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(54) **NOVEL ORGANIC ELECTROLUMINESCENT COMPOUNDS AND ORGANIC ELECTROLUMINESCENT DEVICE USING THE SAME**

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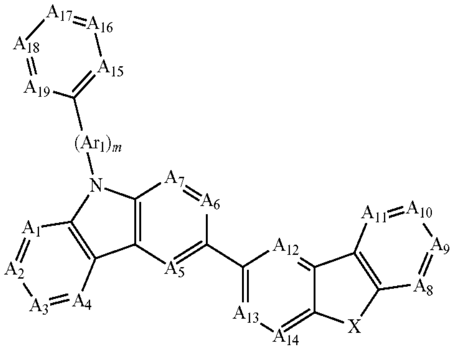
(57) **ABSTRACT**

Provided are a novel organic electroluminescent compound and an organic electroluminescent device using the same. More particularly, the organic electroluminescent compound disclosed herein is represented by Chemical Formula 1:

Chemical Formula 1



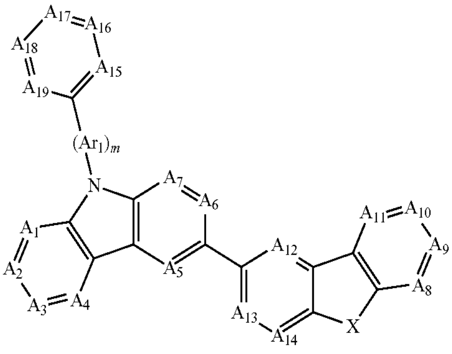
Since the organic electroluminescent compound disclosed herein exhibits good luminous efficiency and excellent life property, it may be used to manufacture OLED devices having very superior operation life.

NOVEL ORGANIC ELECTROLUMINESCENT COMPOUNDS AND ORGANIC ELECTROLUMINESCENT DEVICE USING THE SAME

FIELD OF THE INVENTION

[0001] The present invention relates to novel organic electroluminescent compounds and an organic electroluminescent device using the same. The organic electroluminescent compound according to the present invention is represented by Chemical Formula 1:

Chemical Formula 1



BACKGROUND OF THE INVENTION

[0002] In general, the organic EL device commonly has a configuration of anode/hole injection layer (HIL)/hole transport layer (HTL)/emission material layer (EML)/electron transport layer (ETL)/electron injection layer (EIL)/cathode. Organic electroluminescent devices emitting blue, green or red light may be created depending on how to form the emission material layer.

[0003] At present, 4,4'-bis(carbazol-9-yl) biphenyl (CBP) is the most widely known as a host material for a phosphorescent material. High-efficiency OLEDs using a hole blocking layer comprising 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline (BCP), Bis(2-methyl-8-quinolinato)(p-phenyl-phenolato)aluminum(III) (BAlq), etc. are reported. High-performance OLEDs using BAlq derivatives as a host were reported by Pioneer (Japan) and others.

[0004] Although these materials provide good electroluminescence characteristics, they are disadvantageous in that degradation may occur during the high-temperature deposition process in vacuum because of low glass transition temperature and poor thermal stability. Since the power efficiency of an OLED is given by (π/voltage)×current efficiency, the power efficiency is inversely proportional to the voltage. High power efficiency is required to reduce the power consumption of an OLED. Actually, OLEDs using phosphorescent materials provide much better current efficiency (cd/A) than those using fluorescent materials. However, when the existing materials such as BAlq, CBP, etc. are used as a host of the phosphorescent material, there is no significant advantage in power efficiency (lm/W) over the OLEDs using fluorescent materials because of high driving voltage.

[0005] Further, the OLED devices do not have satisfactory operation life. Therefore, development of more stable, higher-performance host materials is required.

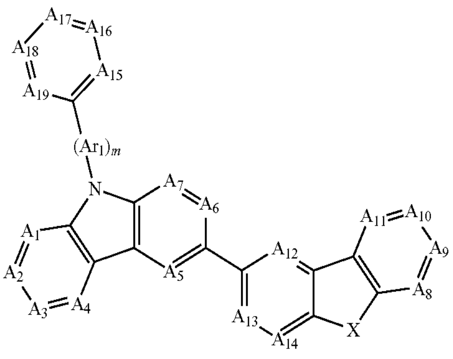
Technical Problem

[0006] Accordingly, an object of the present invention is to provide an organic electroluminescent compound having luminescence efficiency and device operation life improved over existing host materials and having superior backbone with appropriate color coordinates in order to solve the aforesaid problems. Another object of the present invention is to provide a highly efficient and long-life organic electroluminescent device employing the organic electroluminescent compound as an electroluminescent material.

Technical Solution

[0007] The present invention relates to organic electroluminescent compounds represented by Chemical Formula 1, and an organic electroluminescent device using the same. The organic electroluminescent compounds according to the present invention exhibit high luminous efficiency, excellent color purity and life property of the material, so that OLED's with very excellent operation life can be manufactured therefrom.

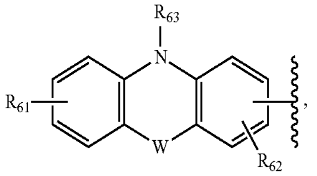
Chemical Formula 1

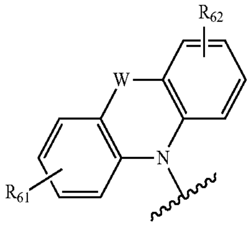


[0008] wherein

[0009] A_1 through A_{19} independently represent CR_1 or N, X represents $-(CR_2R_3)_l-$, $-N(R_4)-$, $-S-$, $-O-$, $-Si(R_5)(R_6)-$, $-P(R_7)-$, $-P(=O)(R_8)-$ or $-B(R_9)-$, and Ar_1 represents (C6-C40)arylene with or without substituent(s) or (C3-C40)heteroarylene with or without substituent(s), except for the case where m is 0, and A_{15} through A_{19} are CR_1 at the same time;

[0010] R_1 through R_9 independently represent hydrogen, deuterium, halogen, (C1-C30)alkyl with or without substituent(s), (C6-C30)aryl with or without substituent(s), substituted or unsubstituted (C6-C30)aryl fused with one or more (C3-C30)cycloalkyl(s) with or without substituent(s), (C3-C30)heteroaryl with or without substituent(s), 5- to 7-membered heterocycloalkyl with or without substituent(s), 5- to 7-membered heterocycloalkyl fused with one or more aromatic ring(s) with or without substituent(s), (C3-C30)cycloalkyl with or without substituent(s), (C3-C30)cycloalkyl fused with one or more aromatic ring(s) with or without substituent(s), cyano, trifluoromethyl, $NR_{21}R_{22}$, $BR_{23}R_{24}$, $PR_{25}R_{26}$, $P(=O)R_{27}R_{28}$, $R^aR^bR^cSi-$, R^dY-, $R^eC(=O)-$, $R^fC(=O)O-$, (C6-C30)ar(C1-C30)alkyl with or without substituent(s), (C2-C30)alkenyl with or without substituent(s), (C2-C30)alkynyl with or without substituent(s), carboxyl, nitro,





or hydroxyl, or each of them may be linked to an adjacent substituent via (C3-C30)alkylene or (C3-C30)alkenylene with or without a fused ring to form an alicylic ring, a mono- or polycyclic aromatic ring or a mono- or polycyclic heteroaromatic ring;

[0011] W represents —$(CR_{51}R_{52})_n$—, —$(R_{51})C{=}C(R_{52})$—, —$N(R_{53})$—, —S—, —O—, —$Si(R_{54})(R_{55})$—, —$P(R_{56})$—, —$P({=}O)(R_{57})$—, —C(=O)— or —$B(R_{58})$—, and R_{51} through R_{58} and R_{61} through R_{63} are the same as R_1 through R_9;

[0012] the heterocycloalkyl or heteroaryl may contain one or more heteroatom(s) selected from B, N, O, S, P(=O), Si and P;

[0013] R_{21} through R_{28} independently represent (C1-C30)alkyl with or without substituent(s), (C6-C30)aryl with or without substituent(s) or (C3-C30)heteroaryl with or without substituent(s), R^a, R^b, and R^c independently represent (C1-C30)alkyl with or without substituent(s) or (C6-C30)aryl with or without substituent(s), Y represents S or O, R^d represent (C1-C30)alkyl with or without substituent(s) or (C6-C30)aryl with or without substituent(s), R^e represent (C1-C30)alkyl with or without substituent(s), (C1-C30)alkoxy with or without substituent(s), (C6-C30)aryl with or without substituent(s) or (C6-C30)aryloxy with or without substituent(s), R^f represent (C1-C30)alkyl with or without substituent(s), (C1-C30)alkoxy with or without substituent(s), (C6-C30)aryl with or without substituent(s) or (C6-C30)aryloxy with or without substituent(s);

[0014] m represents an integer 0 to 2; and

[0015] l and n represent an integer 1 or 2.

[0016] In the present invention, "alkyl", "alkoxy" and other substituents containing "alkyl" moiety include both linear and branched species. In the present invention, "cycloalkyl" includes both adamantyl with or without substituent(s) and (C7-C30)bicycloalkyl with or without substituent(s).

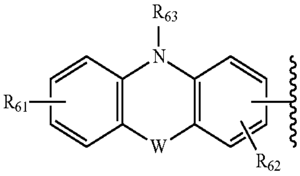
[0017] In the present invention, "aryl" means an organic radical derived from an aromatic hydrocarbon by the removal of one hydrogen atom, and may include a 4- to 7-membered, particularly 5- or 6-membered, single ring or fused ring, including a plurality of aryls linked by chemical bond(s). Specific examples include phenyl, naphthyl, biphenyl, anthryl, indenyl, fluorenyl, phenanthryl, triphenylenyl, pyrenyl, perylenyl, chrysenyl, naphthacenyl, fluoranthenyl, etc., but are not limited thereto. "heteroaryl" means an aryl group containing 1 to 4 heteroatom(s) selected from B, N, O, S, P(=O), Si and P as aromatic ring backbone atom(s), other remaining aromatic ring backbone atoms being carbon. It may be 5- or 6-membered monocyclic heteroaryl or polycyclic heteroaryl resulting from condensation with a benzene ring, and may be partially saturated. Further, the heteroaryl includes more than one heteroaryls linked by chemical bond(s). The heteroaryl includes a divalent aryl group wherein the heteroatom(s) in the ring may be oxidized or quaternized to form, for example, an N-oxide or a quaternary salt.

[0018] Specific examples include monocyclic heteroaryl such as furyl, thienyl, pyrrolyl, imidazolyl, pyrazolyl, thiazolyl, thiadiazolyl, isothiazolyl, isoxazolyl, oxazolyl, oxadiazolyl, triazinyl, tetrazinyl, triazolyl, tetrazolyl, furazanyl, pyridyl, pyrazinyl, pyrimidinyl, pyridazinyl, etc., polycyclic heteroaryl such as benzofuryl, benzothienyl, isobenzofuryl, benzimidazolyl, benzothiazolyl, benzoisothiazolyl, benzoisoxazolyl, benzoxazolyl, isoindolyl, indolyl, indazolyl, benzothiadiazolyl, quinolyl, isoquinolyl, cinnolinyl, quinazolinyl, quinolizinyl, quinoxalinyl, carbazolyl, phenanthridinyl, benzodioxolyl, etc., an N-oxide thereof (e.g., pyridyl N-oxide, quinolyl N-oxide, etc.), a quaternary salt thereof, etc., but are not limited thereto.

[0019] The "(C1-C30)alkyl" groups described herein may include (C1-C20)alkyl or (C1-C10)alkyl and the "(C6-C30)aryl" groups include (C6-C20)aryl or (C6-C12)aryl. The "(C3-C30)heteroaryl" groups include (C3-C20)heteroaryl or (C3-C12)heteroaryl and the "(C3-C30)cycloalkyl" groups include (C3-C20)cycloalkyl or (C3-C7)cycloalkyl. The "(C2-C30)alkenyl or alkynyl" group include (C2-C20)alkenyl or alkynyl, (C2-C10)alkenyl or alkynyl.

[0020] In "with or without substituent(s)", the substituent is further substituted by one or more substituent(s) selected from the group consisting of deuterium, halogen, (C1-C30)alkyl with or without halogen substituent(s), (C6-C30)aryl, (C3-C30)heteroaryl with or without (C6-C30)aryl substituent(s), 5- to 7-membered heterocycloalkyl, 5- to 7-membered heterocycloalkyl fused with one or more aromatic ring(s), (C3-C30)cycloalkyl, (C3-C30)cycloalkyl fused with one or more aromatic ring(s), tri(C1-C30)alkylsilyl, di(C1-C30)alkyl(C6-C30)arylsilyl, tri(C6-C30)arylsilyl, (C2-C30)alkenyl, (C2-C30)alkynyl, cyano, carbazolyl, $NR_{31}R_{32}$, $BR_{33}R_{34}$, $PR_{35}R_{36}$, $P({=}O)R_{37}R_{38}$, (C6-C30)ar(C1-C30)alkyl, (C1-C30)alkyl(C6-C30)aryl, (C1-C30)alkyloxy, (C1-C30)alkylthio, (C6-C30)aryloxy, (C6-C30)arylthio, (C1-C30)alkoxycarbonyl, (C1-C30)alkylcarbonyl, (C6-C30)arylcarbonyl, (C6-C30)aryloxycarbonyl, (C1-C30)alkoxycarbonyloxy, (C1-C30)alkylcarbonyloxy, (C6-C30)arylcarbonyloxy, (C6-C30)aryloxycarbonyloxy, carboxyl, nitro and hydroxyl, or is linked to an adjacent substituent to form a ring, wherein R_{31} through R_{38} independently represent (C1-C30)alkyl, (C6-C30)aryl or (C3-C30)heteroaryl.

[0021] The R_1 through R_9, R_{21} through R_{28}, R_{51} through R_{58} and R_{61} through R_{63} are independently selected from hydrogen, deuterium, halogen, alkyl such as methyl, ethyl, propyl, butyl, pentyl, hexyl, ethylhexyl, heptyl, octyl, etc., aryl such as phenyl, naphthyl, fluorenyl, biphenyl, phenanthryl, terphenyl, pyrenyl, perylenyl, spirobifluorenyl, fluoranthenyl, chrysenyl, triphenylenyl, etc., aryl fused with one or more cycloalkyl such as 1,2-dihydroacenaphthyl, heteroaryl such as dibenzothiophenyl, dibenzofuryl, carbazolyl, pyridyl, furyl, thienyl, quinolyl, triazinyl, pyrimidinyl, pyridazinyl, quinoxalinyl, phenanthrolinyl, etc., heterocycloalkyl fused with one or more aromatic ring such as benzopyrrolidino, benzopiperidino, dibenzomorpholino, dibenzoazepino, etc., amino substituted by aryl such as phenyl, naphthyl, fluorenyl, biphenyl, phenanthryl, terphenyl, pyrenyl, perylenyl, spirobifluorenyl, fluoranthenyl, chrysenyl, triphenylenyl, etc. or heteroaryl such as dibenzothiophenyl, dibenzofuryl, carbazolyl, pyridyl, furyl, thienyl, quinolyl, triazinyl, pyrimidinyl, pyridazinyl, quinoxalinyl, phenanthrolinyl, etc., aryloxy such as biphenyloxy, etc., arylthio such as biphenylthio, etc., aralkyl such as biphenylmethyl, triphenylmethyl, etc.,



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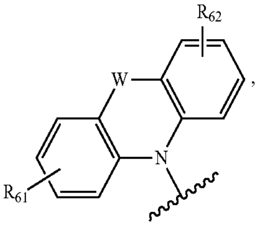

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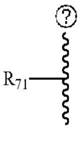
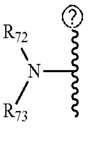
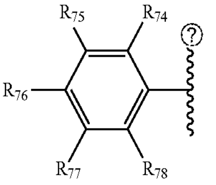
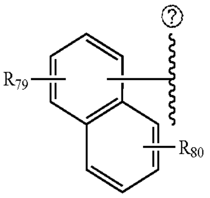
but are not limited thereto, and may be further substituted as shown in Chemical Formula 1.

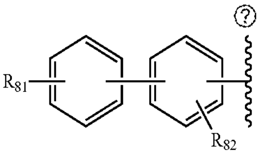
[0022] More specifically, the R_1 through R_9 may be exemplified as following structures but are not limited thereto.

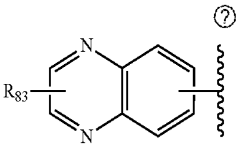


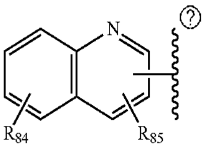


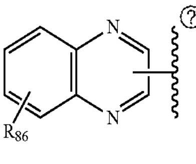


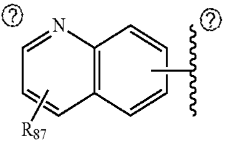












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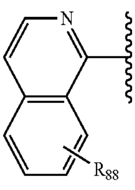

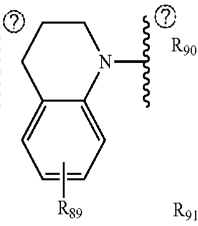

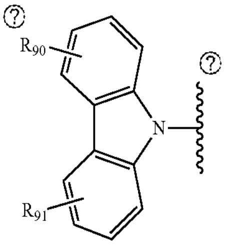

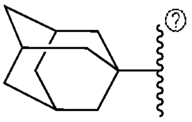

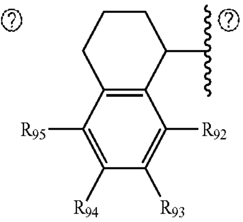

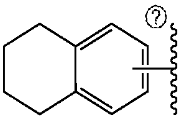

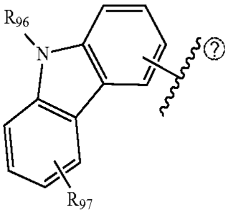

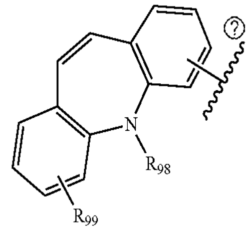

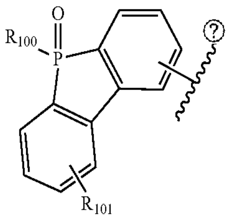

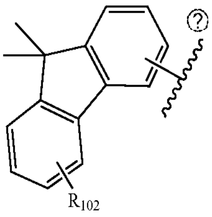

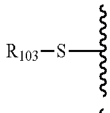

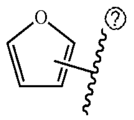

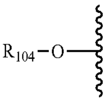

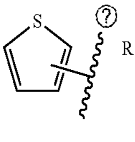

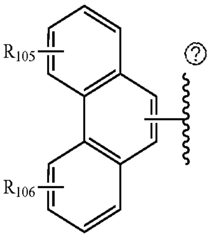

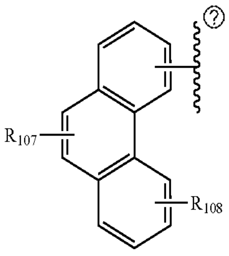

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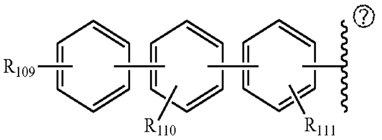

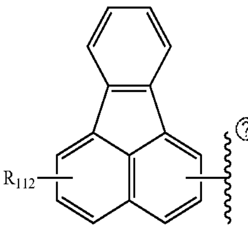

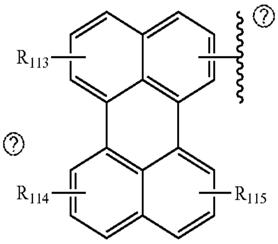

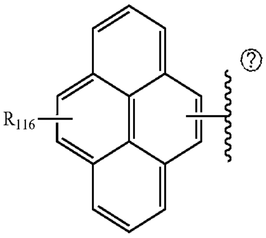

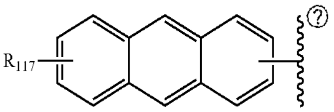

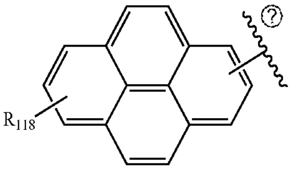

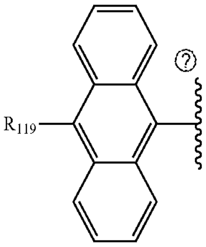

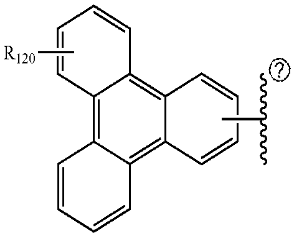

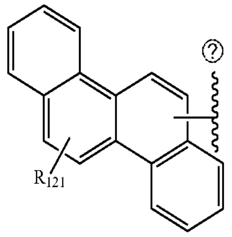

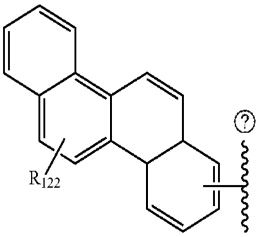

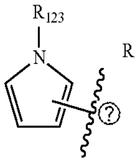

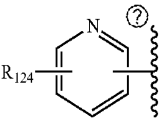

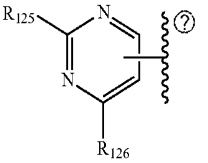

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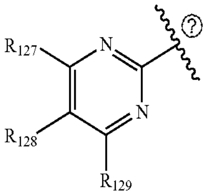
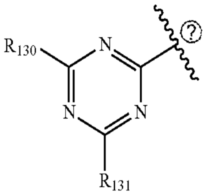
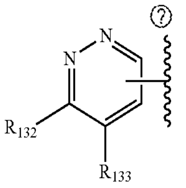
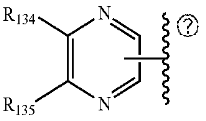
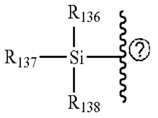






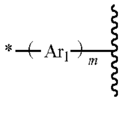




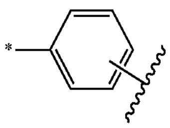
[0023] wherein

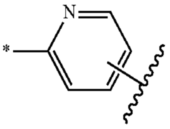
[0024] R_{71} through R_{138} independently represent hydrogen, deuterium, halogen, (C1-C30)alkyl, (C6-C30)aryl, (C6-C30)aryl fused with one or more (C3-C30)cycloalkyl(s), (C3-C30)heteroaryl, 5- to 7-membered heterocycloalkyl, 5- to 7-membered heterocycloalkyl fused with one or more aromatic ring(s), (C3-C30)cycloalkyl, (C3-C30)cycloalkyl fused with one or more aromatic ring(s), cyano, amino, (C1-C30)alkylamino, (C6-C30) arylamino, $NR_{41}R_{42}$, $BR_{43}R_{44}$, $PR_{45}R_{46}$, P(=O) $R_{47}R_{48}$, tri(C1-C30)alkylsilyl, di(C1-C30) alkyl(C6-C30)arylsilyl, tri(C6-C30)arylsilyl, (C6-C30)ar (C1-C30)alkyl, (C1-C30)alkyloxy, (C1-C30)alkylthio, (C6-C30)aryloxy, (C6-C30)arylthio, (C1-C30)alkoxycarbonyl, (C1-C30)alkylcarbonyl, (C6-C30)arylcarbonyl, (C2-C30) alkenyl, (C2-C30)alkynyl, (C6-C30)aryloxycarbonyl, (C1-C30)alkoxycarbonyloxy, (C1-C30)alkylcarbonyloxy, (C6-C30)arylcarbonyloxy, (C6-C30)aryloxycarbonyloxy, carboxyl, nitro or hydroxyl, or each of them may be linked to an adjacent substituent via (C3-C30)alkylene or (C3-C30) alkenylene with or without a fused ring to form an alicylic ring or a mono- or polycyclic aromatic ring, wherein R_{41} through R_{48} independently represent (C1-C30)alkyl, (C6-C30)aryl or (C3-C30)heteroaryl.

