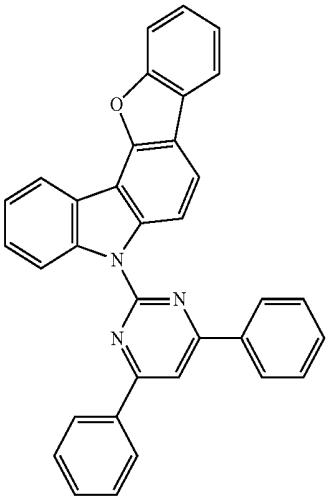

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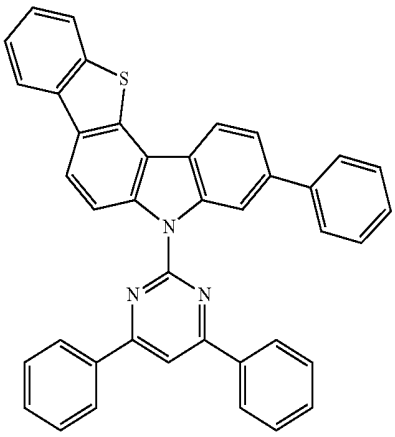

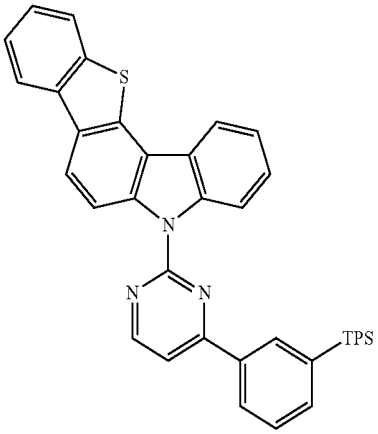

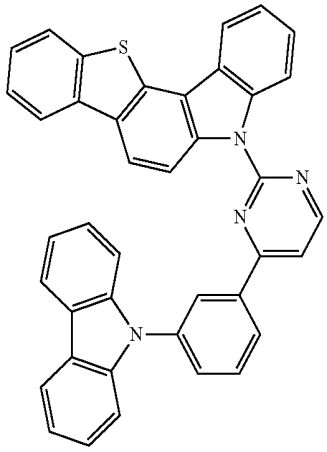

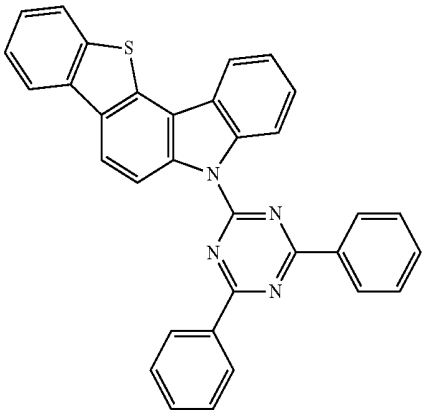

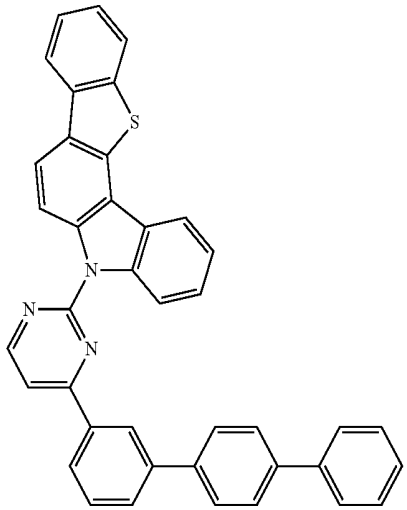

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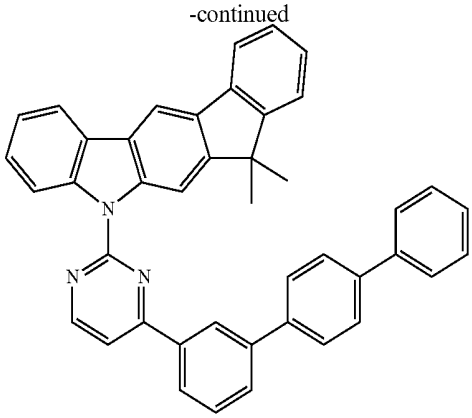

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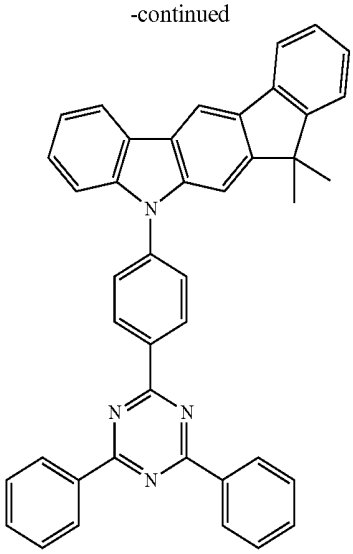

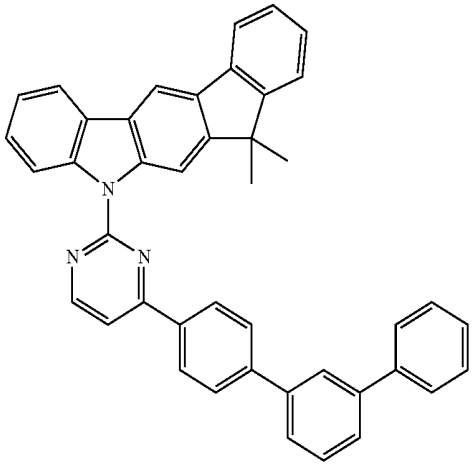

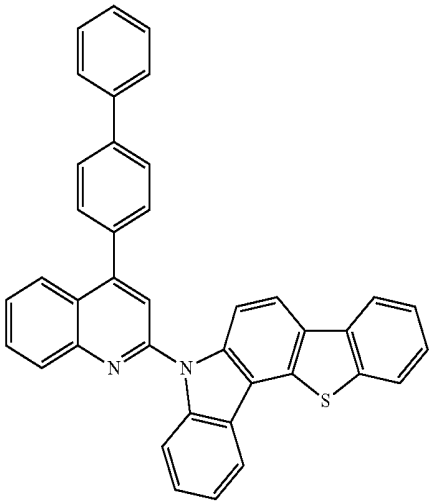

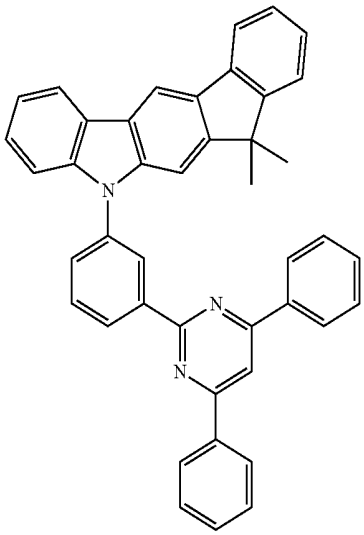

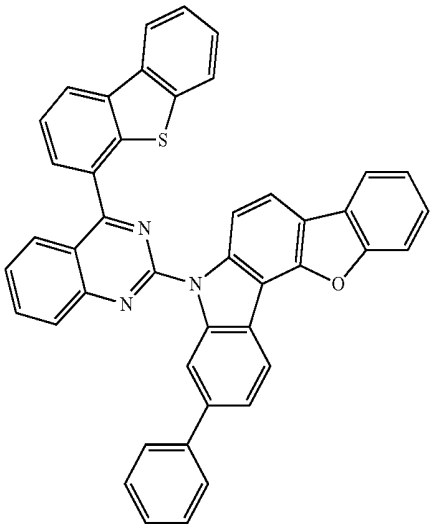

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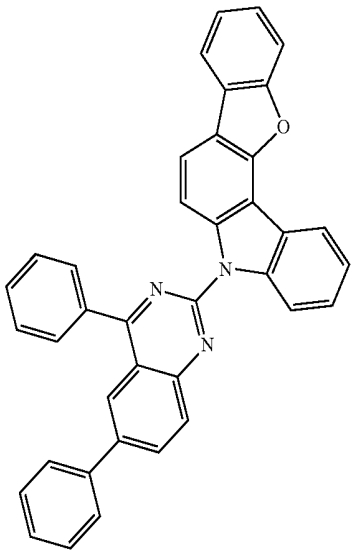

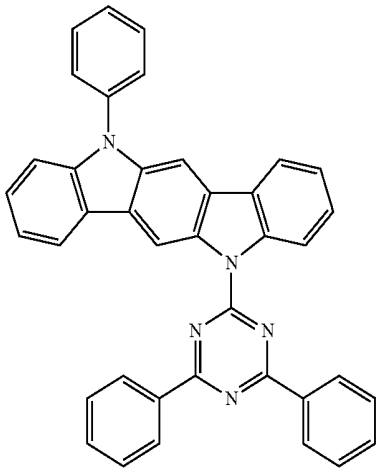

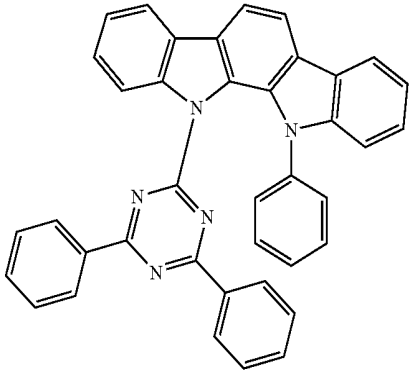

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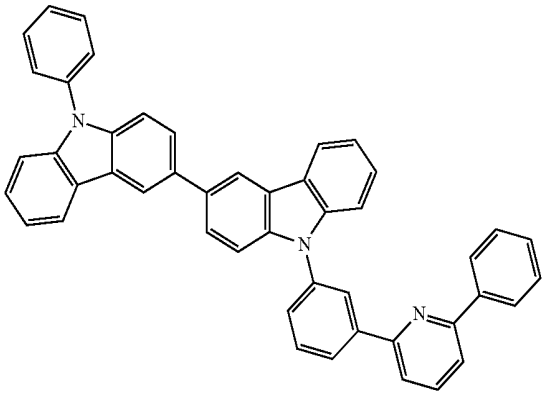

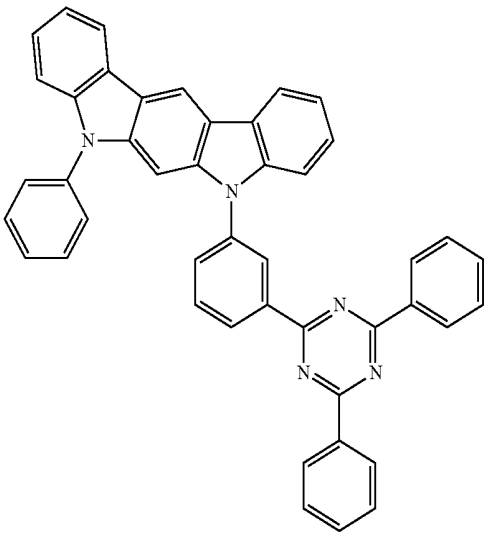

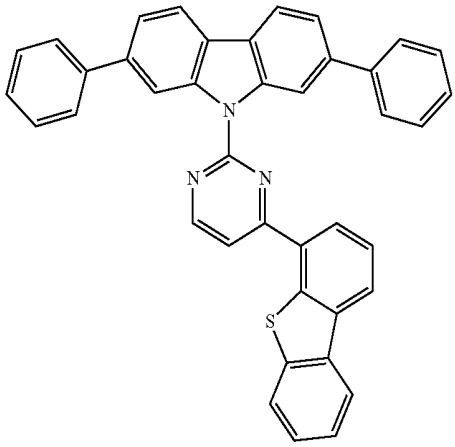

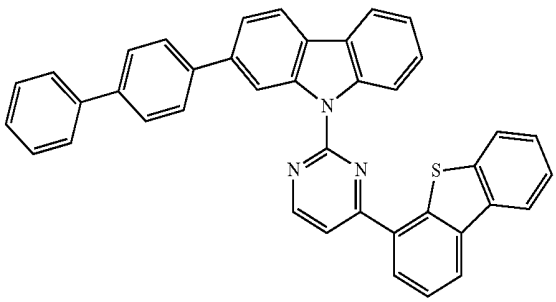

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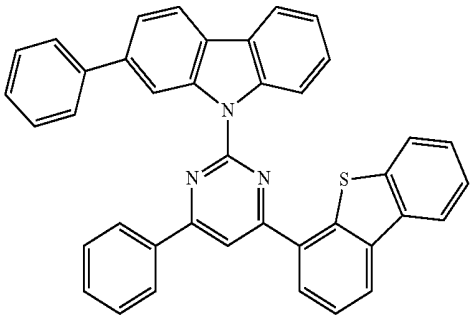

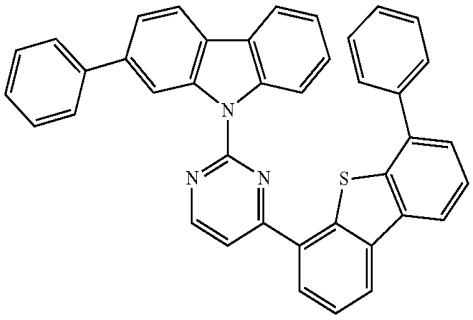

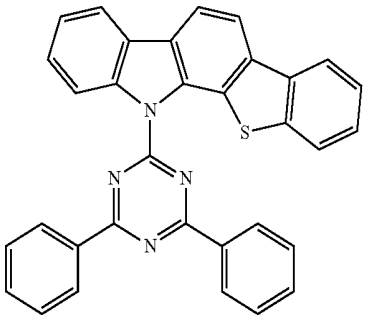

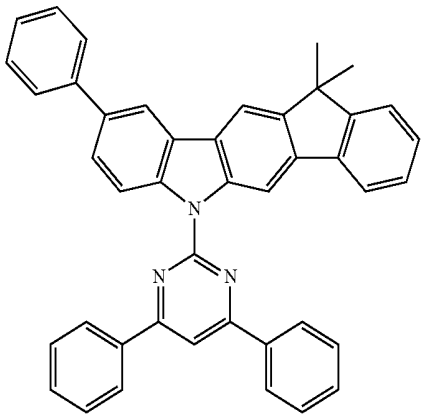

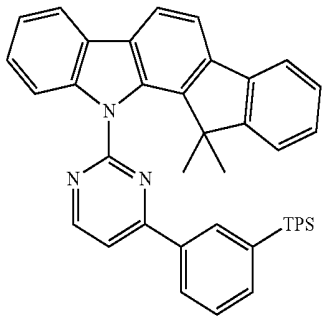

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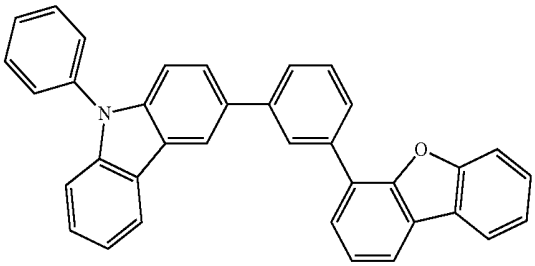

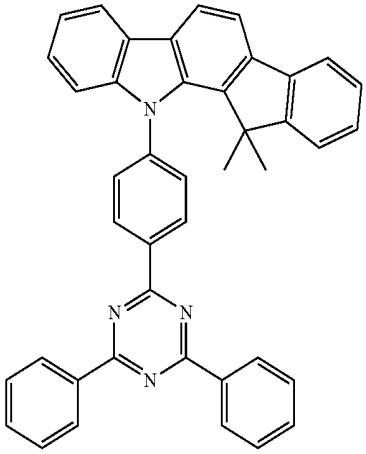

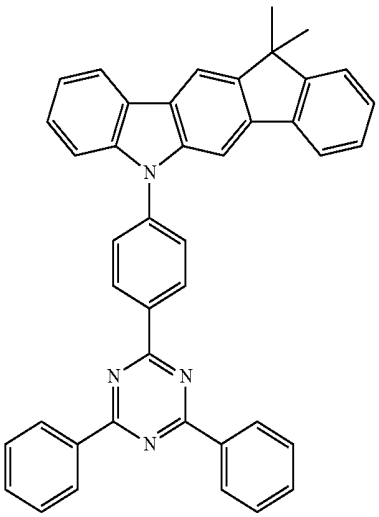

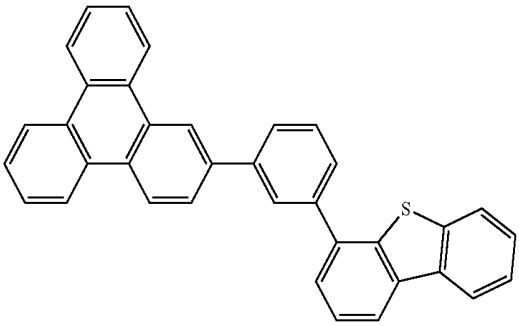

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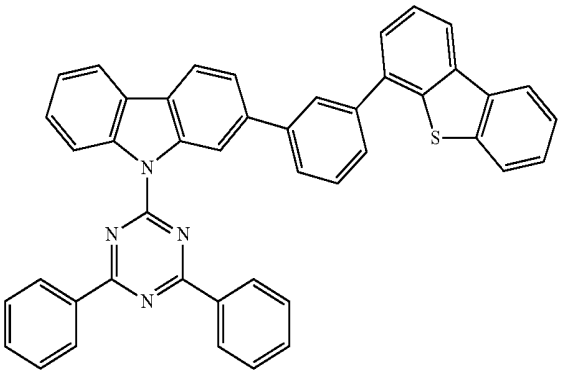

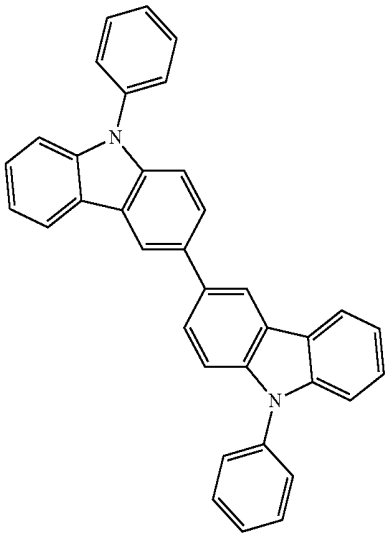

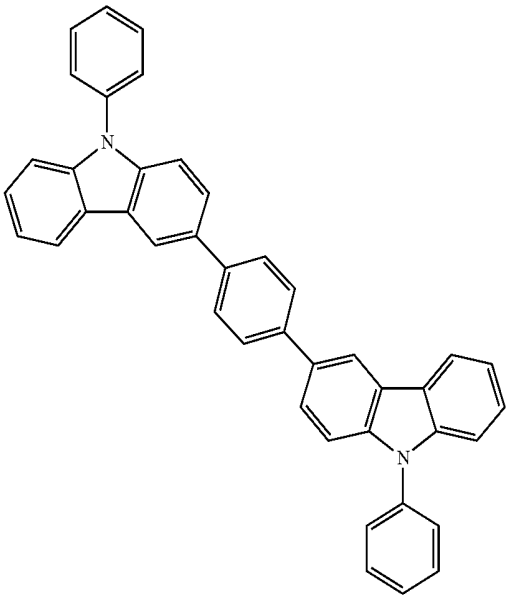

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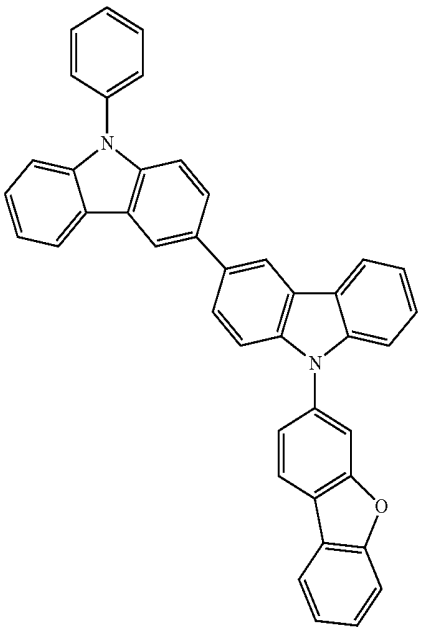

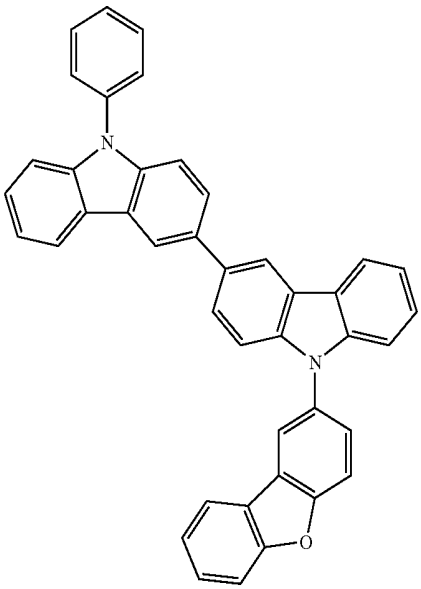

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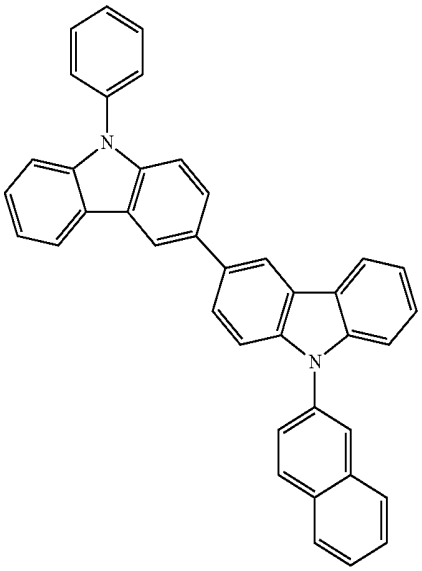

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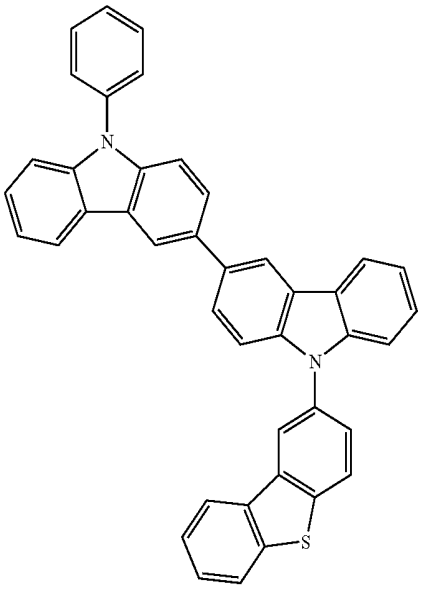
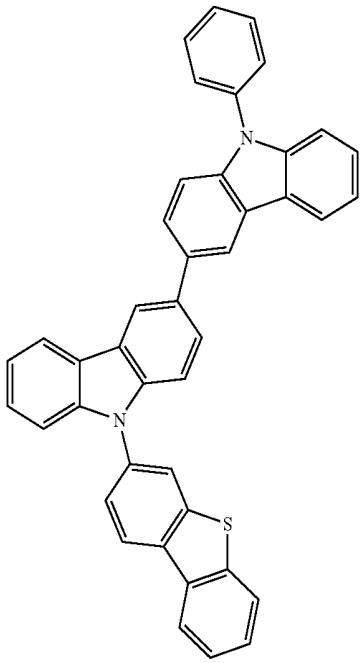


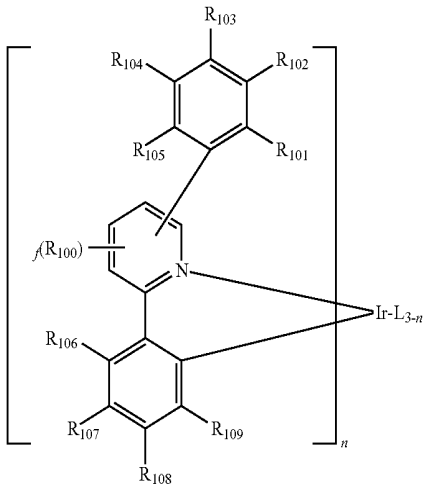


[0043] [wherein TPS represents a triphenylsilyl group]

[0044] The dopant used in the present invention is preferably at least one phosphorescent dopant. The dopant materials applied to the organic electroluminescent device according to the present invention are not limited, but may be preferably selected from metallated complex compounds of iridium, osmium, copper, and platinum, more preferably selected from ortho-metallated complex compounds of iridium, osmium, copper, and platinum, and even more preferably ortho-metallated iridium complex compounds.

[0045] The dopant comprised in the organic electroluminescent device of the present invention is preferably selected from the group consisting of the compounds of formulae 7 to 9 below.

(7)



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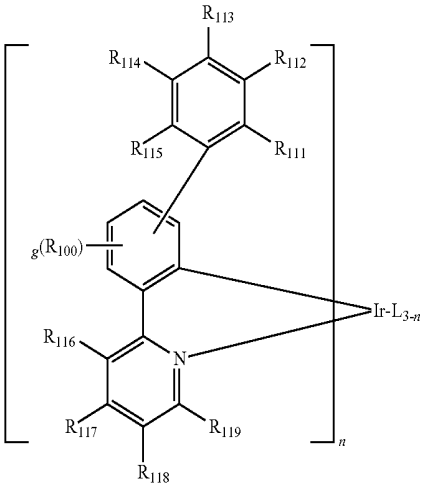
(8)



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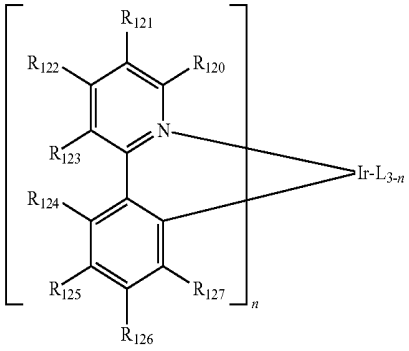
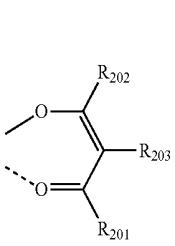
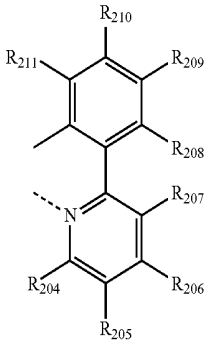


[0046] wherein L is selected from the following structures:





[0047] R_{100} represents hydrogen, a substituted or unsubstituted (C1-C30)alkyl, or a substituted or unsubstituted (C3-C30)cycloalkyl;

[0048] 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(s), a substituted or unsubstituted (C3-C30)cycloalkyl, a cyano, or a substituted or unsubstituted (C1-C30)alkoxy; and adjacent substituents of R_{120} to R_{123} may be linked to each other to form a fused ring, e.g., quinoline;

[0049] 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; and where R_{124} to R_{127} are aryls, adjacent substituents of R_{124} to R_{127} may be linked to each other to form a fused ring, e.g., fluorene;

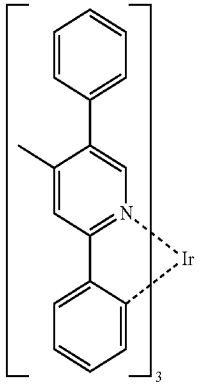
[0050] R_{201} to R_{211} each independently represent hydrogen, deuterium, a halogen, a (C1-C30)alkyl unsubstituted or substituted with a halogen(s), a substituted or unsubstituted (C3-C30)cycloalkyl, or a substituted or unsubstituted (C6-C30)aryl;

[0051] f and g each independently represent an integer of 1 to 3; where f or g is an integer of 2 or more, each of R_{100} may be the same or different; and

[0052] n represents an integer of 1 to 3.

