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

(57) Abstract: Provided are novel organic electroluminescent compounds and organic electroluminescent devices using the same. Since the organic electroluminescent compound exhibits good luminous efficiency and excellent life property, it may be used to manufacture OLED devices having superior operation life and consuming less power due to improved power efficiency.

Description

Title of Invention: NOVEL ORGANIC ELECTROLUMINESCENT COMPOUNDS AND ORGANIC ELECTROLUMINESCENT DEVICE USING THE SAME

Technical Field

[1] The present invention relates to novel organic electroluminescent compounds and an organic electroluminescent device using the same.

Background Art

[2] Among display devices, electroluminescent (EL) devices are advantageous in that they provide wide view angle, superior contrast and fast response rate as self-emissive display devices. In 1987, Eastman Kodak first developed an organic EL device using a low-molecular-weight aromatic diamine and aluminum complex as a substance for forming an electroluminescent layer [*Appl. Phys. Lett.* 51, 913, 1987].

[3] The most important factor to determine luminous efficiency in an organic light-emitting diode (OLED) is electroluminescent material. Though fluorescent materials have been widely used as electroluminescent material up to the present, development of phosphorescent materials is one of the best ways to improve the luminous efficiency theoretically up to four (4) times, in view of electroluminescent mechanism. Up to now, iridium (III) complexes have been widely known as a phosphorescent material, including (acac)Ir(btp)$_2$ (bis(2-(2'-benzothienyl)-pyridinato-N,C-3')iridium-(acetylacetonate)), Ir(ppy)$_3$ (tris(2-phenylpyridine)iridium) and Firpic (Bis(4,6-difluorophenylpyridinato-N,C2)picolinatoiridium), as the red, green and blue one (RGB), respectively. In particular, a lot of phosphorescent materials have been recently investigated in Japan, Europe and America.

[4] At present, 4,4'-N,N'-dicarbazole-biphenyl (CBP) is most widely known as a host material for a phosphorescent material. High-efficiency OLEDs using a hole blocking layer comprising Bathocuproine (BCP), aluminum(III)bis(2-methyl-8-quinolinato)(4-phenylphenolate)) (BAlq), etc. are reported. High-performance OLEDs using BAlq derivatives as a host were reported by Pioneer (Japan) and others.

[5] 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 ef-

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

Disclosure of Invention

Technical Problem

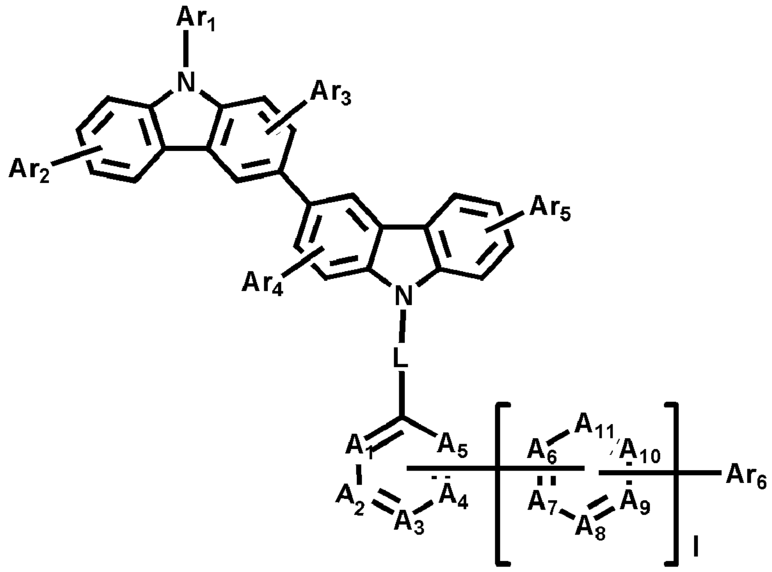
[6] Accordingly, one aspect of the present invention is to provide an organic electroluminescent compound having luminescence efficiency and device operation life improved over existing materials and having superior backbone with appropriate color coordinates in order to solve the aforesaid problems.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

Solution to Problem

[7] Provided are an organic electroluminescent compound represented by Chemical Formula 1 and an organic electroluminescent device using the same. With superior luminescence efficiency and excellent life property, the organic electroluminescent compound according to the present invention may be used to manufacture an OLED device having superior operation life and consuming reduced power by improved power efficiency.

[8] [Chemical Formula 1]

[9]

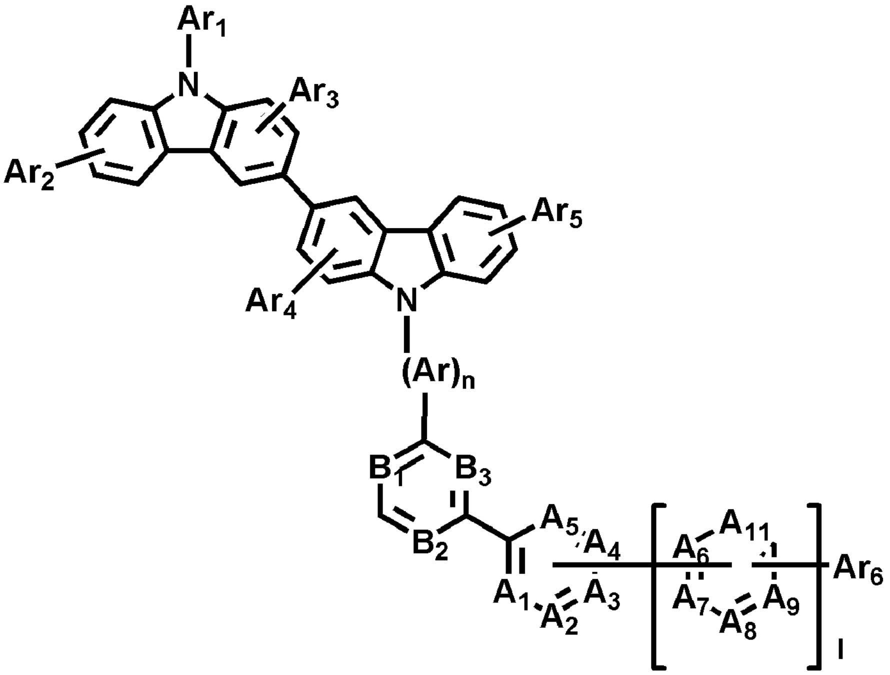


[10] Wherein the l represents an integer of 0 to 2; the L represents (C6-C30)arylene or (C3-C30)heteroarylene; the A_1 to A_{11} independently represent CR7 or N; the R7 and Ar_1 to Ar_6 independently represent any one selected from the group consisting of hydrogen, deuterium, halogen, cyano, nitro, hydroxyl, (C1-C30)alkyl, halo(C1-C30)alkyl, (C3-C30)cycloalkyl, 5- to 7-membered heterocycloalkyl, (C2-C30)alkenyl, (C2-C30)alkynyl, (C6-C30)aryl, (C1-C30)alkoxy, (C6-C30)aryloxy, (C3-C30)heteroaryl, (C6-C30)ar(C1-C30)alkyl, (C6-C30)arylthio, mono or di(C1-C30)alkylamino, mono or di(C6-C30)arylamino, tri(C1-C30)alkylsilyl, di(C1-C30)alkyl(C6-C30)arylsilyl and tri(C6-C30)arylsilyl; each of alkyl, cycloalkyl, heterocycloalkyl, alkenyl, alkynyl, aryl, heteroaryl, arylene, and heteroarylene of the R7, and Ar_1 to Ar_6 is further substituted with one or more selected from the group consisting of deuterium, halogen, cyano, nitro, hydroxyl, (C1-C30)alkyl, halo(C1-C30)alkyl, (C3-C30)cycloalkyl, 5- to 7-membered heterocycloalkyl, (C2-C30)alkenyl, (C2-C30)alkynyl, (C6-C30)aryl, (C1-C30)alkoxy, (C6-C30)aryloxy, (C3-C30)heteroaryl, (C6-C30)ar(C1-C30)alkyl, (C6-C30)arylthio, mono or di(C1-C30)alkylamino, mono or di(C6-C30)arylamino, tri(C1-C30)alkylsilyl, di(C1-C30)alkyl(C6-C30)arylsilyl, (C1-C30)alkyldi(C6-C30)arylsilyl and tri(C6-C30)arylsilyl; carbon atoms of the A_1 to A_{11} and carbon atoms of Ar_6 are linked through a chemical bond, or independently linked via any one selected from the group consisting of $-CR_8R_9-$, -O-, $-NR_{10}-$ and -S- to form a fused ring; and definition on the R_8, R_9, R_{10} and substituents thereof are the same as that of the R7.

[11] Also, the present invention includes the organic electroluminescent compounds represented by following Chemical Formulas 2 to 5 but is not limited thereto.

[12] [Chemical Formula 2]

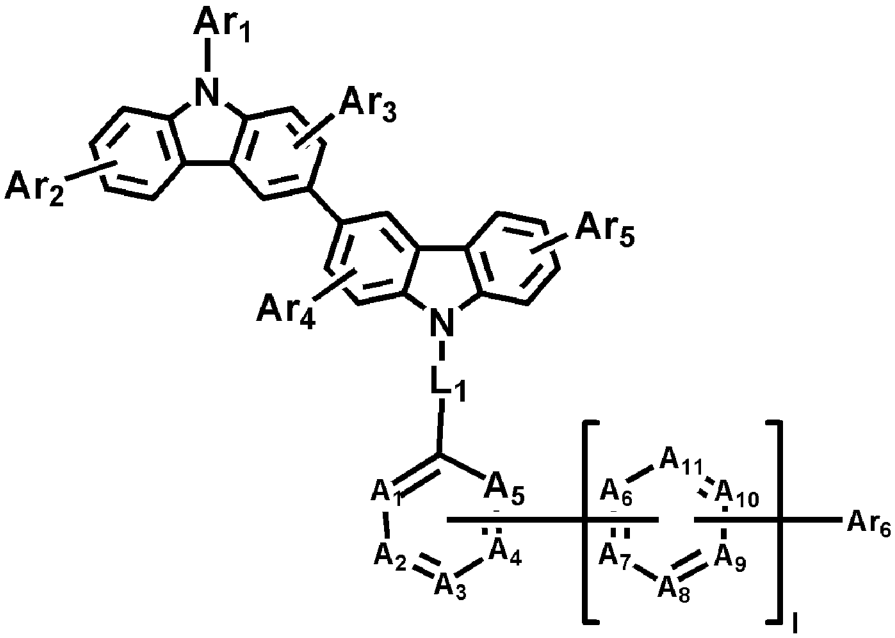
[13]