[0025] The



is exemplified as following structures but not limited thereto. m is the same as defined in Chemical Formula 1.





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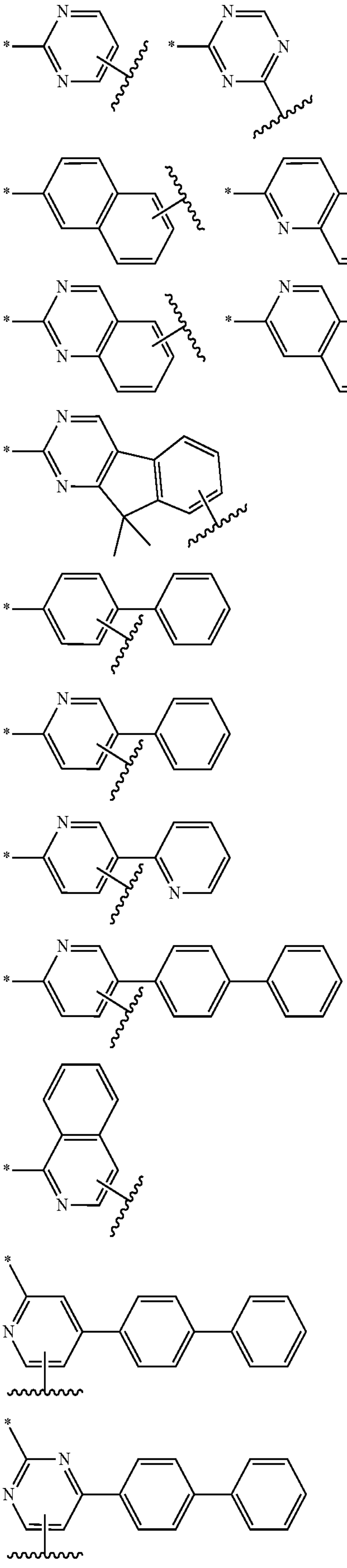

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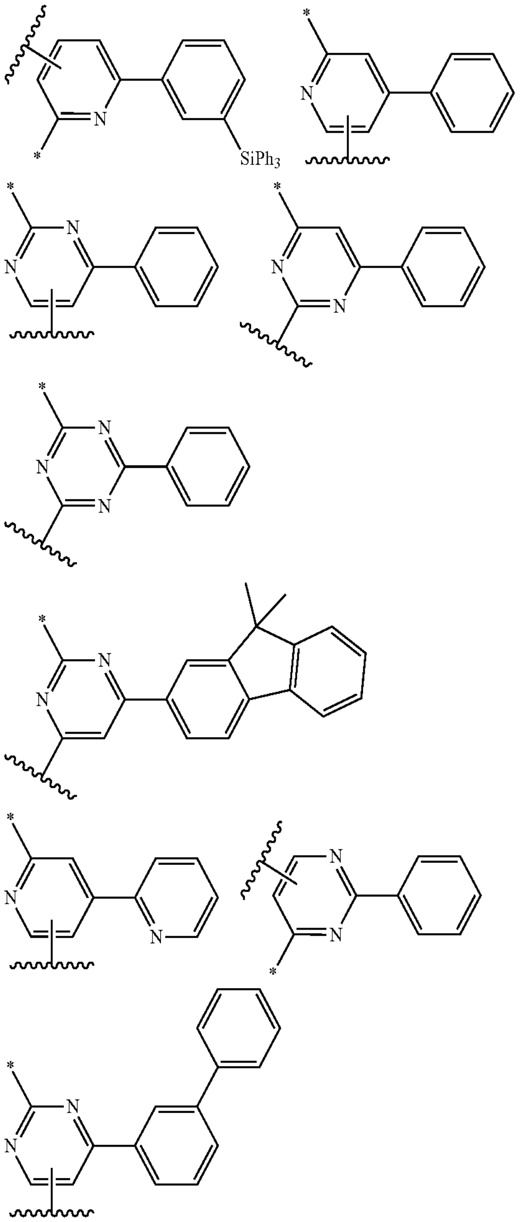
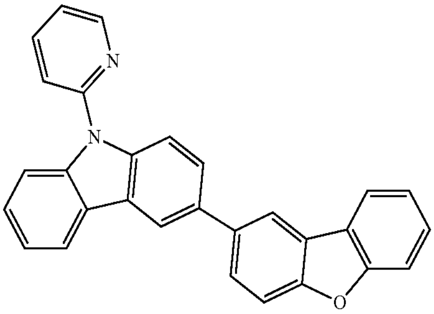


[0026] The organic electroluminescent compound according to the present invention may be specifically exemplified as following compounds but is not limited thereto.

1



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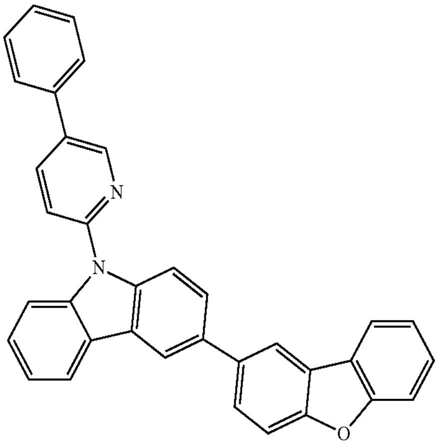

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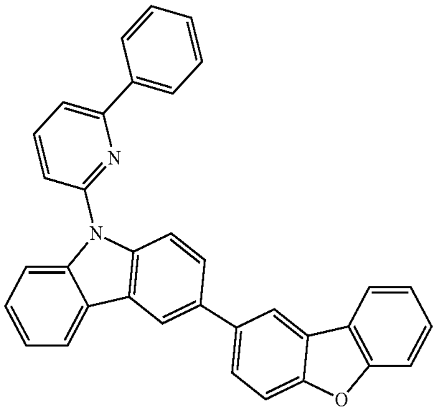

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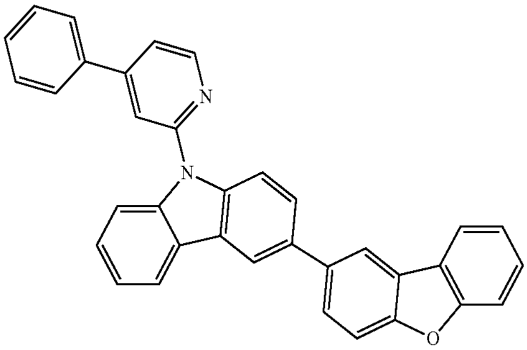

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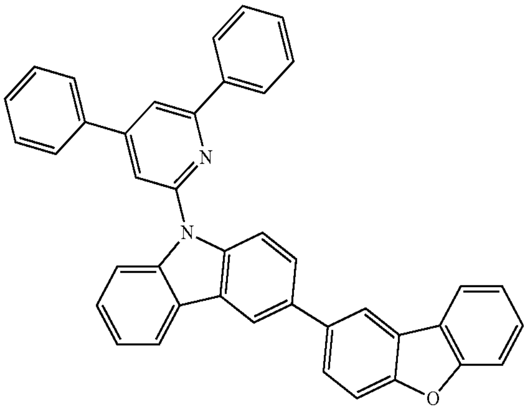

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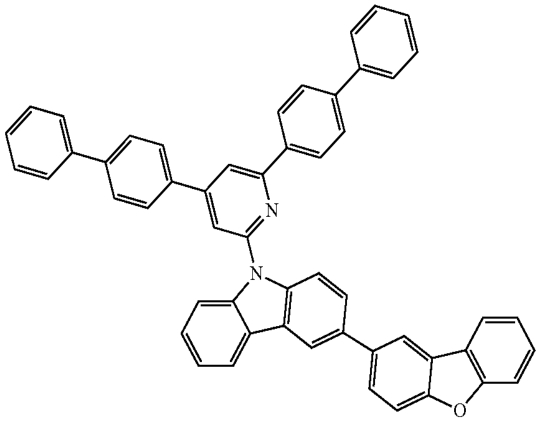

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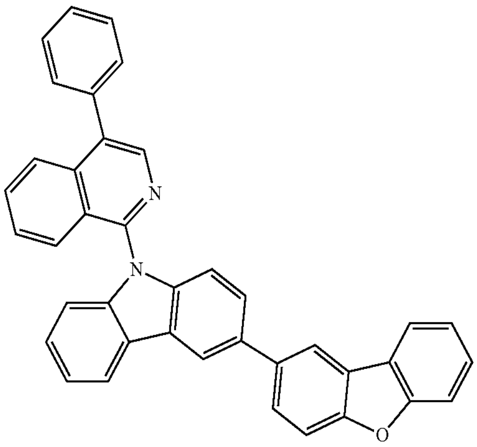

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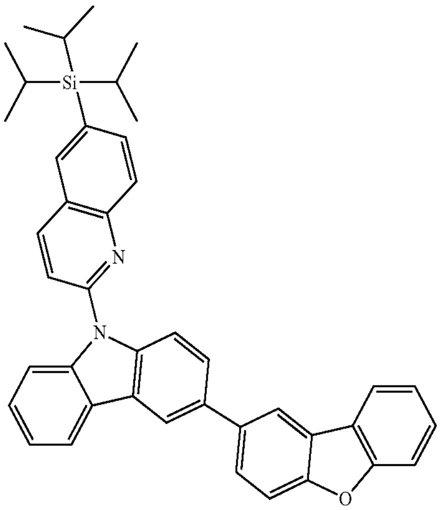

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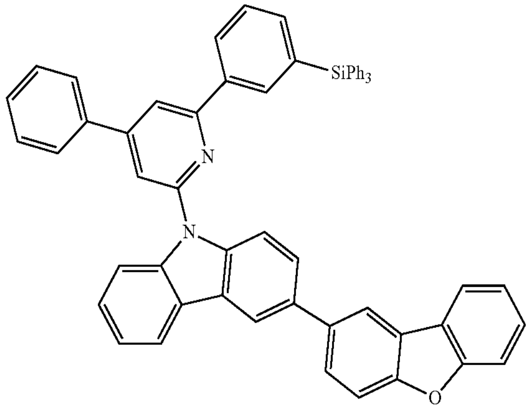

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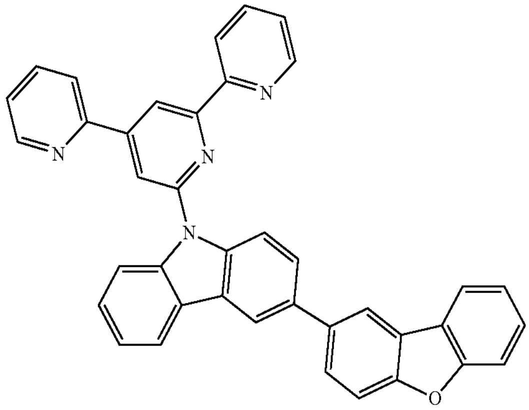

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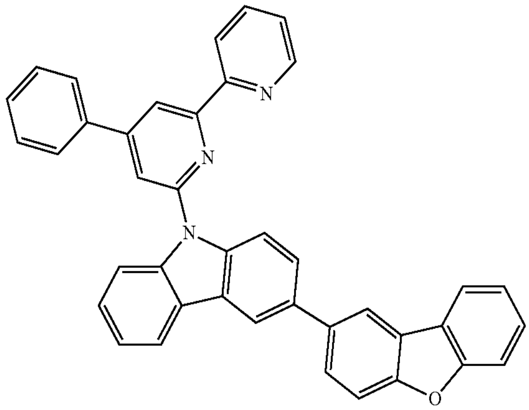

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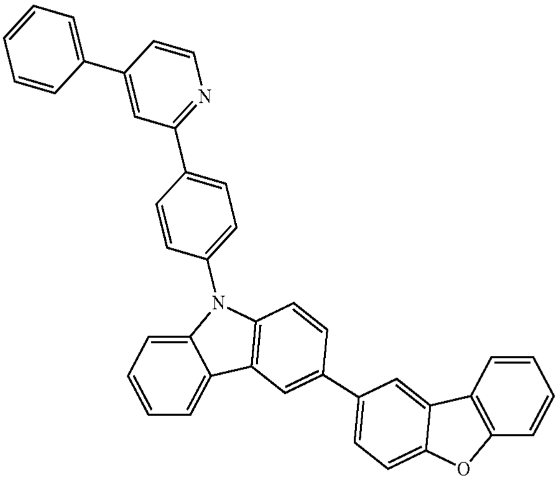

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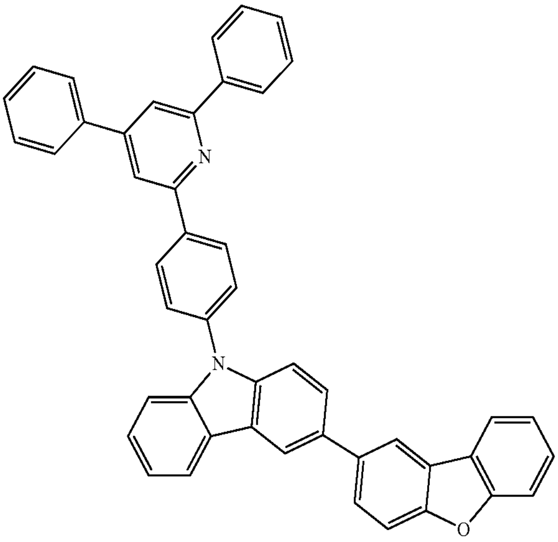

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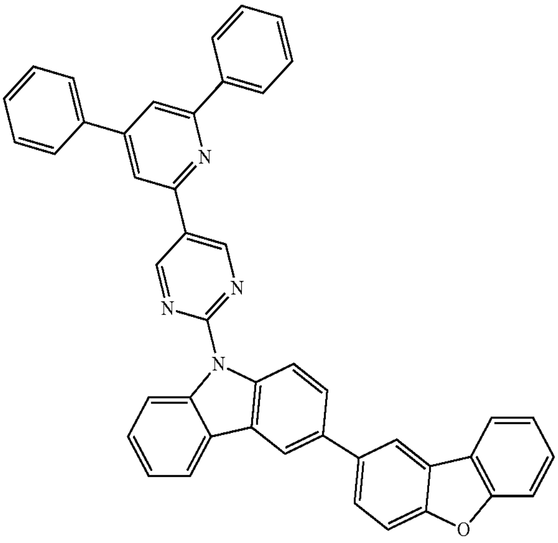

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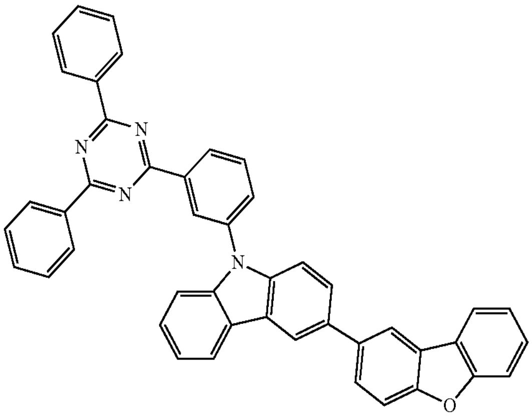

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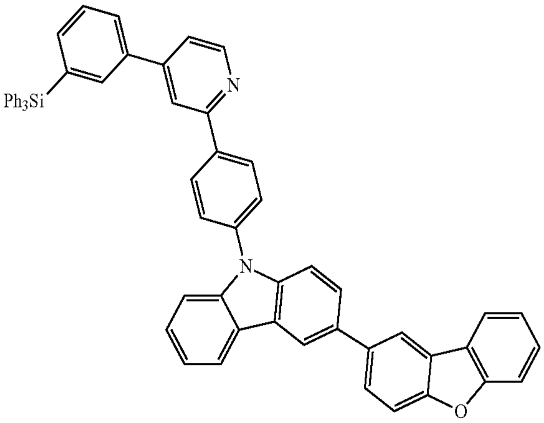

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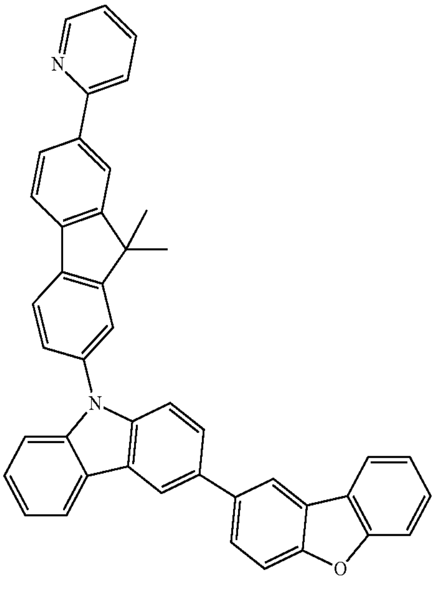

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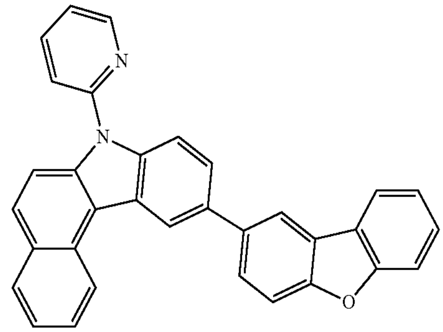

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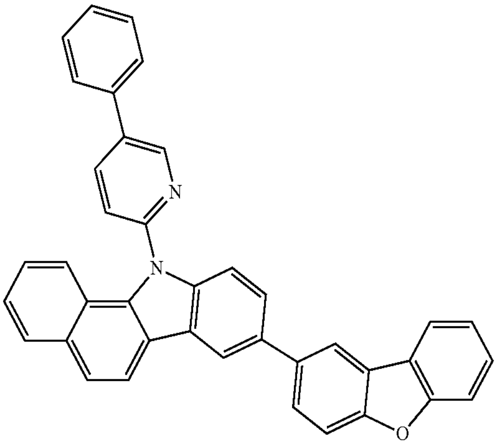

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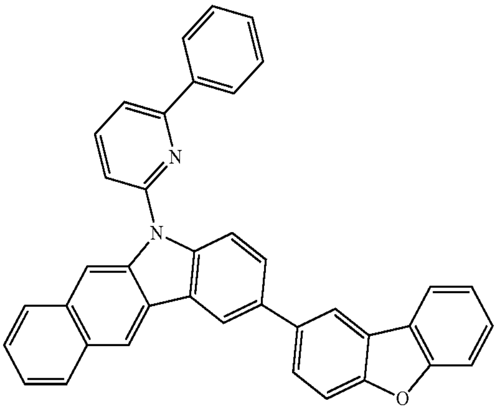

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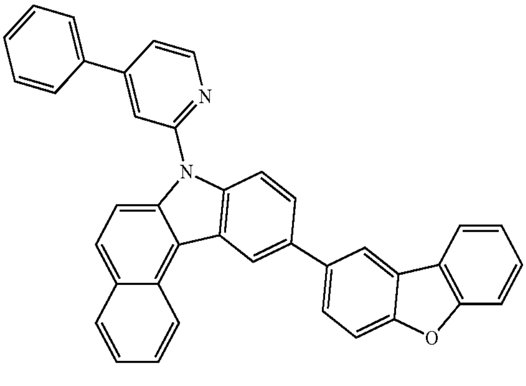

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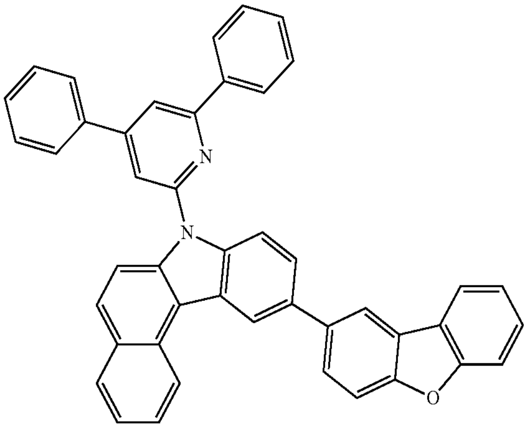

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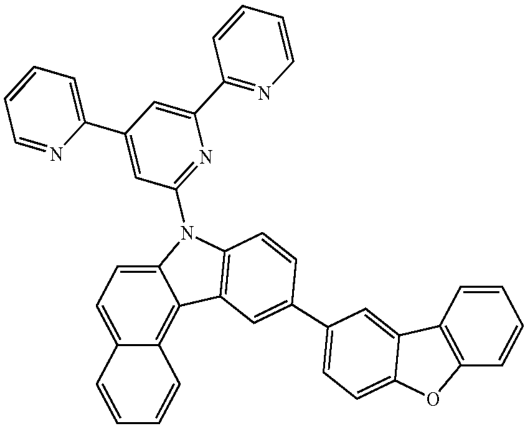