[0053] Specifically, the phosphorescent dopant materials include the following:

D-1



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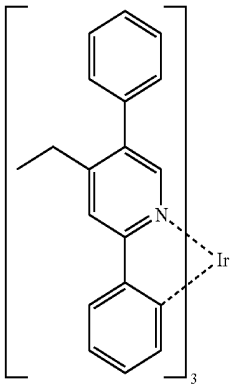

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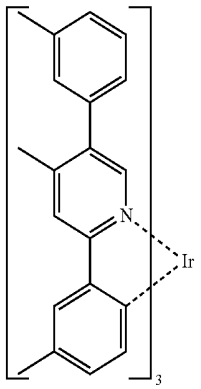

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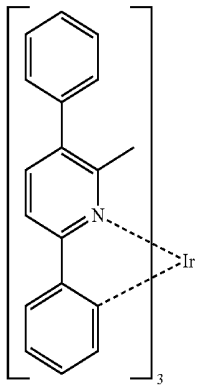

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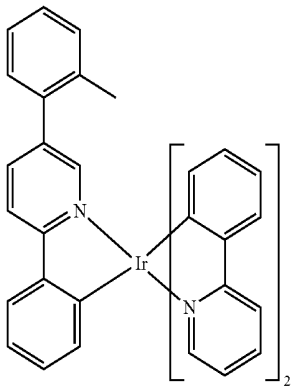

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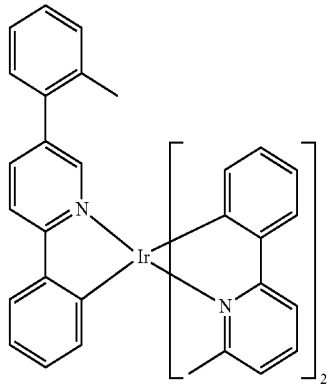

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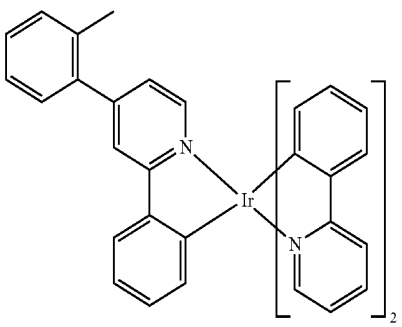

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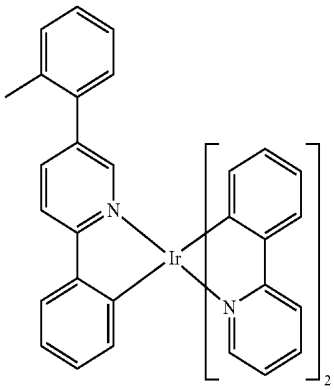

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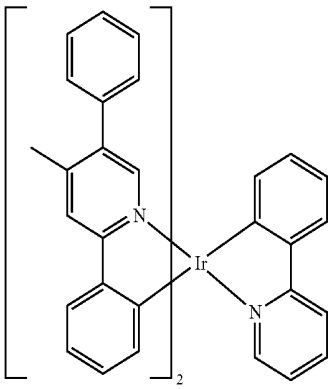

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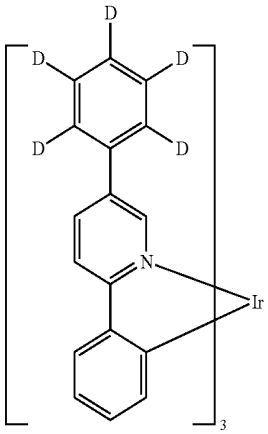

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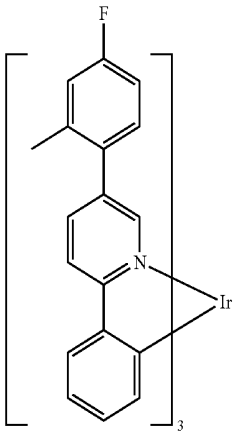

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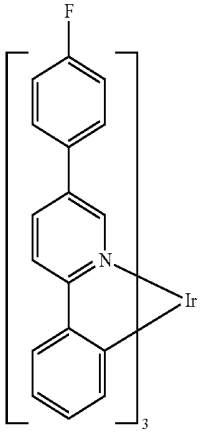

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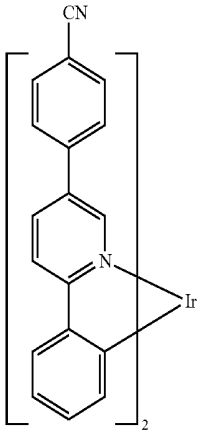

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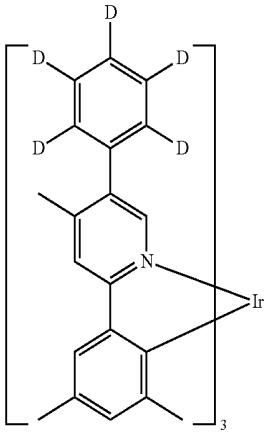

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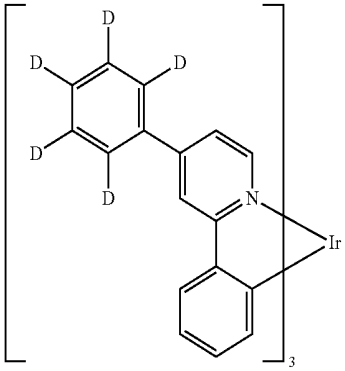

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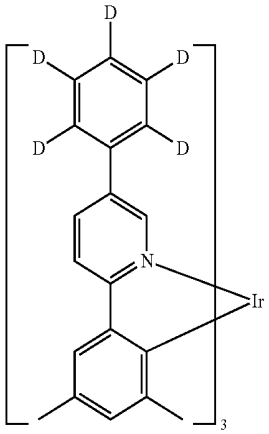

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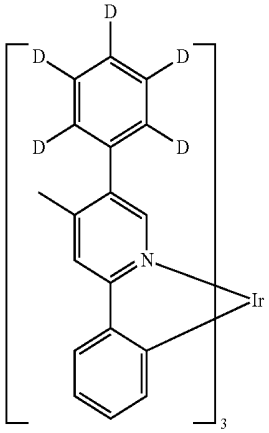

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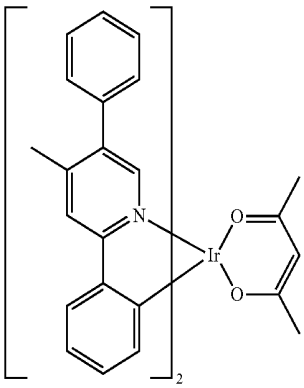

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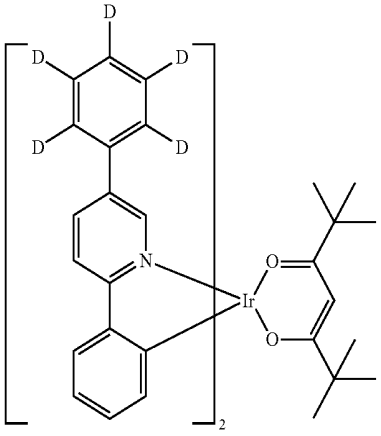

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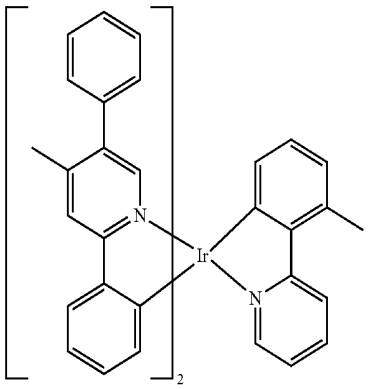

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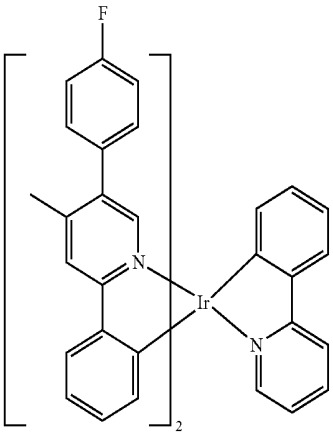

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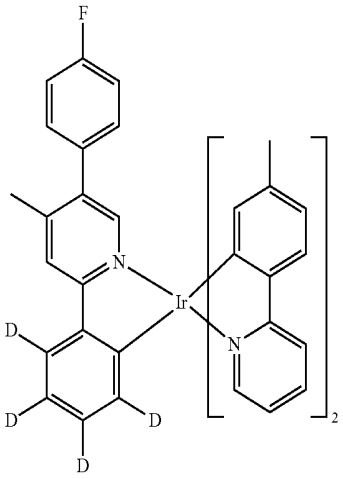

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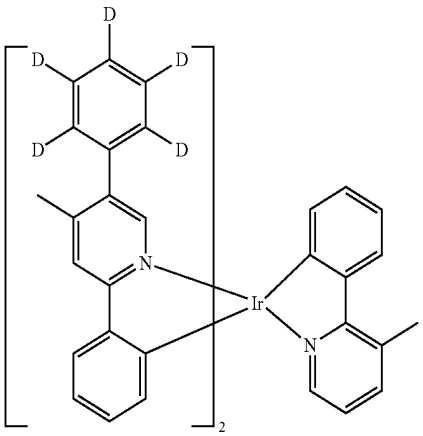

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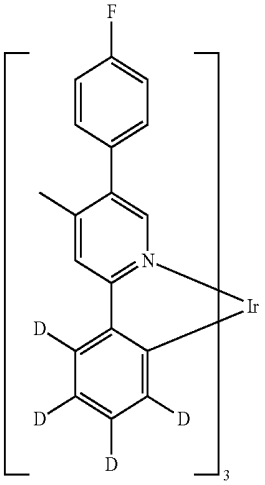

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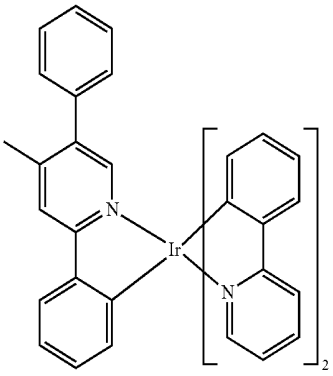

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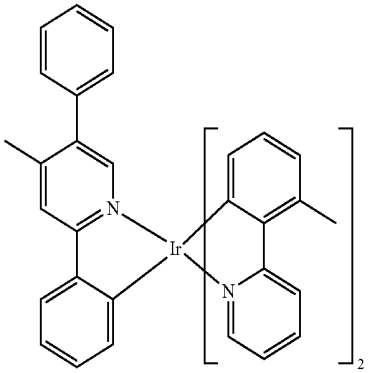

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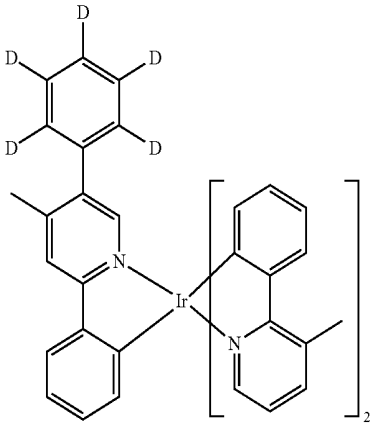

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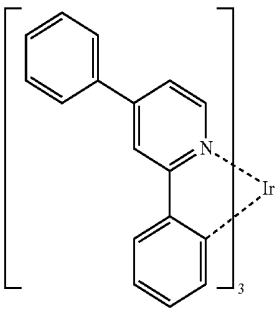

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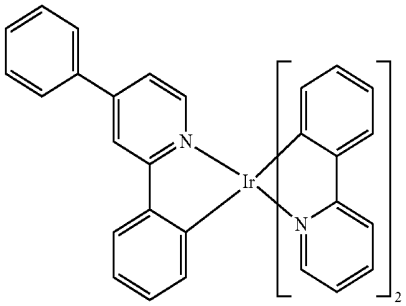

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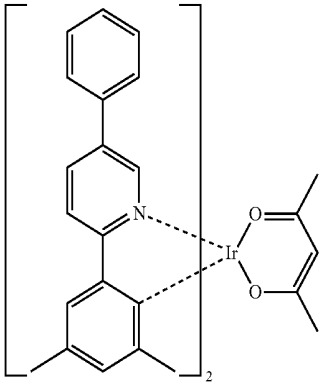

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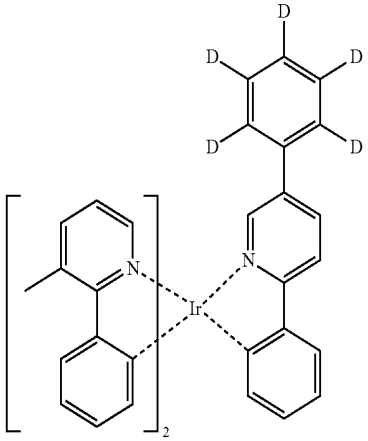

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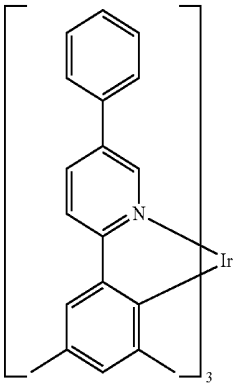

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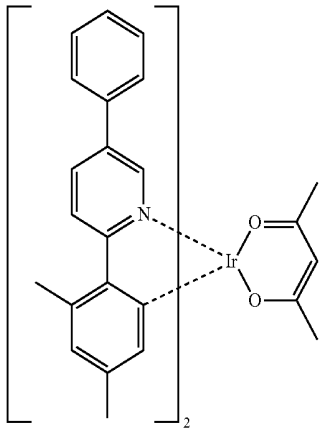

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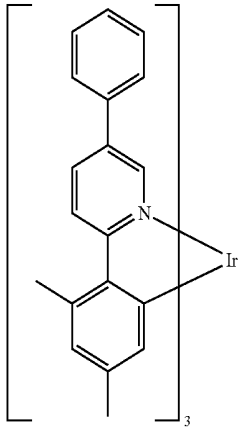

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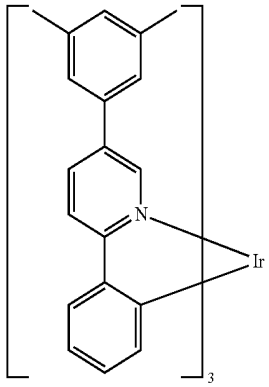

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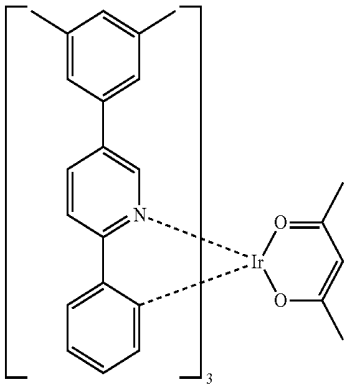

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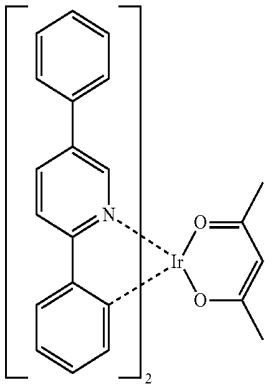

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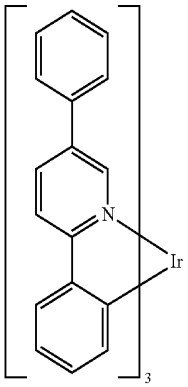

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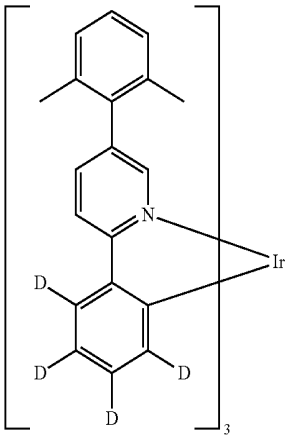

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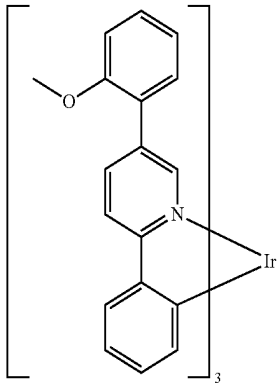

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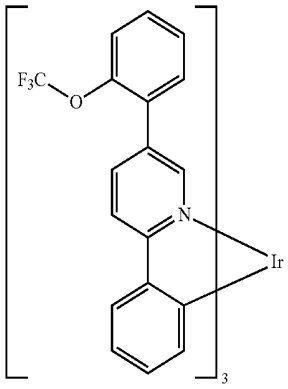

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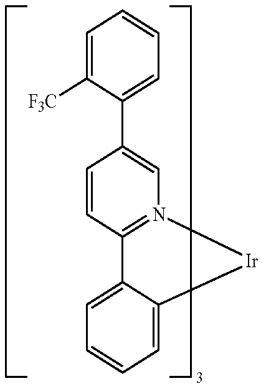

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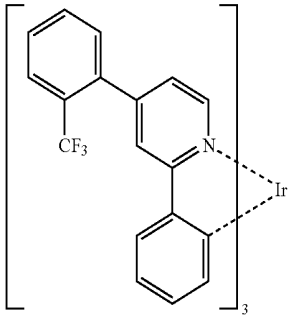

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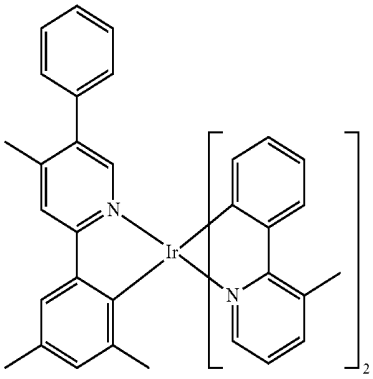

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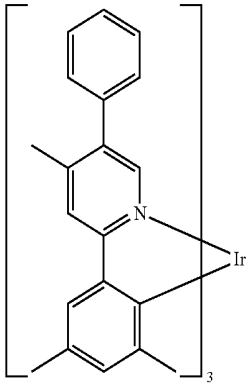

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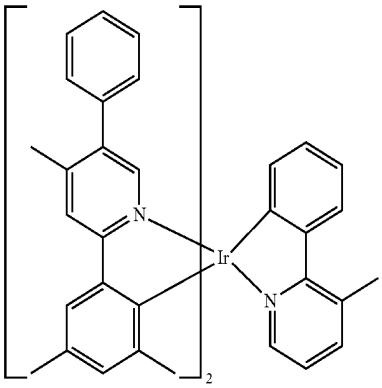

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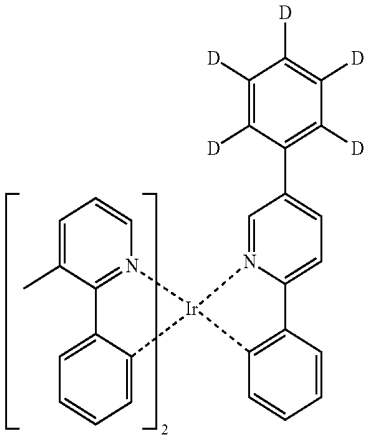

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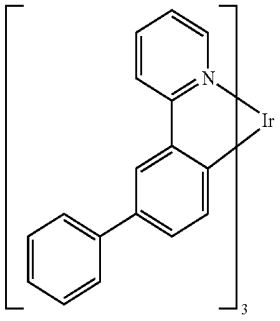

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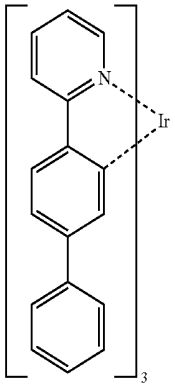

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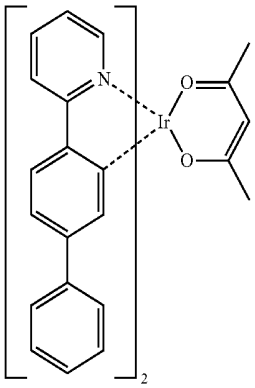

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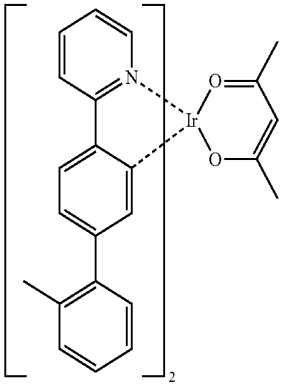

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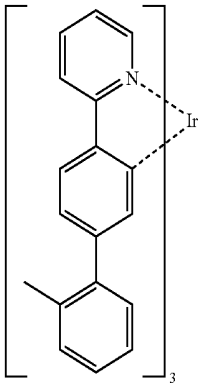

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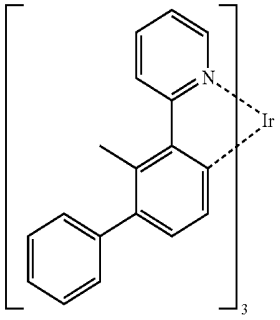

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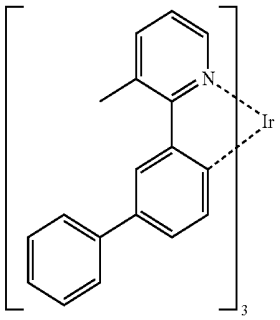

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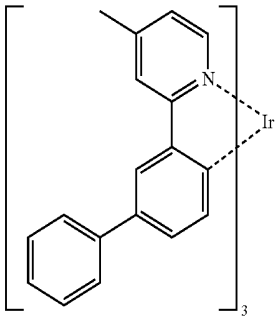

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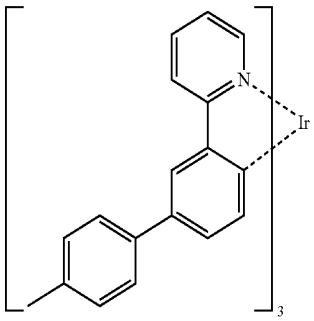

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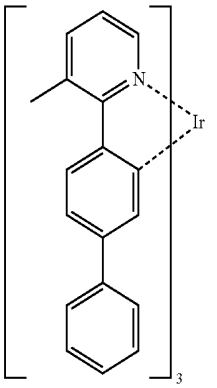

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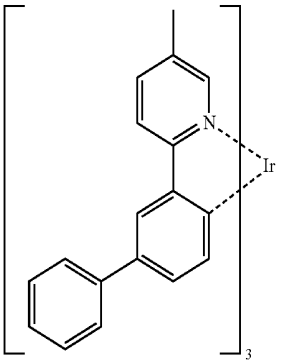

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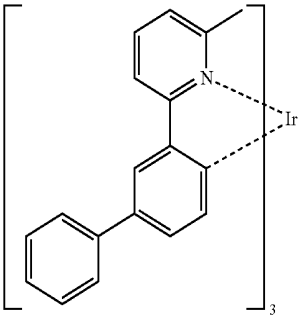

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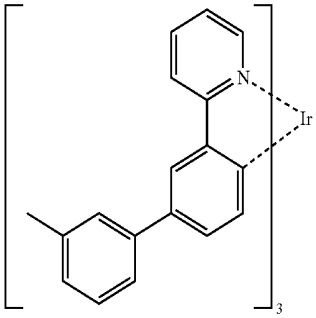

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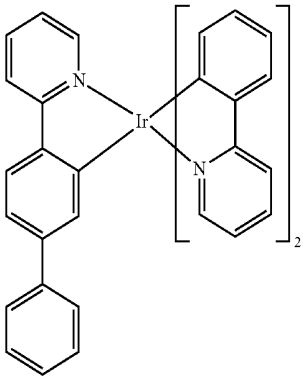

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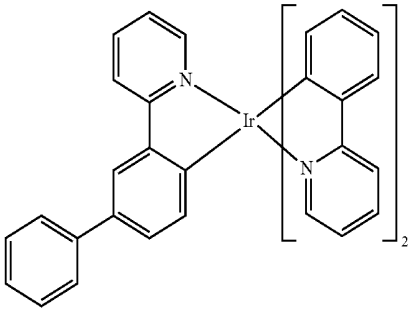

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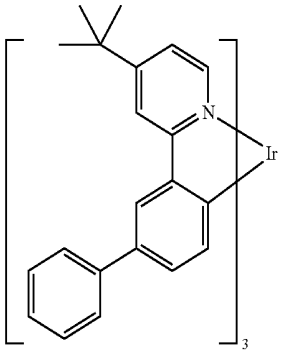

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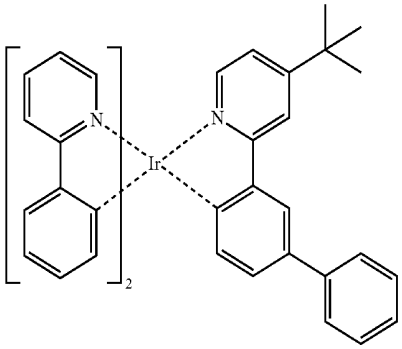

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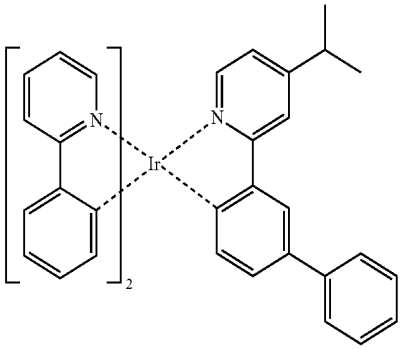

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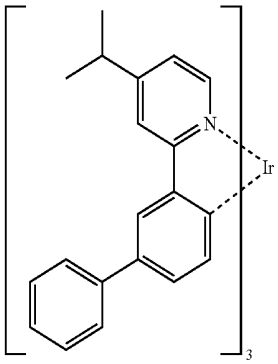

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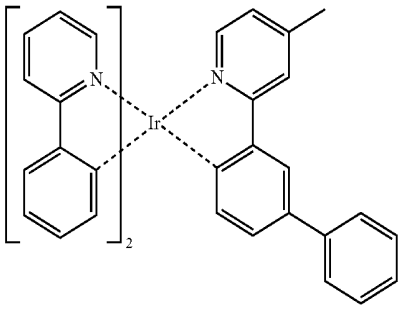

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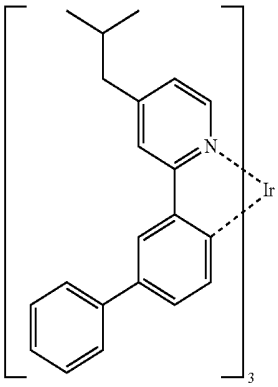