[14] Wherein the l represents an integer of 1 to 2; the Ar represents (C6-C30)arylene, n represents an integer of 1 to 2; the A_1 to A_{11} independently represent CR7 or N; the R7 and Ar_1 to Ar_6 independently represent any one selected from the group consisting of hydrogen, deuterium, halogen, cyano, nitro, hydroxyl, (C1-C30)alkyl, halo(C1-C30)alkyl, (C3-C30)cycloalkyl, 5- to 7-membered heterocycloalkyl, (C2-C30)alkenyl, (C2-C30)alkynyl, (C6-C30)aryl, (C1-C30)alkoxy, (C6-C30)aryloxy, (C3-C30)heteroaryl, (C6-C30)ar(C1-C30)alkyl, (C6-C30)arylthio, mono or di(C1-C30)alkylamino, mono or di(C6-C30)arylamino, tri(C1-C30)alkylsilyl, di(C1-C30)alkyl(C6-C30)arylsilyl and tri(C6-C30)arylsilyl; the B_1, B_2 and B_3 independently represent CH or N, but they do not represent CH at the same time; each of alkyl, cycloalkyl, heterocycloalkyl, alkenyl, alkynyl, aryl and heteroaryl of the R7, Ar_1 to Ar_6 is further substituted with one or more selected from the group consisting of deuterium, halogen, cyano, nitro, hydroxyl, (C1-C30)alkyl, halo(C1-C30)alkyl, (C3-C30)cycloalkyl, 5- to 7-membered heterocycloalkyl,(C2-C30)alkenyl, (C2-C30)alkynyl, (C6-C30)aryl, (C1-C30)alkoxy, (C6-C30)aryloxy, (C3-C30)heteroaryl, (C6-C30)ar(C1-C30)alkyl, (C6-C30)arylthio, mono or di(C1-C30)alkylamino, mono or di(C6-C30)arylamino, tri(C1-C30)alkylsilyl, di(C1-C30)alkyl(C6-C30)arylsilyl, (C1-C30)alkyldi(C6-C30)arylsilyl and tri(C6-C30)arylsilyl; carbon atoms of the A_1 to A_{11} and carbon atoms of Ar_6 are linked through a chemical bond, or independently linked via any one selected from the group consisting of $-CR_8R_9-$, -O-, $-NR_{10}-$ and -S- to form a fused ring; and definition on the R_8, R_9, R_{10} and substituents thereof is the same as that of the R7.

[15] [Chemical Formula 3]

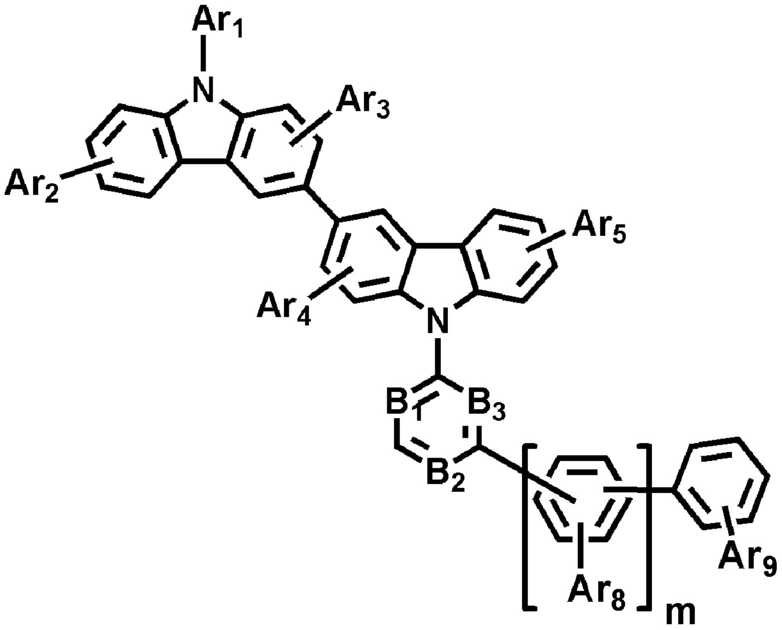
[16]



[17] Wherein the L_1 represents (C3-C30)heteroarylene; definition on Ar_1 to Ar_6 and substituents of Ar_1 to Ar_6 is the same as htat of Ar_1 to Ar_6 in Chemical Formula 1, and definition on A_1 to A_{11} is the same as that of A_1 to A_{11} in Chemical Formula 1; and the l is an integer of 1 to 2.

[18] [Chemical Formula 4]

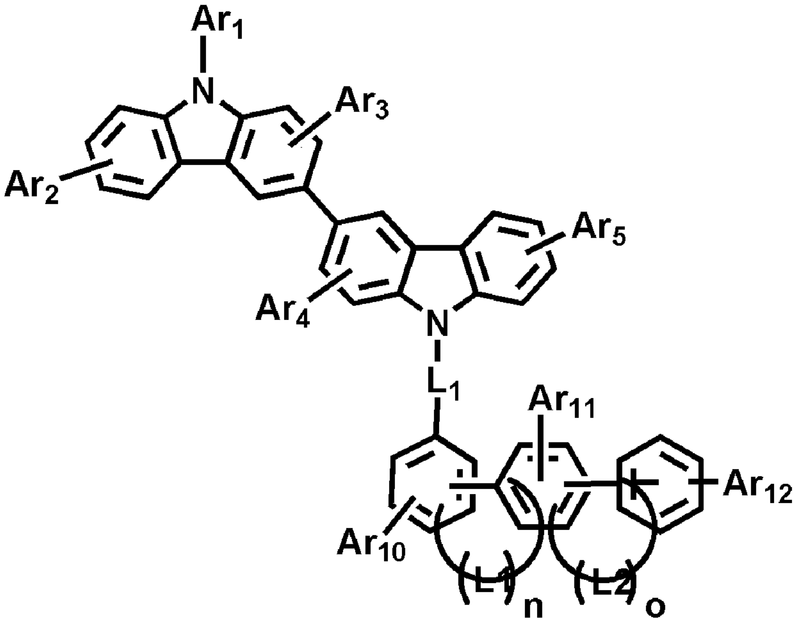
[19]



[20] Wherein definition on Ar_1 to Ar_5, Ar_8 to Ar_9 and substituents thereof is the same as that of Ar_1 to Ar_6 in Chemical Formula 1; and the m represents an integer of 1 to 2, and the B_1, B_2 and B_3 independently represent CH or N, but they are not CH at the same time.

[21] [Chemical Formula 5]

[22]



[23] Wherein L_1 represents (C3-C30)heteroarylene; definition on Ar_1 to Ar_5, Ar_{10} to Ar_{12} and substituents thereof is the same as that of Ar_1 to Ar_6 in Chemical Formula 1;

[24] the L1 to L2 independently represent any one selected from the group consisting of $-CR_8R_9-$, -O-, $-NR_{10}-$ and -S-; definition on the R_8, R_9, R_{10} and substituents thereof is the same as that of R7 in Chemical Formula 1; and the n and o independently represent an integer of 0 to 1, and n+o=1.

[25] In the present invention, "alkyl", "alkoxy" and other substituents containing "alkyl" moiety include both linear and branched species. In the present invention, the "cycloalkyl" includes polycyclic hydrocarbon rings such as substituted or unsubsituted adamantyl or substituted or unsubsituted (C7-C30)bicycloalkyl as well as a monocyclic ring.

[26] 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 aryl groups having single bond(s) therebetween. Specific examples include phenyl, naphthyl, biphenyl, anthryl, indenyl, fluorenyl, phenanthryl, triphenylenyl, pyrenyl, perylenyl, chrysenyl, naphthacenyl, fluoranthenyl, etc., but are not limited thereto. The naphthyl includes 1-naphthyl and 2-naphthyl. The anthryl includes 1-anthryl, 2-anthryl and 9-anthryl, and the fluorenyl includes 1-fluorenyl, 2-fluorenyl, 3-fluorenyl, 4-fluorenyl and 9-fluorenyl. In the present invention, "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

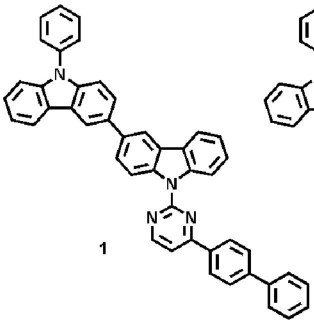
saturated. The heteroaryl also includes one or more heteroaryl groups having single bond(s) therebetween.

[27] 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. Specific examples include monocyclic heteroaryl such as furyl, thiophenyl, pyrrolyl, imidazolyl, pyrazolyl, thiazolyl, thiadiazolyl, isothiazolyl, isoxazolyl, oxazolyl, oxadiazolyl, triazinyl, tetrazinyl, triazolyl, tetrazolyl, furazanyl, pyridyl, pyrazinyl, pyrimidinyl, pyridazinyl, etc., polycyclic heteroaryl such as benzofuranyl, benzothiophenyl, isobenzofuranyl, dibenzocyphenyl, dibenzofuranyl, benzimidazolyl, benzothiazolyl, benzoisothiazolyl, benzoisoxazolyl, benzoxazolyl, isoindolyl, indolyl, indazolyl, benzothiadiazolyl, quinolyl, isoquinolyl, cinnolinyl, quinazolinyl, 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.

[28] 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.

[29] The organic electroluminescent compounds according to the present invention will be specifically exemplified as following compounds but are not limited thereto.

[30]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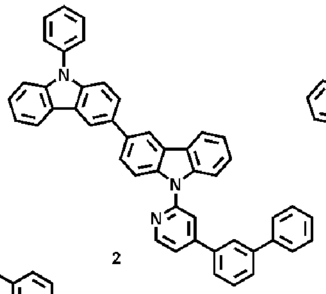
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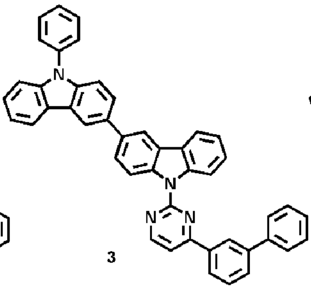
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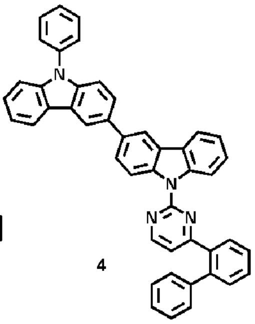
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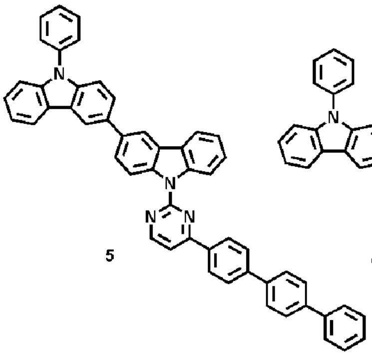
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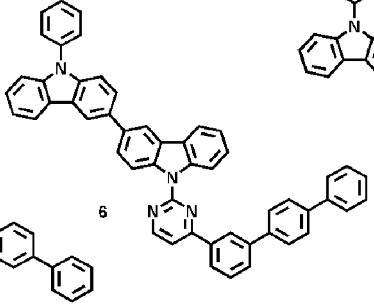
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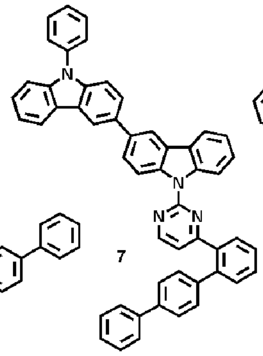
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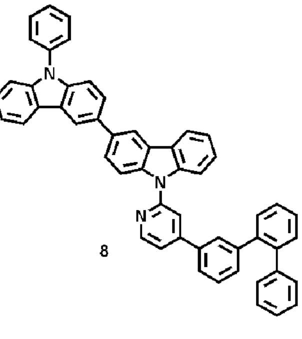
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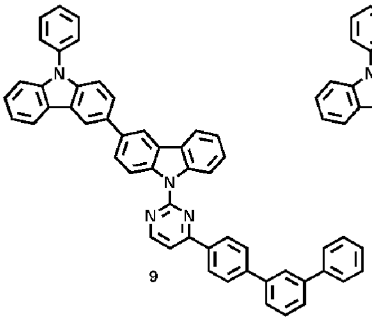