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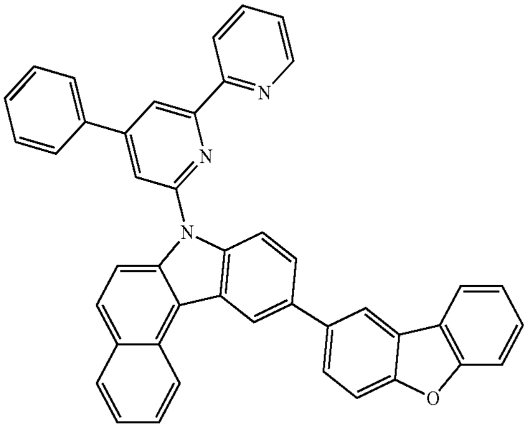

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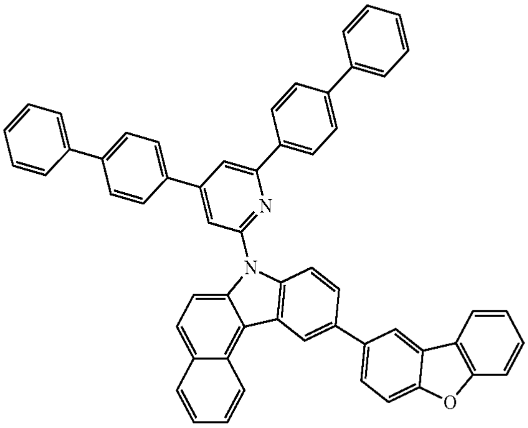

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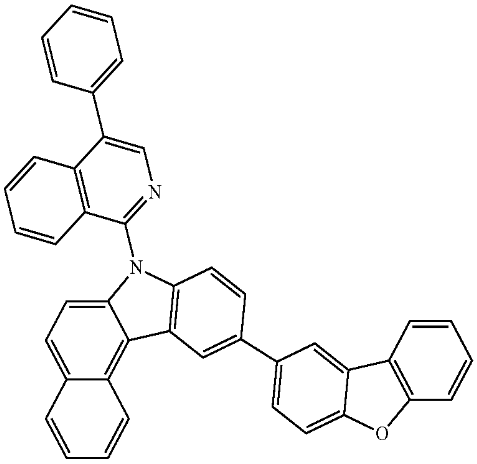

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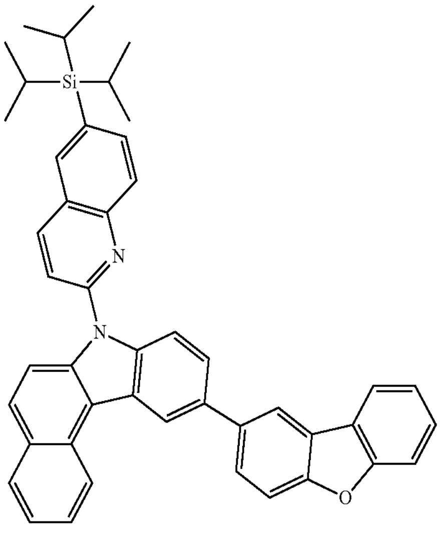

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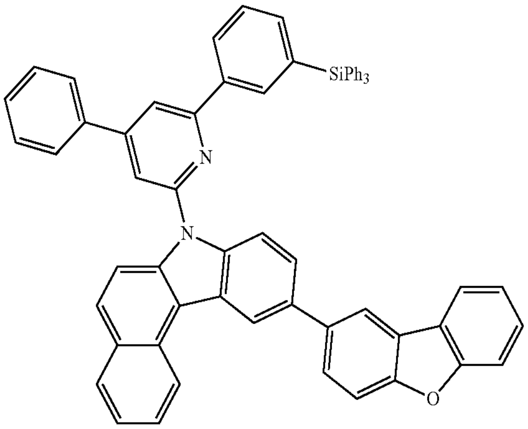

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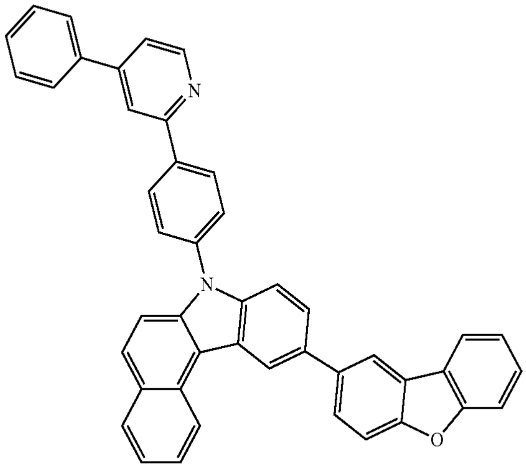

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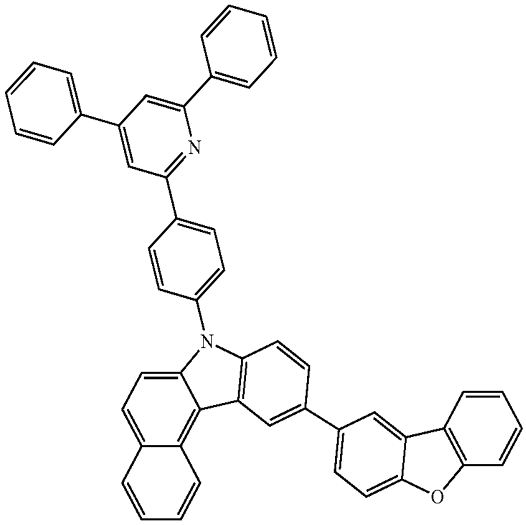

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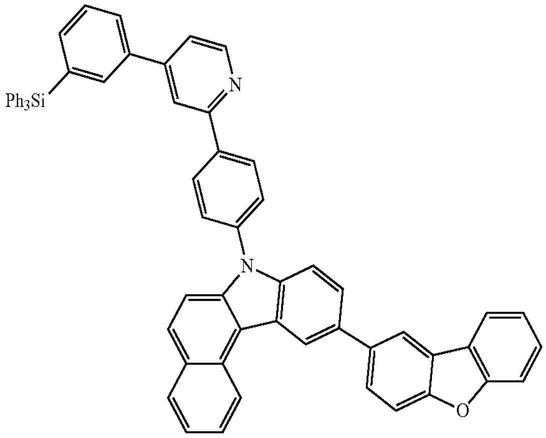

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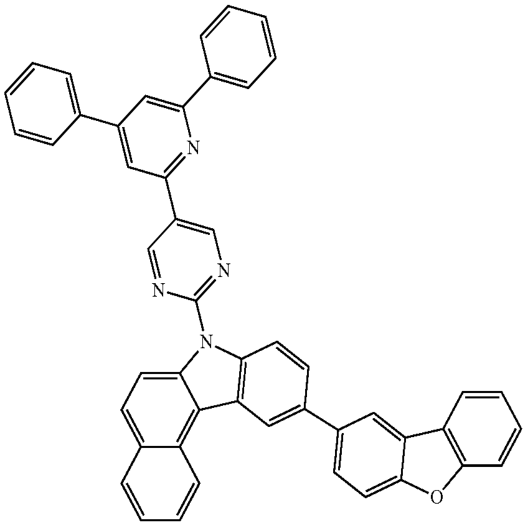

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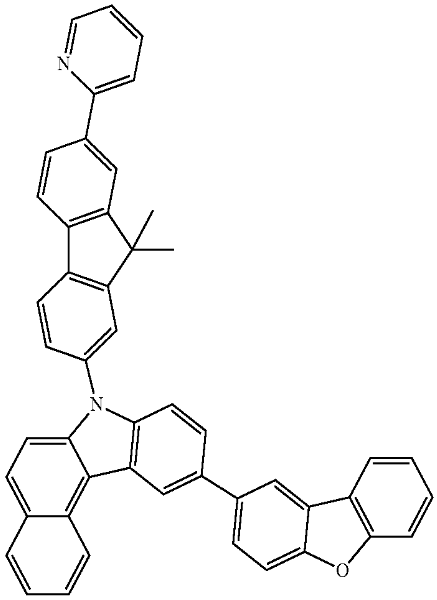

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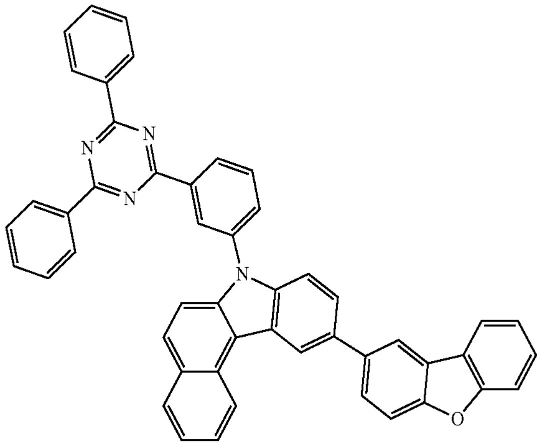

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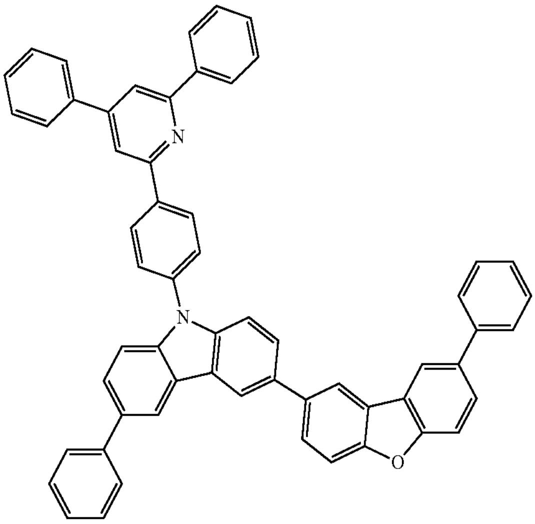

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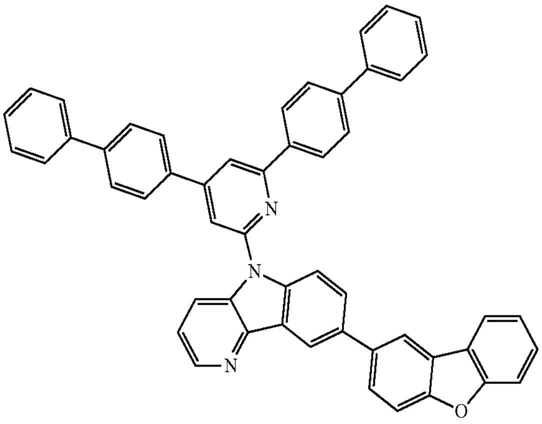

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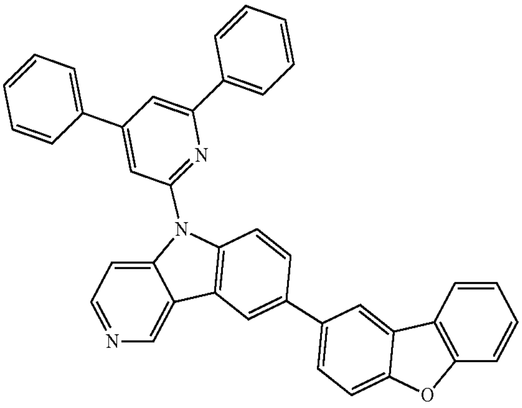

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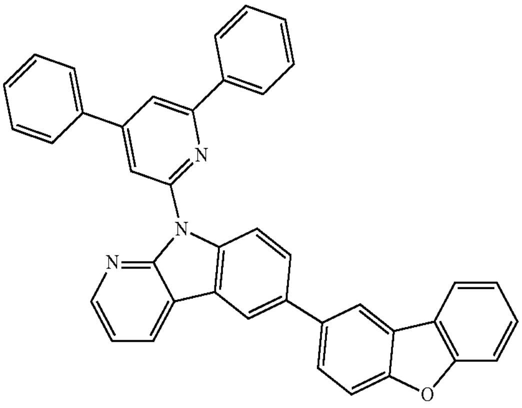

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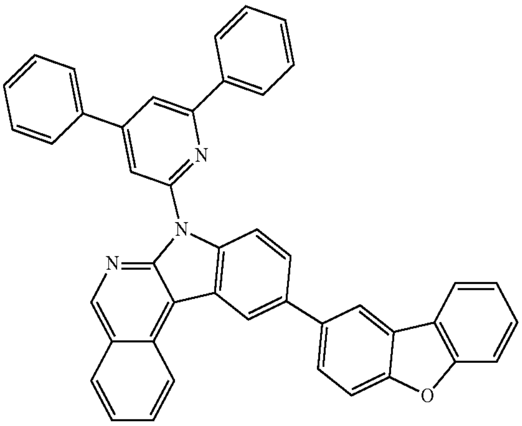

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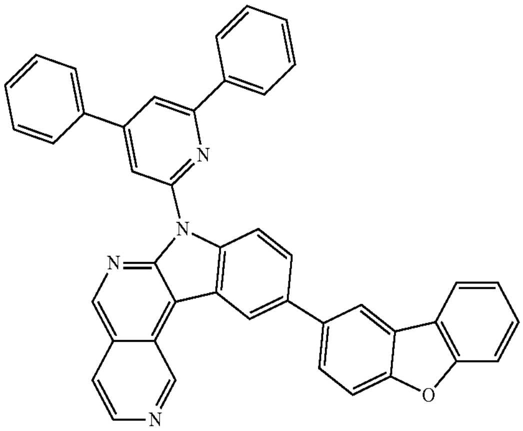

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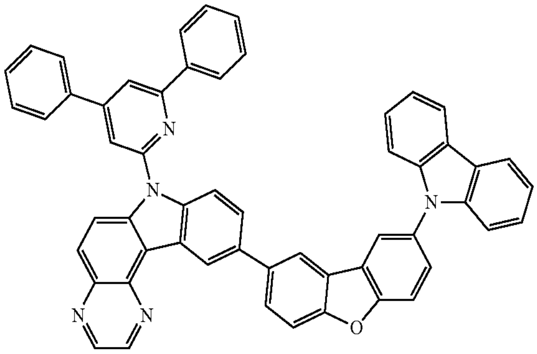

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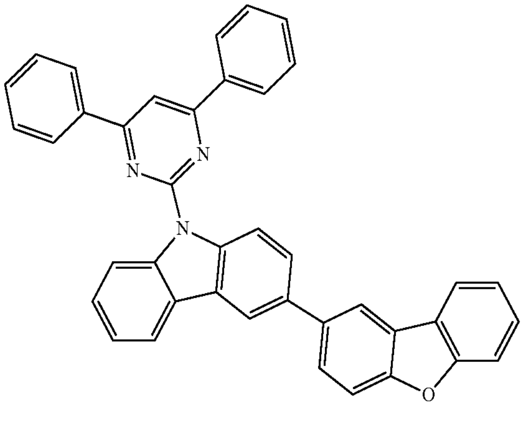

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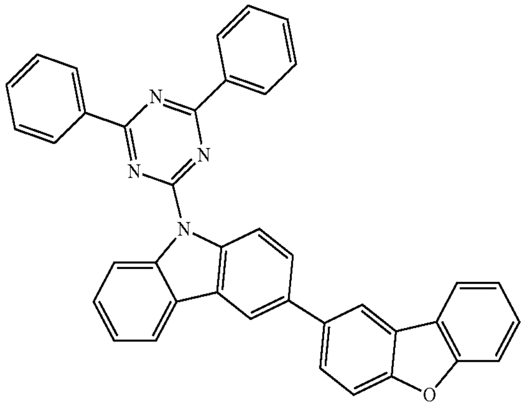

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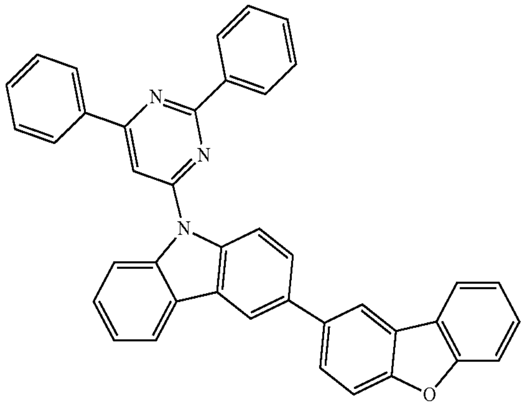

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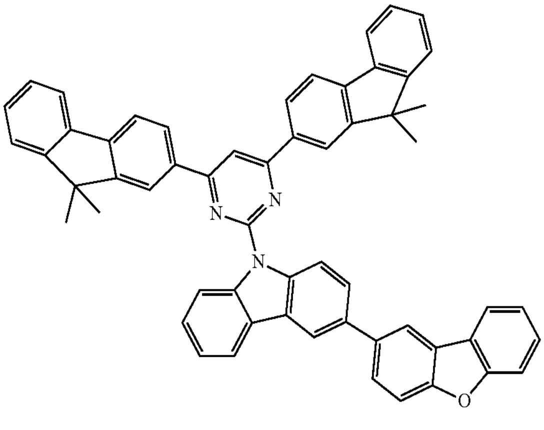

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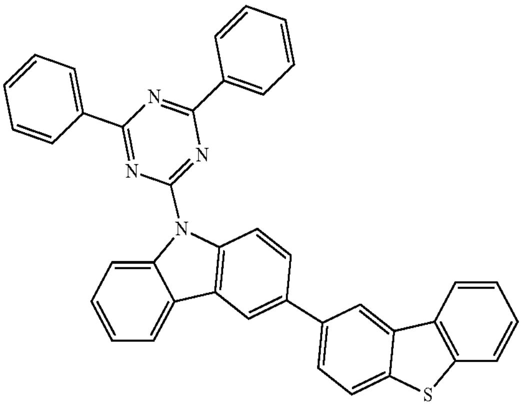

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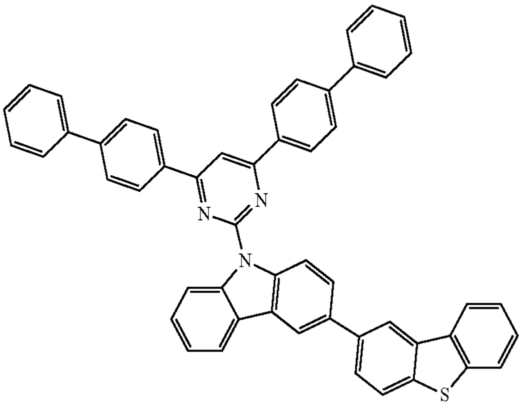

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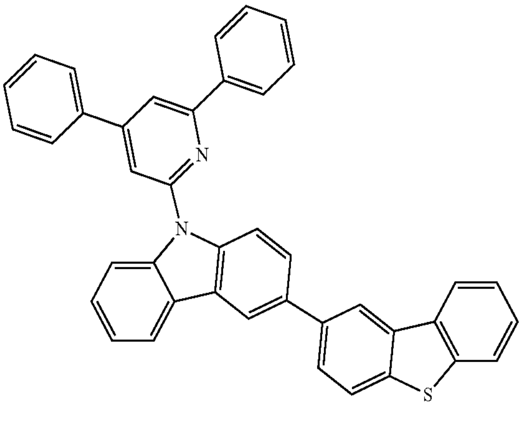

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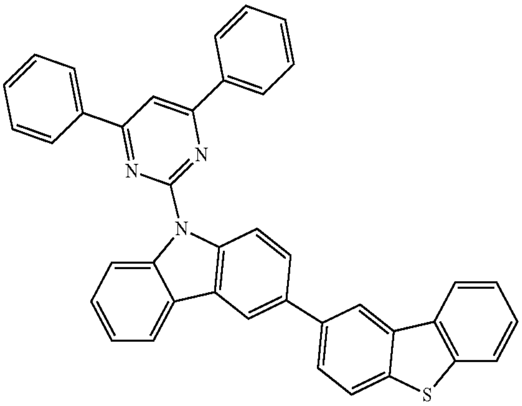

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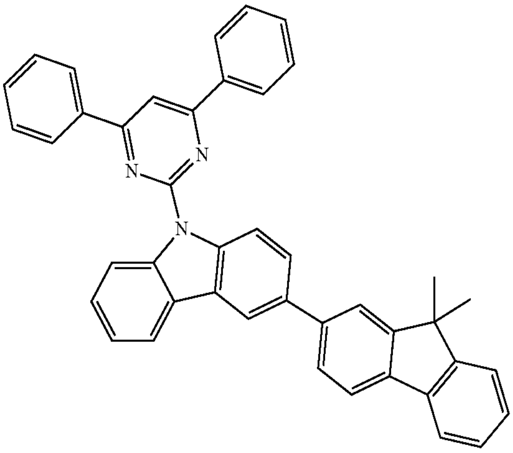

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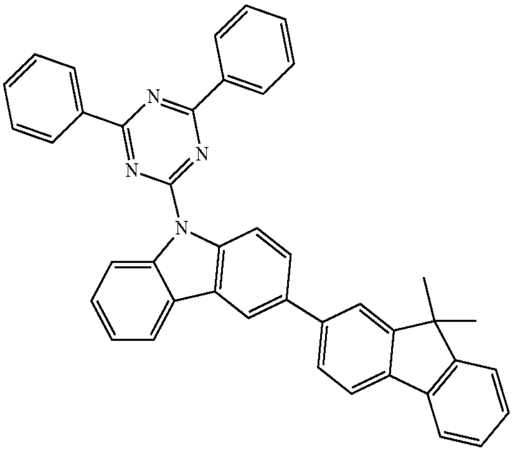

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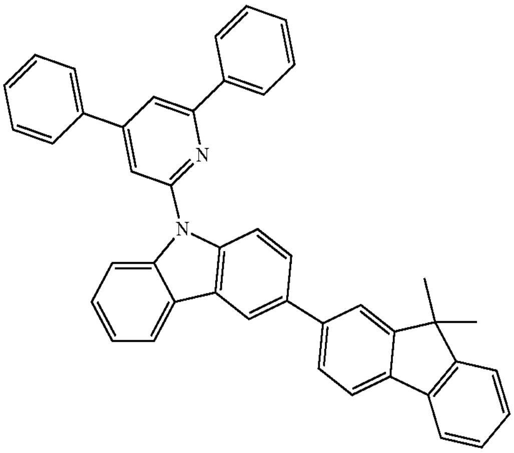