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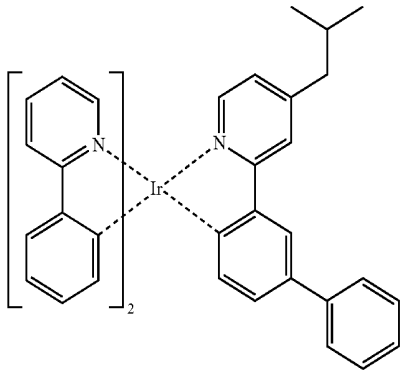

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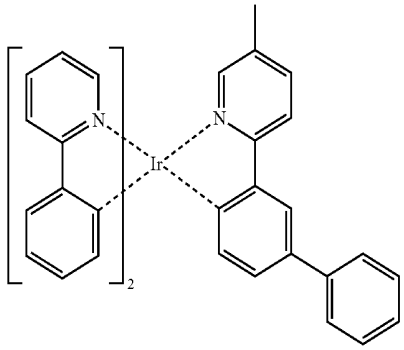

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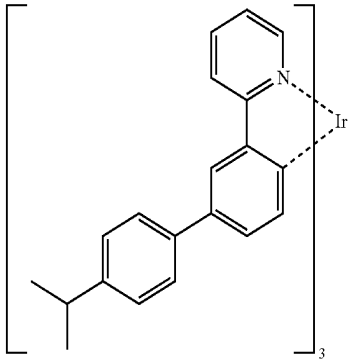

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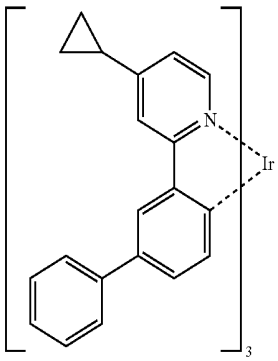

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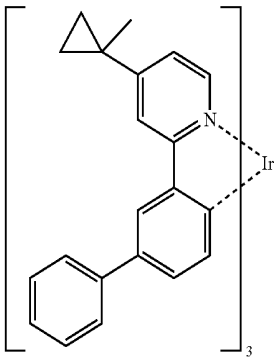

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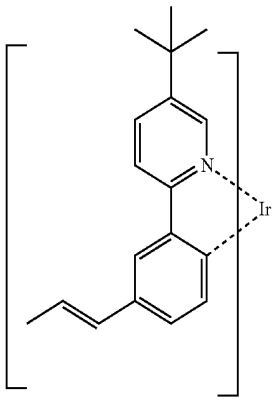

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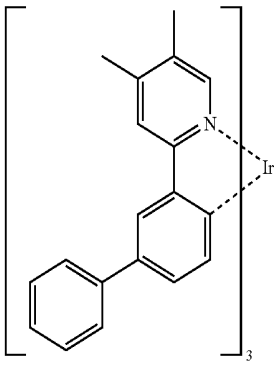

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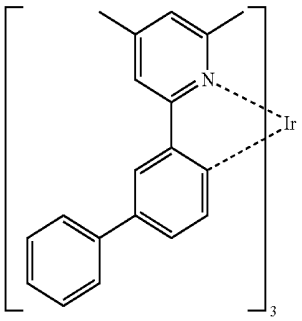

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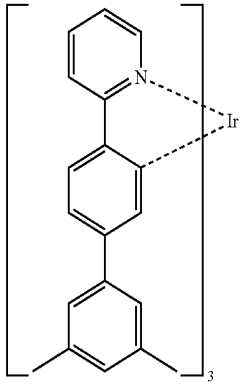

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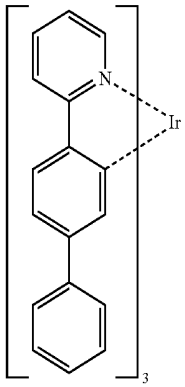

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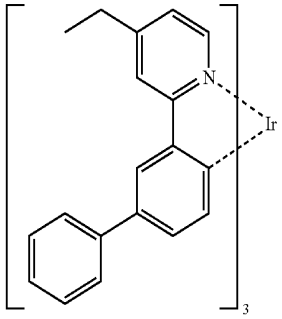

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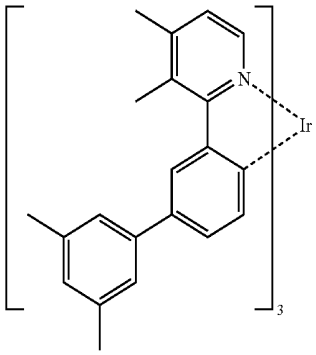

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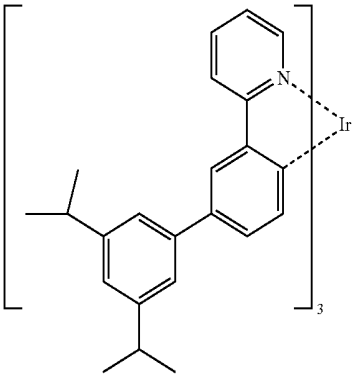

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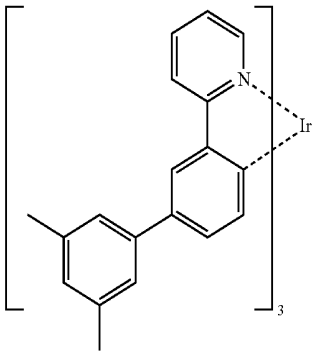

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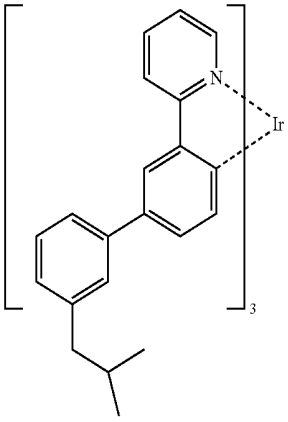

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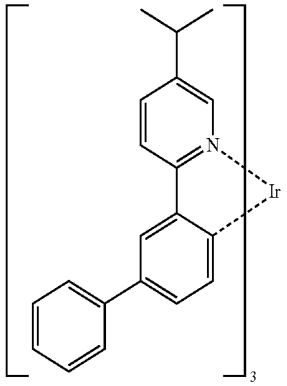

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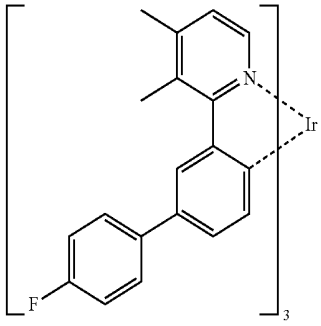

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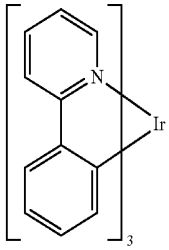

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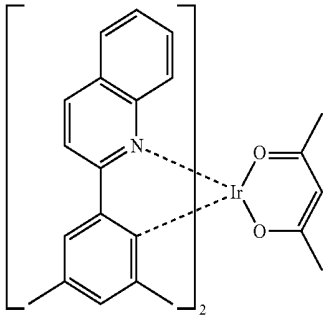

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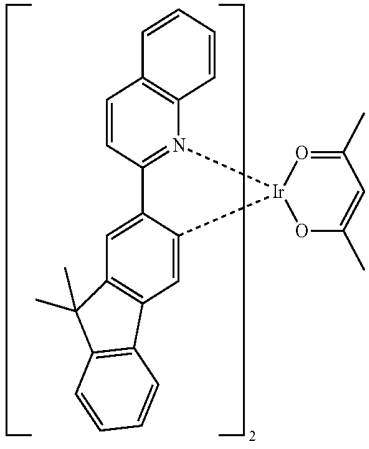

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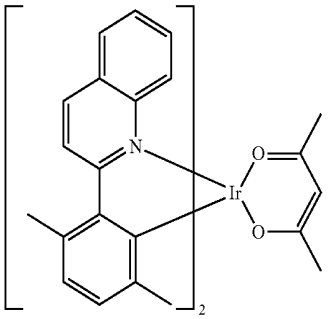

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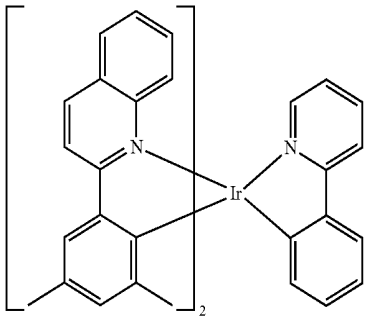

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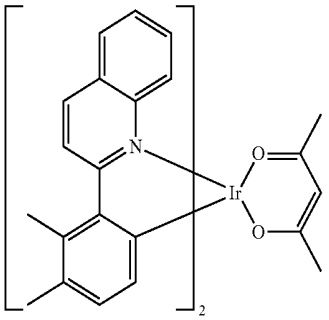

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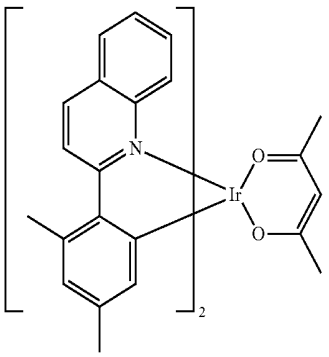

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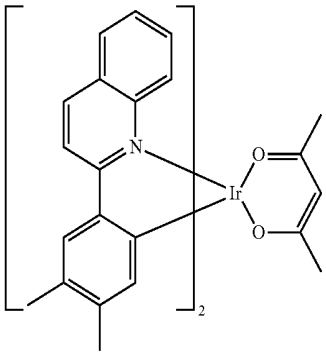

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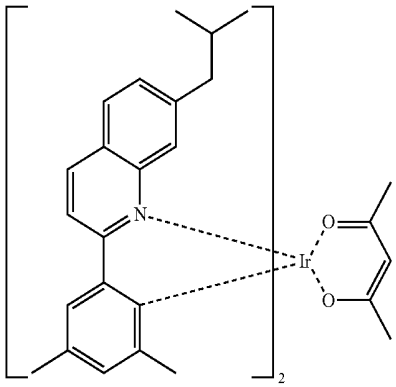

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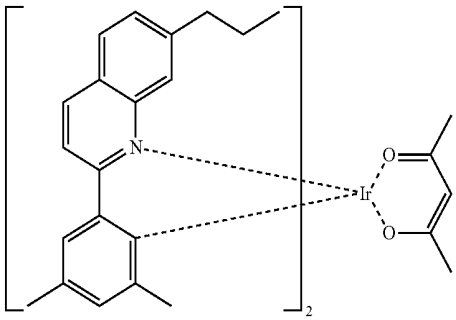

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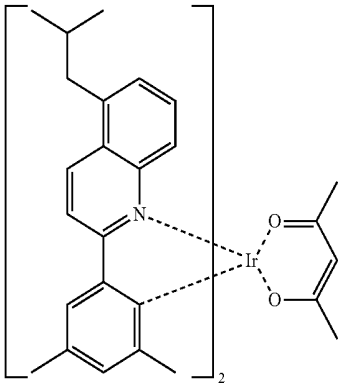

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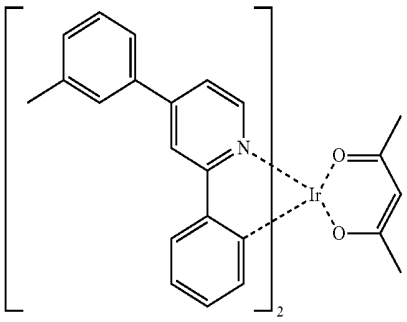

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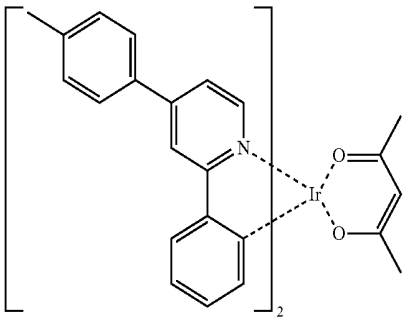

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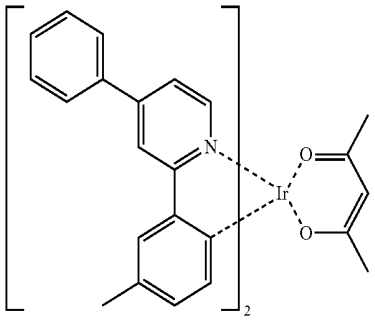

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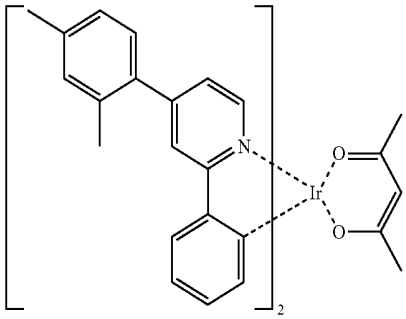

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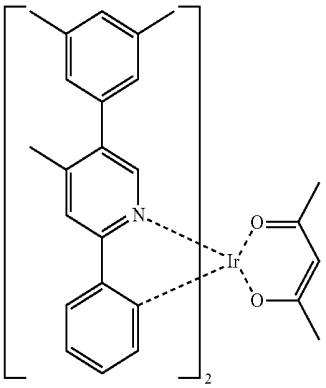

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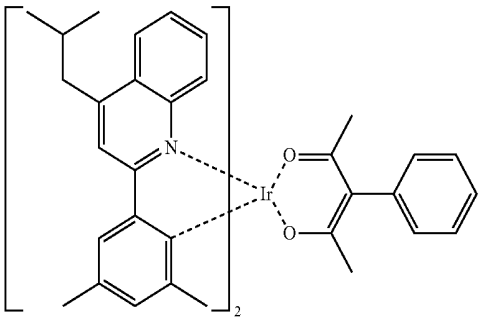

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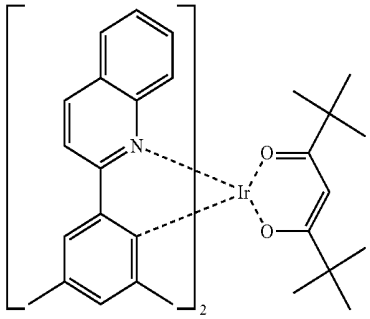

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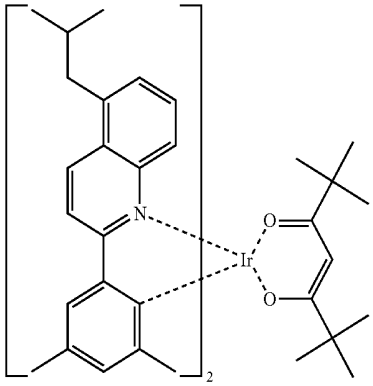

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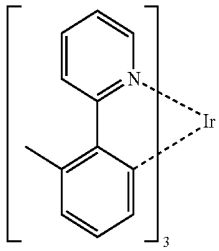

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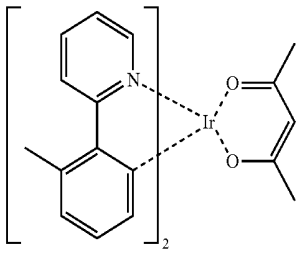

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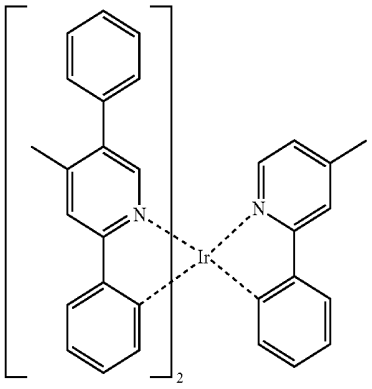

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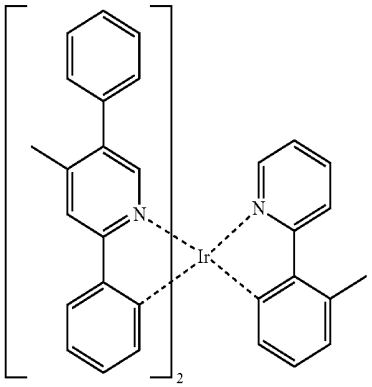

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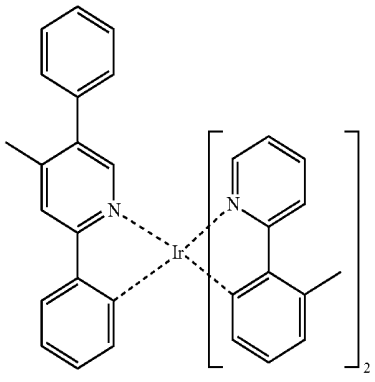

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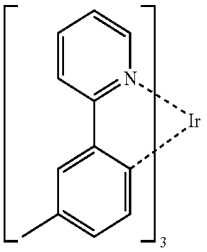

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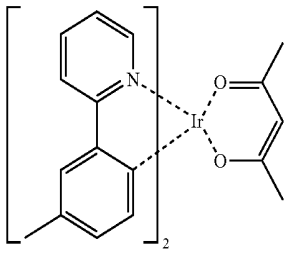

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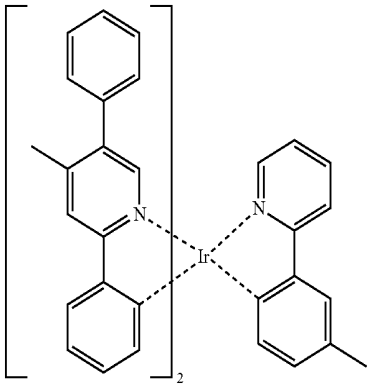

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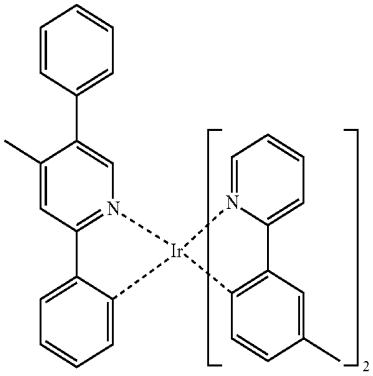

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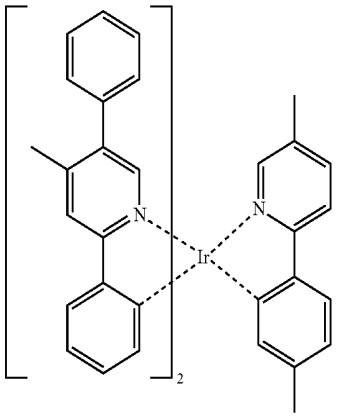

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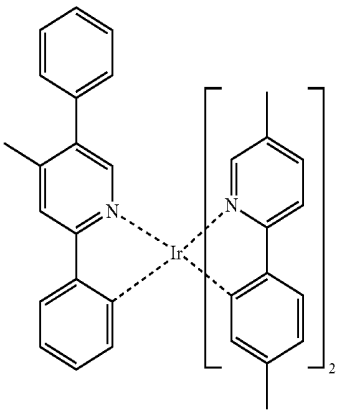

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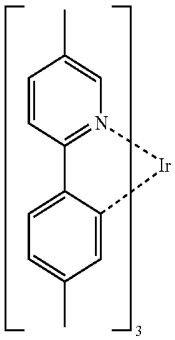

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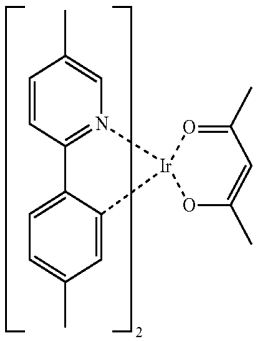

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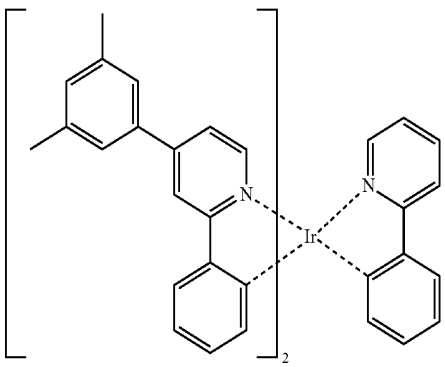

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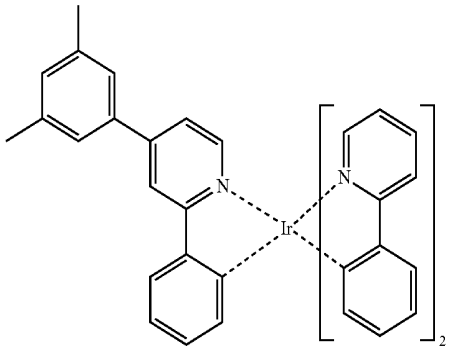

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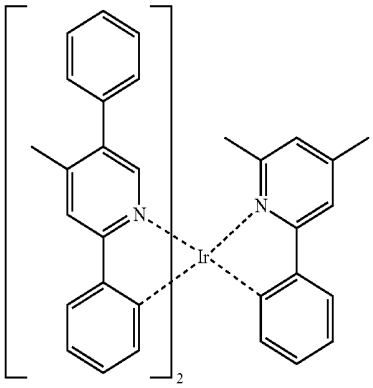

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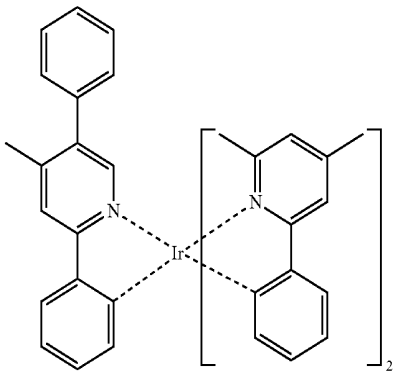

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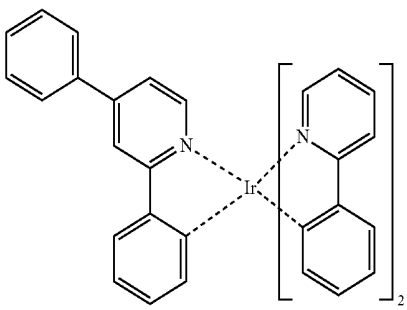

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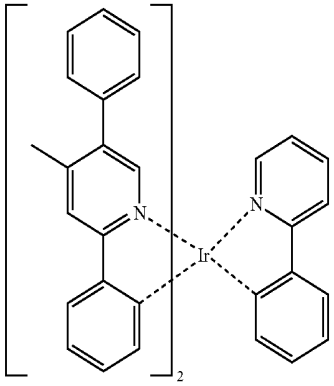

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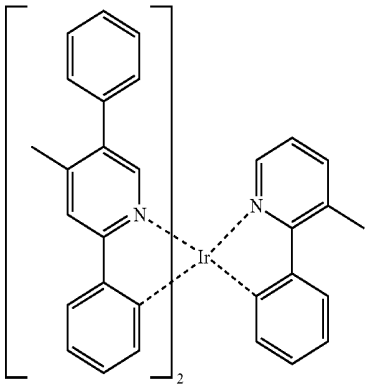

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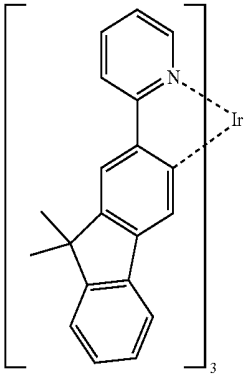

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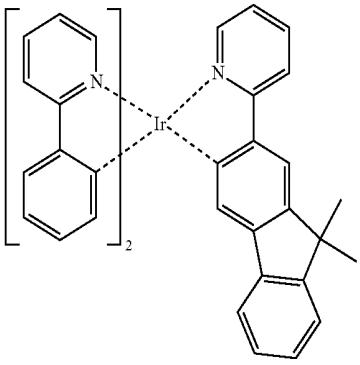

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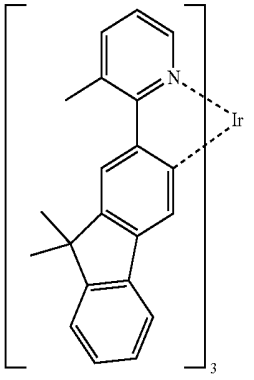

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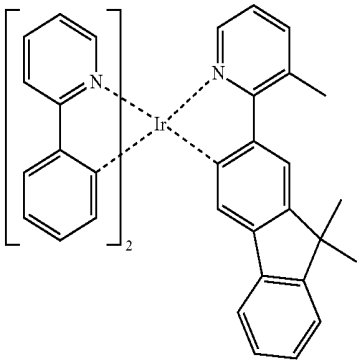

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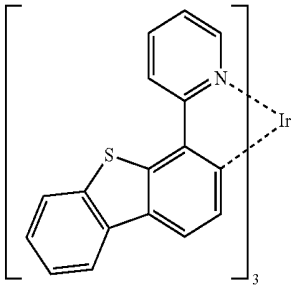

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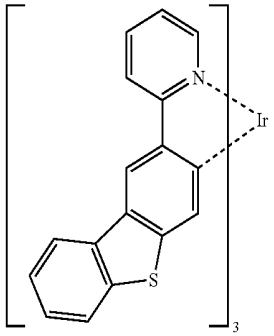

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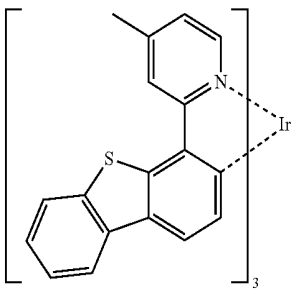

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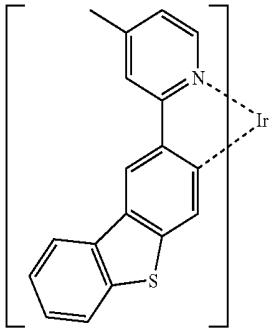

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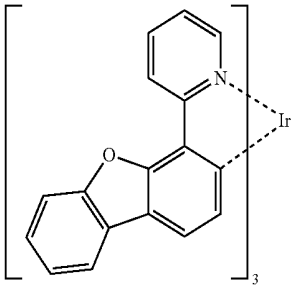

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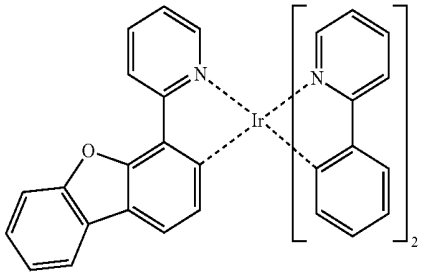

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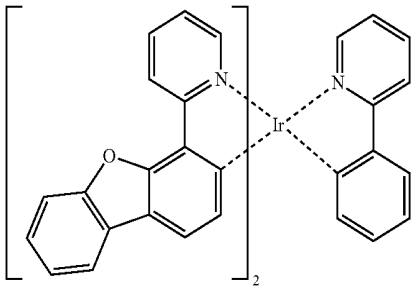

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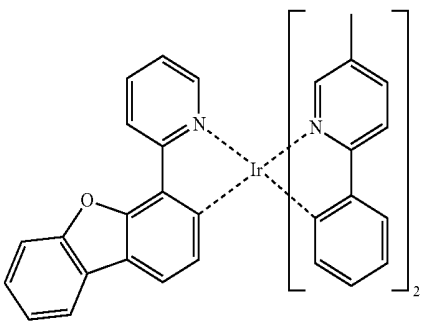