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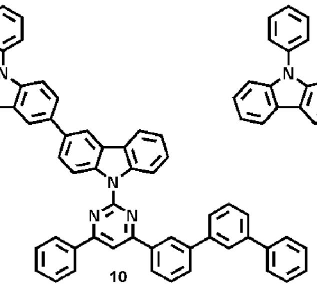

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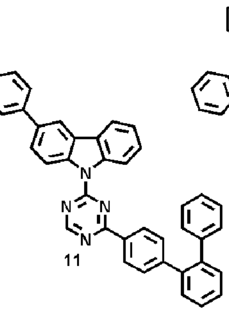

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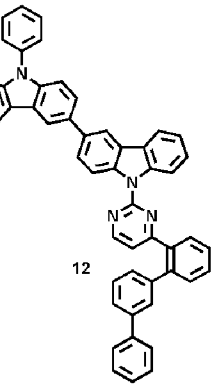

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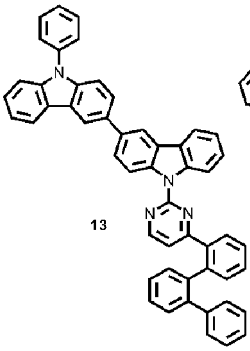

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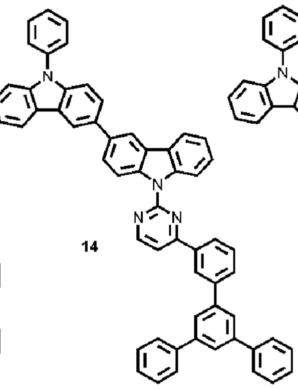

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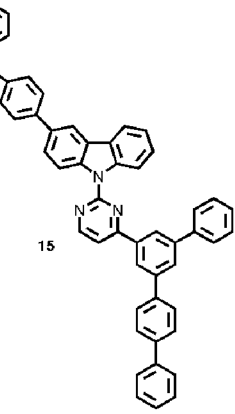

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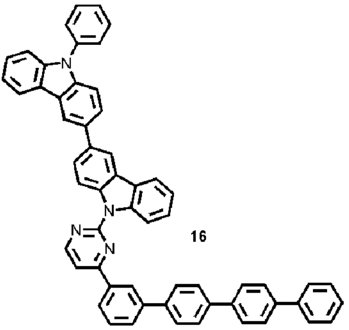

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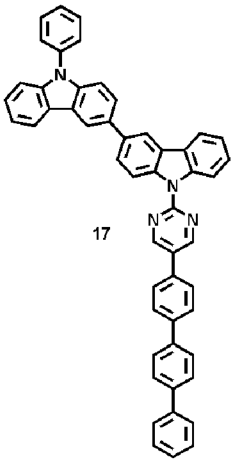

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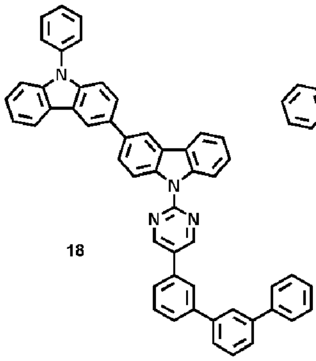

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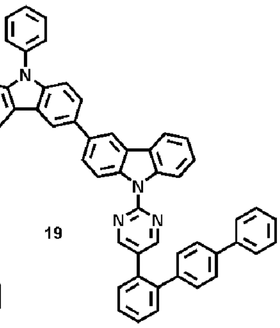

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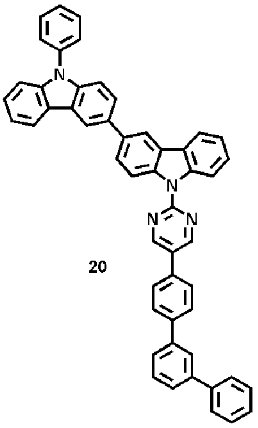

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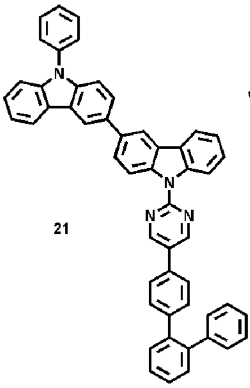
[35]



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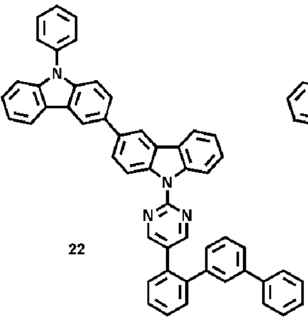

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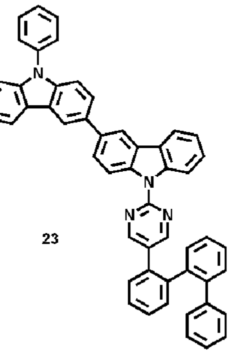

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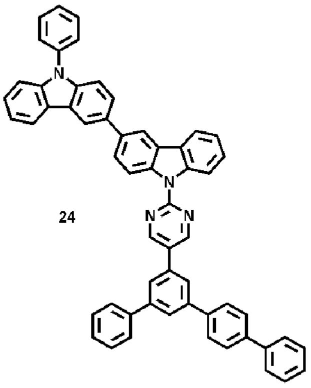

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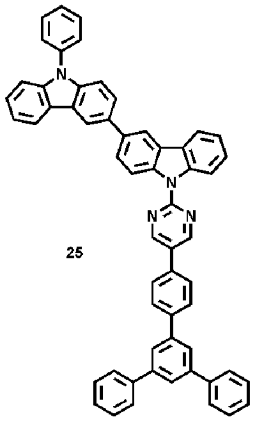

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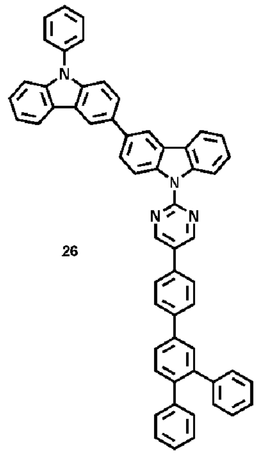

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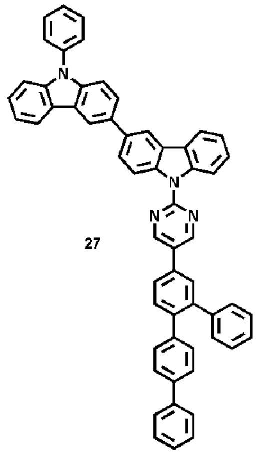

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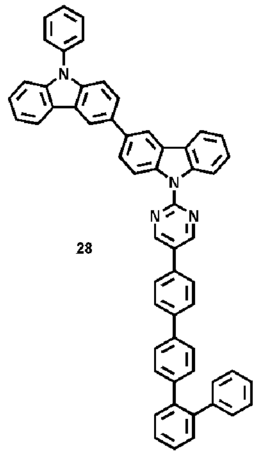

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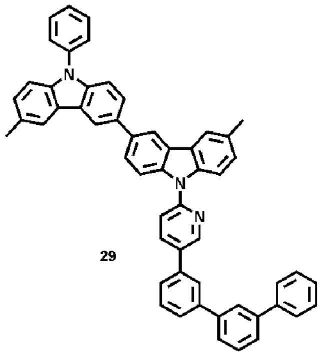

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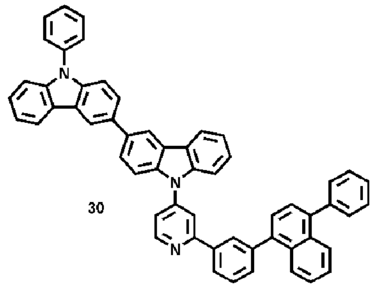

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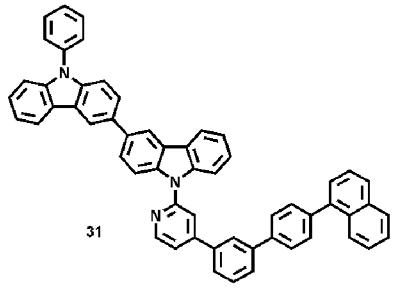

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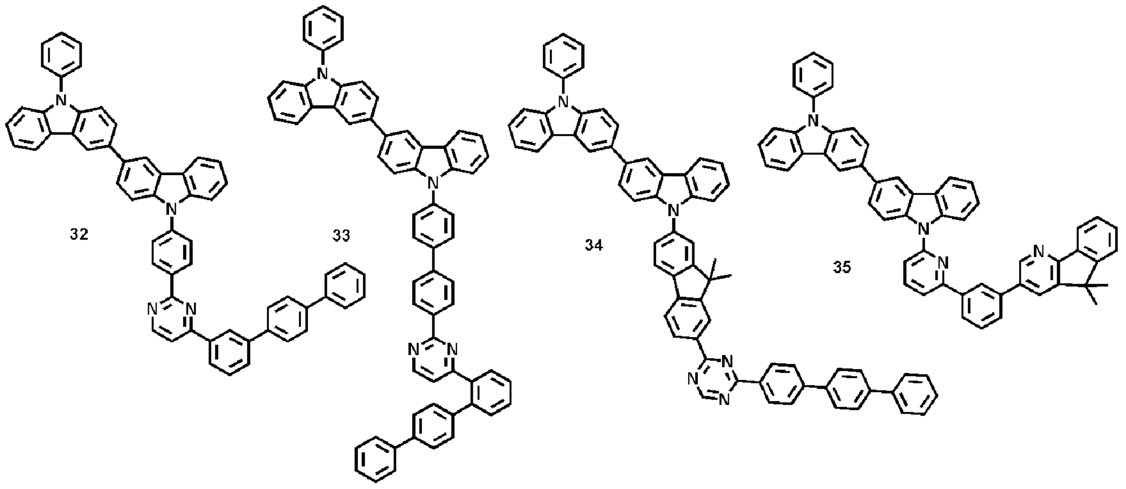