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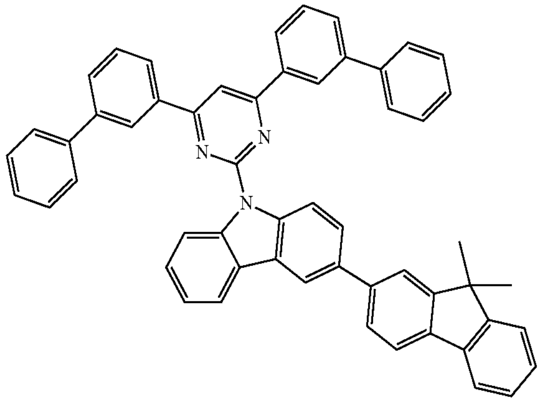

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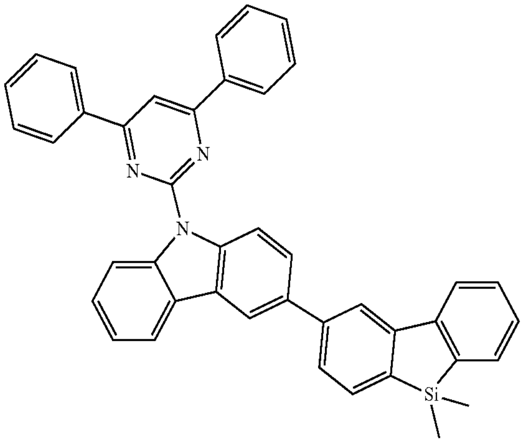

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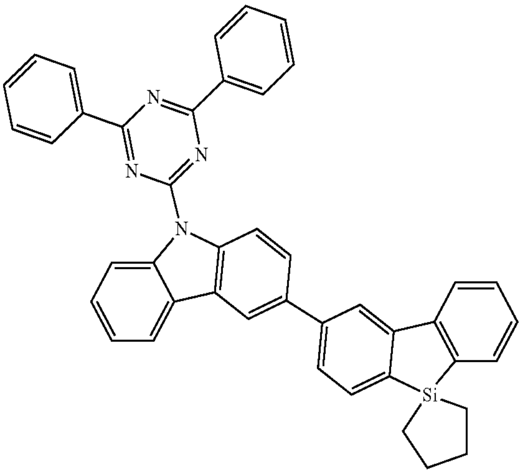

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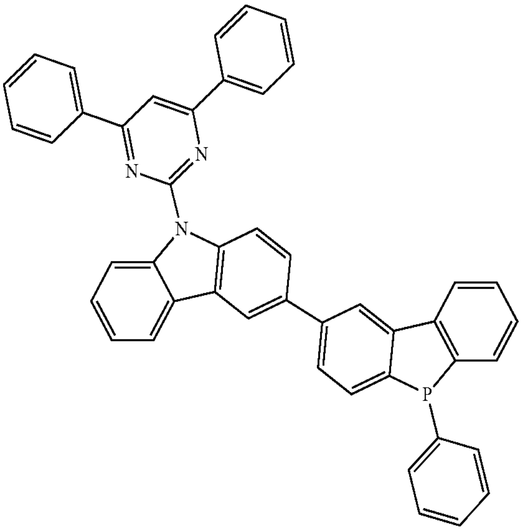

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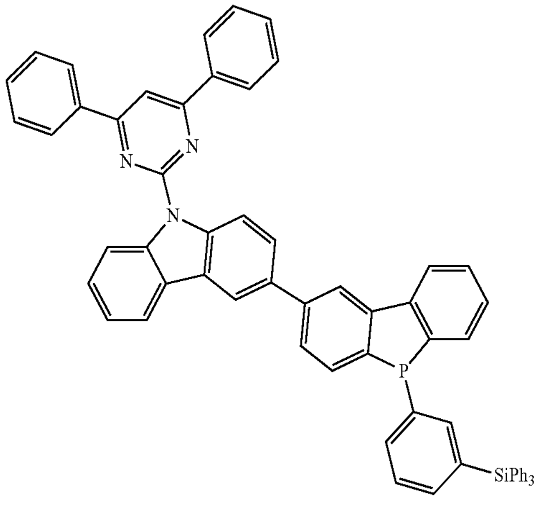

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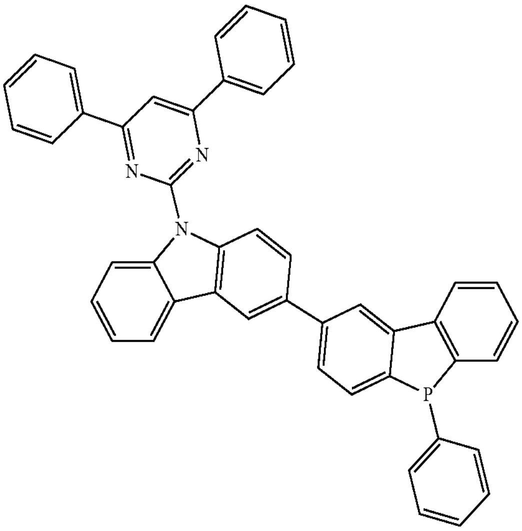

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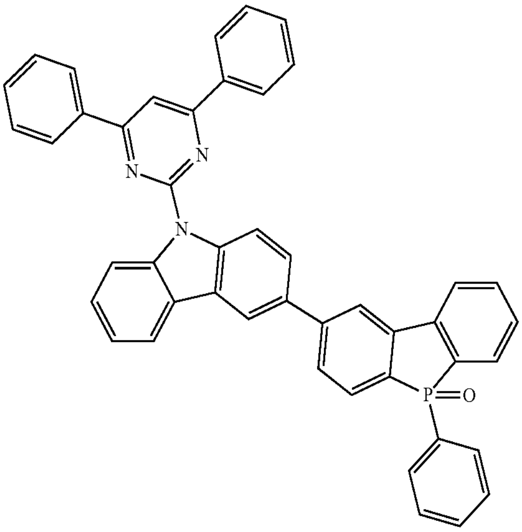

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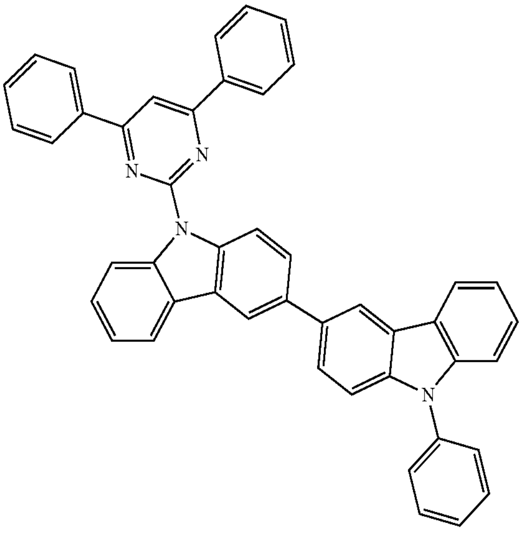

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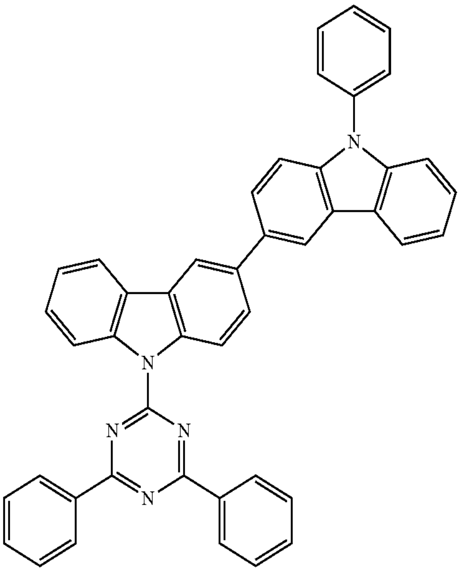

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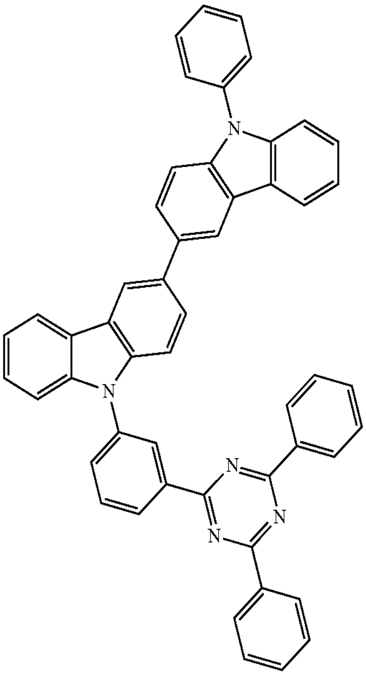

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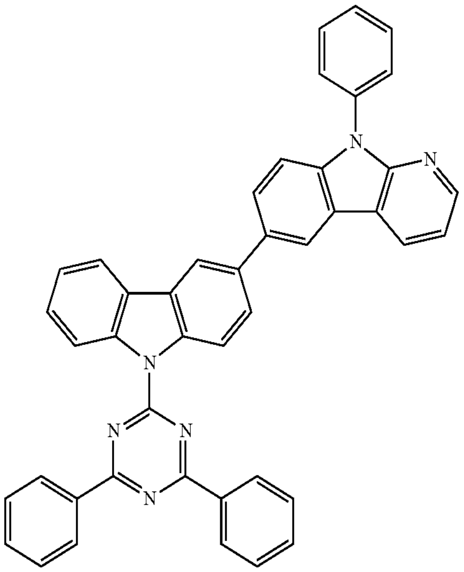

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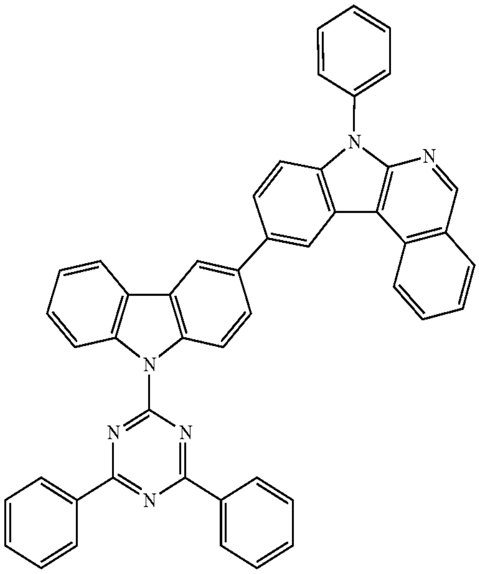

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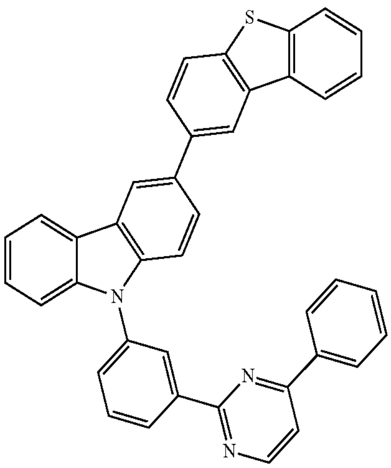

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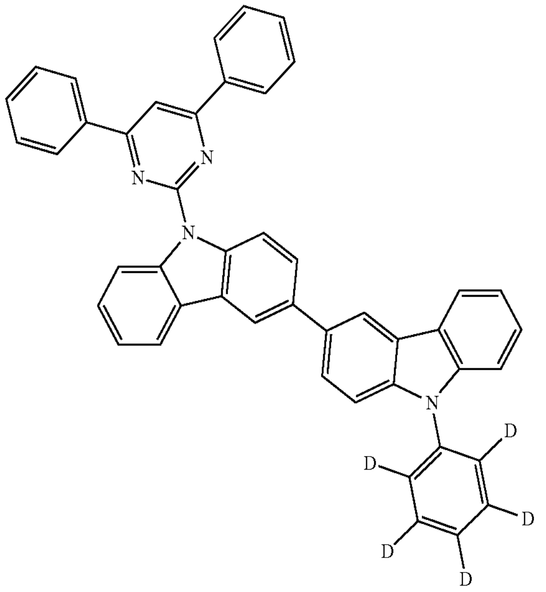

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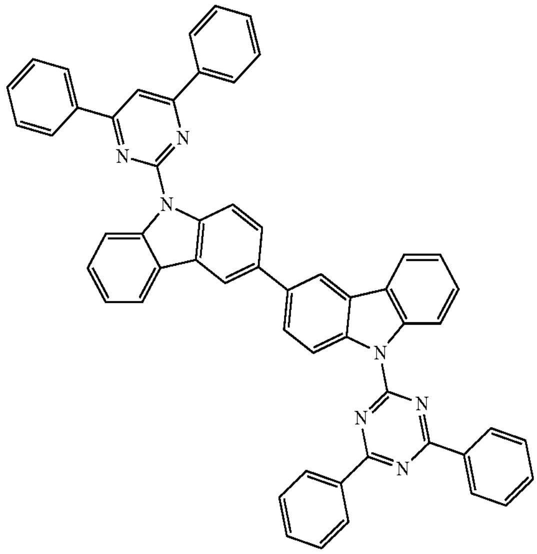

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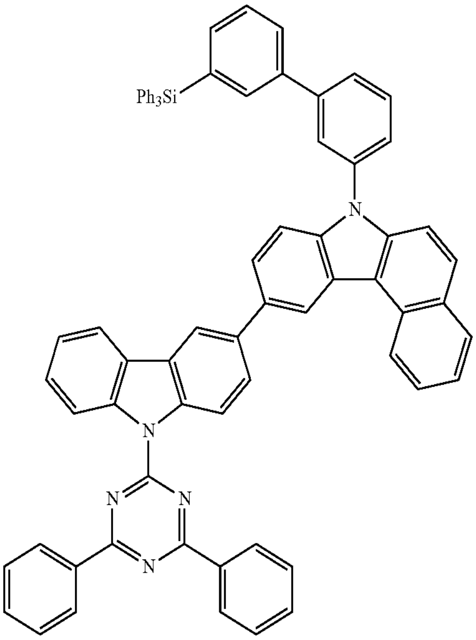

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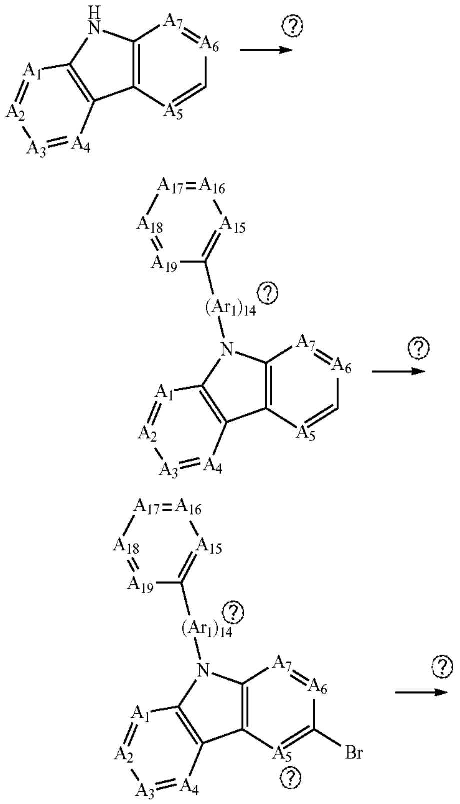
[0027] The organic electroluminescent compound according to the present invention may be prepared as shown in following Reaction Scheme 1.

Reaction Scheme 1



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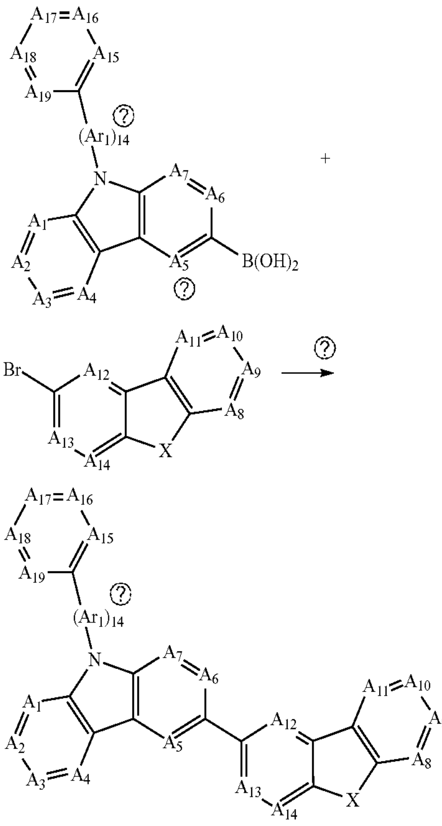


[0028] wherein

[0029] A_1 through A_{19}, X, Ar_1 and m are the same as defined in Chemical Formula 1.

[0030] Provided is an organic electroluminescent device, which comprises a first electrode; a second electrode; and one or more organic layer(s) interposed between the first electrode and the second electrode, wherein the organic layer comprises one or more organic electroluminescent compound(s) represented by Chemical Formula 1. The organic electroluminescent compound is used as a host material of the electroluminescent layer.

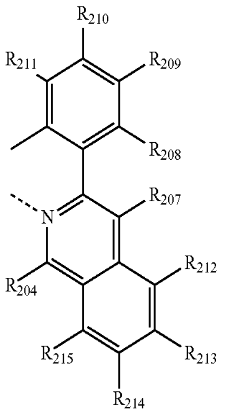
[0031] In addition, the organic layer may include the electroluminescent layer, and the electroluminescent layer may further include one or more dopants besides one or more organic electroluminescent compounds of Chemical Formula 1. The dopant applied to the organic electroluminescent device of the present invention is not specifically limited.

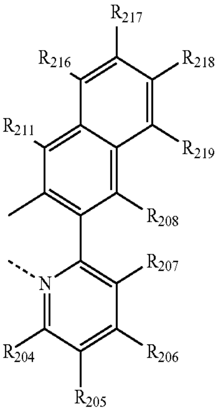
[0032] Preferably, the dopant applied to the organic electroluminescent device of the present invention is selected from following Chemical Formula 2.

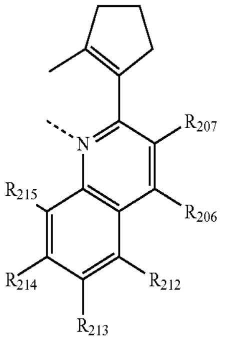
$$M^1L^{101}L^{102}L^{103}$$ Chemical Formula 2

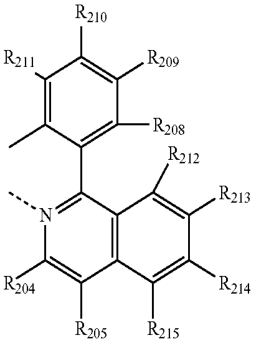
[0033] wherein

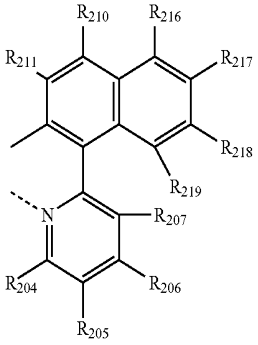
[0034] M^1 is a metal selected from a group consisting of Group 7, Group 8, Group 9, Group 10, Group 11, Group 13, Group 14, Group 15 and Group 16 metals, and ligand L^{101}, L^{102} and L^{103} are independently selected from the following structures;

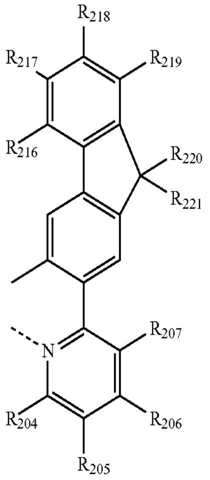

R_{210}
R_{211}
R_{209}
R_{208}
N
R_{207}
R_{212}
R_{204}
R_{215}
R_{213}
R_{214}

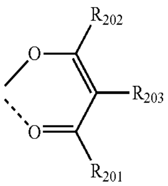

R_{217}
R_{216}
R_{218}
R_{211}
R_{219}
R_{208}
N
R_{207}
R_{204}
R_{206}
R_{205}

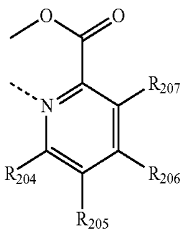

N
R_{207}
R_{215}
R_{206}
R_{214}
R_{212}
R_{213}

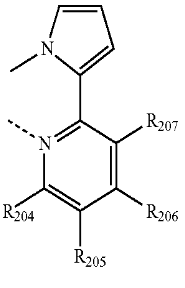

R_{210}
R_{211}
R_{209}
R_{208}
R_{212}
R_{213}
N
R_{204}
R_{214}
R_{205}
R_{215}

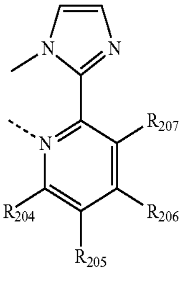

R_{210}
R_{216}
R_{211}
R_{217}
R_{218}
R_{219}
N
R_{207}
R_{204}
R_{206}
R_{205}


R_{218}
R_{217}
R_{219}
R_{216}
R_{220}
R_{221}
N
R_{207}
R_{204}
R_{206}
R_{205}


R_{202}
O
R_{203}
O
R_{201}


O
O
N
R_{207}
R_{204}
R_{206}
R_{205}


N
N
R_{207}
R_{204}
R_{206}
R_{205}


N
N
N
R_{207}
R_{204}
R_{206}
R_{205}

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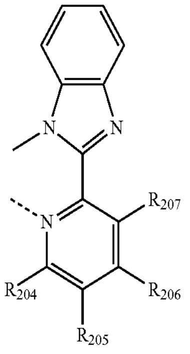
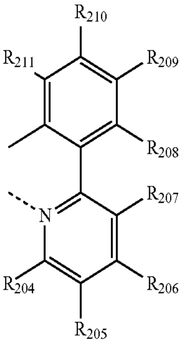