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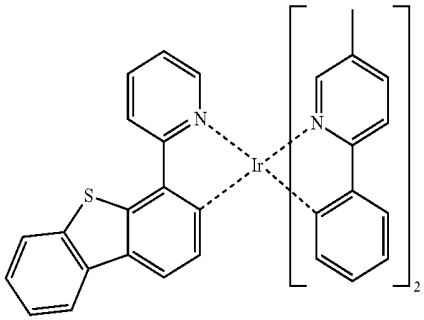

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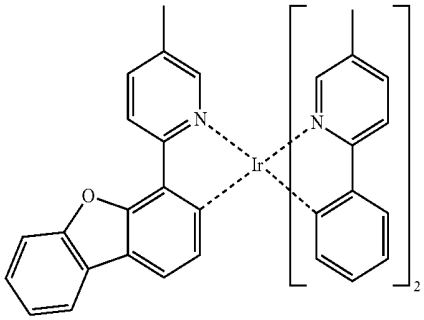

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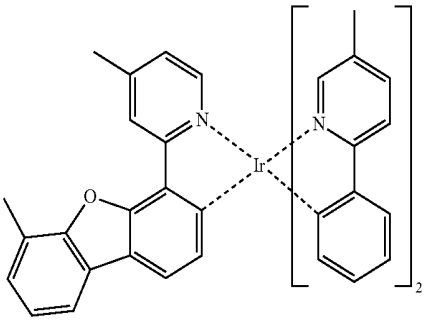

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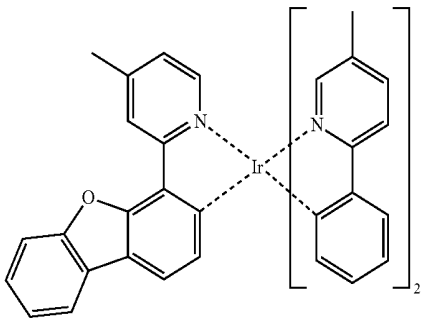

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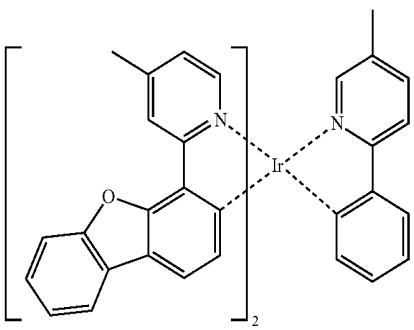

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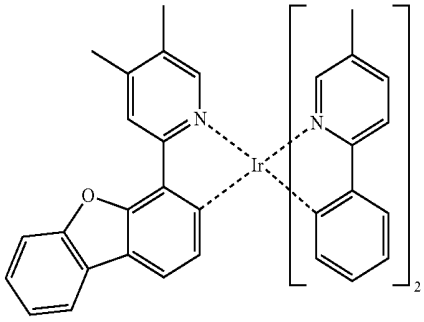

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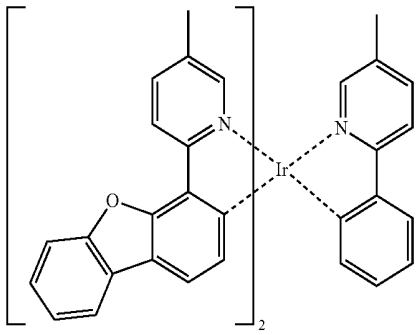

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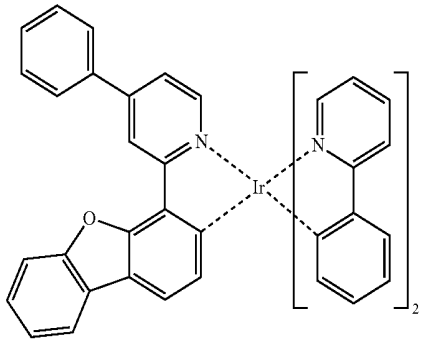

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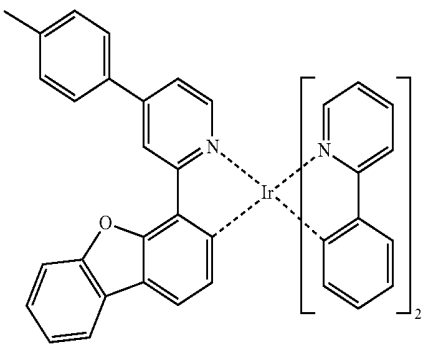

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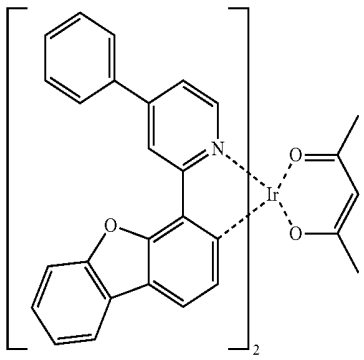

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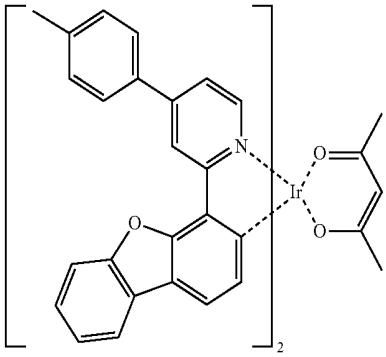

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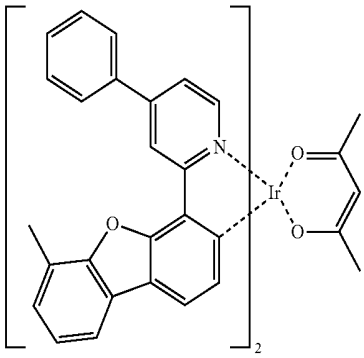

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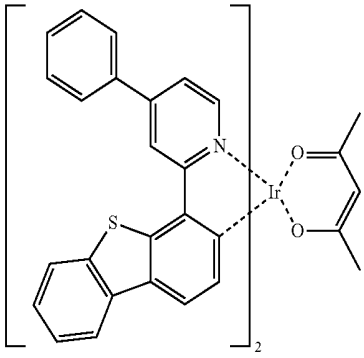

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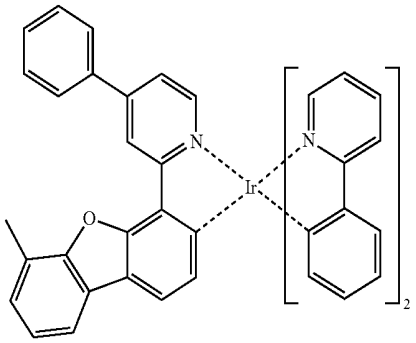

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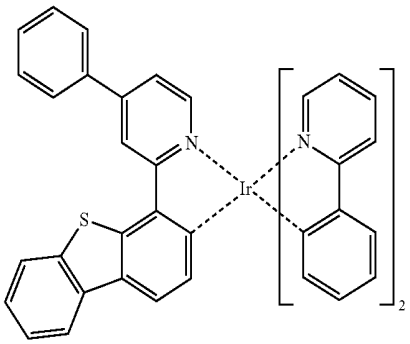

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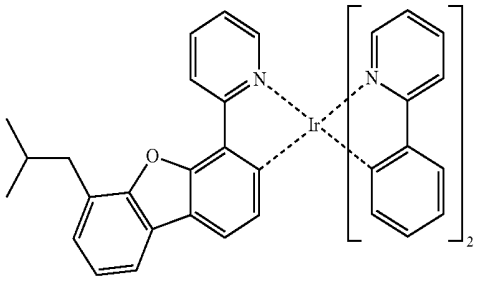

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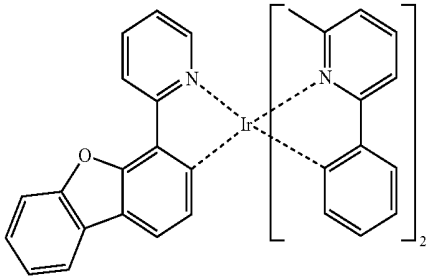

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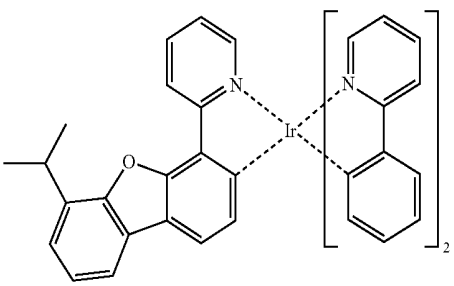

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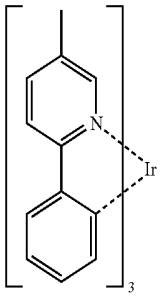

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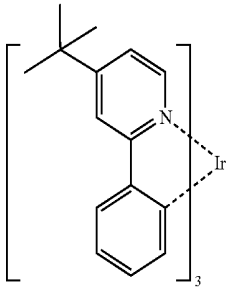

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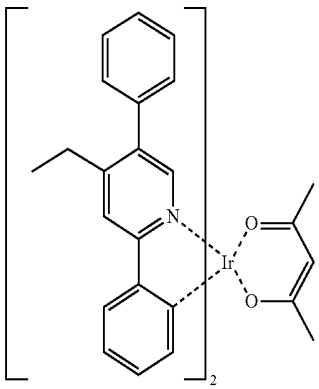

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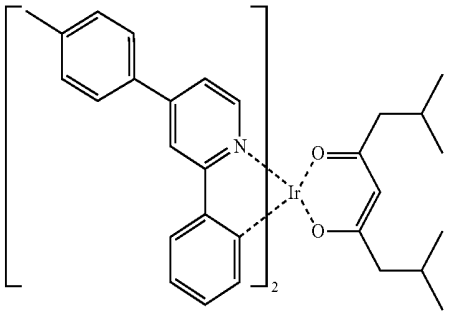

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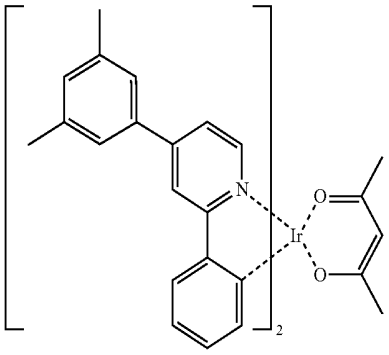

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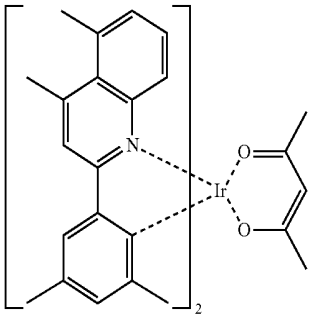

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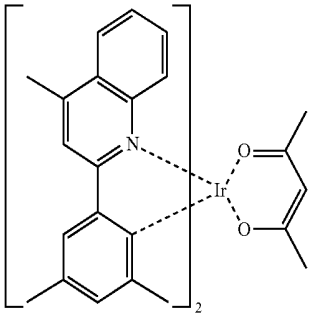

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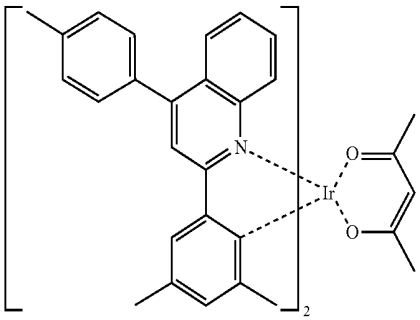

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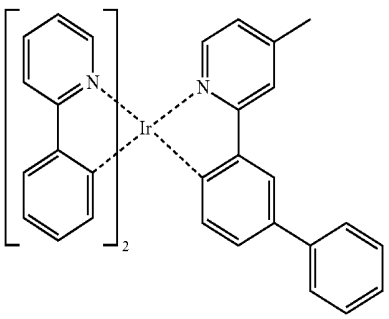

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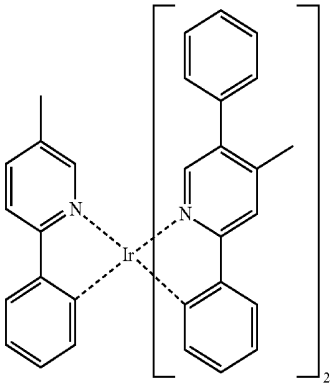

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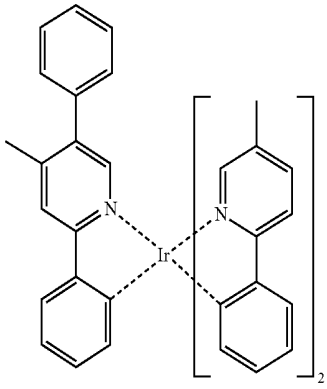

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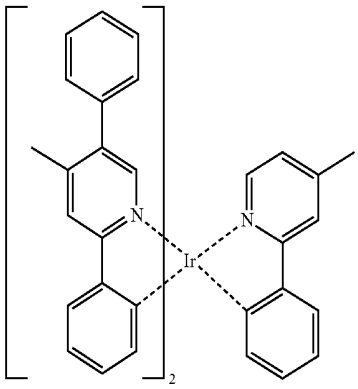

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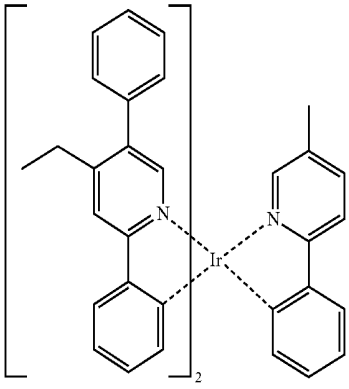

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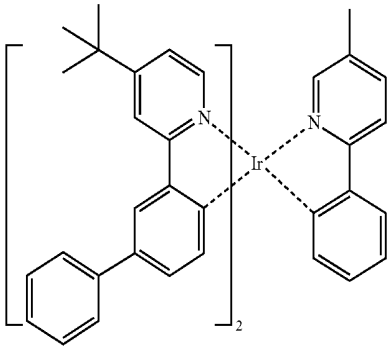

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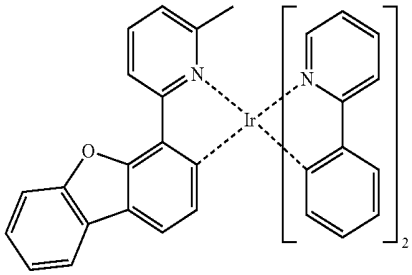

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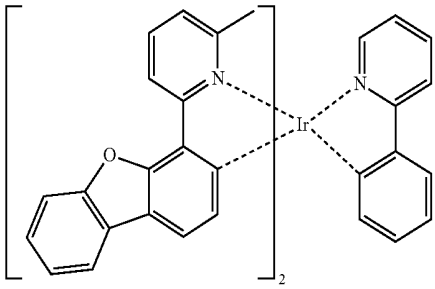

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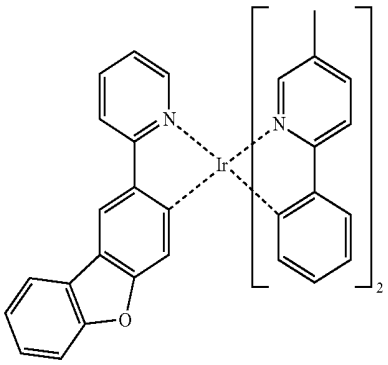

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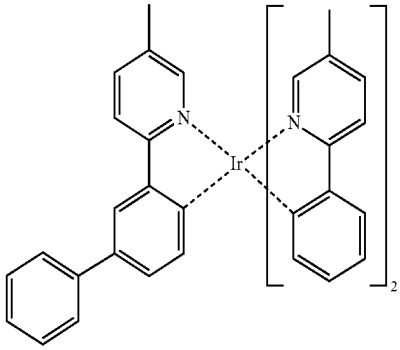

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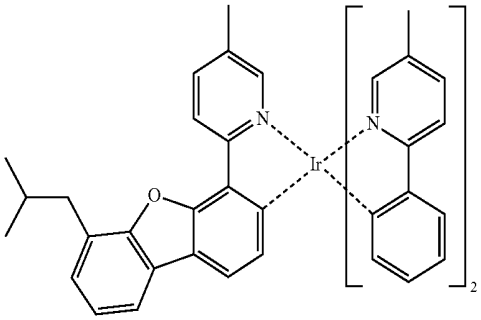

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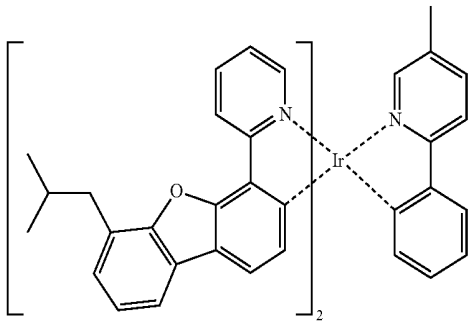

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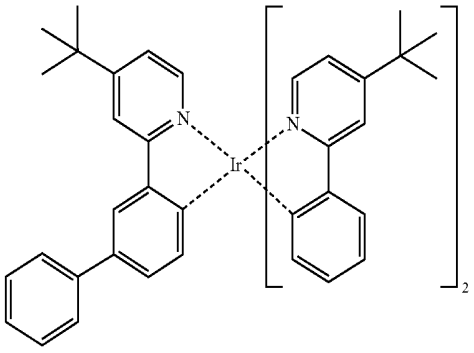

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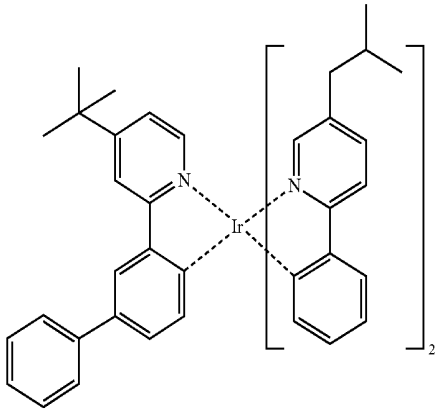

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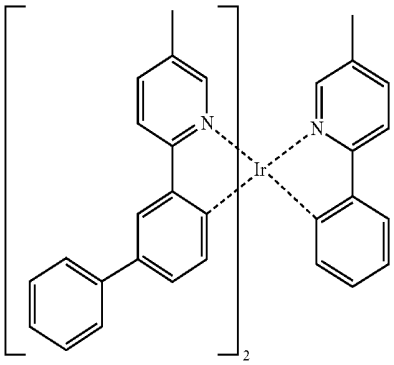

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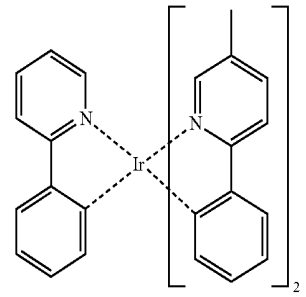

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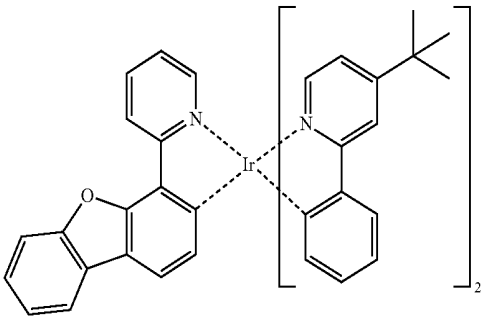

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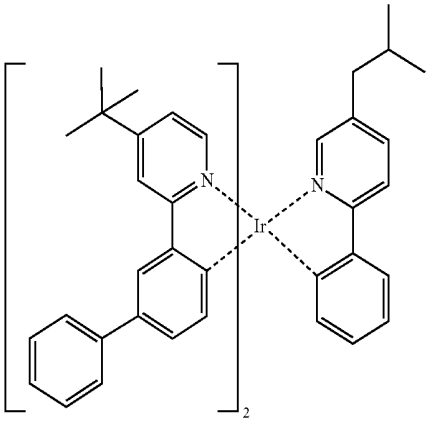

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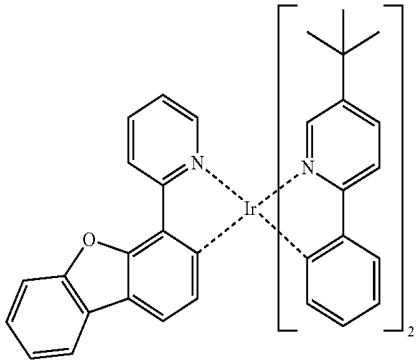

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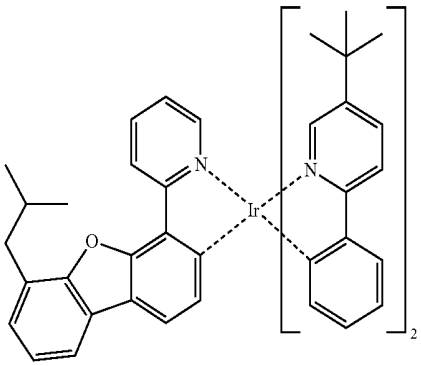

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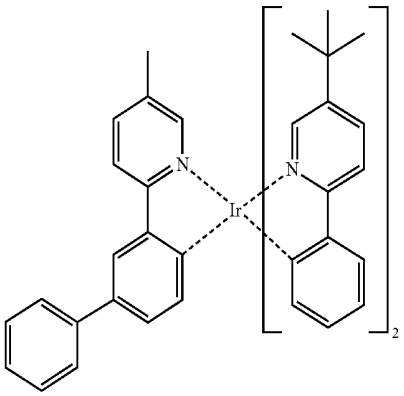

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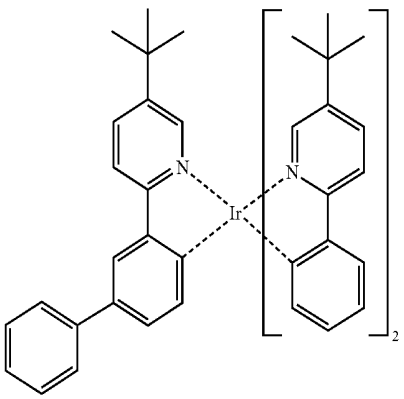

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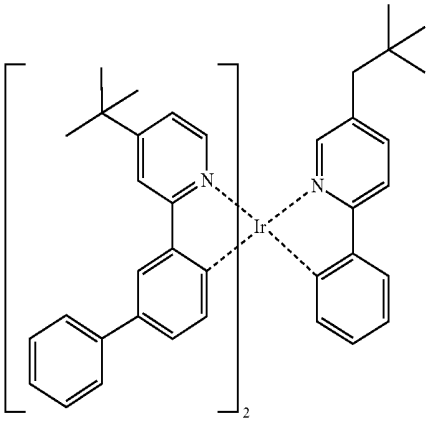

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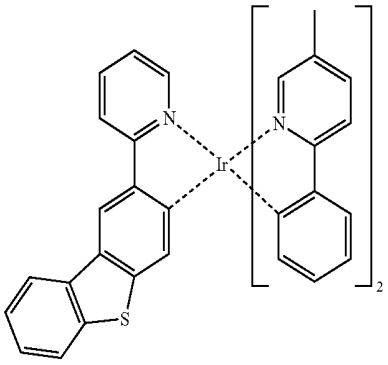

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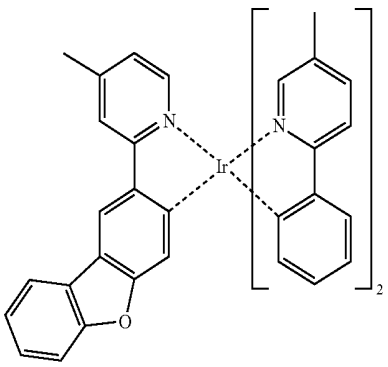

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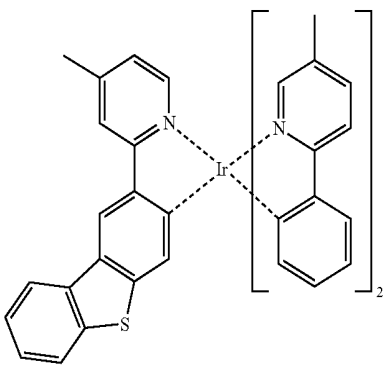

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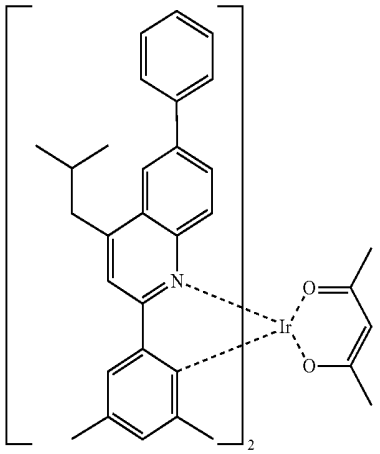

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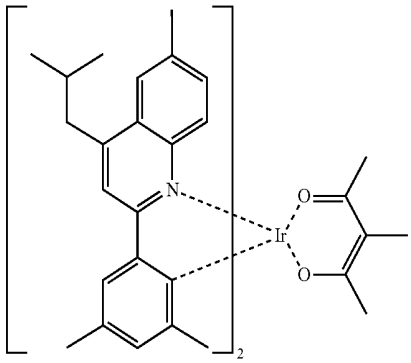

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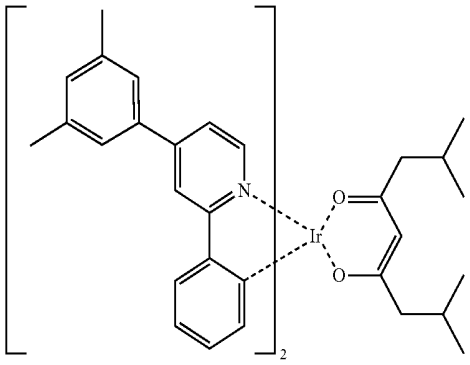

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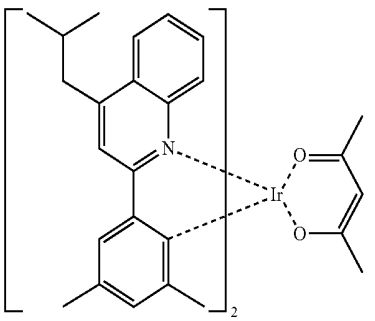

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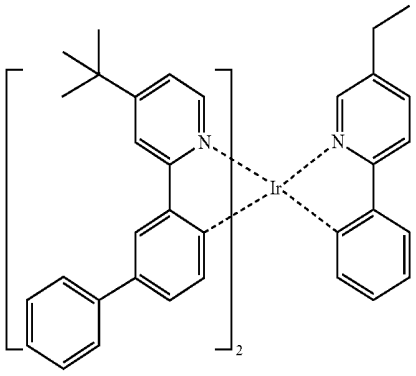

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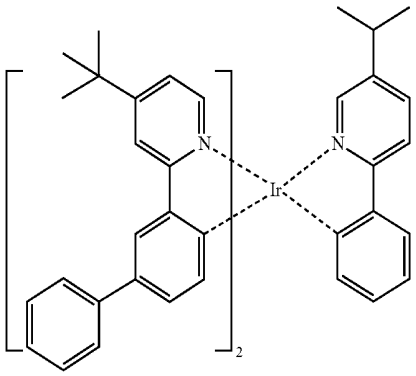

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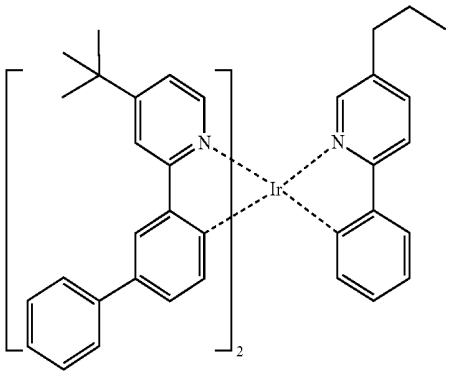

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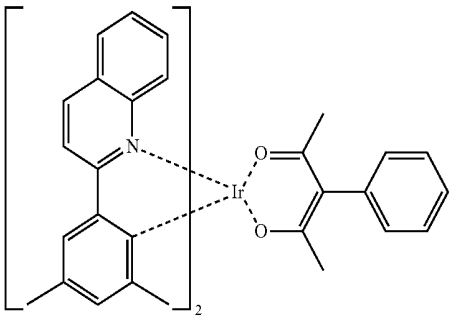

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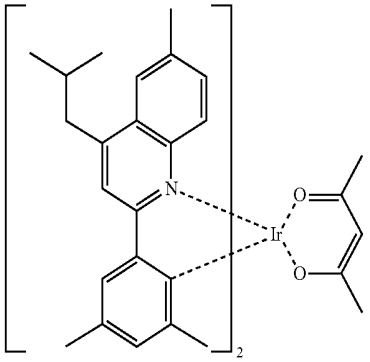

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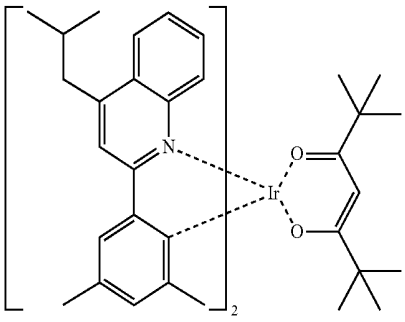


[0054] The organic electroluminescent device according to the present invention may further comprise, in addition to the organic electroluminescent compound represented by formula 1, at least one compound selected from the group consisting of arylamine-based compounds and styrylarylamine-based compounds.