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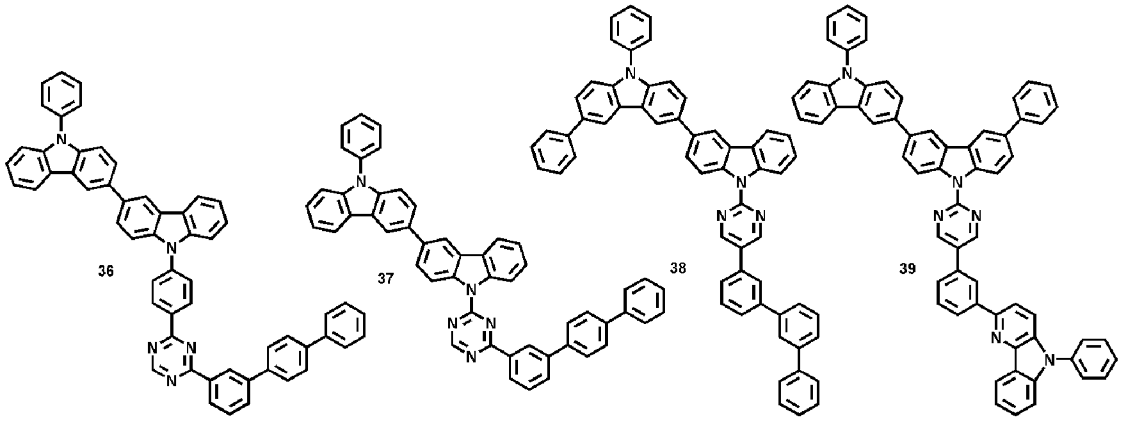

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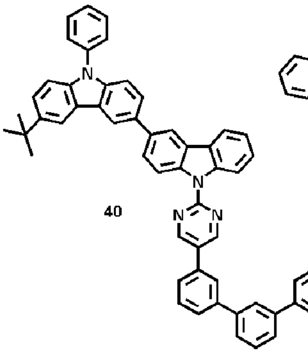
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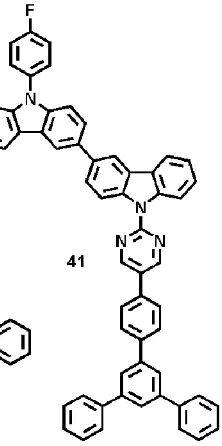
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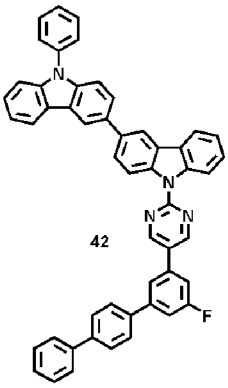
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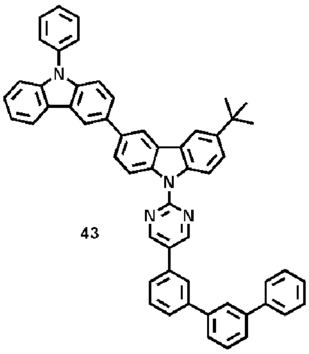
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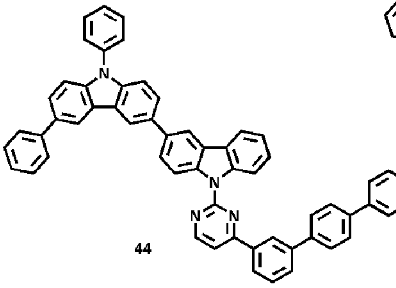
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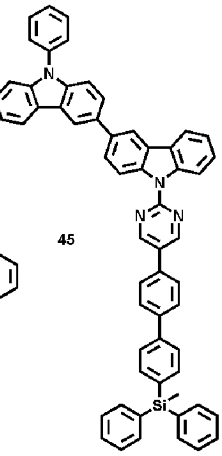
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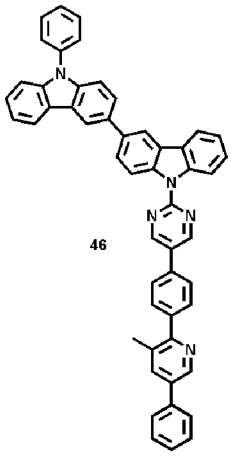
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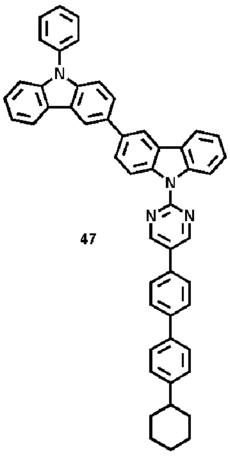
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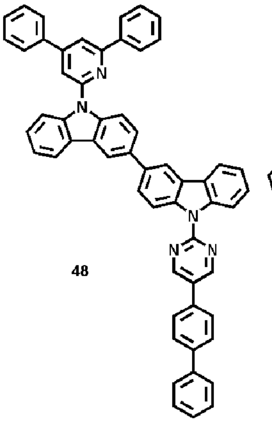
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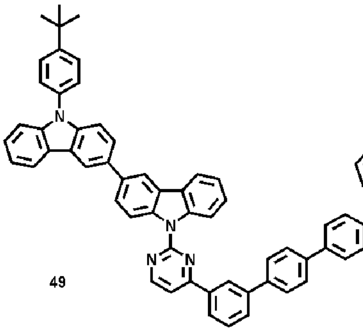
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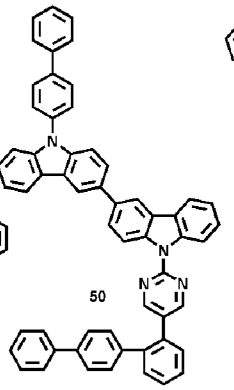
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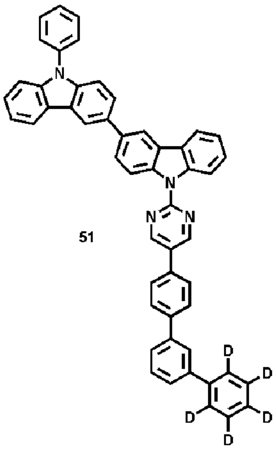
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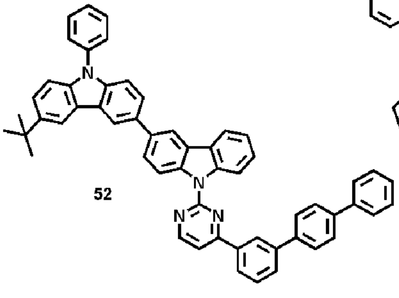
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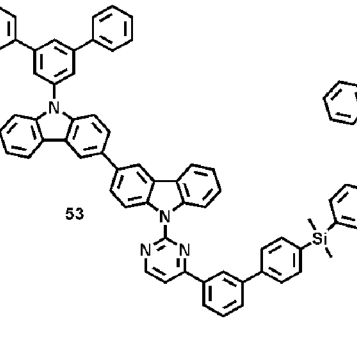
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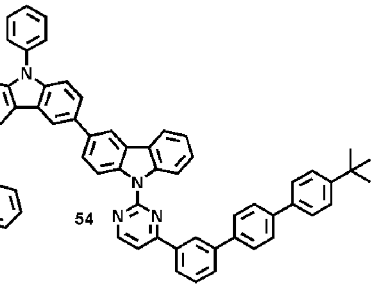
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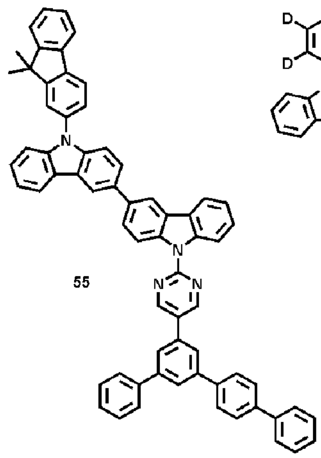

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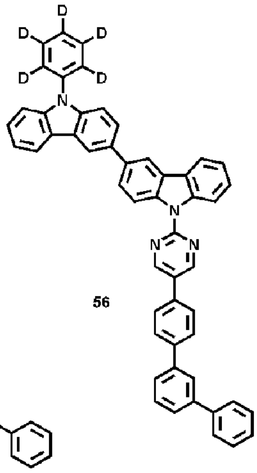

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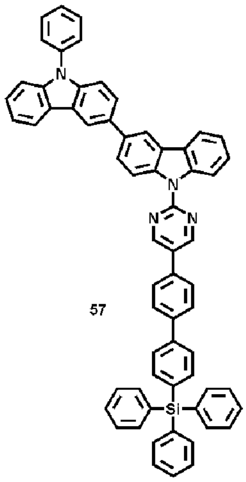

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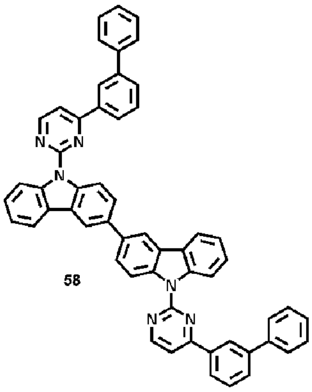

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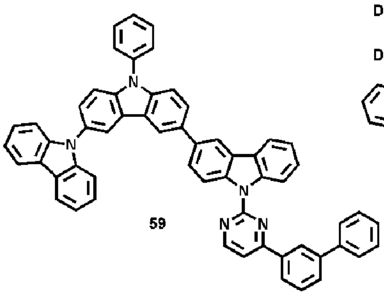

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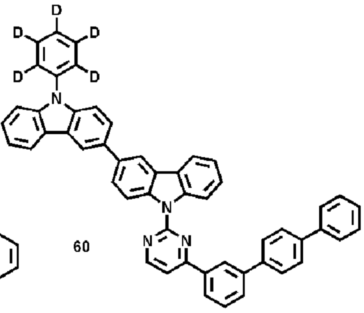

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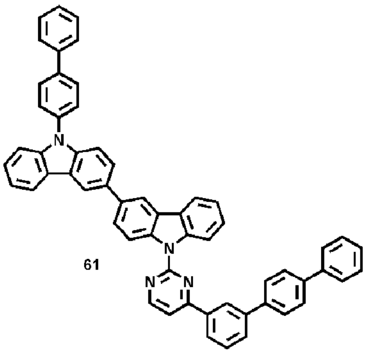

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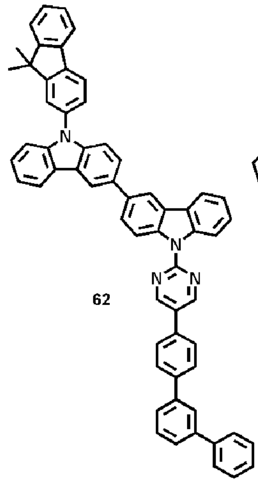

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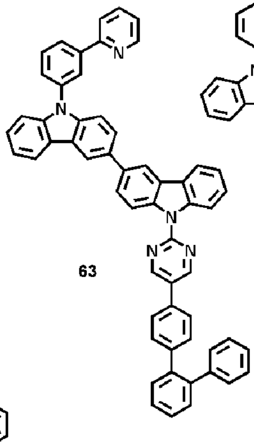

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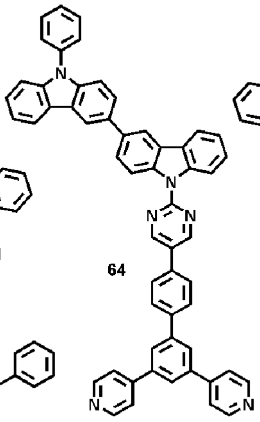