N
N
N
R_{207}
R_{204}
R_{206}
R_{205}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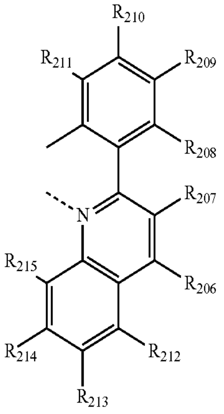
R_{211}
R_{209}
R_{208}
N
R_{207}
R_{204}
R_{206}
R_{205}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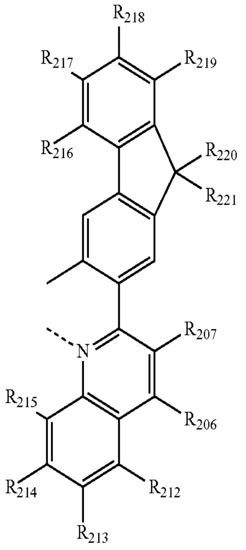
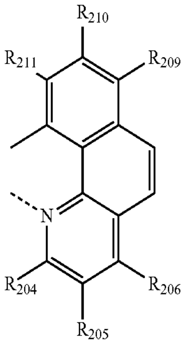
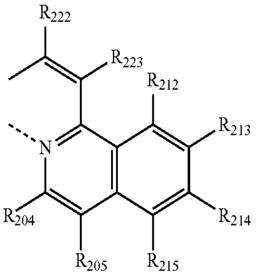
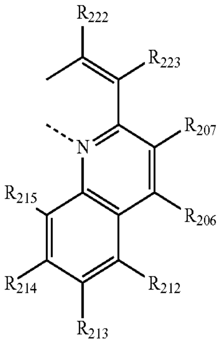
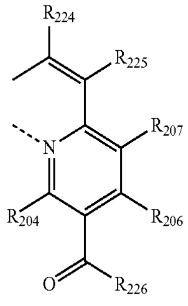
R_{211}
R_{209}
R_{208}
N
R_{207}
R_{215}
R_{206}
R_{214}
R_{212}
R_{213}


R_{218}
R_{217}
R_{219}
R_{216}
R_{220}
R_{221}
N
R_{207}
R_{215}
R_{206}
R_{214}
R_{212}
R_{213}


R_{210}
R_{211}
R_{209}
N
R_{204}
R_{206}
R_{205}


R_{222}
R_{223}
R_{212}
N
R_{213}
R_{204}
R_{214}
R_{205}
R_{215}


R_{222}
R_{223}
N
R_{207}
R_{215}
R_{206}
R_{214}
R_{212}
R_{213}


R_{224}
R_{225}
N
R_{207}
R_{204}
R_{206}
O
R_{226}

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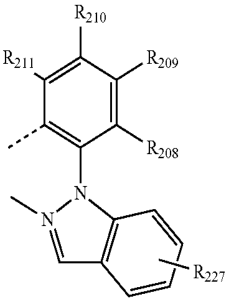
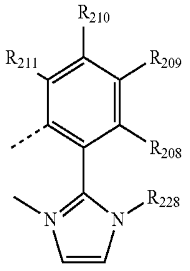
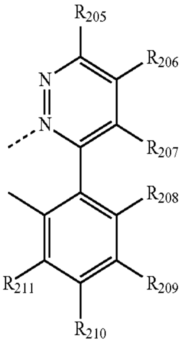
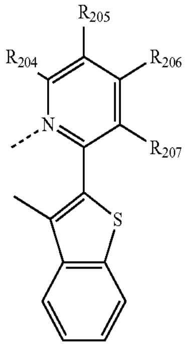
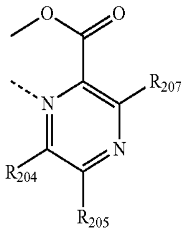
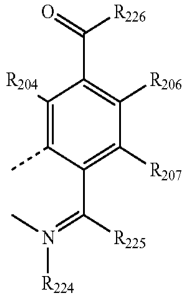


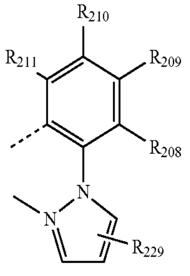


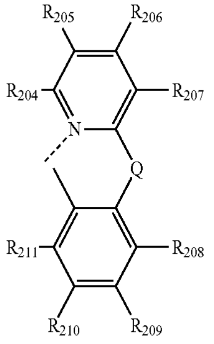












[0035] wherein

[0036] R_{201} through R_{203} independently represent hydrogen, (C1-C30)alkyl with or without halogen substituent(s), (C6-C30)aryl with or without (C1-C30)alkyl substituent(s) or halogen;

[0037] R_{204} through R_{219} independently represent hydrogen, (C1-C30)alkyl with or without substituent(s), (C1-C30) alkoxy with or without substituent(s), (C3-C30)cycloalkyl with or without substituent(s), (C2-C30)alkenyl with or without substituent(s), (C6-C30)aryl with or without substituent (s), mono- or di-(C1-C30)alkylamino with or without substituent(s), mono- or di-(C6-C30)arylamino with or without substituent(s), SF_5, tri(C1-C30)alkylsilyl with or without substituent(s), di(C1-C30)alkyl(C6-C30)arylsilyl with or without substituent(s), tri(C6-C30)arylsilyl with or without substituent(s), cyano or halogen;

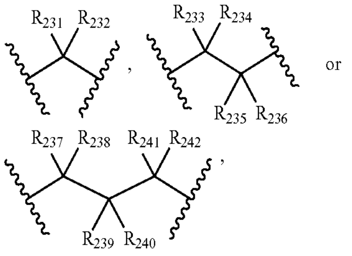
[0038] R_{220} through R_{223} independently represent hydrogen, (C1-C30)alkyl with or without halogen substituent(s) or (C6-C30)aryl with or without (C1-C30)alkyl substituent(s);

[0039] R_{224} and R_{225} independently represent hydrogen, (C1-C30)alkyl with or without substituent(s), (C6-C30)aryl with or without substituent(s) or halogen, or R_{224} and R_{225} may be linked via (C3-C12)alkylene or (C3-C12)alkenylene with or without a fused ring to form an alicylic ring or a mono- or polycyclic aromatic ring;

[0040] R_{226} represents (C1-C30)alkyl with or without substituent(s), (C6-C30)aryl with or without substituent(s), (C5-C30)heteroaryl with or without substituent(s) or halogen;

[0041] R_{227} through R_{229} independently represent hydrogen, (C1-C30)alkyl with or without substituent(s), (C6-C30) aryl with or without substituent(s) or halogen; and

[0042] Q represents



wherein R_{231} through R_{242} independently represent hydrogen, (C1-C30)alkyl with or without halogen substituent(s), (C1-C30)alkoxy, halogen, (C6-C30)aryl with or without substituent(s), cyano or (C5-C30)cycloalkyl with or without substituent(s), or each of them may be linked to an adjacent substituent via alkylene or alkenylene to form a spiro ring or a fused ring, or may be linked to R_{207} or R_{208} via alkylene or alkenylene to form a saturated or unsaturated fused ring.

[0043] The meaning of the electroluminescent layer may be a single layer as a layer where the light is emitted or may be a multiple layer where two or more layers are laminated. In the configuration of the present invention, when host-dopant are used in mixture, it is confirmed that the luminous efficiency are remarkably improved by the electroluminescent host of the present invention. It may be configured at doping concentration of 0.5 to 10 wt %. Compared to other host materials, the electroluminescent host of the present invention has superior conductivity with respect to the hole and electron and excellent stability in material, thereby showing a characteristic of remarkably increasing its life span as well as improving the luminous efficiency.

[0044] The M^1 is selected from a group consisting of Ir, Pt, Pd, Rh, Re, Os, Tl, Pb, Bi, In, Sn, Sb, Te, Au and Ag. The dopant compounds of Chemical Formula 2 are exemplified by the compounds described in Korean Patent Application No. 10-2008-0112855, but are not limited thereto.

[0045] In the organic electronic device of the present invention, the organic layer may further include, in addition to the organic electroluminescent compound represented by Chemical Formula 1, one or more compound(s) selected from a group consisting of arylamine compounds and styrylarylamine compounds, at the same time. The arylamine compounds or styrylarylamine compounds are exemplified in Korean Patent Application No. 10-2008-0123276, 10-2008-0107606 or 10-2008-0118428, but are not limited thereto.

[0046] Further, in the organic electroluminescent device of the present invention, the organic layer may further include, in addition to the organic electroluminescent compound represented by Chemical Formula 1, one or more metal(s) selected from a group consisting of organic metals of Group 1, Group 2, 4th period and 5th period transition metals, lanthanide metals and d-transition elements or complex compound(s). The organic layer may include an electroluminescent layer and a charge generating layer.

[0047] Further, the organic layer may include, in addition to the organic electroluminescent compound of Chemical Formula 1, one or more organic electroluminescent layer(s) emitting blue, green or red light at the same time in order to embody a white-emitting organic electroluminescent device. The compound emitting blue, green or red light may be exemplified by the compounds described in Korean Patent Application No. 10-2008-0123276, 10-2008-0107606 or 10-2008-0118428, but are not limited thereto.

[0048] In the organic electroluminescent device of the present invention, a layer (hereinafter referred to as "surface layer") selected from a chalcogenide layer, a metal halide layer and a metal oxide layer may be placed on the inner surface of one or both electrode(s) among the pair of electrodes. More specifically, a metal chalcogenide (including oxide) layer of silicon or aluminum may be placed on the anode surface of the electroluminescent medium layer, and a metal halide layer or metal oxide layer may be placed on the cathode surface of the electroluminescent medium layer. Operation stability may be attained therefrom.

[0049] The chalcogenide may be, for example, SiO_x ($1 \le x \le 2$), AlO_x ($1 \le x \le 1.5$), SiON, SiAlON, etc. The metal halide may be, for example, LiF, MgF_2, CaF_2, a rare earth metal fluoride, etc. The metal oxide may be, for example, Cs_2O, Li_2O, MgO, SrO, BaO, CaO, etc.

[0050] In the organic electroluminescent device according to the present invention, it is also preferable to arrange on at least one surface of the pair of electrodes thus manufactured a mixed region of an electron transport compound and a reductive dopant, or a mixed region of a hole transport compound and an oxidative dopant. In that case, since the electron transport compound is reduced to an anion, injection and transport of electrons from the mixed region to an electroluminescent medium are facilitated. In addition, since the hole transport compound is oxidized to a cation, injection and transport of holes from the mixed region to an electroluminescent medium are facilitated. Preferable oxidative dopants include various Lewis acids and acceptor compounds. Preferable reductive dopants include alkali metals, alkali metal compounds, alkaline earth metals, rare-earth metals, and mixtures thereof.

[0051] Further, a white-emitting electroluminescent device having two or more electroluminescent layers may be manufactured by employing a reductive dopant layer as a charge generating layer.

Advantageous Effects

[0052] Since the organic electroluminescent compound according to the present invention exhibits good luminous efficiency and excellent life property, it may be used to manufacture OLED devices having very superior operation life.

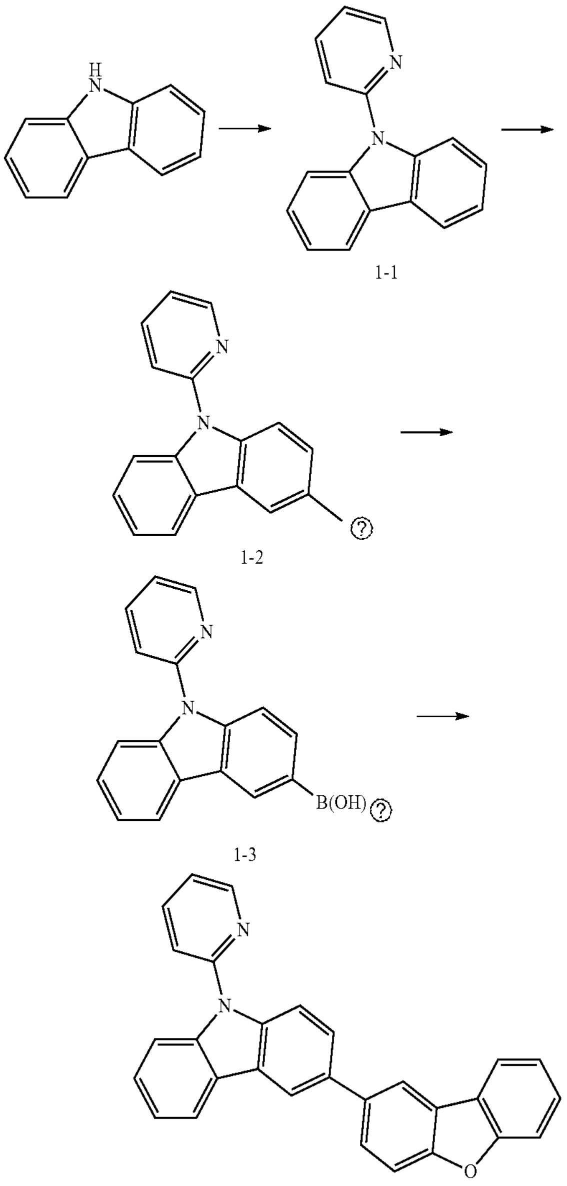
MODE FOR INVENTION

[0053] The present invention is further described with respect to organic electroluminescent compounds according to the present invention, processes for preparing the same, and luminescence properties of devices employing the same. However, the following examples are provided for illustrative purposes only and they are not intended to limit the scope of the present invention.

Preparation Example 1

Preparation of Compound 1

[0054]



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Preparation of Compound 1-1

[0055] 9H-carbazole (10 g, 41.10 mmol), 2-chloropyridine (5.60 g, 49.32 mmol), $Pd(OAc)_2$ (0.46 g), NaOt-bu (7.9 g, 82.20 mmol), toluene (100 mL), $P(t\text{-}bu)_3$ (2 mL, 4.11 mmol, 50% in toluene) were added and stirred under reflux. 10 hours later, the mixture was cooled to room temperature and distilled water was added. Extracting with EA and drying with $MgSO_4$, drying under reduce pressure was performed. Compound 1-1 (8.3 g, 33.98 mmol, 83%) was obtained via column separation.

Preparation of Compound 1-2

[0056] 1-neck flask was filled with Compound 1-1 (8.3 g, 33.98 mmol), formed a vacuum and was filled with argon. After tetrahydrofuran (500 mL) was added, the mixture was stirred at 0° C. for 10 minutes. NBS (7.35 g, 40.78 mmol) was added thereto and stirred at room temperature for one day. Upon completion of the reaction, the product was extracted with distilled water and EA. After drying an organic layer with $MgSO_4$ and removing solvent by a rotary type evaporator, Compound 1-2 (8.5 g, 26.30 mmol, 77%) was obtained via column chromatography using hexan and EA as developing solvent.

Preparation of Compound 1-3

[0057] The 1-neck flask was filled with Compound 1-2 (8.5 g, 26.30 mmol), formed a vacuum and was filled with argon. After tetrahydrofuran (500 mL) was added, the mixture was stirred at 78° C. for 10 minutes. n-BuLi(2.5M in hexane) (15.8 mL, 39.45 mmol) was added dropwise and stirred at −78° C. for 1 hour and a half. Trimethylborate (4.85 mL, 39.45 mmol) was added at −78° C. The mixture was stirred at −78° C. for 30 minutes and stirred at room temperature for 4 hours. Upon completion of the reaction, the product was extracted with distilled water and EA. After drying an organic layer with $MgSO_4$ and removing solvent by a rotary type evaporator, Compound 1-3 (5.2 g, 18.05 mmol, 68.6%) was obtained via column chromatography using hexan and EA as developing solvent.

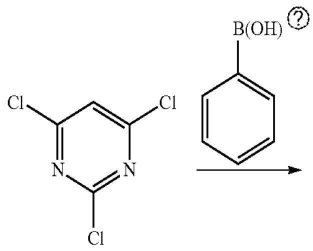
Preparation of Compound 1

[0058] Compound 1-3 (5.0 g, 17.4 mmol), 2-bromodibenzo[b,d]furan (5.2 g, 20.88 mmol), $Pd(PPh_3)_4$ (0.8 g, 0.7 mmol), 2M K_2CO_3 aqueous solution (20 mL), toluene (100 mL), and ethanol (50 mL) were added and stirred under reflux for 12 hours. After washing with distilled water, extracting with EA, and drying with $MgSO_4$, distillation under reduced pressure followed by column separation yielded Compound 1 (4.3 g, 10.48 mmol, 60%).

Preparation Example 2

Preparation of Compound 49

[0059]



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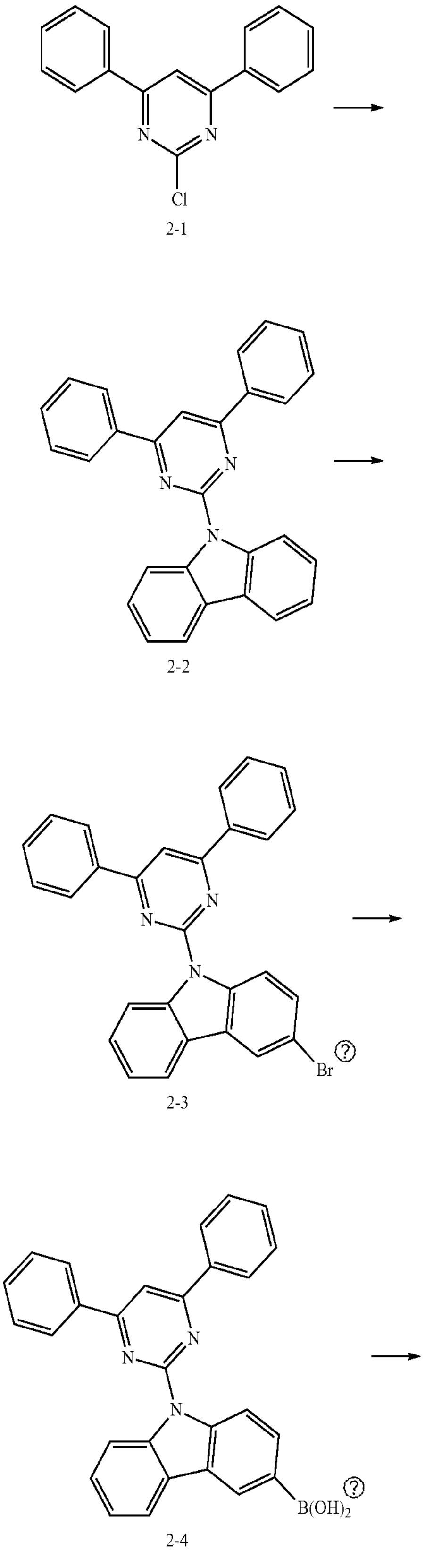

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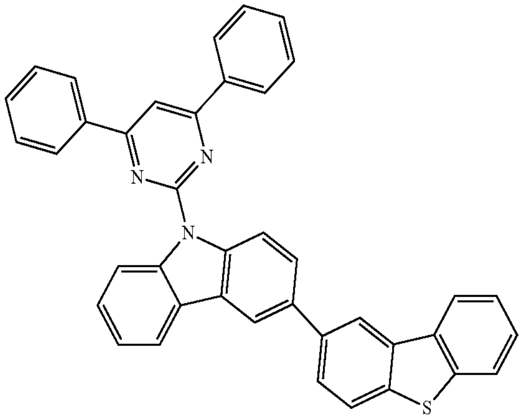


49

Preparation of Compound 2-1

[0060] 2,4,6-trichloropyrimidine (10 g, 54.51 mmol), phenylboronic acid (16.6 g, 136.29 mmol), $Pd(PPh_3)_4$ (3.15 g, 2.72 mmol), 2M K_2CO_3 (50 mL), toluene (100 mL), and ethanol (30 mL) were added and stirred under reflux. 4 hours later, the mixture was cooled to room temperature and distilled water was added thereto. After extracting with EA and drying with $MgSO_4$, distillation under reduced pressure followed by column separation yielded Compound 2-1 (7 g, 26.24 mmol, 48.14%).

Preparation of Compound 2-2

[0061] NaH (1.57 g, 39.36 mmol, 60% in mineral oil) was mixed with DMF (70 mL) and Compound 2-1 (7 g, 26.24 mmol) was dissolved in DMF (60 mL). 1 hour later, Compound 9H-carbazole was dissolved in DMF (70 mL). The mixture was stirred for 10 hours. After adding distilled water, extracting with EA, and drying with $MgSO_4$, distillation under reduced pressure followed by column separation yielded Compound 2-2 (7 g, 14.78 mmol, 56.33%).

Preparation of Compound 2-3

[0062] Compound 2-3 (5.7 g, 11.97 mmol, 80.9%) was obtained by combining Compound 2-2 (7 g, 14.78 mmol) in Preparation Example 1 according to the same method as the preparation of Compound 1-2.

Preparation of Compound 2-4

[0063] Compound 2-4 (3.4 g, 7.70 mmol, 64.4%) was obtained by combining Compound 2-3 (5.7 g, 11.97 mmol) in Preparation Example 1 according to the same method as the preparation of Compound 1-3.

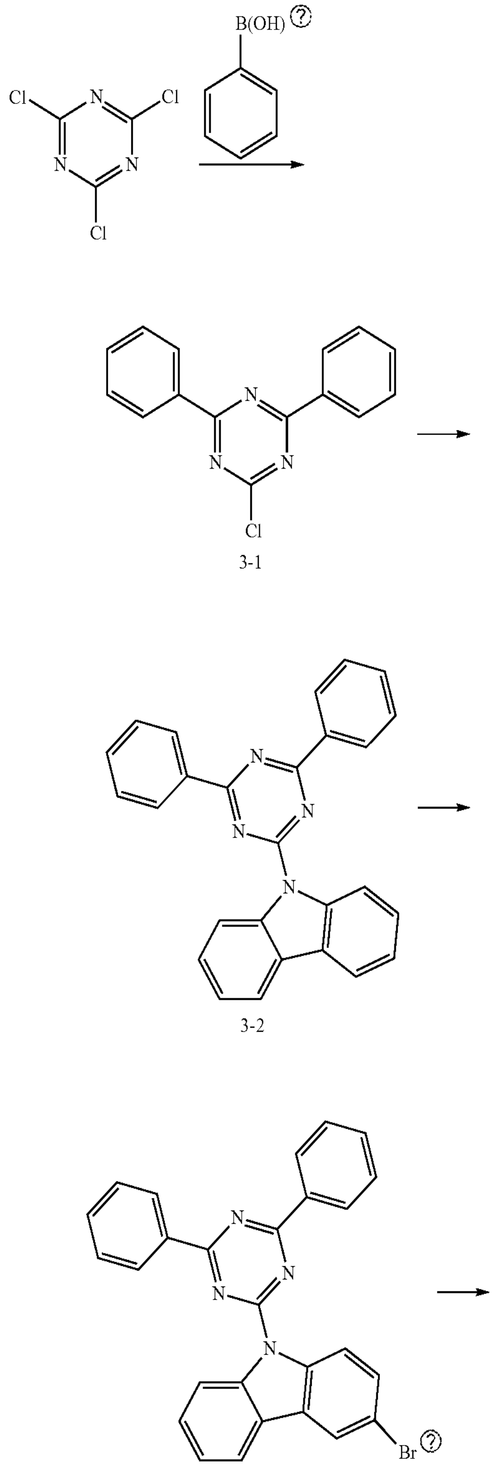
Preparation of Compound 49

[0064] Compound 49 (3.2 g, 5.52 mmol, 72%) was obtained by using Compound 2-4 (3.4 g, 7.70 mmol) and 2-bromodibenzo[b,d]thiophene in Preparation Example 1 according to the same method as the preparation of Compound 1.