[0055] In the organic electroluminescent device according to the present invention, the organic layer may further comprise at least one metal selected from the group consisting of metals of Group 1, metals of Group 2, transition metals of the 4^{th} period, transition metals of the 5^{th} period, lanthanides and organic metals of d-transition elements of the Periodic Table, or at least one complex compound comprising said metal. The organic layer may further comprise a light-emitting layer and a charge generating layer.

[0056] In addition, the organic electroluminescent device according to the present invention 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 organic electroluminescent compound according to the present invention. Also, if necessary, a yellow or orange light-emitting layer can be comprised in the device.

[0057] According to the present invention, at least one layer (hereinafter, "a surface layer") is preferably 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 (including 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, said chalcogenide includes $SiO_X(1 \leq X \leq 2)$, $AlO_X(1 \leq X \leq 1.5)$, SiON, SiAlON, etc.; said metal halide includes LiF, MgF_2, CaF_2, a rare

earth metal fluoride, etc.; and said metal oxide includes Cs_2O, Li_2O, MgO, SrO, BaO, CaO, etc.

[0058] In the organic electroluminescent device according to the present invention, a mixed region of an electron transport compound and reductive dopant, or a mixed region of a hole transport compound and an oxidative dopant is preferably 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. Further, 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 electroluminescent layers and emitting white light.

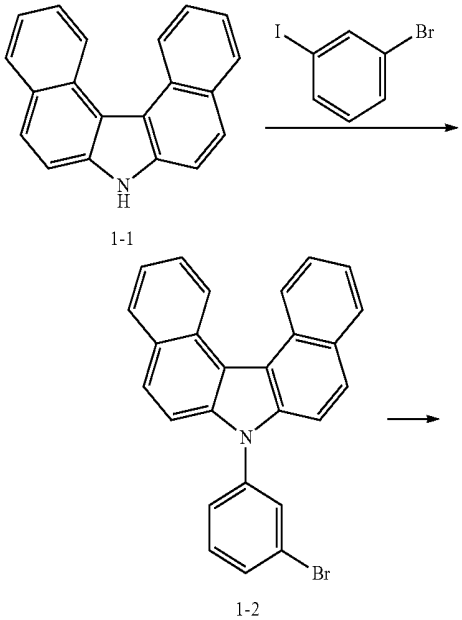
[0059] In order to form each layer of the organic electroluminescent device according to the present invention, dry film-forming methods such as vacuum evaporation, sputtering, plasma and ion plating methods, or wet film-forming methods such as spin coating, dip coating, and flow coating methods can be used.

[0060] 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.

[0061] Hereinafter, the organic electroluminescent compound, the preparation method of the compound, and the properties of the device comprising the organic electroluminescent compound will be explained in detail with reference to the following examples.

Example 1: Preparation of Compound C-1

[0062]



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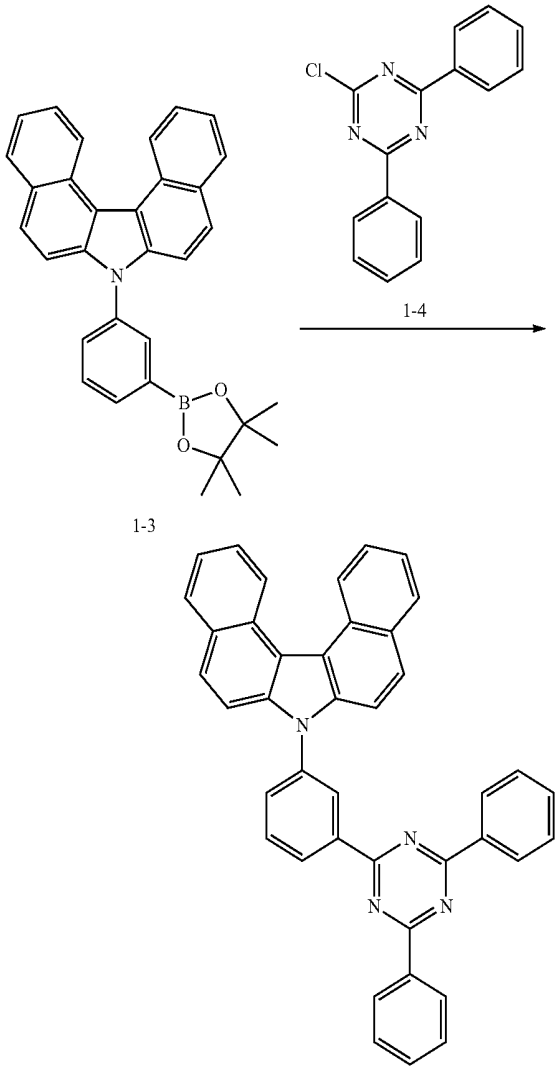


[0063] Preparation of Compound 1-2

[0064] After dissolving compound 1-1 (7H-benzo[c]carbazole, 17.6 g, 65.8 mmol), 3-iodo-1-bromobenzene (23 g, 78.9 mmol), CuI (6.3 g, 33 mmol), ethylenediamine (EDA) (9 mL, 130 mmol), and K_3PO_4 (42 g, 197.4 mmol) in toluene 500 mL in a flask, the mixture was refluxed at 120° C. for 5 hours. After completing the reaction, an organic layer was extracted with ethyl acetate (EA), residual moisture was removed using magnesium sulfate and dried, and separated with column chromatography to obtain compound 1-2 (20 g, yield: 71%).

[0065] Preparation of Compound 1-3

[0066] After dissolving compound 1-2 (15 g, 35.3 mmol), 4,4,4',4',5,5,5',5'-octamethyl-2,2'-bi(1,3,2-dioxaborolane) (14 g, 53 mmol), potassium acetate (KOAc) (11 g, 106 mmol), and bis(triphenylphosphine)palladium(II)dichloride ($Pd(PPh_3)_2Cl_2$) (2.5 g, 0.0035 mmol) in dioxane 300 mL in a flask, the mixture was refluxed. After completing the reaction, an organic layer was extracted with EA, residual moisture was removed using magnesium sulfate and dried, and separated with column chromatography to obtain compound 1-3 (10 g, yield: 61%).

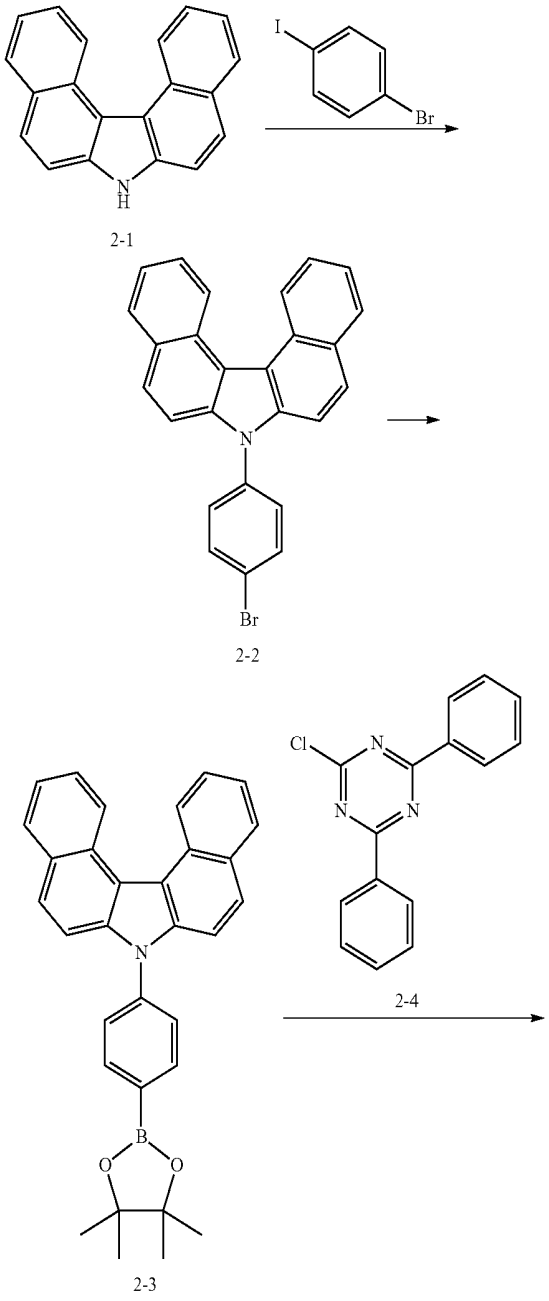
[0067] Preparation of Compound C-1

[0068] After dissolving compound 1-3 (10 g, 21.7 mmol), compound 1-4 (12 g, 0.043 mmol), tetrakis(triphenylphosphine)palladium ($Pd(PPh_3)_4$) (1.3 g, 1.0 mmol), and K_2CO_3 (8.8 g, 65 mmol) in a mixture solvent of toluene, ethanol (EtOH), and H_2O in a flask, the mixture was refluxed at 120° C. for one day. After completing the reaction, an organic layer was extracted with EA, dried, and separated with column chromatography to obtain compound C-1 (7.8 g, yield: 48%).

	MW	UV	PL	M.P.
C-1	574.67	334 nm	482 nm	292° C.

Example 2: Preparation of Compound C-2

[0069]



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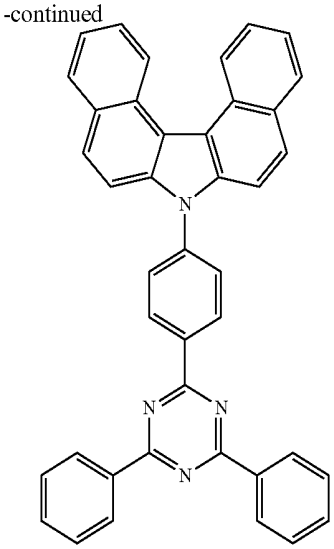


C-2

[0070] Preparation of Compound 2-2

[0071] After dissolving compound 2-1 (7H-benzo[c]carbazole, 17.6 g, 65.8 mmol), 4-iodo-1-bromobenzene (23 g, 78.9 mmol), CuI (6.3 g, 33 mmol), EDA (9 mL, 130 mmol), and K_3PO_4 (42 g, 197.4 mmol) in toluene 500 mL in a flask, the mixture was refluxed at 120° C. for 5 hours. After completing the reaction, an organic layer was extracted with EA, residual moisture was removed using magnesium sulfate and dried, and separated with column chromatography to obtain compound 2-2 (20 g, yield: 71%).

[0072] Preparation of Compound 2-3

[0073] After dissolving compound 2-2 (15 g, 35.3 mmol), 4,4,4',4',5,5,5',5'-octamethyl-2,2'-bi(1,3,2-dioxaborolane) (14 g, 53 mmol), KOAc (11 g, 106 mmol), and $Pd(PPh_3)_2Cl_2$ (2.5 g, 0.0035 mmol) in dioxane 300 mL in a flask, the mixture was refluxed. After completing the reaction, an organic layer was extracted with EA, residual moisture was removed using magnesium sulfate and dried, and separated with column chromatography to obtain compound 2-3 (10 g, yield: 61%).

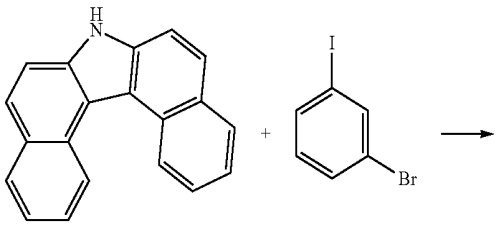
[0074] Preparation of Compound C-2

[0075] After dissolving compound 2-3 (10 g, 21.7 mmol), compound 2-4 (12 g, 0.043 mmol), $Pd(PPh_3)_4$ (1.3 g, 1.0 mmol), and K_2CO_3 (8.8 g, 65 mmol) in a mixture solvent of toluene, ethanol, and H_2O in a flask, the mixture was refluxed at 120° C. for one day. After completing the reaction, an organic layer was extracted with EA, dried, and separated with column chromatography to obtain compound C-2 (3.7 g, yield: 88%).

	MW	UV	PL	M.P.
C-2	574.67	344 nm	473 nm	323° C.

Example 3: Preparation of Compound C-17

[0076]



3-1

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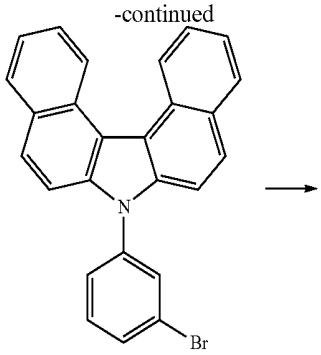
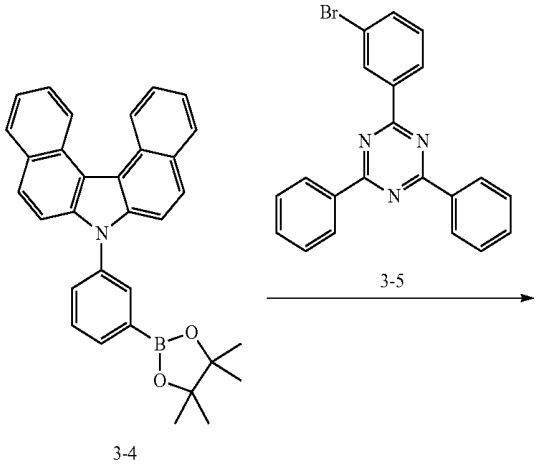
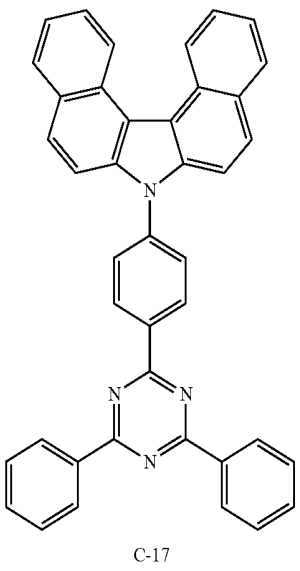


3-3



3-4



C-17

[0077] Preparation of Compound 3-3

[0078] After introducing 7H-benzo[c,g]carbazole (20 g, 74.80 mmol), 1-bromo-3-iodobenzene (23.7 mL, 187.00 mmol), CuI (7.1 g, 37.4 mmol), K_3PO_4 (39.7 g, 187.00 mmol), and toluene 380 mL in a flask, the mixture was refluxed at 120° C. for 2 hours. After completing the reaction, the mixture was filtered with dichloromethane (DCM), dried, and separated with column chromatography to obtain compound 3-3 (23.6 g, yield: 75%).

[0079] Preparation of Compound 3-4

[0080] After dissolving compound 3-3 (70 g, 165.80 mmol), pinacolato diboron (51 g, 198.9 mmol), $PdCl_2(PPh_3)_2$ (5.8 g, 8.29 mmol), and KOAc (33 g, 331.60 mmol) in 1,4-dioxane 830 mL in a flask, the mixture was stirred under reflux for one day. The mixture was then extracted with EA and separated with column chromatography to obtain compound 3-4 (69 g, yield: 88%).

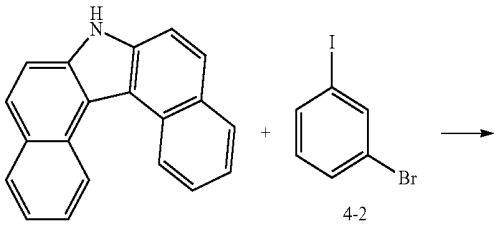
[0081] Preparation of Compound C-17

[0082] After dissolving compound 3-4 (7.0 g, 14.90 mmol), compound 3-5 (7.0 g, 17.90 mmol), $Pd(PPh_3)_4$ (860 mg, 0.75 mmol), and K_2CO_3 (6.2 g, 44.70 mmol) in a mixture solvent of toluene 75 mL, EtOH 20 mL, and H_2O 20 mL in a flask, the mixture was stirred under reflux for 1 hour. After cooling the mixture to room temperature, methanol (MeOH) was added thereto, a solid was filtered and recrystallized with toluene, and separated with column chromatography to obtain compound C-17 (4.6 g, yield: 47%).

	MW	UV	PL	M.P.
C-17	650.77	378 nm	393 nm	267° C.

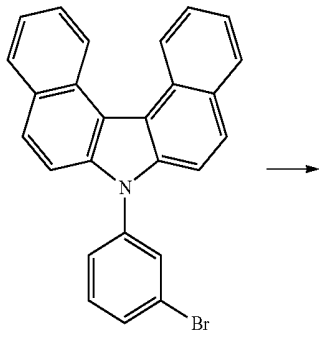
Example 4: Preparation of Compound C-9

[0083]



4-1

4-2



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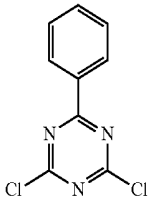

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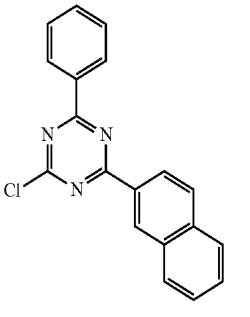
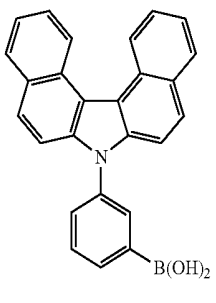


4-6



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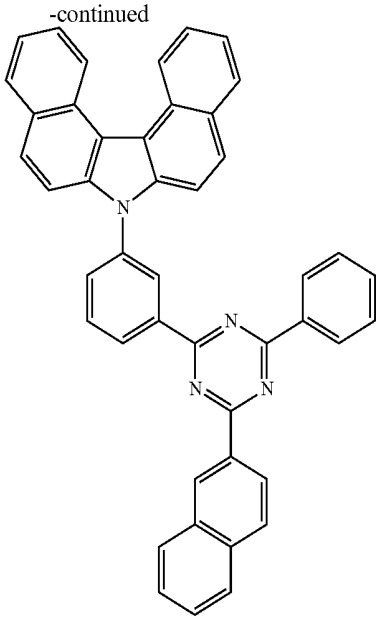


C-9

[0084] Preparation of Compound 4-3

[0085] After introducing 7H-dibenzo[c,g]carbazole (20 g, 74.80 mmol), 1-bromo-3-iodobenzene (23.7 mL, 187.00 mmol), CuI (7.1 g, 37.4 mmol), K_3PO_4 (39.7 g, 187.00 mmol), and toluene 380 mL in a flask and dissolving the solutes in the solvent, the mixture was refluxed at 120° C. for 2 hours. After completing the reaction, the mixture was filtered with DCM, dried, and separated with column chromatography to obtain compound 4-3 (23.6 g, yield: 75%).

[0086] Preparation of Compound 4-4

[0087] After dissolving compound 4-3 (24.0 g, 55.90 mmol) and n-BuLi (34 mL, 83.80 mmol) in tetrahydrofuran (THF) 280 mL in a flask, the mixture was stirred at −78° C. for one hour. Trimethyl borate ($B(OMe)_3$) (9.4 mL, 83.80 mmol) was then added dropwise to the mixture, and the mixture was stirred at room temperature for 4 hours. The mixture was then extracted with EA, and a solid was filtered with hexane (Hex) to obtain compound 4-4 (15.9 g, yield: 74%).

[0088] Preparation of Compound 4-6

[0089] After introducing compound 4-5 (20 g, 88.5 mmol), 2-naphthyl boronic acid (16.7 g, 97.3 mmol), $PdCl_2(PPh_3)_2$ (2.0 g, 2.92 mmol), Na_2CO_3 (23.5 g, 221.3 mmol), THF 440 mL, and H_2O 150 mL in a flask, the mixture was stirred for 2 hours at 65° C. After cooling the mixture to room temperature, distilled water was added thereto. After completing the reaction, an organic layer was extracted with EA, residual moisture was removed using magnesium sulfate and dried, and separated with column chromatography to obtain compound 4-6 (21 g, yield: 81%).

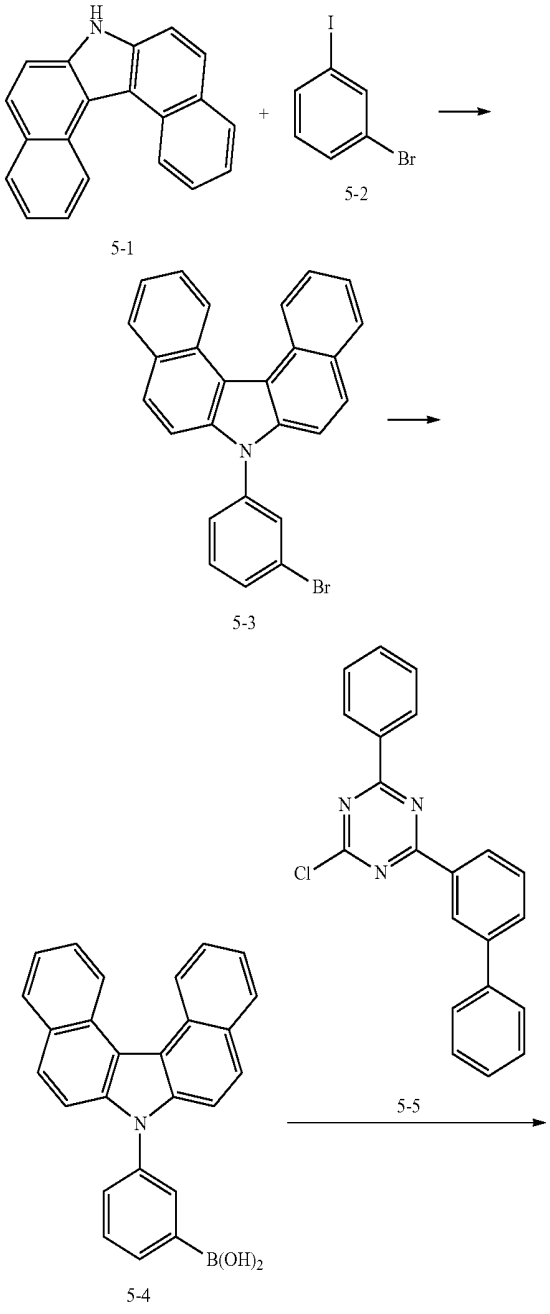
[0090] Preparation of Compound C-9

[0091] After dissolving compound 4-4 (4.0 g, 10.30 mmol), compound 4-6 (4.9 g, 15.50 mmol), $Pd(PPh_3)_4$ (600 mg, 0.52 mmol), and K_2CO_3 (4.3 g, 30.90 mmol) in a mixture solvent of toluene 50 mL, EtOH 12 mL, and H_2O 12 mL in a flask, the mixture was stirred under reflux for 4 hours. After cooling the mixture to room temperature, MeOH was added thereto, a solid was filtered, and separated with column chromatography to obtain compound C-9 (5.6 g, yield: 67%).

	MW	UV	PL	M.P.
C-9	624.73	376 nm	481 nm	200.6° C.

Example 5: Preparation of Compound C-7

[0092]



5-1

5-2

5-3

5-4

5-5

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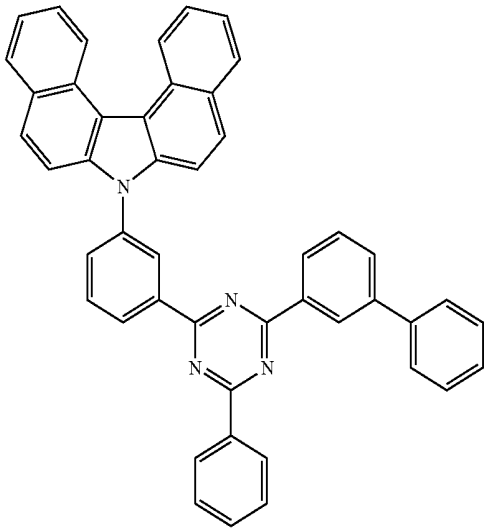


C-7

[0093] Preparation of Compound 5-3

[0094] After introducing 7H-dibenzo[c,g]carbazole (20 g, 74.80 mmol), 1-bromo-3-iodobenzene (23.7 mL, 187.00 mmol), CuI (7.1 g, 37.4 mmol), K_3PO_4 (39.7 g, 187.00 mmol), and toluene 380 mL in a flask and dissolving the solutes in the solvent, the mixture was refluxed at 120° C. for 2 hours. After completing the reaction, the mixture was filtered with DCM, dried, and separated with column chromatography to obtain compound 5-3 (23.6 g, yield: 75%).

[0095] Preparation of Compound 5-4

[0096] After dissolving compound 5-3 (24.0 g, 55.90 mmol) and n-BuLi (34 mL, 83.80 mmol) in THF 280 mL in a flask, the mixture was stirred at −78° C. for one hour. $B(OMe)_3$ (9.4 mL, 83.80 mmol) was then added dropwise to the mixture, and the mixture was stirred at room temperature for 4 hours. The mixture was then extracted with EA, and a solid was filtered with Hex to obtain compound 5-4 (15.9 g, yield: 74%).