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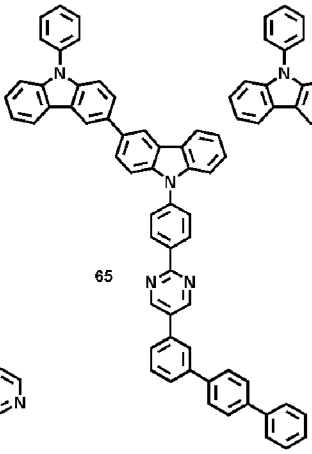

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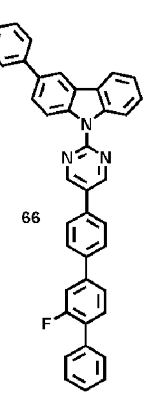

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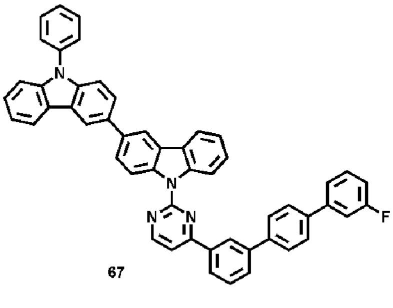

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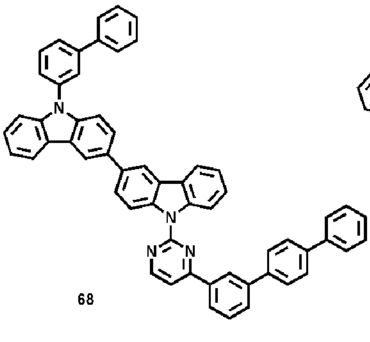

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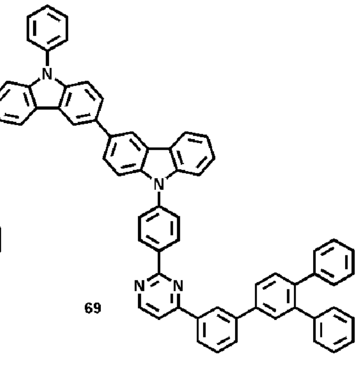

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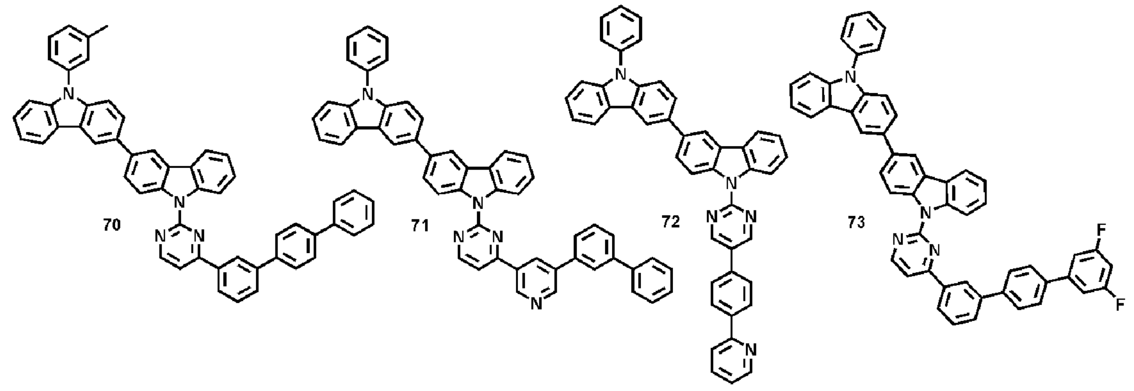

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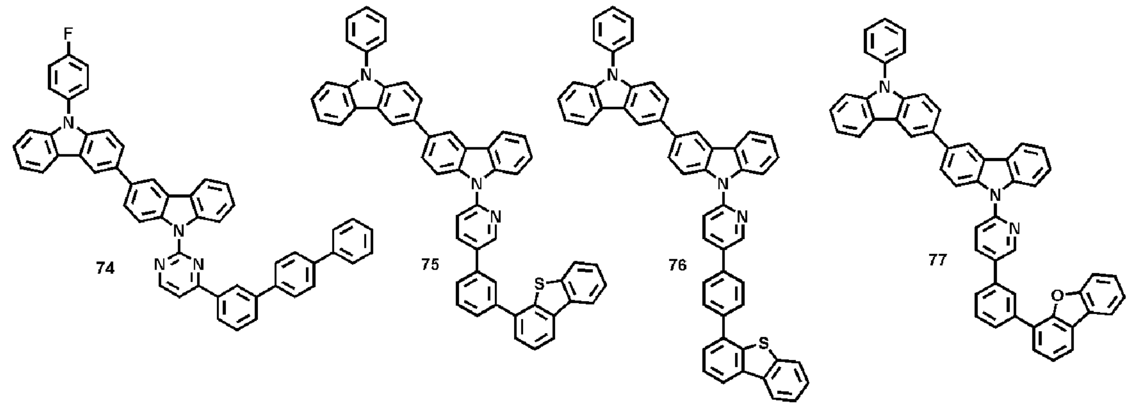

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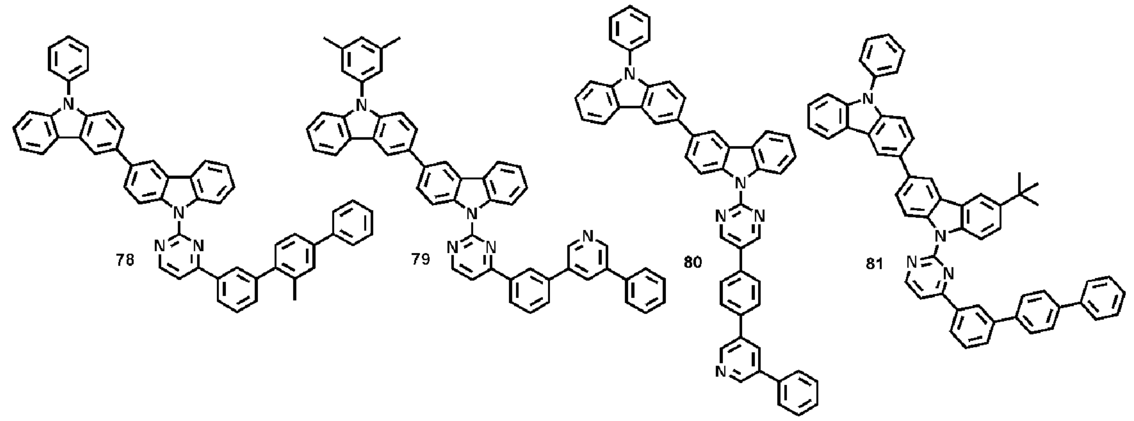

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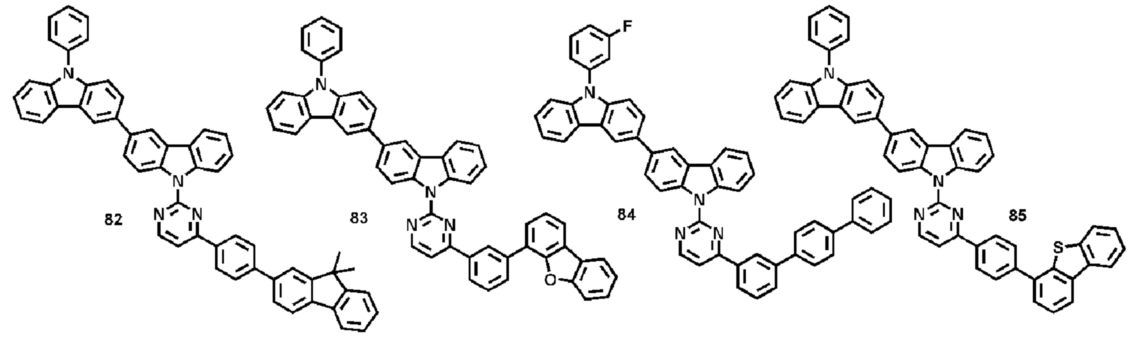