Preparation Example 3

Preparation of Compound 51

[0065]



3-1

3-2

3-3

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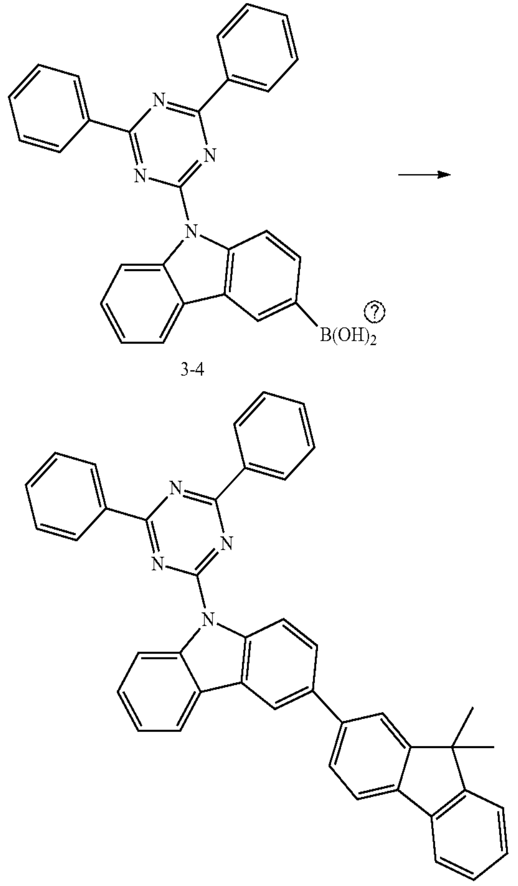


Preparation of Compound 3-1

[0066] Compound 3-1 (13.2 g, 47.7 mmol, 87.5%) was obtained by combining 2,4,6-trichlorotriazine (10 g, 54.51 mmol) in Preparation Example 2 according to the same method as the preparation of Compound 2-1.

Preparation of Compound 3-2

[0067] Compound 3-2 (14.5 g, 36.39 mmol, 76.3%) was obtained by combining Compound 3-1 (13.2 g, 47.7 mmol) in Preparation Example 2 according to the same method as the preparation of Compound 2-2.

Preparation of Compound 3-3

[0068] Compound 3-3 (14.6 g, 30.59 mmol, 84%) was obtained by combining Compound 3-2 (14.5 g, 36.39 mmol) in Preparation Example 2 according to the same method as the preparation of Compound 2-3.

Preparation of Compound 3-4

[0069] Compound 3-4 (7.2 g, 16.28 mmol, 53.2%) was obtained by combining Compound 3-3 (14.6 g, 30.59 mmol) in Preparation Example 2 according to the same method as the preparation of Compound 2-4.

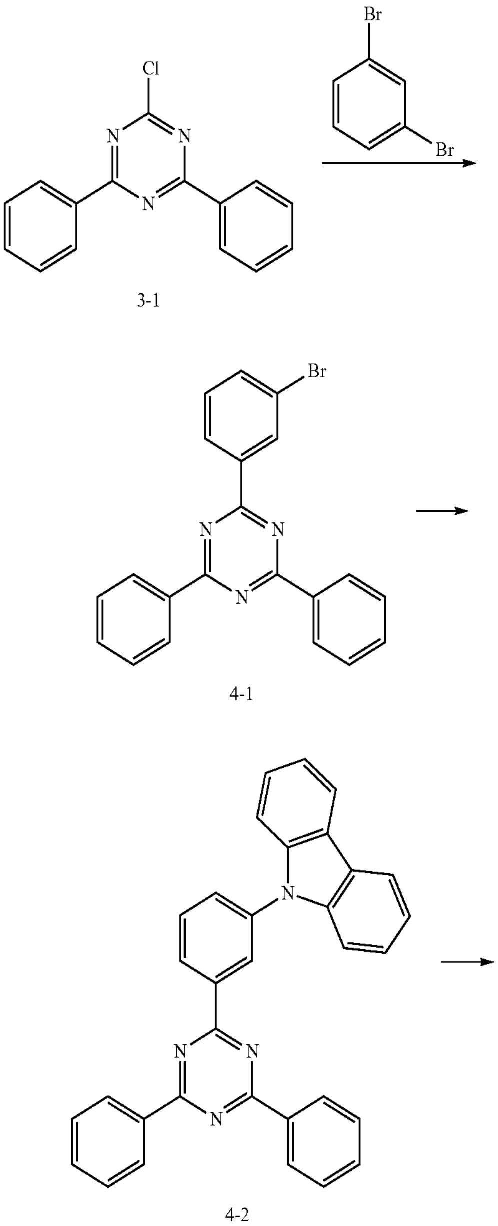
Preparation of Compound 51

[0070] Compound 51 (5.1 g, 8.63 mmol, 53%) was obtained by using Compound 3-4 (7.2 g, 16.28 mmol) and 2-bromo-9,9-dimethyl-9H-fluorene in Preparation Example 2 according to the same method as the preparation of Compound 49.

Preparation Example 4

Preparation of Compound 62

[0071]



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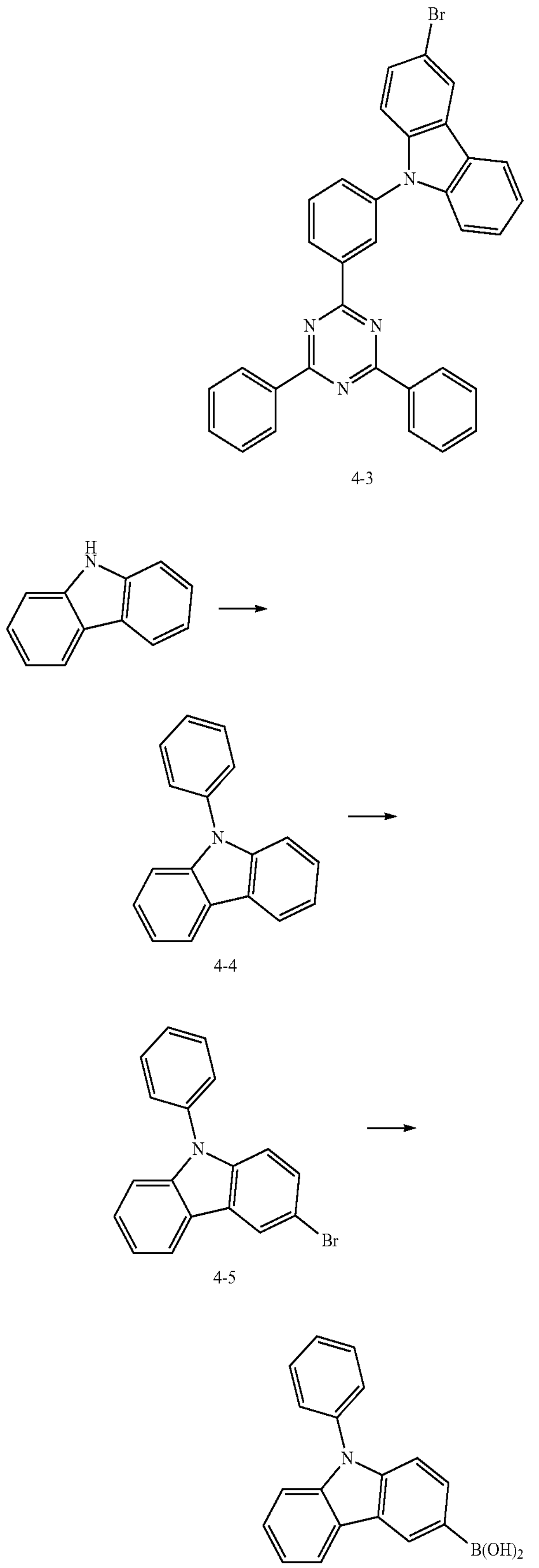

4-3

4-4

4-5

4-6

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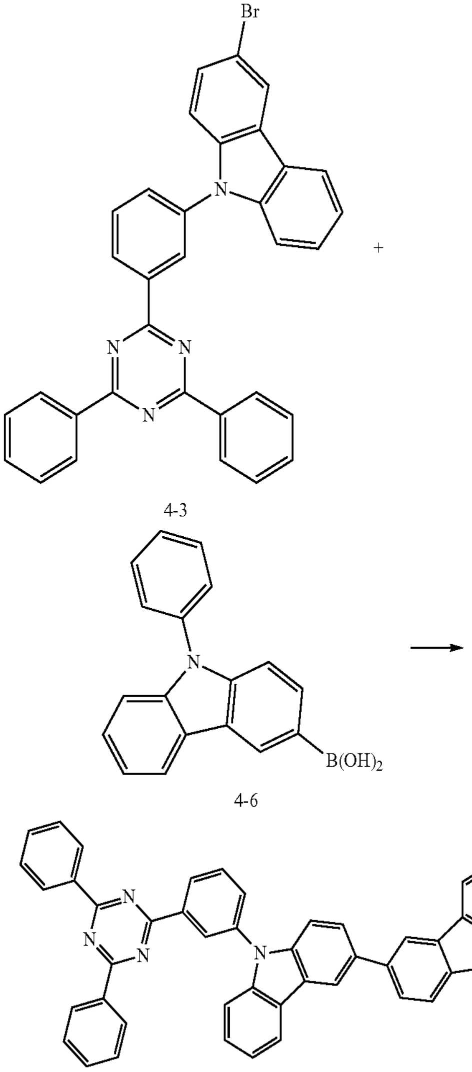


4-3

4-6

62

Preparation of Compound 4-1

[0072] 1,3-dibromobenzene (28 g, 0.119 mol) was dissolved in THF (600 mL) and n-BuLi (47.5 mL) was slowly added dropwise at −78° C. After reacting and stirring for 1 hour, Compound 3-1 (47.5 mL) was slowly added dropwise and slowly heated. The mixture was stirred at room temperature for 5 hours. Upon completion of the reaction, the product was extracted with EA and distilled water. Compound 4-1 (15.7 g, 40.43 mmol, 40.4%) was obtained via column separation.

Preparation of Compound 4-2

[0073] Compound 4-2 (12.5 g, 26.34 mmol, 65.2%) was obtained by combining Compound 4-1 (15.7 g, 40.43 mmol) in Preparation Example 1 according to the same method as the preparation of Compound 1-1.

Preparation of Compound 4-3

[0074] Compound 4-3 (9.8 g, 17.71 mmol, 67.3%) was obtained by combining Compound 4-2 (12.5 g, 26.34 mmol) in Preparation Example 1 according to the same method as the preparation of Compound 1-2.

Preparation of Compound 4-4

[0075] 9H-carbazole (70 g, 0.42 mmol), Iodobenzene (46 mL), cooper (40 g), potassiumcarbonate (174 g), 18-crown-6 (9 g), and 1,2-Dichlorobenzene (2 L) were added and stirred under reflux for 12 hours. Upon completion of the reaction, the product was extracted with EA and dried with $MgSO_4$. Distillation under reduced pressure followed by column separation yielded Compound 4-4 (63.4 g, 260.58 mmol, 62%).

Preparation of Compound 4-5

[0076] Compound 4-5 (52.4 g, 162.63 mmol, 62.4%) was obtained by combining Compound 4-4 (63.4 g, 260.58 mmol) in Preparation Example 1 according to the same method as the preparation of Compound 1-2.

Preparation of Compound 4-6

[0077] Compound 4-6 (20.3 g, 70.70 mmol, 43%) was obtained by combining Compound 4-5 (52.4 g, 162.63 mmol) in Preparation Example 1 according to the same method as the preparation of Compound 1-3.

Preparation of Compound 62

[0078] Compound 62 (5.7 g, 7.96 mmol, 50%) was obtained by using Compound 4-3 (9.8 g, 17.71 mmol) and Compound 4-6 in Preparation Example 1 according to the same method as the preparation of Compound 1.

[0079] Organic electroluminescent Compounds 1 to 68 were prepared according to Preparation Examples 1 to 4 and Table 1 shows ^{1}H NMR and MS/FAB of the prepared organic electroluminescent compounds.

TABLE 1

		MS/FAB	
Cmpd.	^{1}H NMR($CDCl_3$, 200 MHz)	found	calculated
1	δ = 7.25(1H, m), 7.32~7.4(4H, m), 7.66~7.81(6H, m), 7.87~7.94(4H, m), 8.01(1H, m), 8.41(1H, m), 8.55(1H, m)	410.47	410.14
4	δ = 7.25(1H, m), 7.32~7.41(4H, m), 7.51~7.52(5H, m), 7.66~7.81(6H, m), 7.87~7.94(3H, m), 8.4(1H, m), 8.47(1H, m), 8.55(1H, m)	486.56	486.17
5	δ = 7.11(1H, m), 7.25(1H, m), 7.32~7.41(11H, m), 7.66~7.81(6H, m), 7.87~7.94(3H, m), 8.3(2H, m), 8.55~8.6(2H, m)	562.66	562.20
7	δ = 7.25(1H, m), 7.32~7.42(5H, m), 7.49~7.52(5H, m), 7.66~7.81(7H, m), 7.87~7.94(4H, m), 8.43(1H, s), 8.55(1H, m)	536.62	536.19
8	δ = 0.92(12H, m), 1.78(9H, m), 7.25(1H, m), 7.32~7.38(3H, m), 7.66~7.81(6H, m), 7.87~7.96(5H, m), 8.03(1H, m), 8.1(1H, m), 8.38(1H, m), 8.55(1H, m)	616.87	616.29
9	δ = 7.11(1H, m), 7.25(1H, m), 7.32(1H, m), 7.33(1H, m), 7.37~7.46(22H, m), 7.64~7.81(7H, m), 7.87~7.94(3H, m), 8.27(1H, m), 8.4(1H, m), 8.55~8.6(2H, m)	821.05	820.29
10	δ = 7.14(1H, m), 7.25(1H, m), 7.32~7.38(5H, m), 7.66(1H, m), 7.69(1H, m), 7.7(1H, m), 7.71(1H, m), 7.72~7.81(8H, m), 8.53~8.59(3H, m), 9.3(1H, m), 9.92(1H, m)	564.63	564.20
11	δ = 7.14(1H, m), 7.25(2H, m), 7.32~7.41(4H, m), 7.51~7.52(4H, m), 7.66~7.81(7H, m), 7.87~7.94(3H, m), 8.53~8.55(2H, m), 9.3(1H, m), 9.41(1H, m)	563.65	563.20
12	δ = 7.25(1H, m), 7.32~7.41(4H, m), 7.51~7.52(4H, m), 7.66~7.81(8H, m), 7.87~8(4H, m), 8.3(2H, m), 8.44(1H, m), 8.55~8.6(2H, m)	562.66	562.20
13	δ = 7.25(1H, m), 7.32~7.41(11H, m), 7.66~7.81(8H, m), 7.87~7.94(3H, m), 8.2(2H, m), 8.3(4H, m), 8.55(1H, m)	638.75	638.24
14	δ = 7.25(1H, m), 7.32~7.41(11H, m), 7.66~7.81(6H, m), 7.87~7.94(3H, m), 8.26~8.3(3H, m), 8.55~8.56(2H, m), 9.93(2H, m)	640.73	640.23
15	δ = 7.25(1H, m), 7.32~7.51(11H, m), 7.66~7.81(6H, m), 7.87~7.94(3H, m), 8.09(1H, m), 8.28(5H, m), 8.55(1H, m)	640.73	640.23
16	δ = 7.25(1H, m), 7.32~7.46(16H, m), 7.55(3H, m), 7.61(1H, m), 7.62~7.71(10H, m), 7.87~8(4H, m), 8.3(2H, m), 8.44(1H, m), 8.55~8.6(2H, m)	821.05	820.29
17	δ = 1.72(6H, s), 7(1H, m), 7.17(1H, m), 7.25~7.26(2H, m), 7.32~7.38(4H, m), 7.51(1H, m), 7.66~7.81(6H, m), 7.87~7.96(5H, m), 8.07(1H, m), 8.14(1H, m), 8.5~8.55(2H, m)	602.72	602.24

TABLE 1-continued

		MS/FAB	
Cmpd.	^{1}H NMR($CDCl_3$, 200 MHz)	found	calculated
18	δ = 7.32~7.4(3H, m), 7.66~7.81(8H, m), 7.87~8.01(6H, m), 8.16(1H, m), 8.41(1H, m), 8.54(1H, m)	460.52	460.16
20	δ = 7.26(1H, m), 7.32~7.4(4H, m), 7.47~7.55(5H, m), 7.66~7.81(8H, m), 7.87~7.89(2H, m), 8.16(2H, m), 8.3(2H, m)	536.62	536.19
21	δ = 7.32~7.41(3H, m), 7.51~7.52(5H, m), 7.66~7.81(8H, m), 7.87~7.96(4H, m), 8.16(1H, m), 8.4(1H, m), 8.47(1H, m), 8.54(1H, m)	536.62	536.19
22	δ = 7.11(1H, m), 7.32~7.54(10H, m), 7.66~7.81(8H, m), 7.87~7.96(4H, m), 8.16(1H, m), 8.3(2H, m), 8.54(1H, m), 8.6(1H, m)	612.72	612.22
25	δ = 7.11(1H, m), 7.25(4H, m), 7.32~7.41(4H, m), 7.51~7.52(8H, m), 7.66~7.81(8H, m), 7.87~7.96(6H, m), 8.16(1H, m), 8.54(1H, m), 8.6(1H, m), 8.81(2H, m)	764.91	764.28
31	δ = 7.32~7.46(15H, m), 7.55(3H, m), 7.61(1H, m), 7.62(1H, m), 7.66~7.71(11H, m), 7.87~8(5H, m), 8.16(1H, m), 8.3(2H, m), 8.44(1H, m), 8.54(1H, m), 8.6(1H, m)	871.11	870.31
32	δ = 7.32~7.54(10H, m), 7.66~7.81(8H, m), 7.87~7.96(4H, m), 8.16(1H, m), 8.26~8.3(3H, m), 8.54~8.56(2H, m), 9.93(2H, m)	690.79	690.24
33	δ = 1.72(6H, s), 7(1H, m), 7.17(1H, m), 7.26(1H, m), 7.32~7.38(3H, m), 7.51(1H, m), 7.66~7.81(8H, m), 7.87~7.96(6H, m), 8.07(1H, m), 8.14~8.16(2H, m), 8.5~8.54(2H, m)	652.78	652.25
34	δ = 7.32~7.51(10H, m), 7.66~7.81(8H, m), 7.87~7.96(4H, m), 8.09(1H, m), 8.16(1H, m), 8.28(5H, m), 8.54(1H, m)	690.79	690.24
35	δ = 7.41~7.54(18H, m), 7.69~7.81(11H, m), 7.87(1H, m), 8(1H, m), 8.18~8.2(3H, m), 8.3(4H, m)	790.95	790.30
36	δ = 7.11(1H, m), 7.22~7.25(5H, m), 7.32~7.41(4H, m), 7.51~7.52(8H, m), 7.66~7.81(5H, m), 7.88~7.89(3H, m), 7.97~8(2H, m), 8.18(1H, m), 8.43(1H, m), 8.6(1H, m), 8.81(2H, m)	715.84	715.26
37	δ = 7.11(1H, m), 7.32~7.54(11H, m), 7.66~7.81(5H, m), 7.89(1H, m), 8(1H, m), 8.18(1H, m), 8.3(2H, m), 8.43(1H, m), 8.6(1H, m), 9.34(1H, m)	563.65	563.20
38	δ = 7.11(1H, m), 7.32~7.41(11H, m), 7.66~7.81(5H, m), 7.89(1H, m), 8(1H, m), 8.18(1H, m), 8.3(2H, m), 8.43(1H, m), 8.51(1H, m), 8.6(1H, m)	563.65	563.20
39	δ = 7.11(1H, m), 7.32(1H, m), 7.38~7.47(11H, m), 7.66~7.81(6H, m), 7.89~7.92(2H, m), 8(1H, m), 8.18(1H, m), 8.3(2H, m), 8.6(1H, m), 8.91(1H, m)	613.70	613.22
40	δ = 7.11(1H, m), 7.32~7.54(10H, m), 7.66~7.81(6H, m), 7.89(1H, m), 8(1H, m), 8.18(1H, m), 8.3(2H, m), 8.6(1H, m), 8.75(1H, m), 9.39(2H, m)	614.69	614.21
41	δ = 7.11(1H, m), 7.25~7.33(4H, m), 7.41~7.54(10H, m), 7.63(1H, m), 7.66~7.71(8H, m), 7.87(1H, m), 7.94(1H, m), 8.12(1H, m), 8.3(2H, m), 8.55~8.6(2H, m), 8.74(2H, m)	779.88	779.27
42	δ = 7.25(1H, m), 7.32~7.41(5H, m), 7.51(4H, m), 7.66~7.81(10H, m), 7.87~7.94(3H, m), 8.55(1H, m), 8.63(1H, s), (H,)	563.65	563.20
43	δ = 7.25(1H, m), 7.32~7.41(5H, m), 7.51(4H, m), 7.66~7.81(6H, m), 7.87~7.94(3H, m), 8.28(4H, m), 8.55(1H, m)	564.63	564.20
44	δ = 7.25(1H, m), 7.32(2H, s), 7.32~7.41(4H, m), 7.51(4H, m), 7.66~7.81(8H, m), 7.87~7.94(3H, m), 8.28(2H, m), 8.55(1H, m)	563.65	563.20
45	δ = 1.72(12H, s), 7.25~7.38(8H, m), 7.55(2H, m), 7.63~7.81(10H, m), 7.87~7.94(7H, m), 8.55(1H, m), 8.63(1H, s), (H,)	795.97	795.32