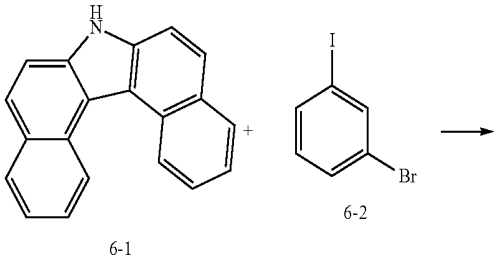
[0097] Preparation of Compound C-7

[0098] After dissolving compound 5-4 (5.0 g, 12.90 mmol), compound 5-5 (6.7 g, 19.40 mmol), $Pd(PPh_3)_4$ (745 mg, 0.66 mmol), and K_2CO_3 (5.3 g, 38.70 mmol) in a mixture solvent of toluene 65 mL, EtOH 16 mL, and H_2O 16 mL in a flask, the mixture was stirred under reflux for 1 hour. After cooling the mixture to room temperature, the mixture was extracted with EA, and separated with column chromatography to obtain compound C-7 (3.8 g, yield: 45%).

	MW	UV	PL	M.P.
C-7	650.77	324 nm	393 nm	146.6° C.

Example 6: Preparation of Compound C-37

[0099]



6-1

6-2

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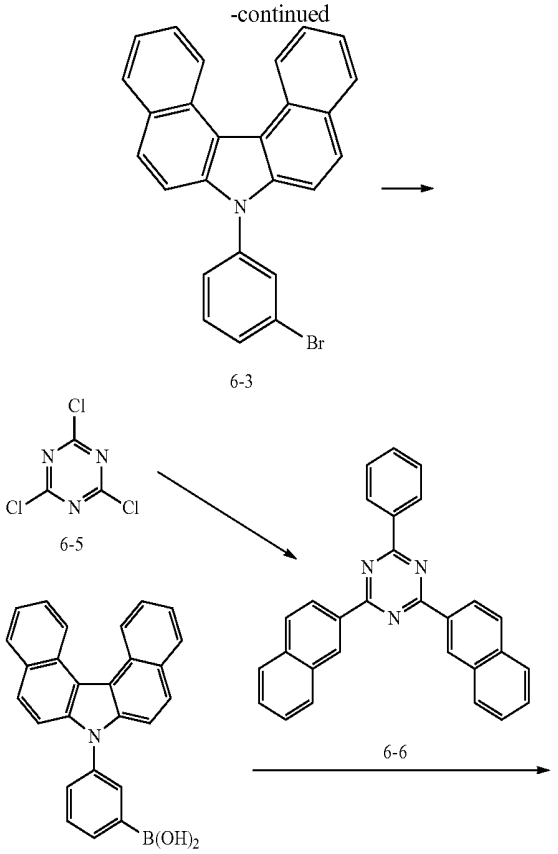
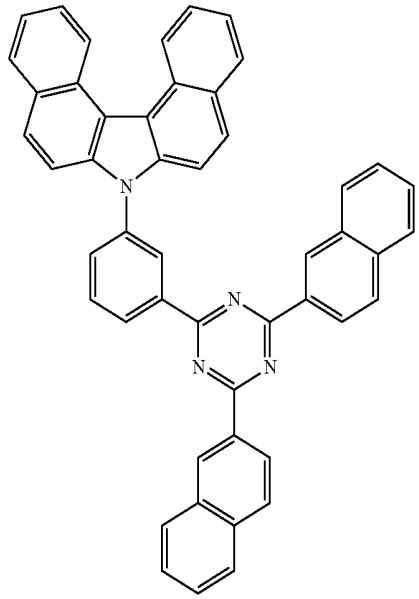


6-3

6-4

6-5

6-6



C-37

[0100] Preparation of Compound 6-3

[0101] After introducing 7H-dibenzo[c,g]carbazole (20 g, 74.80 mmol), 1-bromo-3-iodobenzene (23.7 mL, 187.00 mmol), CuI (7.1 g, 37.4 mmol), K_3PO_4 (39.7 g, 187.00 mmol), and toluene 380 mL in a flask and dissolving the solutes in the solvent, the mixture was refluxed at 120° C. for 2 hours. After completing the reaction, the mixture was filtered with DCM, dried, and separated with column chromatography to obtain compound 6-3 (23.6 g, yield: 75%).

[0102] Preparation of Compound 6-4

[0103] After dissolving compound 6-3 (24.0 g, 55.90 mmol) and n-BuLi (34 mL, 83.80 mmol) in THF 280 mL in a flask, the mixture was stirred at −78° C. for one hour. $B(OMe)_3$ (9.4 mL, 83.80 mmol) was then added dropwise to the mixture, and the mixture was stirred at room temperature for 4 hours. The mixture was then extracted with EA, and a solid was filtered with Hex to obtain compound 6-4 (15.9 g, yield: 74%).

[0104] Preparation of Compound 6-6

[0105] After dissolving compound 6-5 (20 g, 108.5 mmol), 2-naphthyl boronic acid (37.3 g, 216.9 mmol), $PdCl_2(PPh_3)_2$ (2.3 g, 3.3 mmol), and Na_2CO_3 (28.7 g, 271.3 mmol) in a mixture solvent of toluene 540 mL and H_2O 135 mL in a flask, the mixture was stirred for 2 hours at 95° C. After cooling the mixture to room temperature, distilled water was added thereto. After completing the reaction, an organic layer was extracted with ethyl acetate, residual moisture was removed using magnesium sulfate and dried, and separated with column chromatography to obtain compound 6-6 (9 g, yield: 21%).

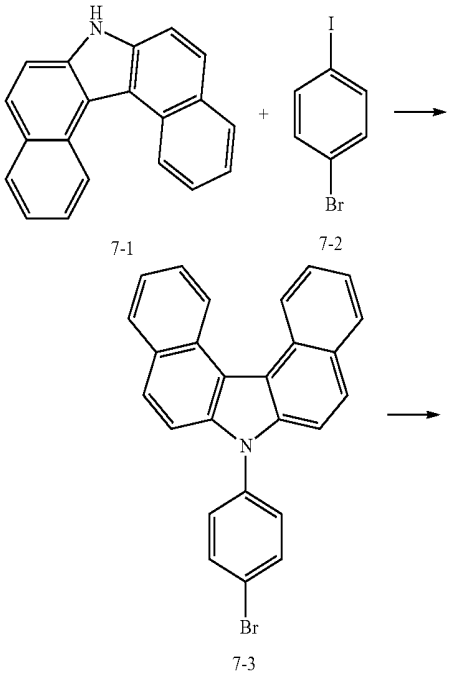
[0106] Preparation of Compound C-37

[0107] After dissolving compound 6-4 (5.0 g, 12.9 mmol), compound 6-6 (5.7 g, 15.50 mmol), $Pd(PPh_3)_4$ (745 mg, 0.65 mmol), and K_2CO_3 (5.3 g, 38.70 mmol) in a mixture solvent of toluene 65 mL, EtOH 16 mL, and H_2O 16 mL in a flask, the mixture was stirred under reflux for 4 hours. After cooling the mixture to room temperature, MeOH was added thereto, a solid was filtered, and separated with column chromatography to obtain compound C-37 (3.7 g, yield: 43%).

	MW	UV	PL	M.P.
C-37	674.79	340 nm	489 nm	290.5° C.

Example 7: Preparation of Compound C-8

[0108]



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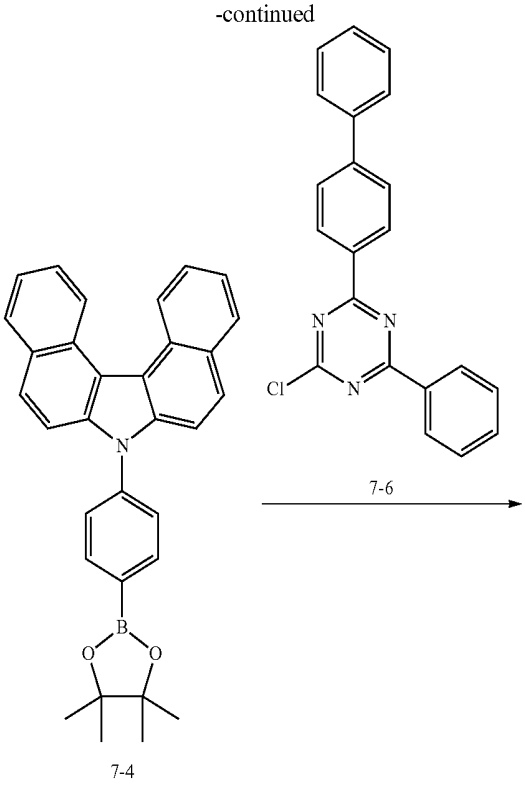
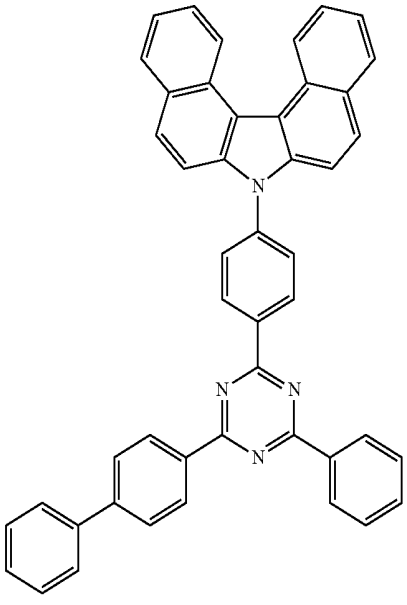




C-8

[0109] Preparation of Compound 7-3

[0110] After introducing 7H-dibenzo[c,g]carbazole (45 g, 168.0 mmol), 1-bromo-4-iodobenzene (95 g, 336.0 mmol), CuI (16 g, 84 mmol), EDA (22.5 mL, 336 mmol), K_3PO_4 (89 g, 420.00 mmol), and toluene 840 mL in a flask and dissolving the solutes in the solvent, the mixture was refluxed at 120° C. for 2 hours. After completing the reaction, the mixture was filtered with DCM, dried, and separated with column chromatography to obtain compound 7-3 (41.8 g, yield: 59%).

[0111] Preparation of Compound 7-4

[0112] After dissolving compound 7-3 (7.2 g, 17.0 mmol), pinacolato diboron (5.2 g, 20.5 mmol), $PdCl_2(PPh_3)_2$ (1.2 g, 1.7 mmol), and KOAc (3.4 g, 34.0 mmol) in 1,4-dioxane 85 mL in a flask, the mixture was stirred under reflux for 3

hours. The mixture was then extracted with EA and separated with column chromatography to obtain compound 7-4 (6.4 g, yield: 80%).

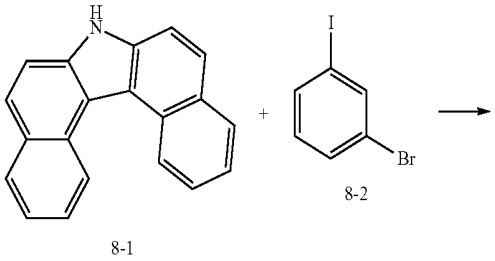
[0113] Preparation of Compound C-8

[0114] After dissolving compound 7-4 (5.9 g, 12.60 mmol), compound 7-6 (4.3 g, 12.60 mmol), $Pd(PPh_3)_4$ (728 mg, 0.63 mmol), and K_2CO_3 (3.5 g, 25.20 mmol) in a mixture solvent of toluene 63 mL, EtOH 16 mL, and H_2O 16 mL in a flask, the mixture was stirred under reflux for 2 hours. After cooling the mixture to room temperature, MeOH was added thereto, a solid was filtered, and separated with column chromatography to obtain compound C-8 (4.0 g, yield: 49%).

	MW	UV	PL	M.P.
C-8	650.77	392 nm	473 nm	225.5° C.

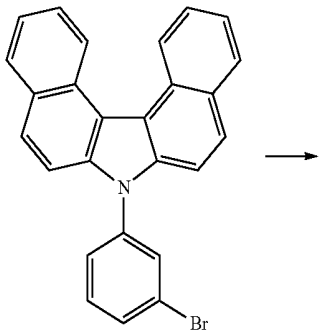
Example 8: Preparation of Compound C-13

[0115]

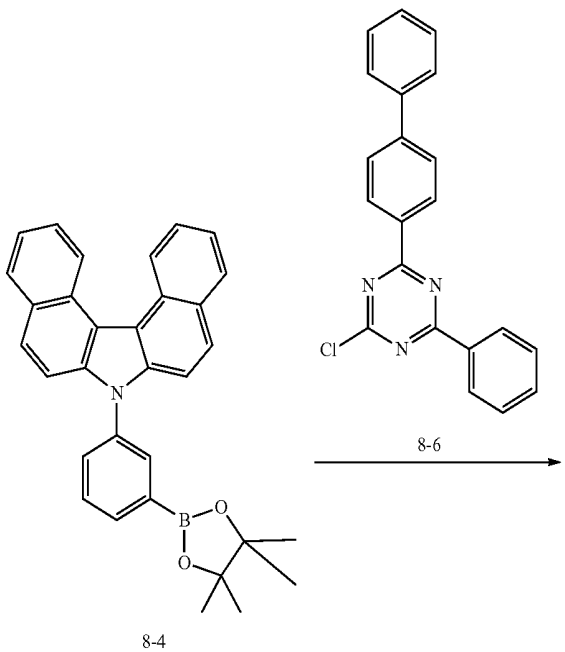


8-1

8-2



8-3



8-4

8-6

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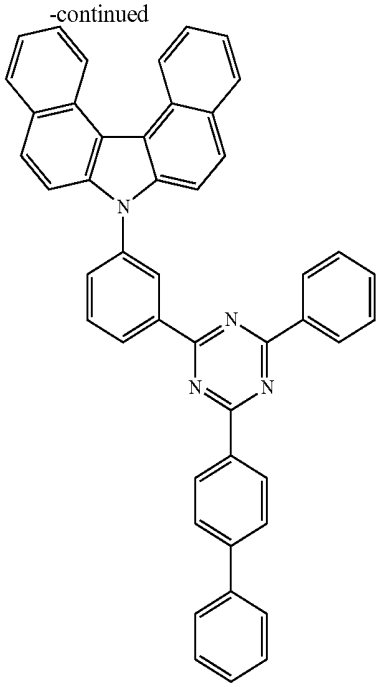


C-13

[0116] Preparation of Compound 8-3

[0117] After introducing 7H-dibenzo[c,g]carbazole (20 g, 74.80 mmol), 1-bromo-3-iodobenzene (23.7 mL, 187.00 mmol), CuI (7.1 g, 37.4 mmol), K_3PO_4 (39.7 g, 187.00 mmol), and toluene 380 mL in a flask and dissolving the solutes in the solvent, the mixture was refluxed at 120° C. for 2 hours. After completing the reaction, the mixture was filtered with DCM, dried, and separated with column chromatography to obtain compound 8-3 (23.6 g, yield: 75%).

[0118] Preparation of Compound 8-4

[0119] After dissolving compound 8-3 (7.2 g, 17.0 mmol), pinacolato diboron (5.2 g, 20.5 mmol), $PdCl_2(PPh_3)_2$ (1.2 g, 1.7 mmol), and KOAc (3.4 g, 34.0 mmol) in 1,4-dioxane 85 mL in a flask, the mixture was stirred under reflux for 3 hours. The mixture was then extracted with EA and separated with column chromatography to obtain compound 8-4 (6.4 g, yield: 80%).

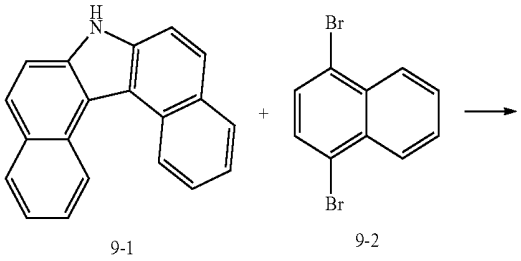
[0120] Preparation of Compound C-13

[0121] After dissolving compound 8-4 (5.5 g, 11.60 mmol), compound 8-6 (4.0 g, 11.60 mmol), $Pd(PPh_3)_4$ (670 mg, 0.58 mmol), and $NaHCO_3$ (2.0 g, 23.20 mmol) in a mixture solvent of THF 63 mL and H_2O 23 mL in a flask, the mixture was stirred under reflux for 2 hours. After cooling the mixture to room temperature, MeOH was added thereto, a solid was filtered, and separated with column chromatography to obtain compound C-13 (4.0 g, yield: 57%).

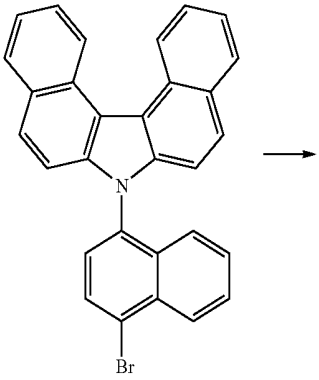
	MW	UV	PL	M.P.
C-13	650.77	382 nm	485 nm	242.2° C.

Example 9: Preparation of Compound C-4

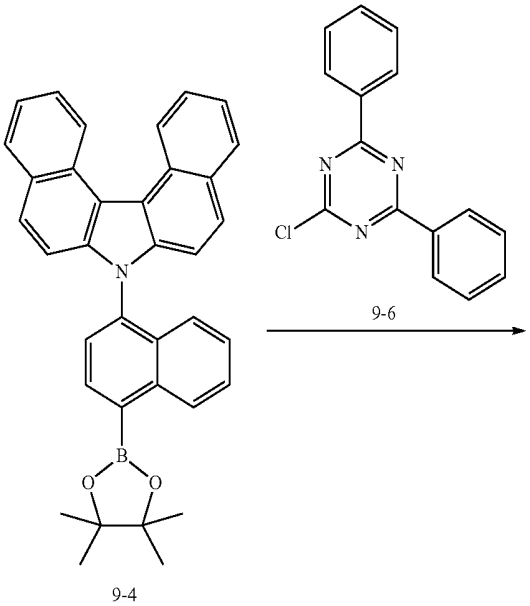
[0122]



9-1 9-2



9-3



9-4 9-6

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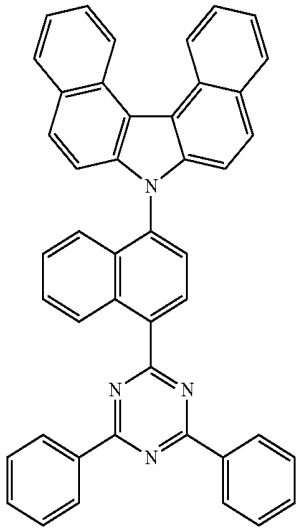


C-4

[0123] Preparation of Compound 9-3

[0124] After introducing 7H-dibenzo[c,g]carbazole (20 g, 74.80 mmol), 1,4-dibromonaphthalene (53.5 g, 187.00 mmol), $CuSO_4.5H_2O$ (1.9 g, 7.5 mmol), K_2CO_3 (20.7 g, 149.60 mmol), and 1,2-dichlorobenzene 374 mL in a flask and dissolving the solutes in the solvent, the mixture was refluxed at 200° C. for 2 days. After completing the reaction, the mixture was filtered with DCM, dried, and separated with column chromatography to obtain compound 9-3 (14.9 g, yield: 42%).

[0125] Preparation of Compound 9-4

[0126] After dissolving compound 9-3 (14.9 g, 31.5 mmol), pinacolato diboron (9.6 g, 37.9 mmol), $PdCl_2(PPh_3)_2$ (2.2 g, 3.2 mmol), and KOAc (6.2 g, 63.0 mmol) in 1,4-dioxane 158 mL in a flask, the mixture was stirred under reflux for 5 hours. The mixture was then extracted with MC and separated with column chromatography to obtain compound 9-4 (8.6 g, yield: 52%).

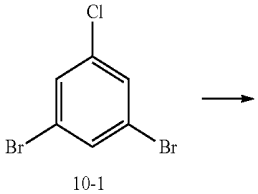
[0127] Preparation of Compound C-4

[0128] After dissolving compound 9-4 (4.0 g, 7.70 mmol), compound 9-6 (2.5 g, 9.20 mmol), $Pd(PPh_3)_4$ (445 mg, 0.39 mmol), and K_2CO_3 (2.2 g, 15.40 mmol) in a mixture solvent of toluene 40 mL, EtOH 10 mL, and H_2O 10 mL in a flask, the mixture was stirred under reflux for 4 hours. After cooling the mixture to room temperature, MeOH was added thereto, a solid was filtered, and separated with column chromatography to obtain compound C-4 (3.1 g, yield: 65%).

	MW	UV	PL	M.P.
C-4	624.73	392 nm	511 nm	292.7° C.

Example 10: Preparation of Compound C-5

[0129]



10-1

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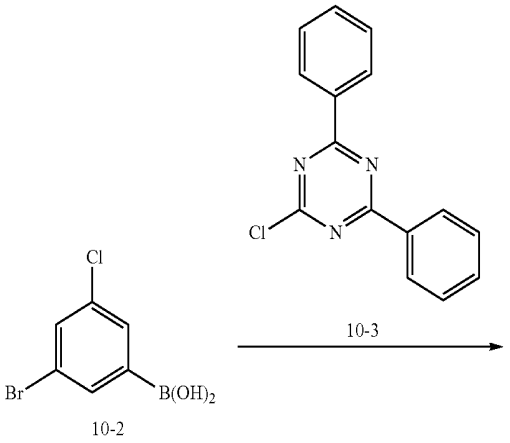

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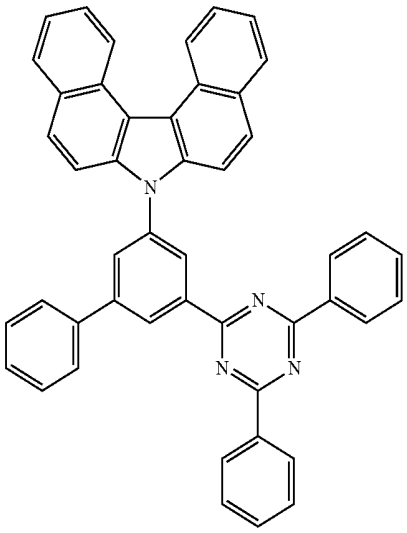
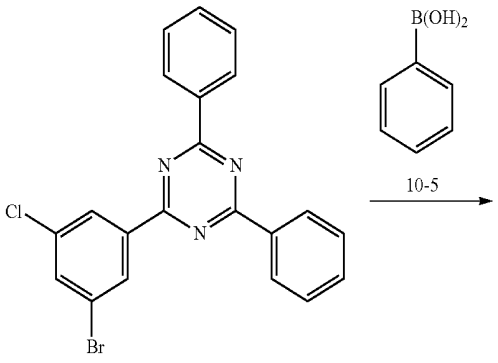
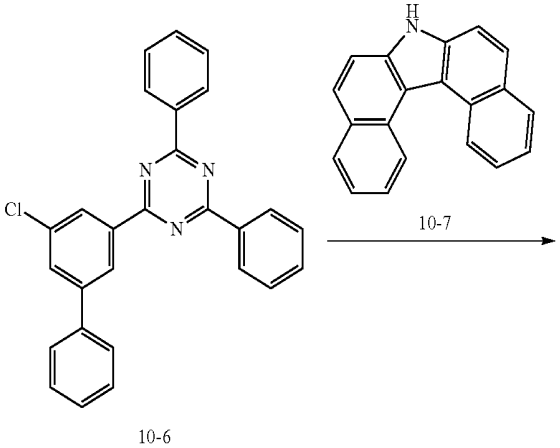


C-5



10-4



10-6

[0130] Preparation of Compound 10-2

[0131] After dissolving compound 10-1 (40.0 g, 147.96 mmol) and n-BuLi (71 mL, 177.55 mmol) in a mixture solvent of toluene 555 mL and THF 185 mL in a flask, the mixture was stirred at −78° C. for one hour. $B(OiPr)_3$ (40.0 mL, 177.55 mmol) was then added dropwise to the mixture, and the mixture was stirred at room temperature for 3 hours. The mixture was then extracted with EA, and a solid was filtered with Hex to obtain compound 10-2 (11.5 g, yield: 33%).

[0132] Preparation of Compound 10-4

[0133] After dissolving compound 10-2 (6.7 g, 28.50 mmol), compound 10-3 (15.2 g, 57.0 mmol), $Pd(PPh_3)_4$ (1.6 g, 1.43 mmol), and K_2CO_3 (7.9 g, 57.00 mmol) in a mixture solvent of toluene 140 mL, EtOH 35 mL, and H_2O 35 mL in a flask, the mixture was stirred under reflux for 3 hours. After cooling the mixture to room temperature, MeOH was added thereto, a solid was filtered, and separated with column chromatography to obtain compound 10-4 (8.8 g, yield: 73%).

[0134] Preparation of Compound 10-6

[0135] After dissolving compound 10-4 (8.3 g, 19.6 mmol), phenyl boronic acid (2.9 g, 23.6 mmol), $Pd(PPh_3)_4$ (1.2 g, 0.98 mmol), and K_2CO_3 (5.4 g, 39.20 mmol) in a mixture solvent of toluene 100 mL, EtOH 25 mL, and H_2O 25 mL in a flask, the mixture was stirred under reflux for 4 hours. The mixture was then cooled to room temperature, extracted with EA, and separated with column chromatography to obtain compound 10-6 (6.2 g, yield: 67%).

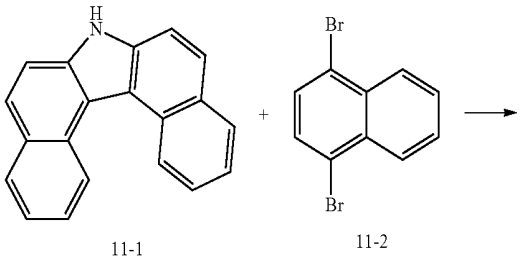
[0136] Preparation of Compound C-5

[0137] After dissolving compound 10-6 (5.4 g, 12.86 mmol), compound 10-7 (3.8 g, 14.10 mmol), $Pd_2(dba)_3$ (589 mg, 0.64 mmol), 2-dicyclohexylphosphino-2',6'-dimethoxy-biphenyl (S-phos) (528 mg, 1.29 mmol), and NaOtBu (1.9 g, 19.29 mmol) in o-xylene 64 mL in a flask, the mixture was stirred under reflux for 6 hours. After cooling the mixture to room temperature, MeOH was added thereto, a solid was filtered, and separated with column chromatography to obtain compound C-5 (5.7 g, yield: 68%).

	MW	UV	PL	M.P.
C-5	650.77	378 nm	485 nm	307.7° C.