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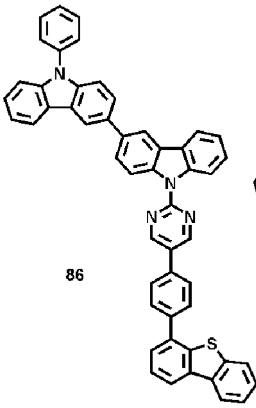
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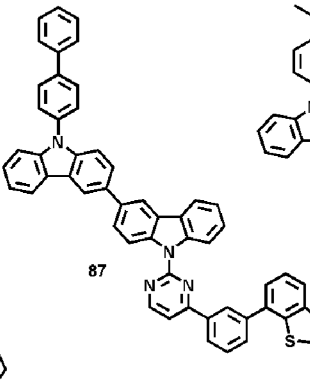
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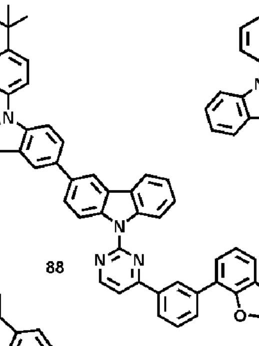
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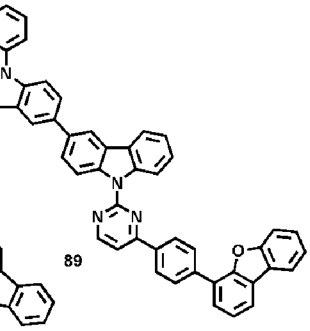
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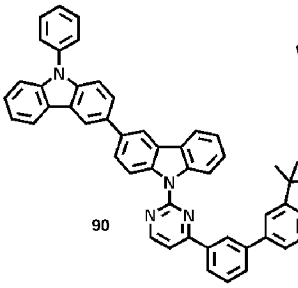
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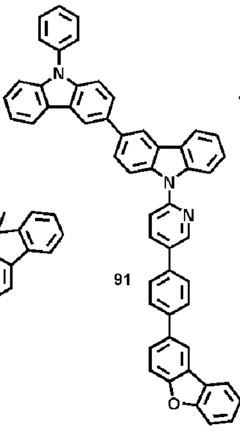
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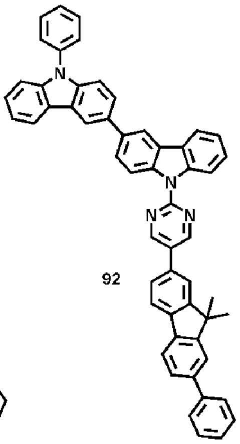
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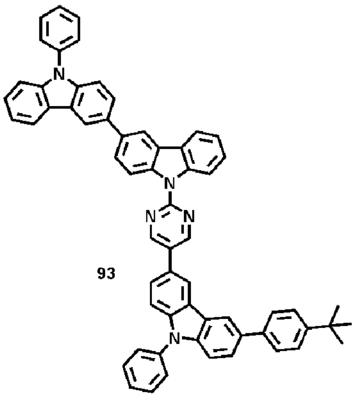
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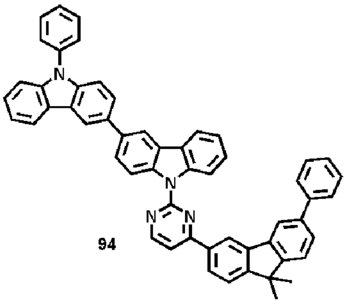
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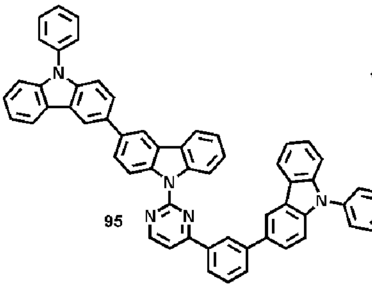
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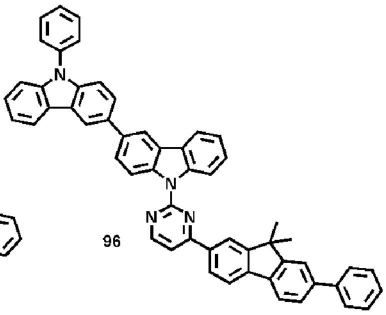
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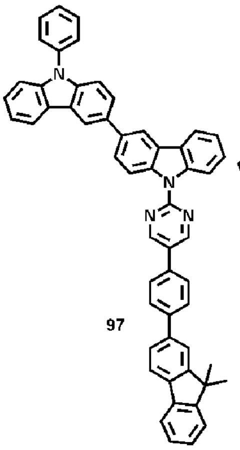
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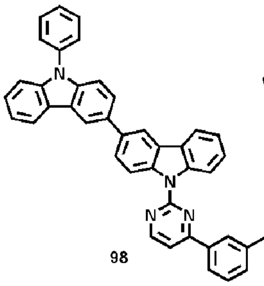
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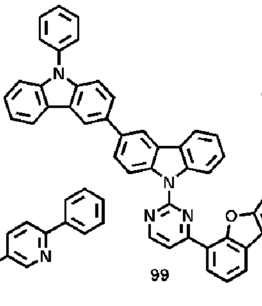
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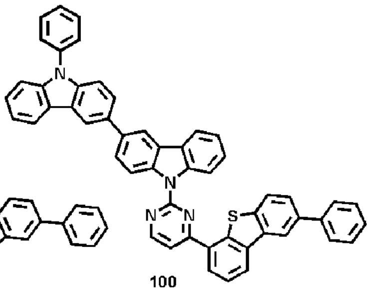
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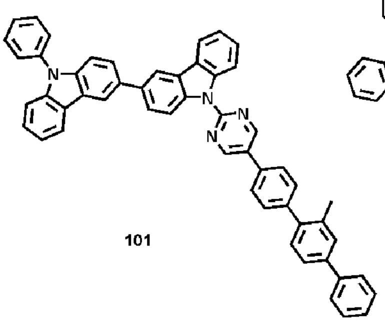
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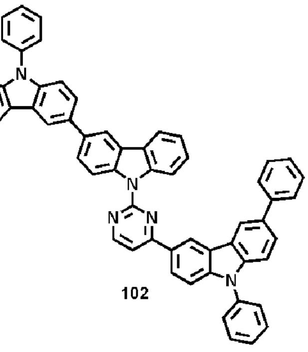
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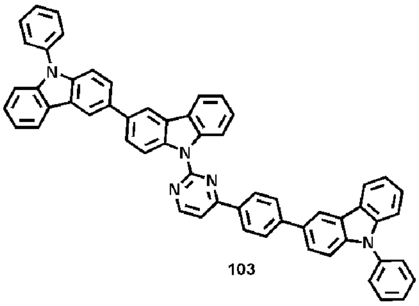
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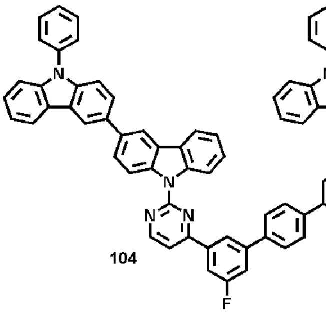
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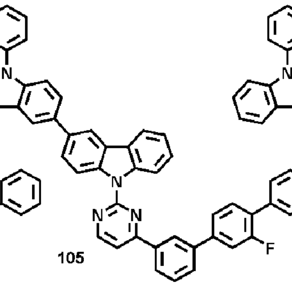
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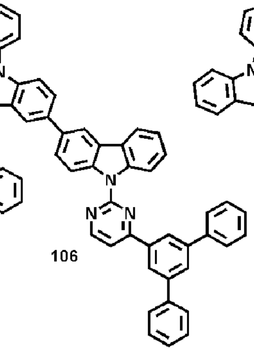
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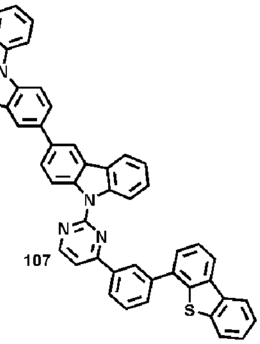
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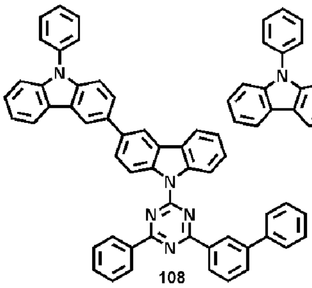
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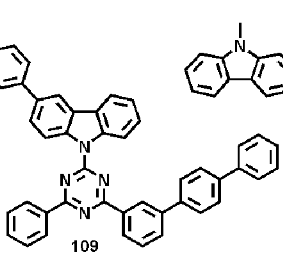
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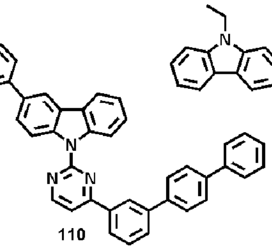
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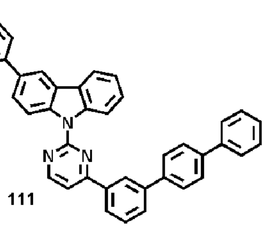
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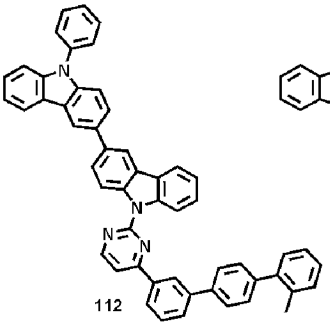
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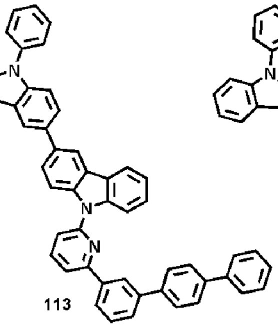
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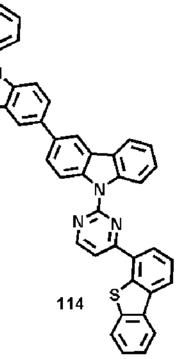
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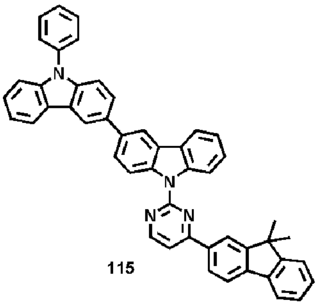
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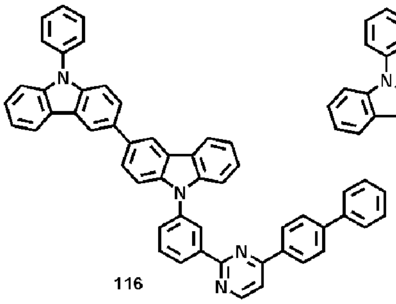
[60]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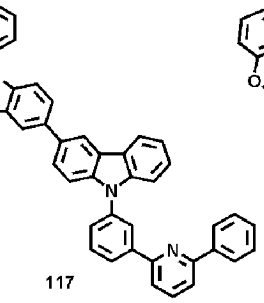
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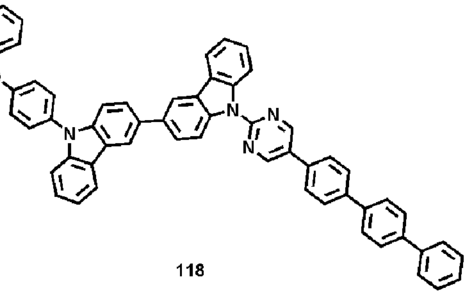
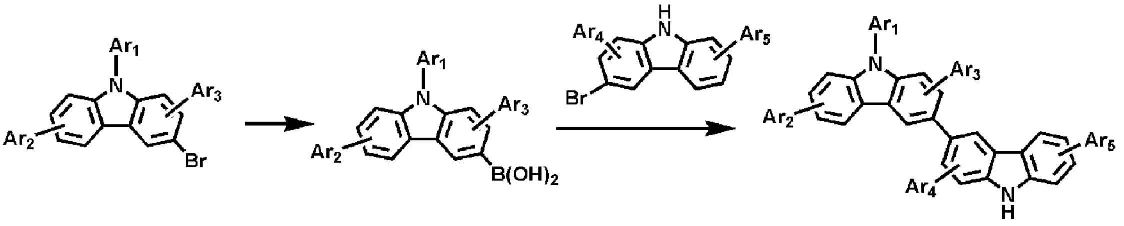

118

[61] The general scheme of the organic electroluminescent compound according to the

present invention is shown below and the organic electroluminescent compound may be prepared through an organic reaction, which is similar to the scheme or well known already.

[62] [Scheme 1]

[63]



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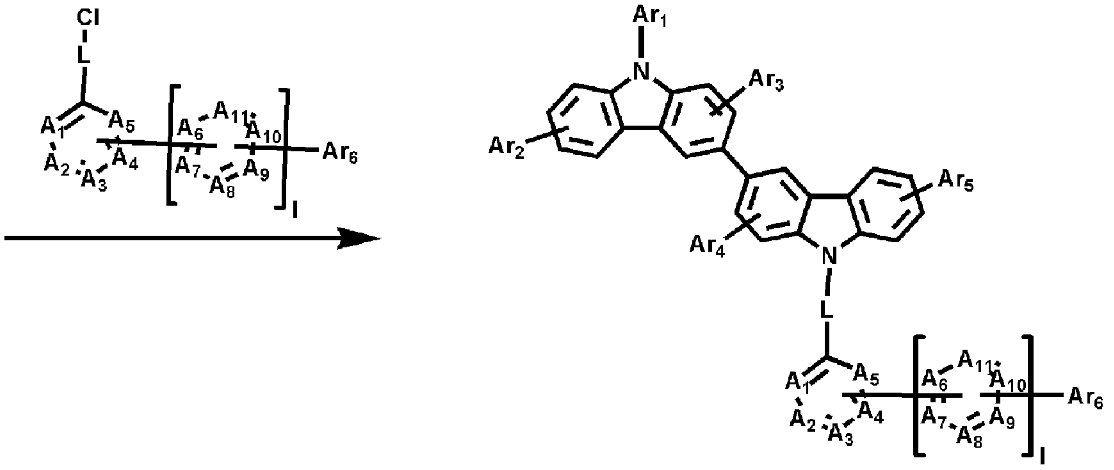


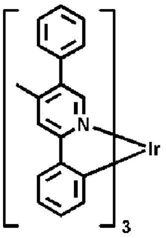
[65]

[66] 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 layer comprises an electroluminescent layer, in which the organic electroluminescent compounds of Chemical Formula 1 are used as a host material.