TABLE 1-continued

		MS/FAB	
Cmpd.	^{1}H NMR(CDCl$_3$, 200 MHz)	found	calculated
46	δ = 7.25(1H, m), 7.33(1H, m), 7.41(2H, m), 7.5~7.52(6H, m), 7.69(1H, m), 7.77(1H, m), 7.86~7.87(2H, m), 7.94~8(4H, m), 8.28(4H, m), 8.45(1H, m), 8.55(1H, m)	580.70	580.17
47	δ = 7.25(1H, m), 7.33(1H, m), 7.41(2H, m), 7.5~7.52(10H, m), 7.69(1H, m), 7.77(1H, m), 7.85~7.87(6H, m), 7.94~8(4H, m), 8.3(4H, m), 8.45(1H, m), 8.55(1H, m), 8.63(1H, s), (H,)	731.90	731.24
48	δ = 7.11(1H, m), 7.25(1H, m), 7.33(1H, m), 7.41~7.54(10H, m), 7.69(1H, m), 7.77(1H, m), 7.86~7.87(2H, m), 7.94~8(4H, m), 8.3(2H, m), 8.45(1H, m), 8.55~8.6(2H, m)	578.72	578.18
49	δ = 7.25(1H, m), 7.33(1H, m), 7.41(2H, m), 7.5~7.52(6H, m), 7.69(1H, m), 7.77~7.79(5H, m), 7.86~7.87(2H, m), 7.94~8(4H, m), 8.45(1H, m), 8.55(1H, m), 8.63(1H, s), (H,)	579.71	579.18
50	δ = 1.72(6H, s), 7.25~7.41(6H, m), 7.51~7.55(6H, m), 7.61(1H, m), 7.69(1H, m), 7.77~7.79(5H, m), 7.87(2H, m), 7.94(1H, m), 8.06(1H, m), 8.55(1H, m), 8.63(1H, s), (H,)	589.73	589.25
51	δ = 1.72(6H, s), 7.25~7.41(6H, m), 7.51~7.55(6H, m), 7.61(1H, m), 7.69(1H, m), 7.77(1H, m), 7.87(2H, m), 7.94(1H, m), 8.06(1H, m), 8.28(4H, m), 8.55(1H, m)	590.71	590.25
52	δ = 1.72(6H, s), 7.11(1H, m), 7.25(1H, m), 7.28(1H, m), 7.33(1H, m), 7.38~7.51(11H, m), 7.61(1H, m), 7.69(1H, m), 7.77(1H, m), 7.87(2H, m), 7.94(1H, m), 8.06(1H, m), 8.3(2H, m), 8.55~8.6(2H, m)	588.74	588.26
53	δ = 1.72(6H, s), 7.25~7.41(6H, m), 7.48~7.61(15H, m), 7.69~7.77(6H, m), 7.87(2H, m), 7.94(1H, m), 8.06(1H, m), 8.55(1H, m), 8.63(1H, s), (H,)	741.92	741.31
54	δ = 0.66(6H, s), 7.25(1H, m), 7.33(2H, m), 7.41(2H, m), 7.51~7.52(5H, m), 7.58~7.61(2H, m), 7.69(1H, m), 7.77~7.94(10H, m), 8.55(1H, m), 8.63(1H, s), (H,)	605.80	605.23
55	δ = 1.3(4H, m), 1.45(4H, m), 7.25(1H, m), 7.33(2H, m), 7.41(2H, m), 7.51~7.52(5H, m), 7.58~7.61(2H, m), 7.69(1H, m), 7.77~7.94(6H, m), 8.28(4H, m), 8.55(1H, m)	632.83	632.24
56	δ = 7.25(1H, m), 7.33~7.42(6H, m), 7.48~7.51(5H, m), 7.69~7.87(12H, m), 7.94(1H, m), 8.03~8.12(3H, m), 8.55(1H, m), 8.63(1H, s), (H,)	655.72	655.22
57	δ = 7.25(1H, m), 7.33~7.55(26H, m), 7.69(1H, m), 7.72~7.79(13H, m), 7.94(1H, m), 8.55(1H, m), 8.63(1H, s), (H,)	893.95	893.34
58	δ = 7.25(1H, m), 7.33(1H, m), 7.41~7.51(11H, m), 7.69~7.81(11H, m), 7.87~7.88(3H, m), 7.94(1H, m), 8.55(1H, m), 8.63(1H, s), (H,)	635.56	635.25
59	δ = 7.25(1H, m), 7.33(1H, m), 7.41~7.51(11H, m), 7.69(1H, m), 7.75(1H, m), 7.77~7.87(13H, m), 8.55(1H, m), 8.63(1H, s), (H,)	671.72	671.21
60	δ = 7.25~7.33(3H, m), 7.41~7.51(10H, m), 7.58~7.63(3H, m), 7.69(1H, m), 7.77~7.79(6H, m), 7.87(1H, m), 7.94~8(2H, m), 8.12(1H, m), 8.18(1H, m), 8.55(1H, m), 8.63(1H, s), (H,)	638.76	638.25
61	δ = 7.25(2H, m), 7.33(2H, m), 7.41~7.51(9H, m), 7.58(2H, m), 7.69(2H, m), 7.77(2H, m), 7.87(2H, m), 7.94(2H, m), 8.28(4H, m), 8.55(2H, m)	639.75	639.24
62	δ = 7.25(2H, m), 7.33(2H, m), 7.41~7.51(11H, m), 7.58(2H, m), 7.69(2H, m), 7.77(2H, m), 7.87(2H, m), 7.94(2H, m), 8.09(1H, m), 8.28(5H, m), 8.55(2H, m)	715.84	715.27
63	δ = 7.25(1H, m), 7.33~7.51(11H, m), 7.58(2H, m), 7.69(1H, m), 7.77(2H, m), 7.87(1H, m), 7.94~8(2H, m), 8.18(1H, m), 8.28(4H, m), 8.43(1H, m), 8.51~8.55(2H, m)	640.73	640.24
64	δ = 7.25(1H, m), 7.33(1H, m), 7.41~7.51(11H, m), 7.58(2H, m), 7.69(1H, m), 7.76~7.77(3H, m), 7.87~8(4H, m), 8.18(1H, m), 8.28(4H, m), 8.55(1H, m), 8.91(1H, m)	690.79	690.25

TABLE 1-continued

		MS/FAB	
Cmpd.	^{1}H NMR(CDCl$_3$, 200 MHz)	found	calculated
65	δ = 7.25(1H, m), 7.33(1H, m), 7.41~7.56(8H, m), 7.69(1H, m), 7.77~7.79(3H, m), 7.86~7.87(2H, m), 7.94~8(4H, m), 8.09(1H, m), 8.28(1H, m), 8.45(1H, m), 8.54~8.55(2H, m)	579.71	579.18
66	δ = 7.25~7.33(3H, m), 7.41(2H, m), 7.5~7.51(5H, m), 7.63(1H, m), 7.69(1H, m), 7.77~7.79(6H, m), 7.87(1H, m), 7.94~8(2H, m), 8.12(1H, m), 8.18(1H, m), 8.55(1H, m), 8.63(1H, s),(H,)	643.79	643.28
67	δ = 7.25~7.33(3H, m), 7.41(4H, m), 7.5~7.51(9H, m), 7.63(1H, m), 7.69(1H, m), 7.77~7.79(6H, m), 7.87(1H, m), 7.94~8(2H, m), 8.12(1H, m), 8.18(1H, m), 8.28(4H, m), 8.55(1H, m), 8.63(1H, s),(H,)	793.91	793.30
68	δ = 7.25(1H, m), 7.33~7.42(26H, m), 7.61~7.69(7H, m), 7.76~7.77(3H, m), 7.87(1H, m), 7.94~8(2H, m), 8.09(1H, m), 8.16~8.18(2H, m), 8.28(4H, m), 8.54~8.55(2H, m)	1024.29	1023.38

Example 1

Manufacture of OLED Device Using the Organic Electroluminescent Compound According to the Present Invention

[0080] An OLED device was manufactured using the electroluminescent material according to the present invention. First, a transparent electrode ITO thin film (15Ω/□) obtained from a glass for OLED (produced by Samsung Corning) was subjected to ultrasonic washing with trichloroethylene, acetone, ethanol and distilled water, sequentially, and stored in isopropanol before use.

[0081] Then, an ITO substrate was equipped in a substrate folder of a vacuum vapor deposition apparatus, and 4,4',4"-tris(N,N-(2-naphthyl)-phenylamino)triphenylamine (2-TNATA) was placed in a cell of the vacuum vapor deposition apparatus, which was then ventilated up to 10^{-6} torr of vacuum in the chamber. Then, electric current was applied to the cell to evaporate 2-TNATA, thereby forming a hole injection layer having a thickness of 60 nm on the ITO substrate.

[0082] Then, N,N'-bis(α-naphthyl)-N,N'-diphenyl-4,4'-diamine (NPB) was placed in another cell of the vacuum vapor deposition apparatus, and electric current was applied to the cell to evaporate NPB, thereby forming a hole transport layer having a thickness of 20 nm on the hole injection layer.

[0083] After forming the hole injection layer and the hole transport layer, an electroluminescent layer was formed thereon as follows. Compound 49 was placed in a cell of a vacuum vapor deposition apparatus as host, and Ir(ppy)$_3$[tris(2-phenylpyridine)iridium] was placed in another cell as a dopant. The two materials were evaporated at different rates such that an electroluminescent layer having a thickness of 30 nm was vapor-deposited on the hole transport layer at 4 to 10 wt %.

[0084] Subsequently, tris(8-hydroxyquinoline)-aluminum (III) (Alq) was vapor-deposited with a thickness of 20 nm as an electron transport layer. Then, after vapor-depositing lithium quinolate (Liq) of a following structure with a thickness of 1 to 2 nm as an electron injection layer, an Al cathode having a thickness of 150 nm was formed using another vacuum vapor deposition apparatus to manufacture an OLED. Each compound used in the OLED was purified by vacuum sublimation at 10^{-6} torr.

Example 2

Manufacture of OLED Device Using the Organic Electroluminescent Compounds of the Present Invention

[0085] An OLED was manufactured as in Example 1 except that Compound 23 according to the present invention is used as host material on the electroluminescent layer and an organic iridium complex (piq)$_2$Ir(acac)[bis-(1-phenylisoquinolyl)iridium(III)acetylacetonate] is used as electroluminescent dopant.

Comparative Examples 1 and 2

Electroluminescent Properties of the OLED Device Using Conventional Electroluminescent Material

[0086] An OLED device was manufactured in the same manner as Examples 1 and 3 except that 4,4'-Bis(carbazol-9-yl)-biphenyl (CBP) instead of the compounds of the present invention was used as host material in a cell of the vacuum vapor deposition apparatus.

[0087] Luminous efficiency of the OLED devices including the organic electroluminescent compound according to the present invention manufactured in Examples 1 to 2 and Comparative Examples 1 and 2 and the conventional electroluminescent compound was measured at 1,000 cd/m^2. The result is given in Table 2.

TABLE 2

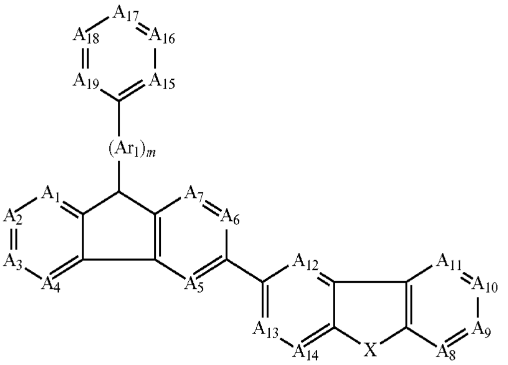
No.		Host	Dopant	Hole blocking layer	Driving voltage (V) @1,000 cd/m^2	Power efficiency (cd/A) @1,000 cd/m^2	Color
Example 1	6	49	Ir(ppy)$_3$	—	6.7	30.1	Green
	7	59	Ir(ppy)$_3$	—	6.5	28.1	Green
	8	60	Ir(ppy)$_3$	—	6.7	30.3	Green
	9	62	Ir(ppy)$_3$	—	6.4	28.3	Green
	10	67	Ir(ppy)$_3$	—	6.3	29.0	Green
Example 2	16	23	(piq)$_2$Ir(acac)	—	6.2	7.1	Red
	17	30	(piq)$_2$Ir(acac)	—	6.1	7.6	Red
	18	34	(piq)$_2$Ir(acac)	—	6.0	7.8	Red
	19	53	(piq)$_2$Ir(acac)	—	6.3	7.6	Red
	20	55	(piq)$_2$Ir(acac)	—	6.4	7.3	Red
Comparative Example 1		CBP	Ir(ppy)$_3$	BAlq	7.5	25.1	Green
Comparative Example 2		CBP	(piq)$_2$Ir(acac)	BAlq	7.5	6.5	Red

[0088] As shown in Table 2, the organic electroluminescent compounds according to the present invention have excellent properties compared with the conventional material. In addition, the device using the organic electroluminescent compound according to the present invention as host material for emitting red or green light has excellent electroluminescent properties and drops driving voltage, thereby increasing power efficiency and improving power consumption.

What is claimed is:

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

Formula 1



wherein

A_1 to A_{14} independently represent CR_1;

A_{15} to A_{19} independently represent CR_1 or N;

Ar_1 represents a substituted or unsubstituted quinazolinyl group;

m represents an integer 1;

X represents —N(R_4)—, wherein R_4 represents (C6-C30)aryl with or without substituent(s), or substituted or unsubstituted (C6-C30)aryl fused with one or more (C3-C30)cycloalkyl(s) with or without substituent(s); and

R_1 independently represents hydrogen, deuterium, halogen, (C1-C30)alkyl with or without substituent(s), (C6-C30)aryl with or without substituent(s), substituted or unsubstituted (C6-C30)aryl fused with one or more (C3-C30)cycloalkyl(s) with or without substituent(s), (C3-C30)heteroaryl with or without substituent(s), 5- to 7-membered heterocycloalkyl with or without substituent(s), 5- to 7-membered heterocycloalkyl fused with one or more aromatic ring(s) with or without substituent (s), (C3-C30)cycloalkyl with or without substituent(s), (C3-C30)cycloalkyl fused with one or more aromatic ring(s) with or without substituent(s), cyano, trifluoromethyl, $R^aR^bR^cSi$—, or (C6-C30)aryl(C1-C30)alkyl with or without substituent(s), wherein R^a, R^b, and R^c independently represent (C1-C30)alkyl with or without substituent(s) or (C6-C30)aryl with or without substituent (s).

2. The compound of claim **1** wherein

A_1 through A_{14} independently represent CH;

A_{15} to A_{19} independently represent CR_1; and

R_1 independently represents hydrogen, deuterium, (C6-C30)aryl with or without substituent(s), substituted or unsubstituted (C6-C30)aryl fused with one or more (C3-C30)cycloalkyl(s) with or without substituent(s), (C3-C30)cycloalkyl with or without substituent(s), (C3-C30)cycloalkyl fused with one or more aromatic ring(s) with or without substituent(s).

3. The compound of claim **2** wherein R_1 independently represents hydrogen or deuterium.

4. The compound of claim **1**, wherein Ar_1 represents an unsubstituted quinazolinyl group.

5. The compound of claim **1**, wherein the quinazolinyl group is bound to the carbazole nitrogen through the nitrogen-containing ring of the quinazolinyl group.

6. The compound of claim **1**, wherein R_1 represents hydrogen or deuterium.

7. An organic electroluminescence device material comprising the compound of claim **1**.

8. An organic electroluminescence device comprising: a first electrode, a second electrode, and a plurality of organic layers provided between the first electrode and the second electrode, the organic layers comprising an electroluminescent layer, wherein at least one of the organic layers comprises the organic electroluminescence device material of claim **7**.

9. The organic electroluminescence device of claim **8**, wherein the electroluminescent layer comprises the organic electroluminescence device material as a host material.

10. The organic electroluminescence device of claim **8**, wherein the electroluminescent layer comprises a phosphorescent material.

11. The organic electroluminescence device of claim **10**, wherein the phosphorescent material is an ortho-metalated complex of a metal atom selected from iridium (Ir), osmium (Os) and platinum (Pt).

12. The organic electroluminescence device of claim **8**, wherein an electron injection layer is provided between an electrode and the electroluminescent layer.

13. The organic electroluminescence device of claim **12**, wherein the electron injection layer comprises lithium quinolate.

14. The organic electroluminescence device of claim **8**, wherein an electron transport layer is provided between an electrode and the electroluminescent layer, the electron transport layer comprising the organic electroluminescence device material.

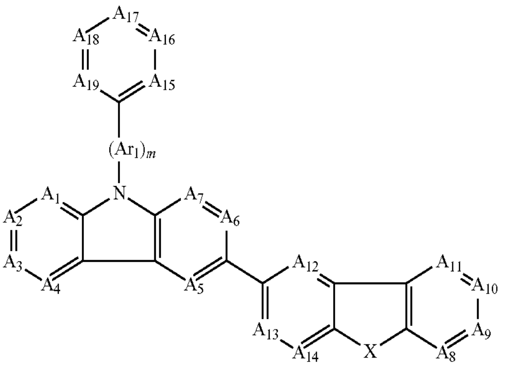
15. The organic electroluminescence device of claim **8**, wherein a reductive dopant layer is present between an electrode and at least one of the organic layers.

16. An organic electroluminescent device comprising a first electrode, a second electrode and a plurality of organic layers provided between the first electrode and the second electrode, the organic layers comprising an electroluminescent layer, wherein

at least one of the organic layers is the electroluminescent layer comprising a host material and a phosphorescent material providing phosphorescence,

the host material being a compound represented by a formula 1 below:

Formula 1



wherein

A_1 to A_{14} independently represent CR_1;

A_{15} to A_{19} independently represent CR_1 or N;

Ar represents a substituted or unsubstituted quinazolinyl group;

m represents an integer 1;

X represents —$N(R_4)$—, wherein R_4 represents (C6-C30) aryl with or without substituent(s), or substituted or unsubstituted (C6-C30)aryl fused with one or more (C3-C30)cycloalkyl(s) with or without substituent(s); and

R_1 independently represents hydrogen, deuterium, halogen, (C1-C30)alkyl with or without substituent(s), (C6-C30)aryl with or without substituent(s), substituted or unsubstituted (C6-C30)aryl fused with one or more (C3-C30)cycloalkyl(s) with or without substituent(s), (C3-C30)heteroaryl with or without substituent(s), 5- to 7-membered heterocycloalkyl with or without substituent(s), 5- to 7-membered heterocycloalkyl fused with one or more aromatic ring(s) with or without substituent(s), (C3-C30)cycloalkyl with or without substituent(s), (C3-C30)cycloalkyl fused with one or more aromatic ring(s) with or without substituent(s), cyano, trifluoromethyl, $R^aR^bR^cSi$—, or (C6-C30)aryl(C1-C30)alkyl with or without substituent(s), wherein R^a, R^b, and R^c independently represent (C1-C30)alkyl with or without substituent(s) or (C6-C30)aryl with or without substituent(s).

17. The organic electroluminescent device of claim **16**, wherein the electroluminescent layer comprises a host material and phosphorescent material, the phosphorescent material being an ortho-metalated complex of a metal atom selected from iridium (Ir), osmium (Os) and platinum (Pt).

18. The organic electroluminescence device of claim **16**, wherein an electron injection layer is provided between an electrode and the electroluminescent layer.

19. The organic electroluminescence device of claim **18**, wherein the electron injection layer comprises lithium quinolate.

20. The organic electroluminescence device of claim **16**, wherein an electron transport layer is provided between an electrode and the electroluminescent layer, the electron transport layer comprising a compound represented by the formula 1.

21. The organic electroluminescence device of claim **16**, wherein a reductive dopant layer is present between an electrode and at least one of the organic layers.

22. An organic electroluminescent device comprising a first electrode, a second electrode and a plurality of organic layers provided between the first electrode and the second electrode, the organic layers comprising an electroluminescent layer, wherein

the emitting layer comprises the compound according to claim **1** and a phosphorescent material, wherein the compound is represented by formula 1,

A_1 through A_{14} independently represent CH;

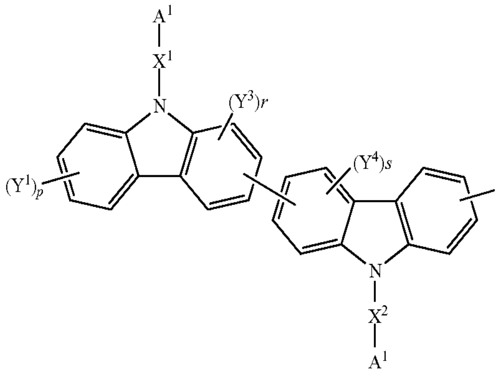
A_{15} to A_{19} independently represent CR_1;

R_1 independently represents hydrogen, deuterium, (C6-C30)aryl with or without substituent(s), substituted or unsubstituted (C6-C30)aryl fused with one or more (C3-C30)cycloalkyl(s) with or without substituent(s), (C3-C30)cycloalkyl with or without substituent(s), (C3-C30)cycloalkyl fused with one or more aromatic ring(s) with or without substituent(s); and

the phosphorescent material is an Ir complex.