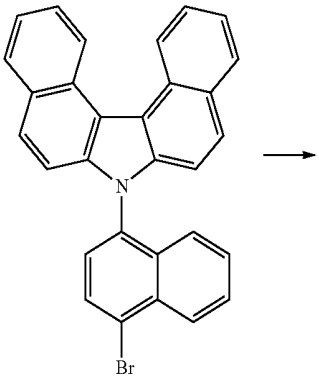
Example 11: Preparation of Compound C-16

[0138]

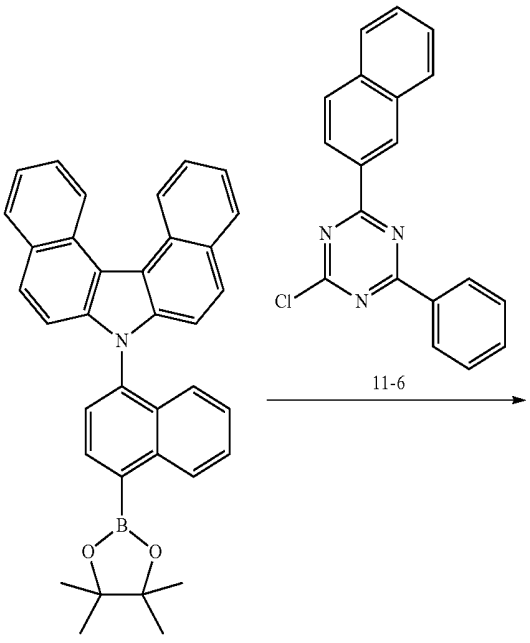


11-1

11-2



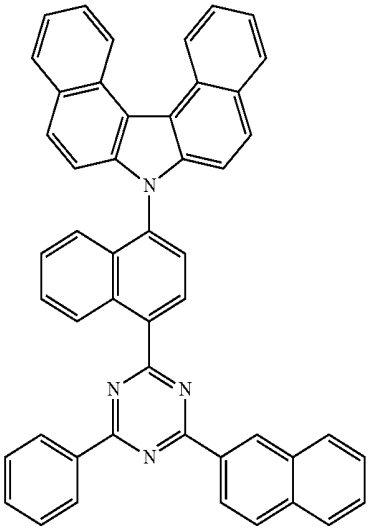
11-3



11-4

11-6

-continued



C-16

[0139] Preparation of Compound 11-3

[0140] After introducing 7H-dibenzo[c,g]carbazole (20 g, 74.80 mmol), 1,4-dibromonaphthalene (53.5 g, 187.00 mmol), $CuSO_4.5H_2O$ (1.9 g, 7.5 mmol), K_2CO_3 (20.7 g, 149.60 mmol), and 1,2-dichlorobenzene 374 mL in a flask and dissolving the solutes in the solvent, the mixture was refluxed at 200° C. for 2 days. After completing the reaction, the mixture was filtered with DCM, dried, and separated with column chromatography to obtain compound 11-3 (14.9 g, yield: 42%).

[0141] Preparation of Compound 11-4

[0142] After dissolving compound 11-3 (14.9 g, 31.5 mmol), pinacolato diboron (9.6 g, 37.9 mmol), $PdCl_2(PPh_3)_2$ (2.2 g, 3.2 mmol), and KOAc (6.2 g, 63.0 mmol) in 1,4-dioxane 158 mL in a flask, the mixture was stirred under reflux for 5 hours. The mixture was then extracted with MC and separated with column chromatography to obtain compound 11-4 (8.6 g, yield: 52%).

[0143] Preparation of Compound C-16

[0144] After dissolving compound 11-4 (5.7 g, 10.97 mmol), compound 11-6 (4.2 g, 13.20 mmol), $Pd(PPh_3)_4$ (634 mg, 0.55 mmol), and K_2CO_3 (3.0 g, 21.94 mmol) in a mixture solvent of toluene 60 mL, EtOH 15 mL, and H_2O 15 mL in a flask, the mixture was stirred under reflux for 2 hours and 30 minutes. After cooling the mixture to room temperature, MeOH was added thereto, a solid was filtered, and separated with column chromatography to obtain compound C-16 (5.1 g, yield: 69%).

	MW	UV	PL	M.P.
C-16	674.81	412 nm	585 nm	281.9° C.

Device Examples 1-1 to 1-12: Production of an Organic Electroluminescent Device Comprising the Organic Electroluminescent Compound According to the Present Invention as a Host

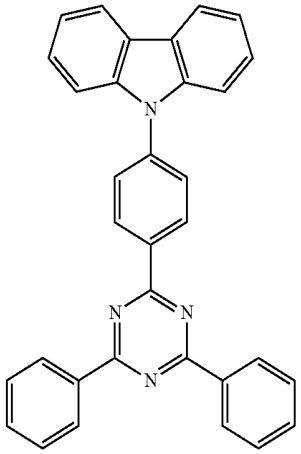
[0145] An OLED device was produced comprising the organic electroluminescent compound according to the pres-

ent invention. A transparent electrode indium tin oxide (ITO) thin film (10 Ω/sq) on a glass substrate for an organic light-emitting diode (OLED) device (Geomatec, Japan) was subjected to an ultrasonic washing with trichloroethylene, acetone, ethanol, and distilled water, sequentially, and was then stored in isopropanol. Next, the ITO substrate was 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 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 first hole injection layer having a thickness of 80 nm on the ITO substrate. Dipyrazino[2,3-f:2',3'-h]quinoxaline-2,3,6,7,10,11-hexacarbonitrile was then introduced into another cell of said vacuum vapor depositing apparatus, and was evaporated by applying an 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 was introduced into another cell of said vacuum vapor depositing apparatus, and was evaporated by applying an 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-(4-(9,9-diphenyl-9H,9'H-[2,9'-bifluorene]-9'-yl)phenyl)-9,9-dimethyl-N-phenyl-9H-fluorene-2-amine was introduced into another cell of said vacuum vapor depositing apparatus, and was evaporated by applying an electric current to the cell, thereby forming a second hole transport layer having a thickness of 60 nm on the first hole transport layer. Thereafter, host compounds as listed in Table 1 below was introduced into one cell of the vacuum vapor depositing apparatus as a host, and compound D-96 was introduced into another cell as a dopant. The two materials were deposited in a doping amount of 3 wt % (the amount of dopant) based on the total amount of the host and dopant to form a light-emitting layer having a thickness of 40 nm on the second hole transport layer. 2,4-bis(9,9-dimethyl-9H-fluoren-2-yl)-6-(naphthalen-2-yl)-1,3,5-triazine and lithium quinolate were then introduced into another two cells, evaporated at the same time, and deposited to form an electron transport layer having a thickness of 30 nm on the light-emitting layer. Next, 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 80 nm was deposited by another vacuum vapor deposition apparatus on the electron injection layer. Thus, an OLED device was produced.

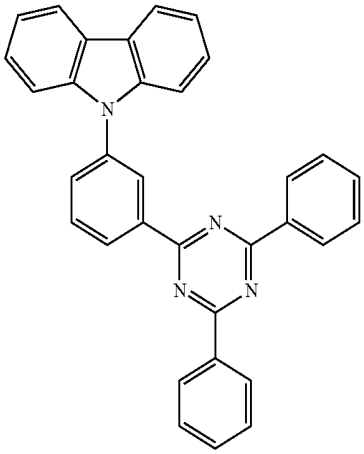
Comparative Examples 1-1 to 1-3: Production of an Organic Electroluminescent Device Comprising a Conventional Organic Electroluminescent Material as a Host

[0146] An OLED device was produced in the same manner as in the Device Examples above, except for using the compounds below as a host of the light-emitting material.

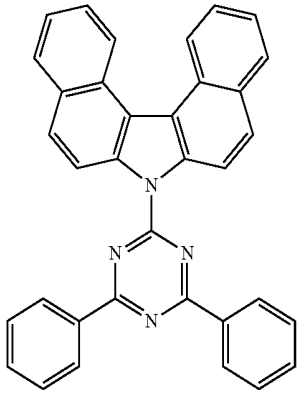
A



B



C



[0147] The evaluation results of the organic electroluminescent devices produced in Device Examples 1-1 to 1-12 and Comparative Examples 1-1 to 1-3 are shown in Table 1 as follows:

TABLE 1

	Host	Voltage (V)	Efficiency (cd/A)	Lifespan T98 (hr)	Color
Device Example 1-1	C-1	4.6	26.0	14	Red
Device Example 1-2	C-2	4.9	29.0	20	Red
Device Example 1-3	C-9	5.1	27.4	25	Red
Device Example 1-4	C-7	5.3	27.2	11	Red

TABLE 1-continued

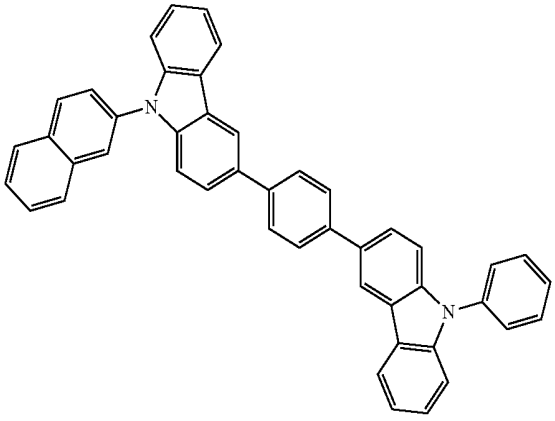
	Host	Voltage (V)	Efficiency (cd/A)	Lifespan T98 (hr)	Color
Device Example 1-5	C-37	4.9	26.9	8	Red
Device Example 1-6	C-10	4.6	25.4	12	Red
Device Example 1-7	C-11	5.2	28.8	28	Red
Device Example 1-8	C-8	4.4	23.0	9	Red
Device Example 1-9	C-13	4.7	26.5	12	Red
Device Example 1-10	C-4	4.7	24.9	42	Red
Device Example 1-11	C-5	4.7	24.9	20	Red
Device Example 1-12	C-16	5.1	24.1	38	Red
Comparative Example 1-1	A	4.6	23.2	0	Red
Comparative Example 1-2	B	5.5	19.3	0	Red
Comparative Example 1-3	C	5.4	24.0	2	Red

[0148] The data of driving voltage, efficiency, and color coordinate in Table 1 are based on 5,000 nit of luminance, and the lifespan data are time taken to be reduced from 100% to 98% of the luminance at 5,000 nit and a constant current.

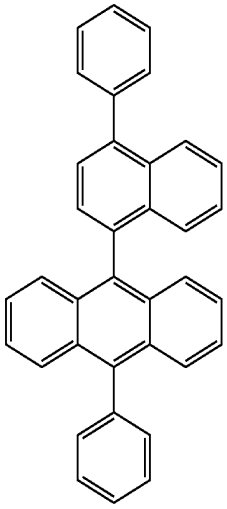
Comparative Example 2-1: Production of a Blue Light-Emitting Organic Electroluminescent Device not Comprising an Electron Buffer Layer

[0149] An OLED device was produced 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) device (Geomatec, Japan) was subjected to an ultrasonic washing with acetone, ethanol, and distilled water, sequentially, and was then stored in isopropanol. Next, the ITO substrate was 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 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 first hole injection layer having a thickness of 60 nm on the ITO substrate. 1,4,5,8,9,12-hexaazatriphenylene-hexacarbonitrile (HAT-CN) was then introduced into another cell of said vacuum vapor depositing apparatus, and was evaporated by applying an 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 was introduced into another cell of said vacuum vapor depositing apparatus, and was evaporated by applying an electric current to the cell, thereby forming a first hole transport layer having a thickness of 20 nm on the second hole injection layer. 9-(naphthalen-2-yl)-3-(4-(9-phenyl-9H-carbazol-3-yl)phenyl)-9H-carbazole as below (HT-2) was introduced into another cell of said vacuum vapor depositing apparatus, and was evaporated by applying an electric current to the cell, thereby forming a second hole transport layer having a thickness of 5 nm on the first hole transport layer. Thereafter, compound BH-1 as below was introduced into one cell of the vacuum vapor depositing apparatus as a host, and compound BD-1 as below was introduced into another cell as a dopant. The two materials were evaporated at different rates and were deposited in a doping amount of 2 wt % (the amount of dopant) based on the total amount of the host and dopant to form a light-emitting layer having a thickness of 20 nm on the second hole transport layer. 2-(3-(phenanthren-9-yl)-5-(pyridin-3-yl)phenyl)-4,6-diphenyl-1,3,5-triazine and lithium quinolate were then introduced into another two cells, evaporated at the same rate in an amount of 50 wt % each, and deposited to form an electron transport layer having a thickness of 35 nm on the light-emitting layer. Next, 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 80 nm was deposited by another vacuum vapor deposition apparatus on the electron injection layer. Thus, an OLED device was produced. All the materials used for producing the OLED device were those purified by vacuum sublimation at 10^{-6} torr.

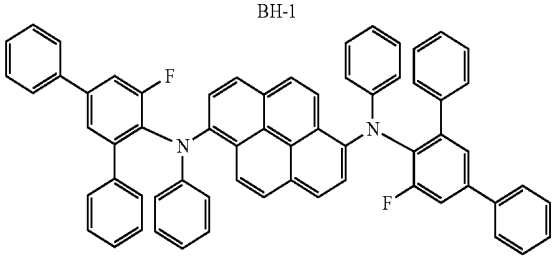
[0150] A driving voltage at 1,000 nit of luminance, CIE color coordinate, and time taken to be reduced from 100% to 90% of the luminance at 2,000 nit and a constant current of OLEDs are shown in Table 2 below.



HT-2

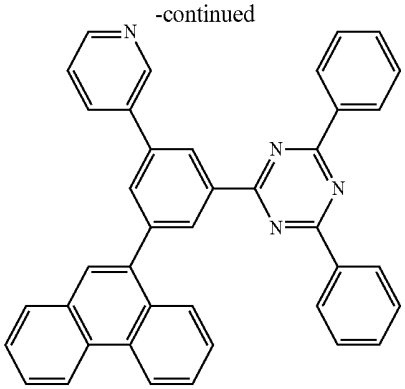


BH-1



BD-1

-continued



ETL

Comparative Example 2-2, and Device Examples 2-1 and 2-2: Production of a Blue Light-Emitting Organic Electroluminescent Device According to the Present Invention

[0151] An OLED device was produced in the same manner as in Comparative Example 2-1, except for reducing the thickness of the electron transport layer to 30 nm, and inserting an electron buffer layer of 5 nm between the light-emitting layer and the electron transport layer, and evaluated. The evaluation results of the devices produced in Comparative Example 2-2, and Device Examples 2-1 and 2-2 are shown in Table 2 as follows:

TABLE 2

	Electron Buffer Layer	Voltage (V)	Color	Lifespan (%)
Comparative Example 2-1	—	4.2	Blue	38.7
Comparative Example 2-2	C	4.0	Blue	34.0
Device Example 2-1	C-1	4.6	Blue	57.8
Device Example 2-2	C-2	4.4	Blue	64.1

[0152] The blue fluorescent materials used at present have several problems. First, when exposed to high temperature during a process of producing a panel, a current characteristic of the blue fluorescent luminescent device changes to cause a problem of a change in luminance, and a drop of an interfacial characteristic between a light-emitting layer and an electron injection layer causes a decrease in luminance and lifespan. Second, in the case of devices comprising an anthracene based blue fluorescent host and a pyrene based dopant, an absolute value of a LUMO (lowest unoccupied molecular orbital) energy of the host (Ah) is higher than that of the dopant (Ad), and hole traps are magnified so that efficiency increases due to interfacial luminescence between the electron transport layer and the fluorescent light-emitting layer, but there is a problem in that the lifespan decreases.

[0153] Originally, LUMO energy and HOMO (highest occupied molecular orbital) energy levels have negative values. However, for convenience, the LUMO energy level and HOMO energy level are expressed in absolute values in the present invention. In addition, the values of the LUMO energy level are compared based on absolute values. In the present invention, Values measured by density functional theory (DFT) are used for the LUMO energy level and HOMO energy level.

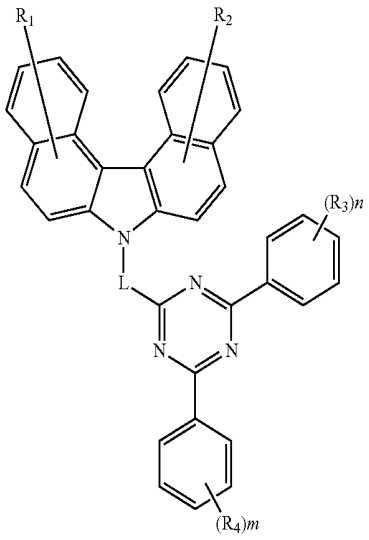
[0154] In the blue organic electroluminescent device according to the present invention, by interposing an electron buffering layer, electron injection is controlled and interfacial characteristics between the light-emitting layer and the electron injection layer are improved, and thus lifespan characteristics are focused. Specifically, by interposing an electron buffer layer in the organic electroluminescent device, electron injection and transport can be controlled due to the difference of electron affinity according to LUMO energy level, between the light-emitting layer and the electron transport zone.

[0155] In the organic electroluminescent device according to the present invention, the LUMO energy level of the electron buffer layer may be higher than the LUMO energy level of the host compound. Specifically, the difference in the LUMO energy levels between the electron buffer layer and the host compound may be 0.4 eV or less. For example, the LUMO energy levels of the electron buffer layer and the host compound may be 2.0 eV and 1.6 eV, respectively, and thus the difference in the LUMO energy levels may be 0.4 eV. Due to such LUMO barrier between the host compound and the electron buffer layer, improved lifespan characteristics can be shown compared to a device not comprising an electron buffer layer. This is because a drop of an interfacial characteristic within the device is mitigated through electron injection control effect due to the electron buffer layer.

[0156] As shown in Table 2, due to the electron injection control effect of the electron buffer layer of the present invention, Device Examples 2-1 and 2-2 showed better lifespan characteristics than Comparative Examples 2-1 and 2-2 which do not comprise an electron buffer layer. These results can be effectively used henceforth in the field of flexible display or lighting device which require long lifespan.

1. An organic electroluminescent compound represented by the following formula 1:

(1)



wherein

L represents a substituted or unsubstituted (C6-C30) arylene;

R_1 to R_4 each independently represent hydrogen, deuterium, a halogen, a cyano, 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 (C1-C30) alkoxy, a substituted or unsubstituted tri(C1-C30)alkylsilyl, a substituted or unsubstituted di(C1-C30)alkyl (C6-C30)arylsilyl, a substituted or unsubstituted (C1-C30)alkyldi(C6-C30)arylsilyl, a substituted or unsubstituted tri(C6-C30)arylsilyl, a substituted or unsubstituted mono- or di-(C1-C30)alkylamino, a substituted or unsubstituted mono- or di-(C6-C30)arylamino, or a substituted or unsubstituted (C1-C30)alkyl (C6-C30)arylamino; or are linked to an adjacent substituent(s) to form a substituted or unsubstituted, mono- or polycyclic, (C3-C30) alicyclic or aromatic ring, whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen, and sulfur;

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

n and m represent an integer of 0 to 3.

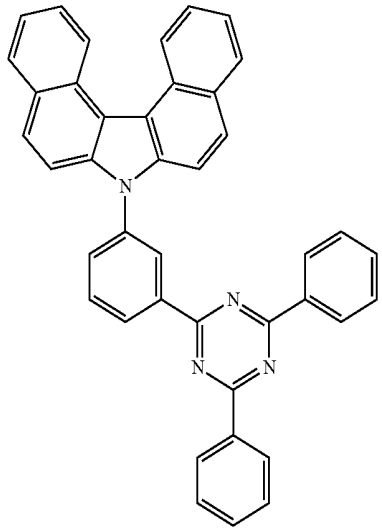
2. The organic electroluminescent compound according to claim **1**, wherein the substituents of the substituted (C1-C30)alkyl, the substituted (C6-C30)aryl, the substituted 3- to 30-membered heteroaryl, the substituted (C3-C30)cycloalkyl, the substituted (C1-C30)alkoxy, the substituted tri(C1-C30)alkylsilyl, the substituted di(C1-C30)alkyl(C6-C30)arylsilyl, the substituted (C1-C30)alkyldi(C6-C30)arylsilyl, the substituted tri(C6-C30)arylsilyl, the substituted mono- or di-(C1-C30)alkylamino, the substituted mono- or di-(C6-C30)arylamino, the substituted (C1-C30)alkyl(C6-C30)arylamino, and the substituted mono- or polycyclic, (C3-C30) alicyclic or aromatic ring in R_1 to R_4 each independently are at least one selected from the group consisting of deuterium, a halogen, a cyano, a carboxyl, a nitro, a hydroxyl, 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 5- to 30-membered heteroaryl unsubstituted or substituted with a (C6-C30)aryl, a (C6-C30)aryl unsubstituted or substituted with a 5- 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.

3. The organic electroluminescent compound according to claim **1**, wherein L represents a substituted or unsubstituted (C6-C20)arylene, and R_1 to R_4 each independently represent hydrogen, or a substituted or unsubstituted (C6-C20)aryl, or are linked to an adjacent substituent(s) to form a substituted or unsubstituted, mono- or polycyclic, (C6-C20) alicyclic or aromatic ring, whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen, and sulfur.

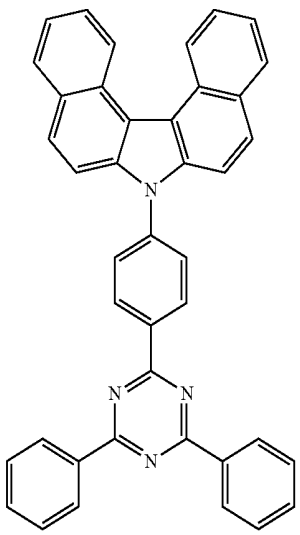
4. The organic electroluminescent compound according to claim **1**, wherein L represents a (C6-C12)arylene unsubstituted or substituted with a (C1-C6)alkyl or a (C6-C12)aryl, and R_1 to R_4 each independently represent hydrogen or an unsubstituted (C6-C12)aryl, or are linked to an adjacent substituent(s) to form a mono- or polycyclic, (C6-C15) alicyclic or aromatic ring unsubstituted or substituted with a (C1-C6)alkyl or a (C6-C12)aryl, whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen, and sulfur.

5. The organic electroluminescent compound according to claim **1**, wherein the compound represented by formula 1 is selected from the group consisting of:

C-1



C-2



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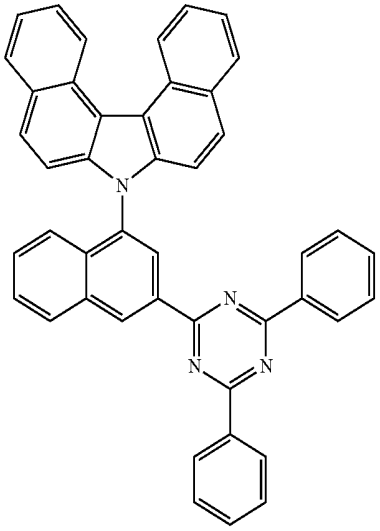
C-3



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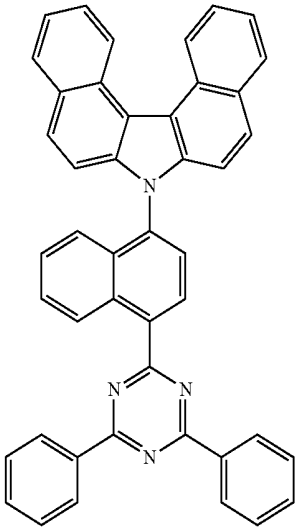
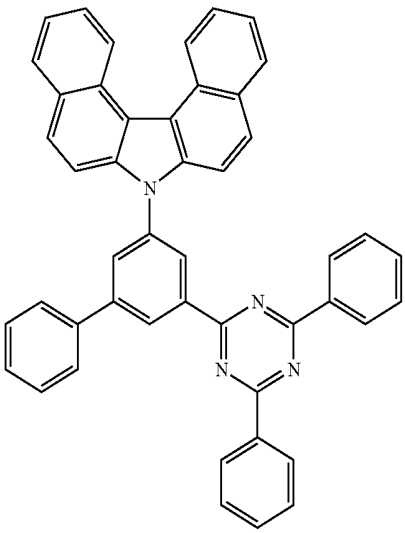


C-5



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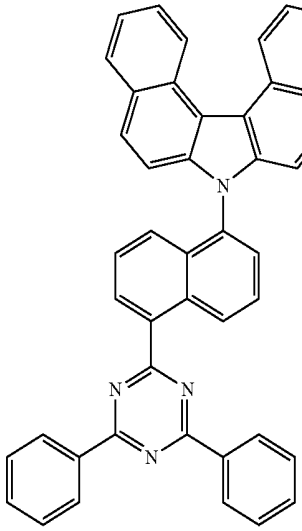
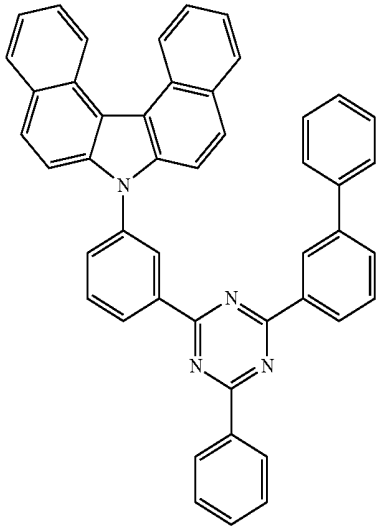
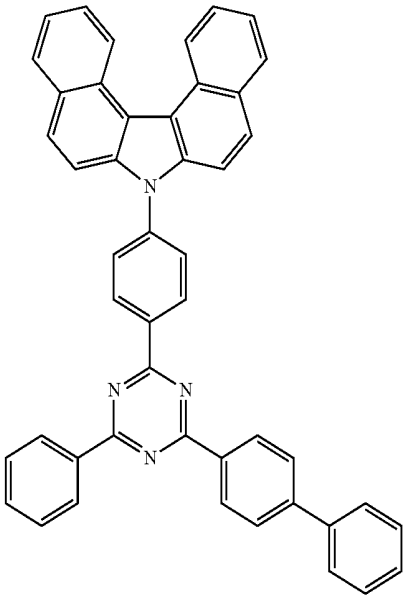
C-6



C-7



C-8



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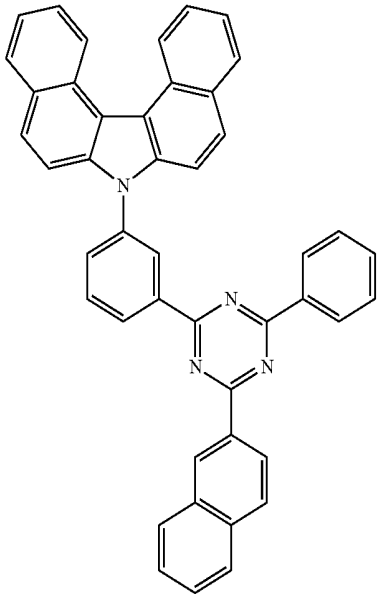
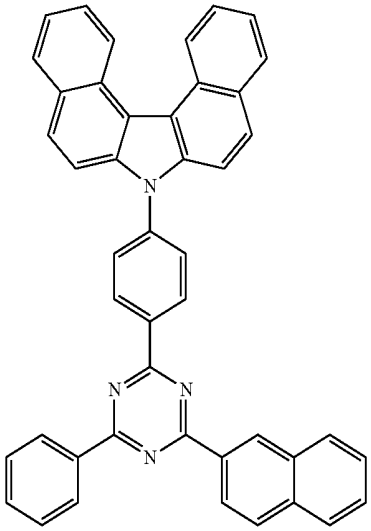
C-9