[67] When the organic electroluminescent compounds of Chemical Formula 1 are used as a host in the electroluminescent layer, one or more phosphorant dopant(s) are included. The phosphorant dopant applied to the organic electroluminescent device according to the present invention is not specifically limited but may be selected from Ir, Pt and Cu as a metal included in the phosphorant dopant.

[68] To be specific, the compounds having following structures may be used as the phosphorantdopant compound.

[69]



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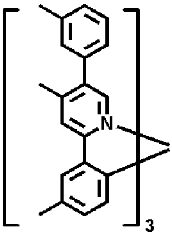

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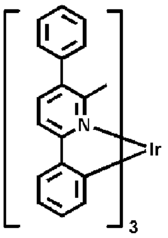

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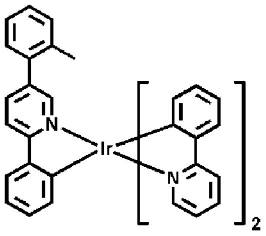

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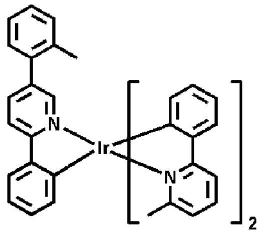

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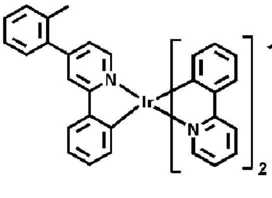
[70]



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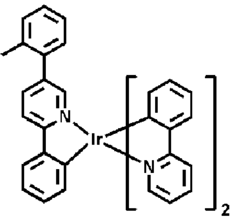

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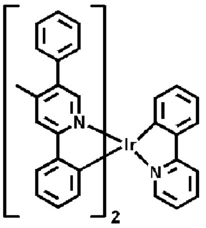

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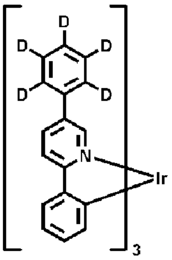

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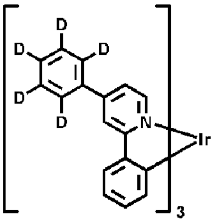

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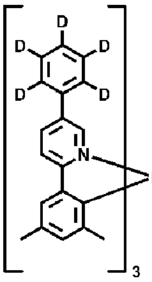
[71]



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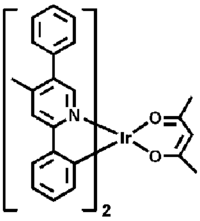

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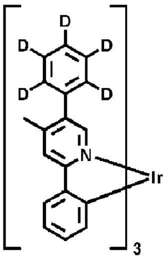

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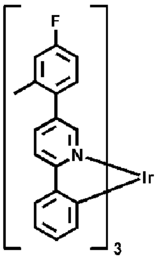

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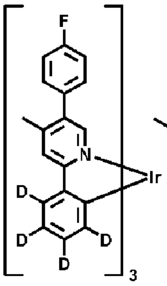

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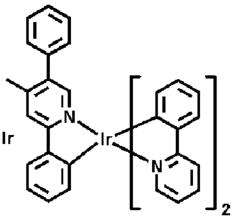
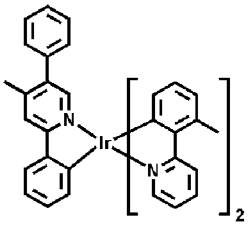


D16

[72]



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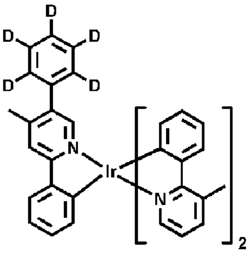

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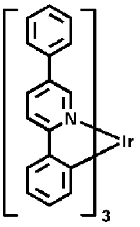

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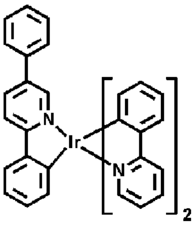

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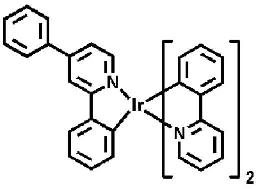

D21

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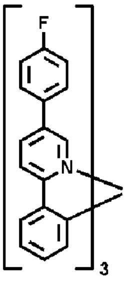

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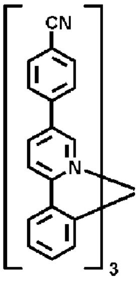

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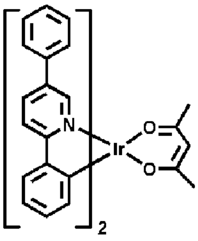

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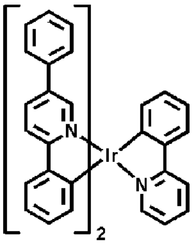

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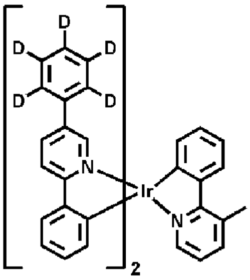

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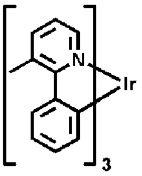
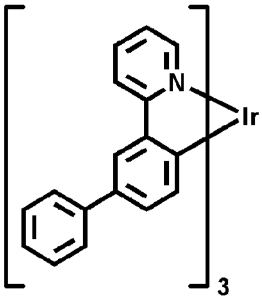


D27

[74]



D28

[75] The organic electroluminescent device according to the present invention includes the organic electroluminescent compound of Chemical Formula 1 and includes one or more compound(s) seleceted from the group consisting of arylamine compound or styrylarylamine compound 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.

[76] 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 the 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.

[77] 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, red or green light at the same time in order to embody a white-emitting organic electroluminescent device. The compounds 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.

[78] 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.The chalcogenide may be, for example, SiO_x ($1 \leq x \leq 2$), AlO_x ($1 \leq x \leq 1.5$), 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.

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

Advantageous Effects of Invention

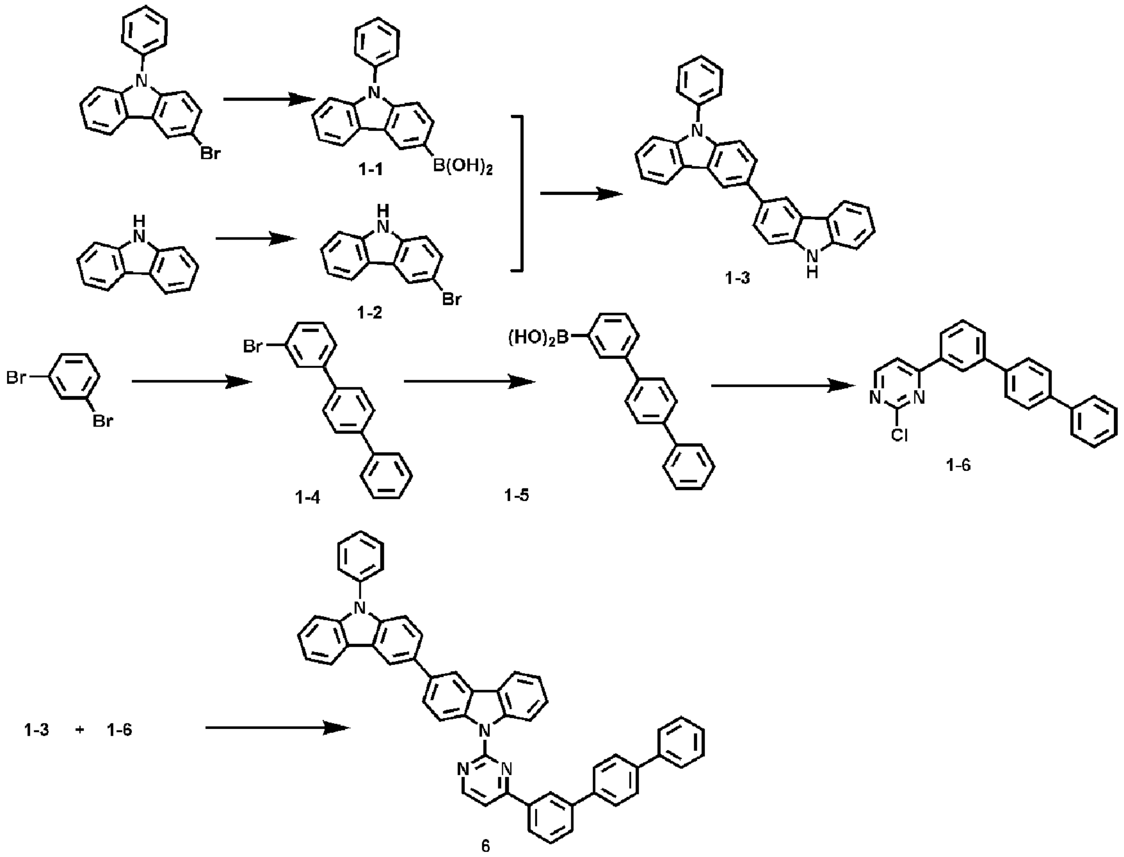
[80] Since the organic electroluminescent compound according to the present invention exhibits good luminous efficiency and excellent life property, it may be used to manufacture OLED devices having very superior operation life.

Mode for the Invention

[81] 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.

[82] [Preparation Example 1] Preparation of Compound **6**

[83]



[84] 3-Bromo-N-phenylcarbazole 20g(62.07mmol) was dissolved in THF 200ml and n-buLi 29ml(74.48mmol, 2.5M in Hexane) was slowly added thereto at -78 ℃. One hour later, triisopropylborate 19.9ml(86.90mmol) was added to the mixture. The mixture was stirred at room temperature for 12 hours and distilled water was added thereto. After extracting with EA, drying with magnesium sulfate, and distilling under reduced pressure, Compound **1-1** 12g(41.79mmol, 67.33%) was obtained through recystallization with EA and Hexane.

[85] Carbazole 20g(119.6mmol) was dissolved in DMF 200ml and NBS 21.2g(119.6mmol) was added there to at 0℃. After stirring for 12 hours, distilled water was added and a produced solid was filltered under reduced pressure. The obtained solid was added to methanol, and the mixture was stirred and filltered under reduced pressure. The obtained solid was added to EA and methanol, stirred and filltered under reduced pressure to obtain Compound **1-2** 17g(69.07mmol, 58.04%).