23. A biscarbazole derivative represented by a formula 2 below,

Formula 2



where: A^1 represents a substituted or unsubstituted quinazoline ring bound to X^1 through the nitrogen-containing ring of the quinazoline, when A^1 has a substituent, the substituent of A^1 is an alkyl group having 1 to 20 carbon atoms, alkoxy group having 1 to 20 carbon atoms, haloalkyl group having 1 to 20 carbon atoms, alkylsilyl group having 1 to 10 carbon atoms, arylsilyl group having 6 to 30 ring carbon atoms, cyano group, halogen atom, aromatic hydrocarbon group having 6 to 30 ring carbon atoms, substituted or unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms, or monocyclic aromatic heterocyclic group having 2 to 30 ring carbon atoms;

A^2 represents a substituted or unsubstituted aromatic hydrocarbon group having 6 to 30 ring carbon atoms, when A^2 has a substituent, the substituent of A^2 is an alkyl group having 1 to 20 carbon atoms, alkoxy group having 1 to 20 carbon atoms, haloalkyl group having 1 to 20 carbon atoms, alkylsilyl group having 1 to 10 carbon atoms, arylsilyl group having 6 to 30 ring carbon atoms, cyano group, halogen atom, aromatic hydrocarbon group having 6 to 30 ring carbon atoms, substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms, or monocyclic aromatic heterocyclic group having 2 to 30 ring carbon atoms;

X^1 and X^2 each are a linking group and independently represent a single bond, substituted or unsubstituted aromatic hydrocarbon group having 6 to 30 ring carbon atoms, substituted or unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms, when X^1 and X^2 each have a substituent, the substituent of X^1 and X^2 is an alkyl group having 1 to 20 carbon atoms, alkoxy group having 1 to 20 carbon atoms, haloalkyl group having 1 to 20 carbon atoms, alkylsilyl group having 1 to 10 carbon atoms, arylsilyl group having 6 to 30 ring carbon atoms, cyano group, halogen atom, aromatic hydrocarbon group having 6 to 30 ring carbon atoms, substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms, or monocyclic aromatic heterocyclic group having 2 to 30 ring carbon atoms:

Y^1, Y^3 and Y^4 independently represent a hydrogen atom, fluorine atom, cyano group, substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, substituted or unsubstituted alkoxy group having 1 to 20 carbon atoms, substituted or unsubstituted haloalkyl group having 1 to 20 carbon atoms, substituted or unsubstituted haloalkoxy group having 1 to 20 carbon atoms, substituted or unsubstituted alkylsilyl having 1 to 10 carbon atoms, substituted or unsubstituted arylsilyl having 6 to 30 carbon atoms, substituted or unsubstituted aromatic hydrocarbon group having 6 to 30 ring carbon atoms, substituted or unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms, substituted or unsubstituted aromatic heterocyclic group having 2 to 30 ring carbon atoms, or substituted or unsubstituted fused aromatic heterocyclic group having 2 to 30 ring carbon atoms:

Y^2 represents a hydrogen atom, fluorine atom, cyano group, unsubstituted alkyl group having 1 to 20 carbon atoms, unsubstituted alkoxy group having 1 to 20 carbon atoms, unsubstituted haloalkyl group having 1 to 20 carbon atoms, unsubstituted haloalkoxy group having 1 to 20 carbon atoms unsubstituted alkylsilyl having 1 to 10 carbon atoms, unsubstituted arylsilyl having 6 to 30 carbon atoms, unsubstituted aromatic hydrocarbon group having 6 to 30 ring carbon atoms, unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms unsubstituted monocyclic aromatic heterocyclic group having 2 to 30 ring carbon atoms, or unsubstituted fused aromatic heterocyclic group having 2 to 30 ring carbon atoms;

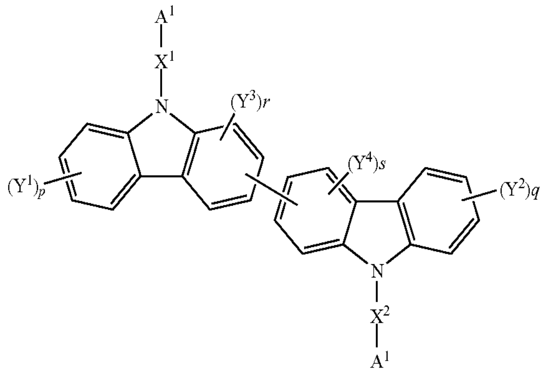
adjacent ones of Y^1 to Y^4 are allowed to be bonded to each other to form a ring structure;

p and q represent an integer of 1 to 4; r and s represent an integer of 1 to 3; and

when p and q are an integer of 2 to 4 and r and s are an integer of 2 to 3, a plurality of Y^1 to Y^4 are allowed to be the same or different.

24. The biscarbazole derivative according to claim **23**, wherein the biscarbazole derivative is represented by a formula 3 below,

Formula 3



where: A^1, A^2, X^1, X^2, Y^1 to Y^4, p, q, r and s represent the same as A^1, A^2, X^1, X^2, Y^1 to Y^4, p, q, r and s of the formula 2.

25. The biscarbazole derivative according to claim **24**, wherein in formula 3

when A^1 has a substituent, the substituent of A^1 is an aromatic hydrocarbon group having 6 to 30 ring carbon atoms or a substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms;

Y^1 to Y^4 are a hydrogen atom; and

when A^2 has a substituent, the substituent of A^2 is an aromatic hydrocarbon group having 6 to 30 ring carbon atoms or a substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms.

26. The biscarbazole derivative according to claim **24**, wherein in formula 3

when A^1 has a substituent, the substituent of A^1 is an aromatic hydrocarbon group having 6 to 30 ring carbon atoms or a substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms;

Y^1 to Y^4 are a hydrogen atom;

when A^2 has a substituent, the substituent of A^2 is an aromatic hydrocarbon group having 6 to 30 ring carbon atoms or a substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms; and

X^1 is a single bond.

27. The biscarbazole derivative according to claim **24**, wherein in formula 3 when A^1 has a substituent, the substituent of A^1 is an aromatic hydrocarbon group having 6 to 30 ring carbon atoms or a substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms;

Y^1 to Y^4 are a hydrogen atom;

when A^2 has a substituent, the substituent of A^2 is an aromatic hydrocarbon group having 6 to 30 ring carbon atoms or a substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms; and

X^1 is an unsubstituted aromatic hydrocarbon group having 6 to 30 ring carbon atoms or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms.

28. An organic-EL-device material comprising the biscarbazole derivative according to claim **23**.

29. An organic electroluminescence device comprising: a cathode: an anode; and a plurality of organic thin-film layers provided between the cathode and the anode, the organic thin-film layers comprising an emitting layer, wherein

at least one of the organic thin-film layers comprises the organic-EL-device material according to claim **28**.

30. The organic electroluminescence device according to claim **29**, wherein the emitting layer comprises the organic-EL-device material as a host material.

31. The organic electroluminescence device according to claim **29**, wherein the emitting layer comprises a phosphorescent material.

32. The organic electroluminescence device according to claim **31**, wherein

the phosphorescent material is an ortho-metalated complex of a metal atom selected from iridium (Ir), osmium (Os) and platinum (Pt).

33. The organic electroluminescence device according to claim **29**, wherein

an electron injecting layer is provided between the cathode and the emitting layer, the electron injecting layer comprising a nitrogen-containing cyclic derivative.

34. The organic electroluminescence device according to claim **29**, wherein

an electron transporting layer is provided between the cathode and the emitting layer, the electron transporting layer comprising the organic-EL-device material.

35. The organic electroluminescence device according to claim **29**, wherein

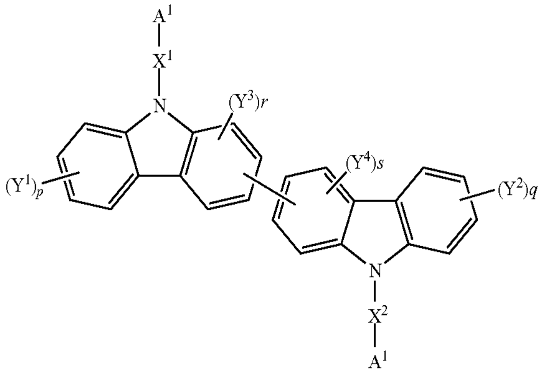
a reduction-causing dopant is present at an interfacial region between the cathode and at least one of the organic thin-film layers.

36. An organic electroluminescence device comprising: a cathode; an anode; and a plurality of organic thin-film layers provided between the cathode and the anode, the organic thin-film layers comprising an emitting layer, wherein

at least one of the organic thin-film layers is the emitting layer comprising a first host material, a second host material and a phosphorescent material providing phosphorescence,

the first host material being a compound represented by a formula (4) below,

(4)



where: A^1 represents a substituted or unsubstituted quinazoline ring bound to X^1 through the nitrogen-containing ring of the quinazoline, when A^1 has a substituent, the substituent of A^1 is an alkyl group having 1 to 20 carbon atoms, alkoxy group having 1 to 20 carbon atoms, haloalkyl group having 1 to 20 carbon atoms, alkylsilyl group having 1 to 10 carbon atoms, arylsilyl group having 6 to 30 ring carbon atoms, cyano group, halogen atom, aromatic hydrocarbon group having 6 to 30 ring carbon atoms, substituted or unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms, or monocyclic aromatic heterocyclic group having 2 to 30 ring carbon atoms;

A^2 represents a substituted or unsubstituted aromatic hydrocarbon group having 6 to 30 ring carbon atoms, when A^2 has a substituent, the substituent of A^2 is an alkyl group having 1 to 20 carbon atoms, alkoxy group having 1 to 20 carbon atoms, haloalkyl group having 1 to 20 carbon atoms, alkylsilyl group having 1 to 10 carbon atoms, arylsilyl group having 6 to 30 ring carbon atoms, cyano group, halogen atom, aromatic hydrocarbon group having 6 to 30 ring carbon atoms, substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms, or monocyclic aromatic heterocyclic group having 2 to 30 ring carbon atoms;

X^1 and X^2 each are a linking group and independently represent a single bond, substituted or unsubstituted aromatic hydrocarbon group having 6 to 30 ring carbon atoms, substituted or unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms, when X^1 and X^2 each have a substituent, the substituent of X^1 and X^2 is an alkyl group having 1 to 20 carbon atoms, alkoxy group having 1 to 20 carbon atoms, haloalkyl group having 1 to 20 carbon atoms, alkylsilyl group having 1 to 10 carbon atoms, arylsilyl group having 6 to 30 ring carbon atoms, cyano group, halogen atom, aromatic hydrocarbon group having 6 to 30 ring carbon atoms, substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms, or monocyclic aromatic heterocyclic group having 2 to 30 ring carbon atoms;

Y^1, Y^3 and Y^4 independently represent a hydrogen atom, fluorine atom, cyano group, substituted or unsubstituted alkyl group having 1 to 20 carbon atoms, substituted or unsubstituted alkoxy group having 1 to 20 carbon atoms, substituted or unsubstituted haloalkyl group having 1 to 20 carbon atoms, substituted or unsubstituted haloalkoxy group having 1 to 20 carbon atoms, substituted or unsubstituted alkylsilyl having 1 to 10 carbon atoms, substituted or unsubstituted arylsilyl having 6 to 30 carbon atoms, substituted or unsubstituted aromatic hydrocarbon group having 6 to 30 ring carbon atoms, substituted or unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms, substituted or unsubstituted aromatic heterocyclic group having 2 to 30 ring carbon atoms, or substituted or unsubstituted fused aromatic heterocyclic group having 2 to 30 ring carbon atoms;

Y^2 represents a hydrogen atom, fluorine atom, cyano group, unsubstituted alkyl group having 1 to 20 carbon atoms, unsubstituted alkoxy group having 1 to 20 carbon atoms, unsubstituted haloalkyl group having 1 to 20 carbon atoms, unsubstituted haloalkoxy group having 1 to 20 carbon atoms, unsubstituted alkylsilyl having 1 to 10 carbon atoms, unsubstituted arylsilyl having 6 to 30 carbon atoms, unsubstituted aromatic hydrocarbon group having 6 to 30 ring carbon atoms, unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms, unsubstituted monocyclic aromatic heterocyclic group having 2 to 30 ring carbon atoms, or unsubstituted fused aromatic heterocyclic group having 2 to 30 ring carbon atoms;

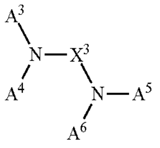
adjacent ones of Y^1 to Y^1 are allowed to be bonded to each other to form a ring structure:

p and q represent an integer of 1 to 4; r and s represent an integer of 1 to 3; and

when p and q are an integer of 2 to 4 and r and s are an integer of 2 to 3, a plurality of Y^1 to Y^4 are allowed to be the same or different.

37. The organic electroluminescence device according to claim **36**, wherein the second host material is represented by either one of a formula (13) or (14) below,

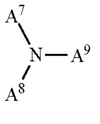
(13)



where: X^3 represents a substituted or unsubstituted arylene group having 10 to 40 ring carbon atoms; and

A^3 to A^6 represent a substituted or unsubstituted aryl group having 6 to 60 ring carbon atoms, or heteroaryl group having 6 to 60 ring atoms,

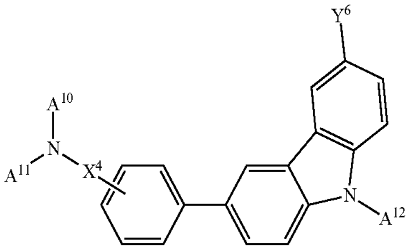
(14)



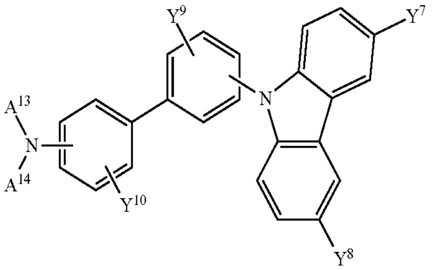
where: A^7 to A^9 represent a substituted or unsubstituted aryl group having 6 to 60 ring carbon atoms, or heteroaryl group having 6 to 60 ring atoms.

38. The organic electroluminescence device according to claim **37**, wherein the second host material is represented by any one of formulae (15) to (19) below,

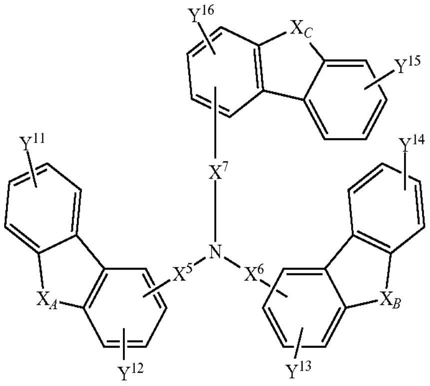
(15)



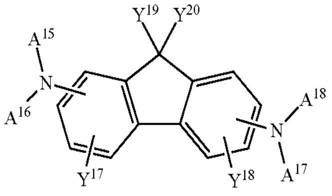
(16)



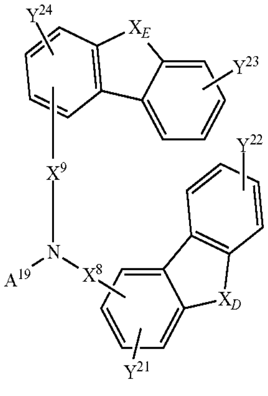
(17)



(18)



(19)



where: A^1 to A^{19} each represent a substituted or unsubstituted aryl group having 6 to 40 carbon atoms, or substituted or unsubstituted aromatic heterocyclic group having 2 to 40 carbon atoms;

variable pairs A^{10} and A^{11}; A^{13} and A^{14}; A^{15} and A^{16}; A^{17} and A^{18} together with the nitrogen to which they are bonded optionally form a ring;

X^4 to X^9 represent a single bond or a linking group having 1 to 30 carbon atoms;

Y^6 to Y^{24} represent a hydrogen atom, halogen atom, substituted or unsubstituted alkyl group having 1 to 40 carbon atoms, substituted or unsubstituted heterocyclic group having 3 to 20 carbon atoms, substituted or unsubstituted aryl group having 6 to 40 carbon atoms, substituted or unsubstituted aralkyl group having 7 to 20 carbon atoms, substituted or unsubstituted alkenyl group having 2 to 40 carbon atoms, substituted or unsubstituted alkylamino group having 1 to 40 carbon atoms, substituted or unsubstituted aralkylamino group having 7 to 60 carbon atoms, substituted or unsubstituted alkylsilyl group having 3 to 20 carbon atoms, substituted or unsubstituted arylsilyl group having 8 to 40 carbon atoms, substituted or unsubstituted aralkylsilyl group having 8 to 40 carbon atoms, or substituted or unsubstituted halogenated alkyl group having 1 to 40 carbon atoms; and

X_A, X_B, X_C, X_D, X_E each represent a sulfur atom, an oxygen atom or a monoaryl-substituted nitrogen atom.

39. The organic electroluminescence device according to claim **36**, wherein

the emitting layer comprises a host material and a phosphorescent material, the phosphorescent material being an ortho-metalated complex of a metal atom selected from iridium (Ir), osmium (Os) and platinum (Pt).

40. The organic electroluminescence device according to claim **36**, wherein

an electron injecting layer is provided between the cathode and the emitting layer, the electron injecting layer comprising a nitrogen-containing cyclic derivative.

41. The organic electroluminescence device according to claim **36**, wherein

an electron transporting layer is provided between the cathode and the emitting layer, the electron transporting layer comprising a compound represented by the formula (4).

42. The organic electroluminescence device according to claim **36**, wherein

a reduction-causing dopant is present at an interfacial region between the cathode and at least one of the organic thin-film layers.

43. The biscarbazole derivative according to claim **23**, wherein in formula 2

when A^1 has a substituent, the substituent of A^1 is an aromatic hydrocarbon group having 6 to 30 ring carbon atoms or a substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms;

Y^1 to Y^4 are a hydrogen atom; and

when A^2 has a substituent, the substituent of A^2 is an aromatic hydrocarbon group having 6 to 30 ring carbon atoms or a substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms.

44. The biscarbazole derivative according to claim **23**, wherein in formula 2

when A^1 has a substituent, the substituent of A^1 is an aromatic hydrocarbon group having 6 to 30 ring carbon atoms or a substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms;

Y^1 to Y^4 are a hydrogen atom;

when A^2 has a substituent, the substituent of A^2 is an aromatic hydrocarbon group having 6 to 30 ring carbon atoms or a substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms; and

X^1 is a single bond.

45. The biscarbazole derivative according to claim **23**, wherein in formula 2

when A^1 has a substituent, the substituent of A^1 is an aromatic hydrocarbon group having 6 to 30 ring carbon atoms or a substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms;

Y^1 to Y^4 are a hydrogen atom;

when A^2 has a substituent, the substituent of A^1 is an aromatic hydrocarbon group having 6 to 30 ring carbon atoms or a substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms; and

X^1 is an unsubstituted aromatic hydrocarbon group having 6 to 30 ring carbon atoms or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms.

46. An organic electroluminescence device comprising: a cathode; an anode; and a plurality of organic thin-film layers provided between the cathode and the anode, the organic thin-film layers comprising an emitting layer, wherein

the emitting layer comprises the biscarbazole derivative according to claim **23** and a phosphorescent material, wherein the biscarbazole derivative is represented by formula 2, and when A^1 has a substituent, the substituent of A^1 is an aromatic hydrocarbon group having 6 to 30 ring carbon atoms or a substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms;

Y^1 to Y^4 are a hydrogen atom;

when A^2 has a substituent, the substituent of A^2 is an aromatic hydrocarbon group having 6 to 30 ring carbon atoms or a substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms;

X^1 is a single bond, an unsubstituted aromatic hydrocarbon group having 6 to 30 ring carbon atoms or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms; and

the phosphorescent material is an Ir complex.

47. The organic electroluminescence device according to claim **46**, wherein X^1 is a single bond in formula 2.

48. The organic electroluminescence device according to claim **46**, wherein X^1 is an unsubstituted aromatic hydrocarbon group having 6 to 30 ring carbon atoms or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms in formula 2.

49. An organic electroluminescence device comprising: a cathode; an anode; and a plurality of organic thin-film layers provided between the cathode and the anode, the organic thin-film layers comprising an emitting layer, wherein

the emitting layer comprises the biscarbazole derivative according to claim **24** and a phosphorescent material,

the biscarbazole derivative being represented by the formula 3, and when A^1 has a substituent, the substituent of A^1 is an aromatic hydrocarbon group having 6 to 30 ring carbon atoms or a substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms;

Y^1 to Y^4 are a hydrogen atom;

when A^2 has a substituent, the substituent of A^2 is an aromatic hydrocarbon group having 6 to 30 ring carbon atoms Or a substituted or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms;

X^1 is a single bond, an unsubstituted aromatic hydrocarbon group having 6 to 30 ring carbon atoms or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms; and

the phosphorescent material is an Ir complex.

50. The organic electroluminescence device according to claim **49**, wherein

X^1 is a single bond in formula 3.

51. The organic electroluminescence device according to claim **49**, wherein

X^1 is an unsubstituted aromatic hydrocarbon group having 6 to 30 ring carbon atoms or an unsubstituted fused aromatic hydrocarbon group having 10 to 30 ring carbon atoms in formula 3.

* * * * *

专利名称(译)	新型有机电致发光化合物和使用其的有机电致发光器件		
公开(公告)号	US20150171341A1	公开(公告)日	2015-06-18
申请号	US14/624921	申请日	2015-02-18
[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	LEE SOO YOUNG CHO YOUNG JUN KWON HYUCK JOO KIM BONG OK KIM SUNG MIN YOON SEUNG SOO		
发明人	LEE, SOO YOUNG CHO, YOUNG JUN KWON, HYUCK JOO KIM, BONG OK KIM, SUNG MIN YOON, SEUNG SOO		
IPC分类号	H01L51/00 C07D403/04 C07D403/14 C07D405/14		
CPC分类号	H01L51/0067 C07D405/14 H01L51/0072 H01L51/0073 H01L51/5072 H01L51/0052 C07D403/14 H01L51/5016 H01L51/5092 C07D403/04 C07D409/14 C07D471/04 C07D471/14 C07D487/04 C07D487/14 C07F7/0812 C07F7/0814 C09K11/06 C09K2211/1007 C09K2211/1011 C09K2211/1029 C09K2211/1044 C09K2211/1059 C09K2211/1088 H01L51/0074 H01L51/0085 H01L51/5036 H05B33/10 H05B33/14		
优先权	1020090073260 2009-08-10 KR PCT/KR2010/005092 2010-08-03 WO		
外部链接	Espacenet USPTO		

摘要(译)

本发明提供一种新型有机电致发光化合物和使用该化合物的有机电致发光器件。更具体地，本文公开的有机电致发光化合物由化学式1表示：由于本文公开的有机电致发光化合物表现出良好的发光效率和优异的寿命特性，因此它可用于制造具有非常优异的使用寿命的OLED器件。