C-10



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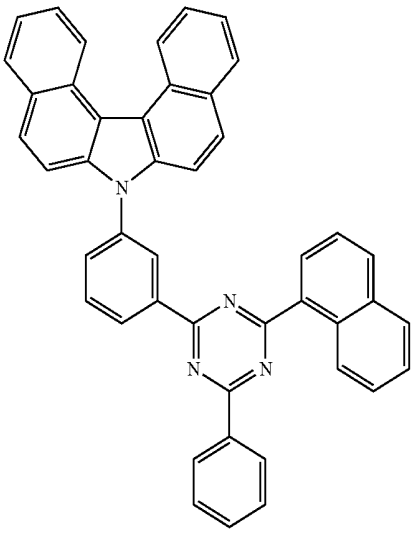

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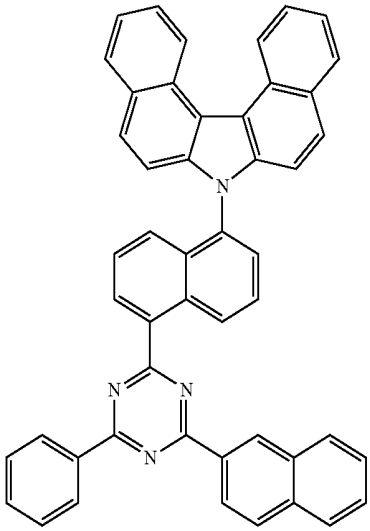
C-12



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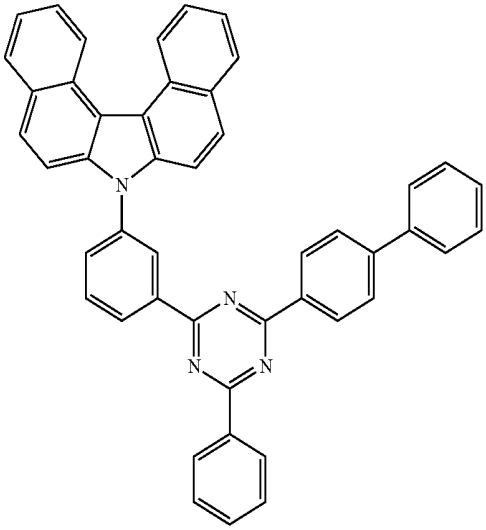

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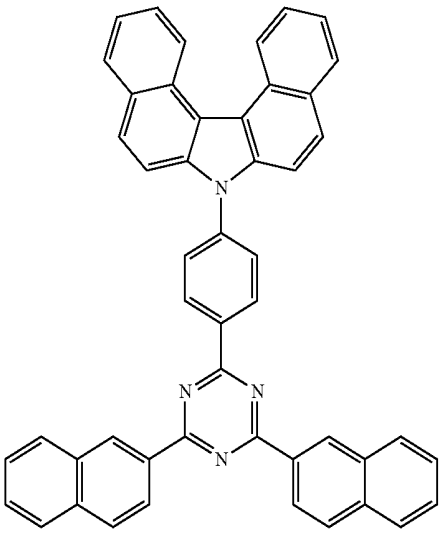

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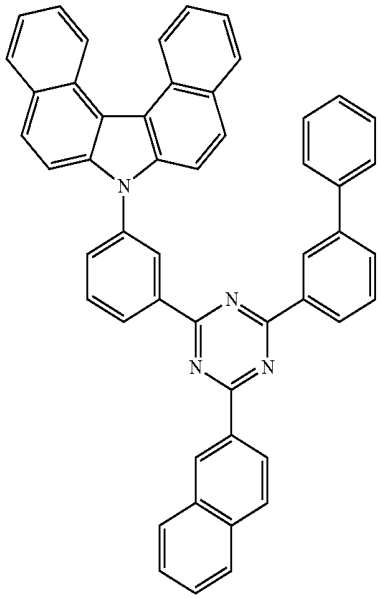

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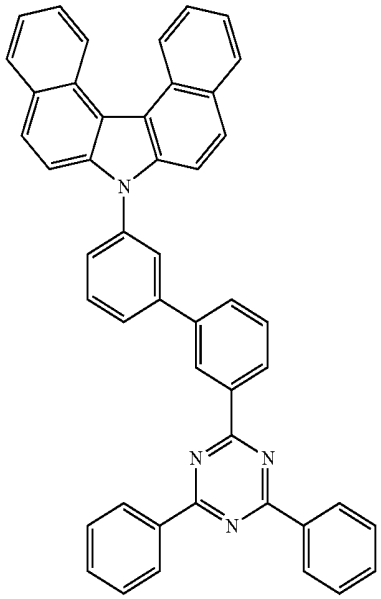

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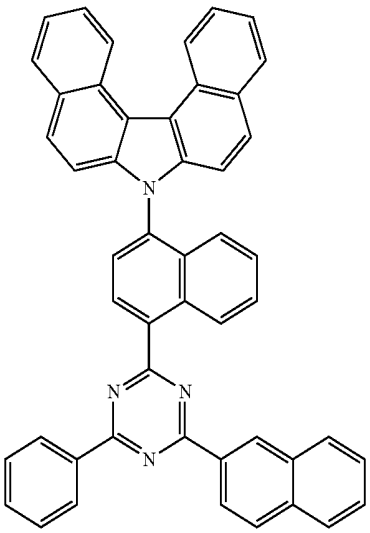

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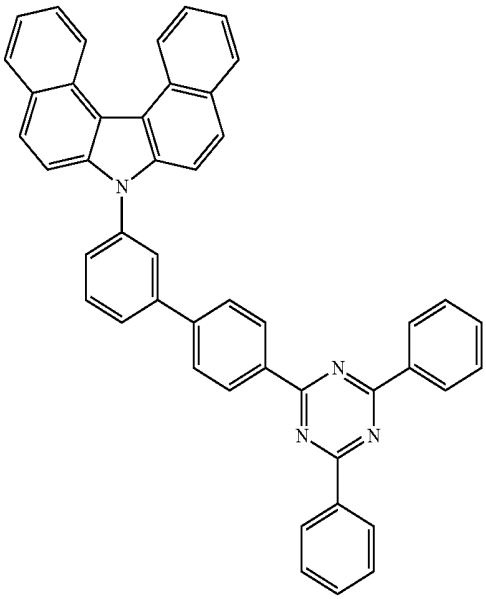

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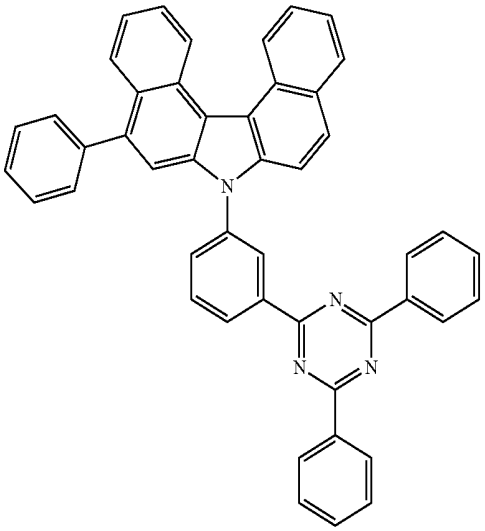
C-19



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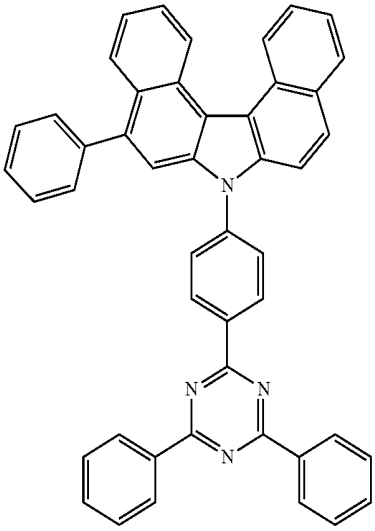

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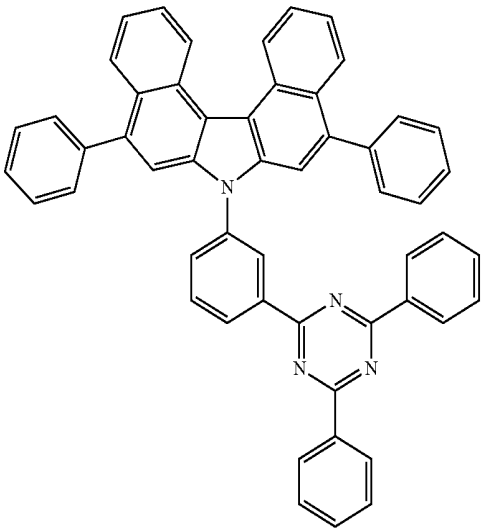

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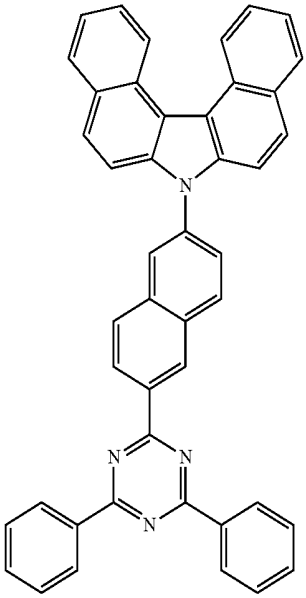

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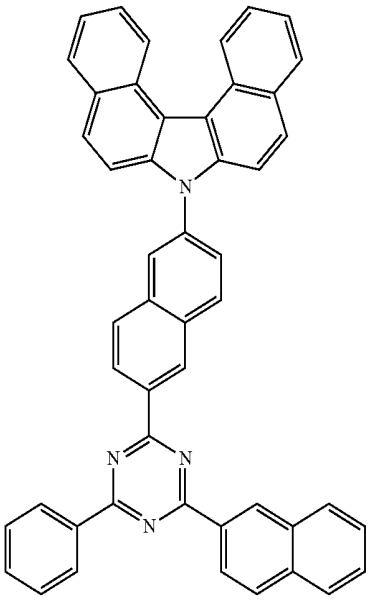

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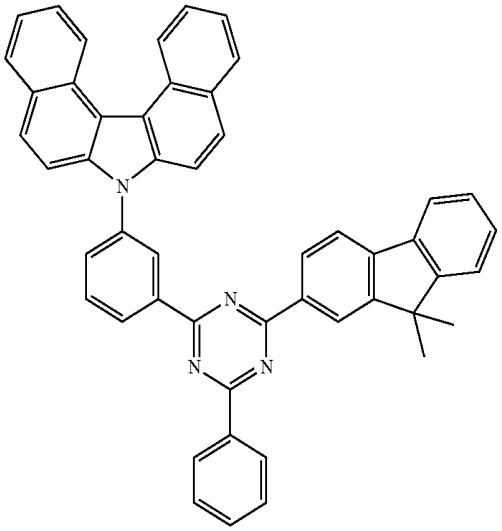

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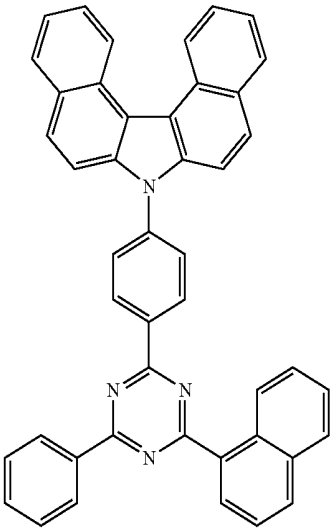

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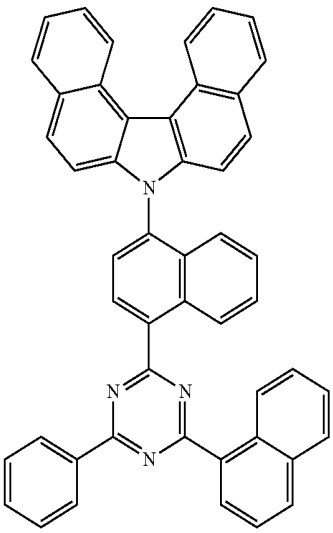

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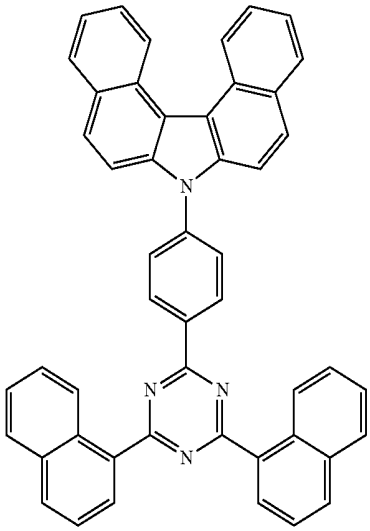
C-27



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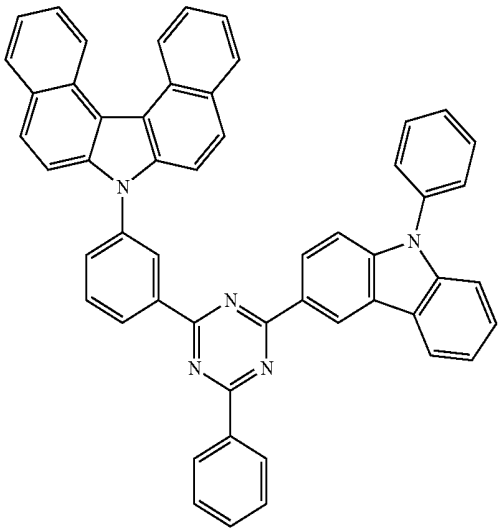

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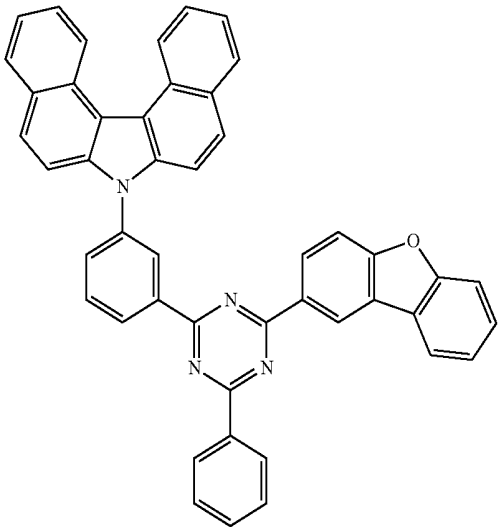

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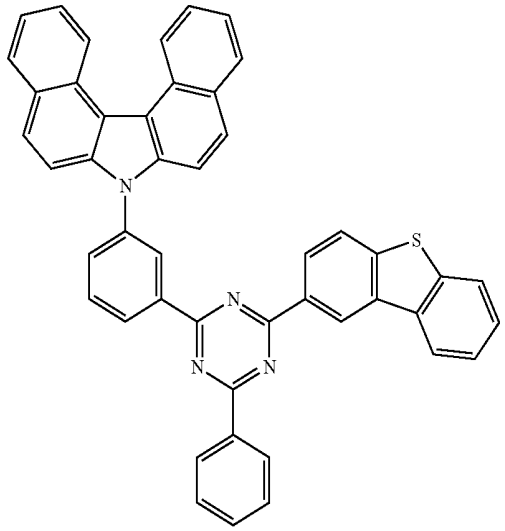

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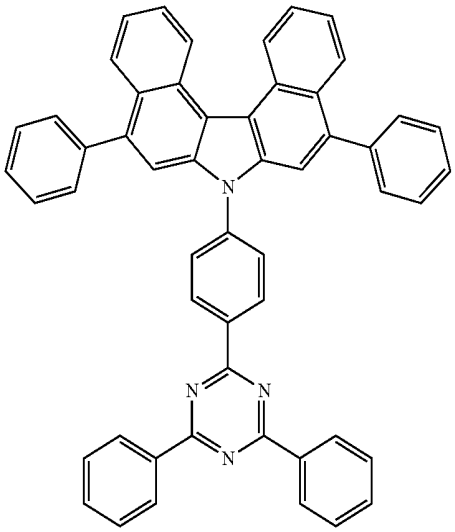

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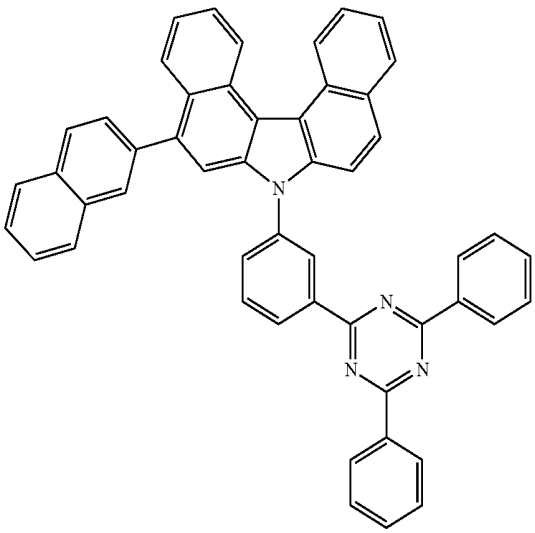

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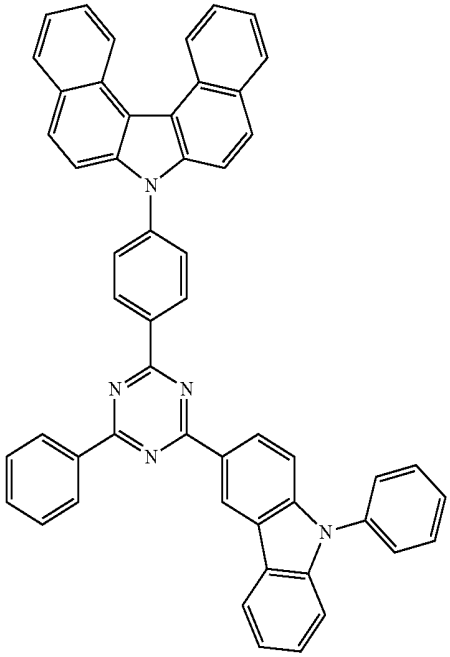

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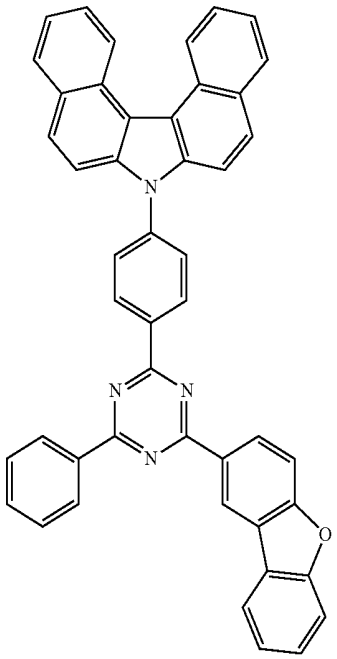

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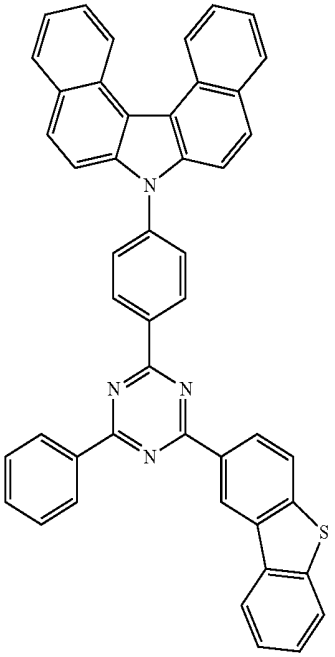
C-35



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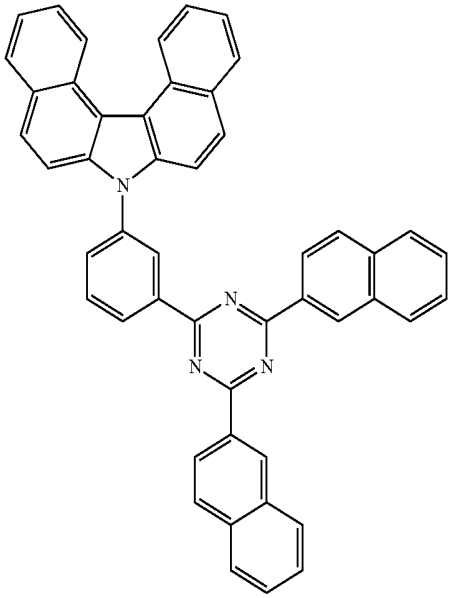
C-37



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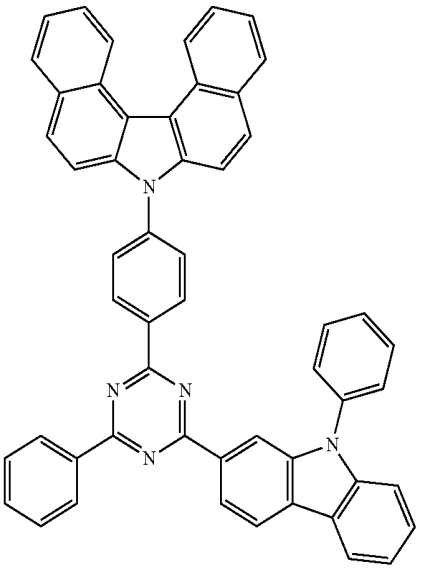

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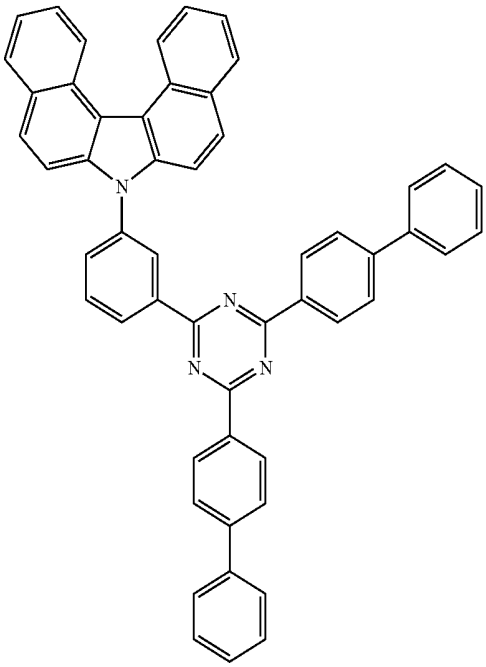

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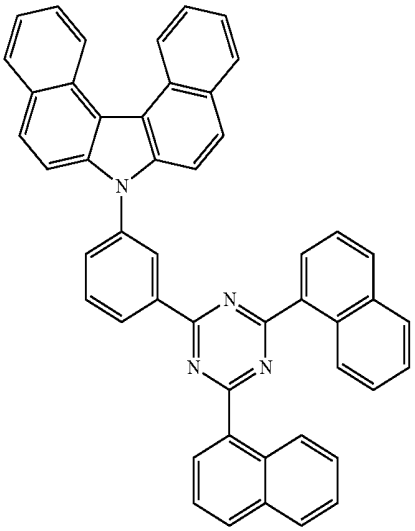
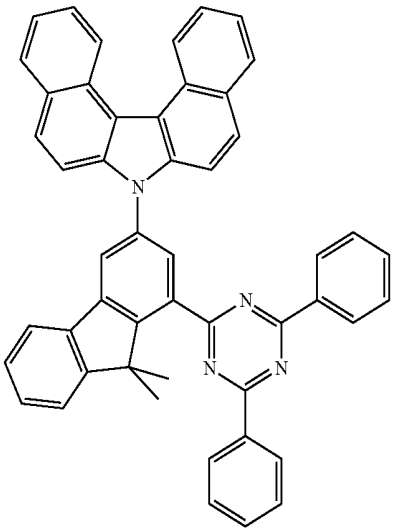
C-39



C-40



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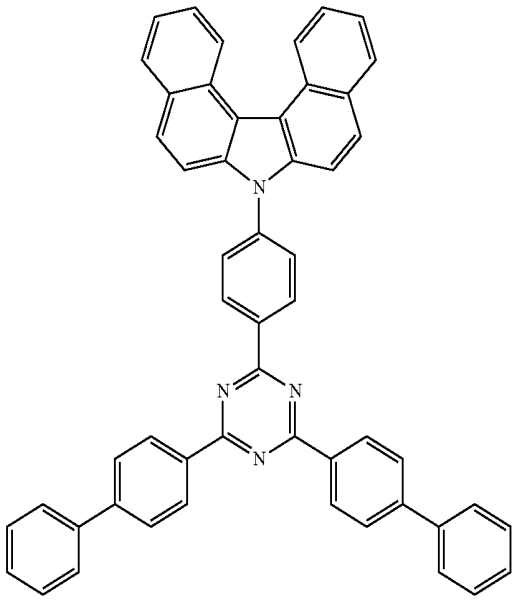
C-41



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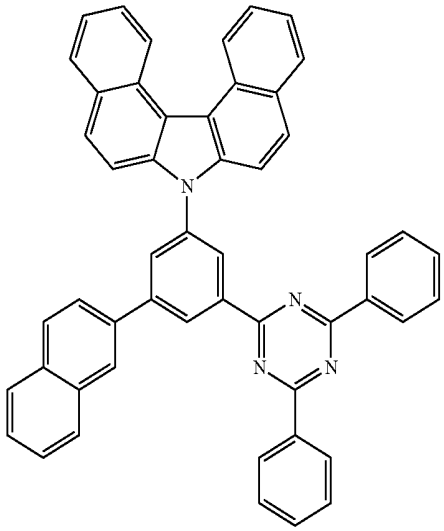

6. An organic electroluminescent device comprising the organic electroluminescent compound according to claim **1**.

7. The organic electroluminescent device according to claim **6**, wherein the organic electroluminescent compound is comprised in an electron buffer layer.

* * * * *

专利名称(译)	有机电致发光化合物和包含其的有机电致发光器件		
公开(公告)号	US20180022991A1	公开(公告)日	2018-01-25
申请号	US15/550400	申请日	2016-01-21
[标]申请(专利权)人(译)	罗门哈斯电子材料有限公司		
申请(专利权)人(译)	罗门哈斯电子材料KOREA LTD.		
当前申请(专利权)人(译)	罗门哈斯电子材料KOREA LTD.		
[标]发明人	KANG HEE RYONG HONG JIN RI KIM BITNARI CHO SANG HEE		
发明人	KANG, HEE-RYONG HONG, JIN-RI KIM, BITNARI CHO, SANG-HEE		
IPC分类号	C09K11/06 H01L51/50 C07D209/82 H01L51/00 C07D403/10 C07D251/24		
CPC分类号	C09K11/06 C07D403/10 C07D251/24 C07D209/82 H01L51/0072 H01L51/5024 C07D409/14 C07D405/14 C09B57/00 C09B57/008 C09B57/10 H01L51/0052 H01L51/0058 H01L51/0067 H01L51/0085 H01L51/5016		
优先权	1020150021675 2015-02-12 KR 1020160002161 2016-01-07 KR		
外部链接	Espacenet USPTO		

摘要(译)

本发明涉及有机电致发光化合物和包含该化合物的有机电致发光器件。根据本发明的有机电致发光化合物可以包含在发光层或电子缓冲层中，并且有效地制备具有低驱动电压，优异的电流和功率效率以及显着改善的操作寿命的有机电致发光器件。

(1)