[86] Compound **1-1** 12g(41.79mmol), Compound **1-2** 11.3g(45.97mmol), $Pd(PPh_3)_4$ 1.4g(1.25mmol), 2M K_2CO_3 52ml, toluene 150ml, and ethanol 30ml were stirred under reflux. 5 hours later, the mixture was cooled to room temperature and distilled water was added thereto. After extracting with EA, drying with magnesium sulfate, and distilling under reduced pressure, Compound **1-3** 10g(24.48mmol, 58.57%) was obtained through recystallization with EA and Hexane.

[87] 1,3-dibromobenzene 36.5ml(302.98mmol), 4-biphenylboronic acid 40g(201.98mmol), Pd(PPh$_3$)$_4$ 4.25g(6.05mmol), 2M Na$_2$CO$_3$ 250ml, toluene 400ml, and ethanol 100ml were added and stirred under reflux. 12 hours later, the mixture was cooled to room temperature and distilled water was added thereto. After extracting with EA, drying with magnesium sulfate, and distilling under reduced pressure, Compound **1-4** 25g(80.85mmol, 40.12%) was obtained via columnn separation.

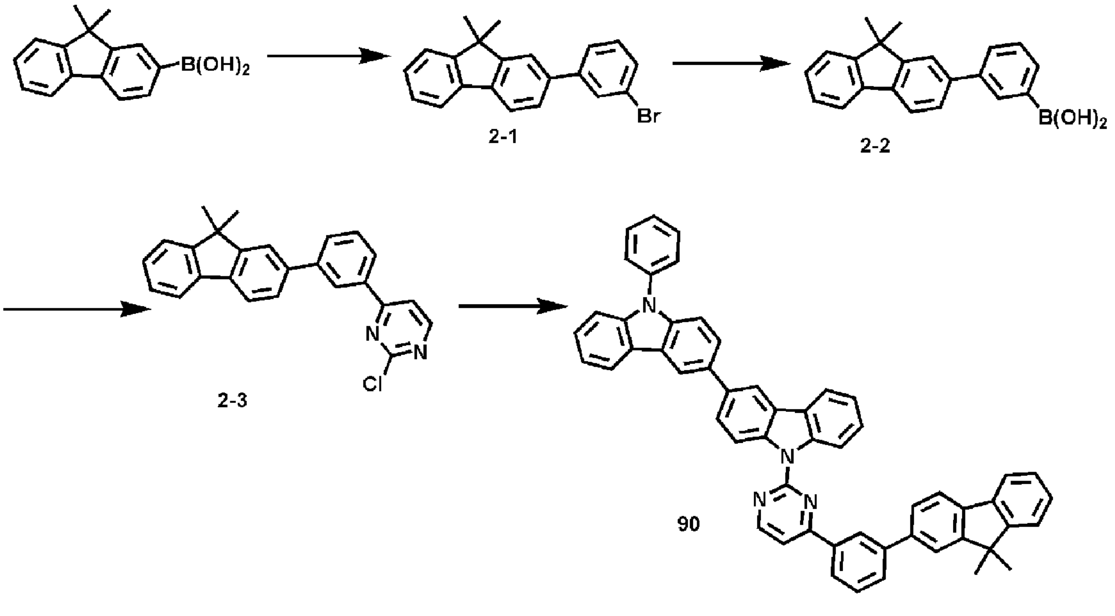
[88] Compound **1-4** 25g(80.85mmol) was dissolved in THF and n-buLi 42ml(105.10mmol, 2.5M in Hexane) was slowly added thereto at -78℃. one hour later, trimethylborate 14.42ml(129.3mmol) was added to the mixture. The mixture was stirred for 12 hours at room temperature and distilled water was added thereto. After extracting with EA, drying with magnesium sulfate, and distilling under reduced pressure, Compound **1-5** 20g(72.96mmol, 90.24%) was obtained through recystallization with MC and Hexane.

[89] Compound **1-5** 20g(72.96mmol), 2,4-dichloropyrimidine 9.8g(80.25mmol), Pd(PPh$_3$)$_4$ 2.28g(2.18mmol), 2M Na$_2$CO$_3$ 80ml, toluene 150ml, and ethanol 50ml were added and stirred under reflux for 5 hours. The mixture was coolded to room temperature and distilled water was added thereto. After extracting with EA, drying with magnesium sulfate, and distilling under reduced pressure, Compound **1-6** 11g(32.08mmol, 43.97%) was obtained through recystallization with EA and Methanol.

[90] Compound **1-3** 5.2g(12.83mmol), and Compound **1-6** 4g(11.66mmol) were dissolved in DMF 150ml and NaH 0.7g(17.50mmol, 60% in mineral oil) was added thereto. The mixture was stirred for 12 hours at room temperature and methanol and distilled water were added thereto. A produced solid was filltered under reduced pressure to obtain Compound **6** 5g(6.99mmol,59.98%) via columnn separation.

[91] [Preparation Example 2] Preparation of Compound **90**

[92]

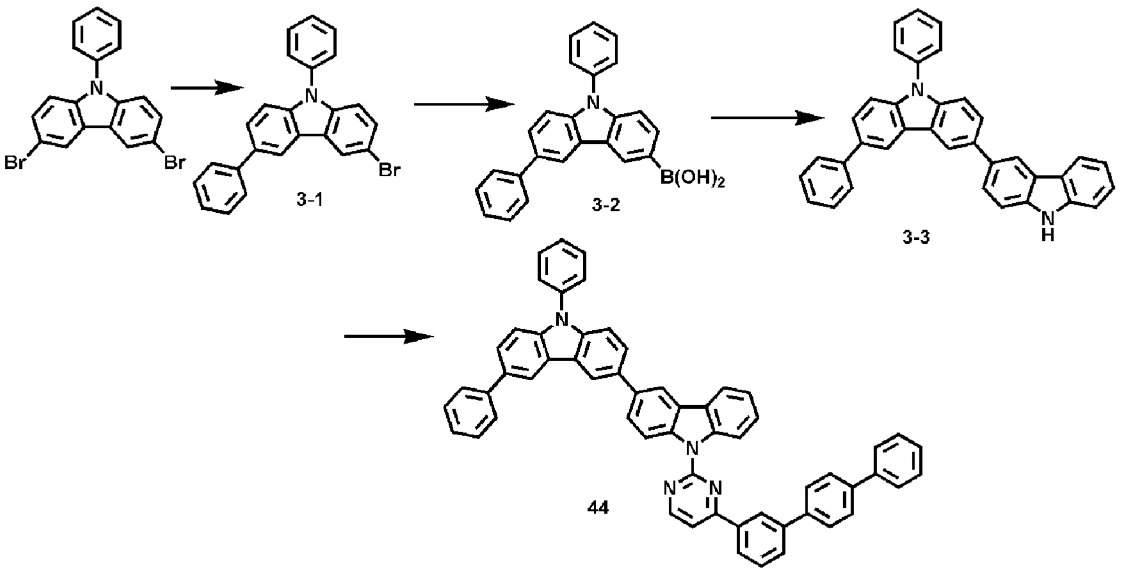


[93] 9,9-dimethyl-2-fluoreneboronic acid 30g(126mmol), 1,3-dibromobenzene 30.45mmol(252mmol), $PdCl_2(PPh_3)_2$ 2.6g(3.78mmol), 2M Na_2CO_3 160ml, and toluene 800m were added and stirred at 100°C for 5 hours. The mixture was cooled to room temperature, extracted with EA and washed with distilled water. After drying with magnesium sulfate and distilling under reduced pressure, Compound **2-1** 30g(85.89mmol, 67.46%) was obtained via columnn separation.

[94] Compound **2-2,** Compound **2-3** andCompound **90** were respectivelyreacted by using Compound 2-1 in the same manner as Compound **1-5,** Compound **1-6,** and Compound **6.**

[95] [Preparation Example 3] Preparation of Compound **44**

[96]

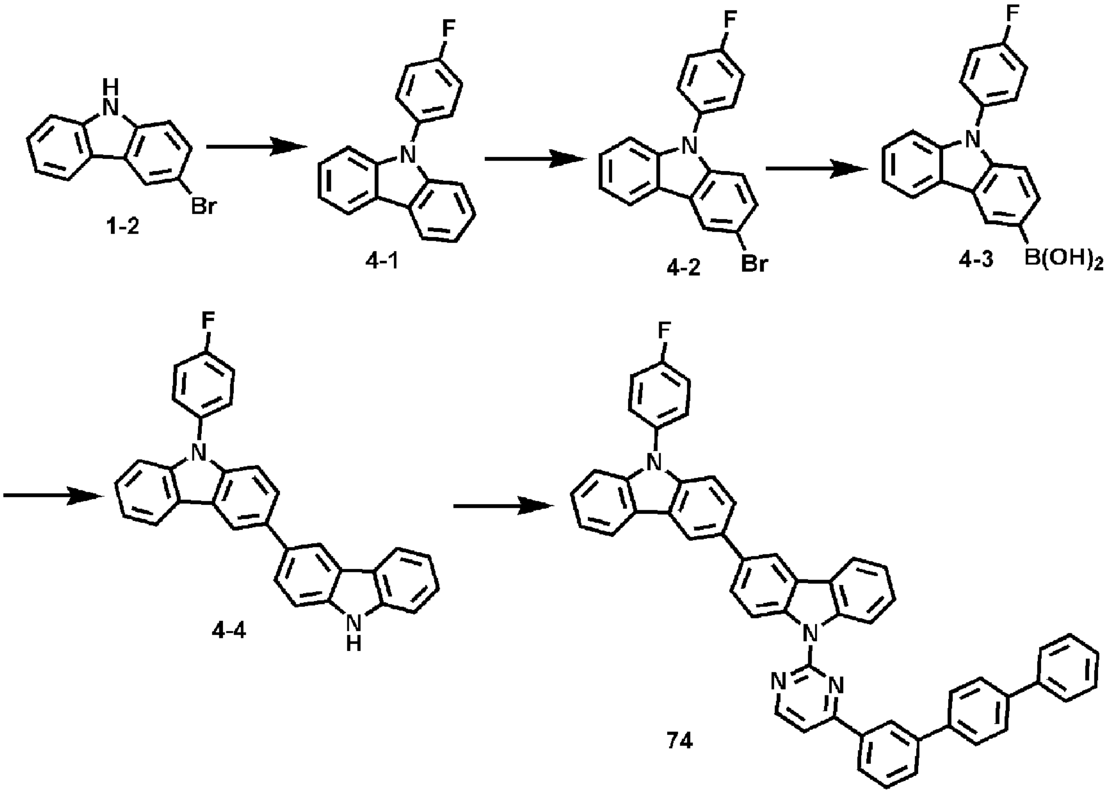


[97] Compound **3-1** was reacted in the same manner as Compound **2-1** by using 3,6-dibromo-9-phenyl-9*H*-carbazole and phenyl boronic acid as a starting matrial.

[98] Compound **3-2**, Compound **3-3**, and Compound **44** were repectvely reacted by using Compound 3-1 in the same manner as Compound **1-1,** Compound **1-3,** andCompound **6.**

[99] [Preparation Example 4] Preparation of Compound **74**

[100]



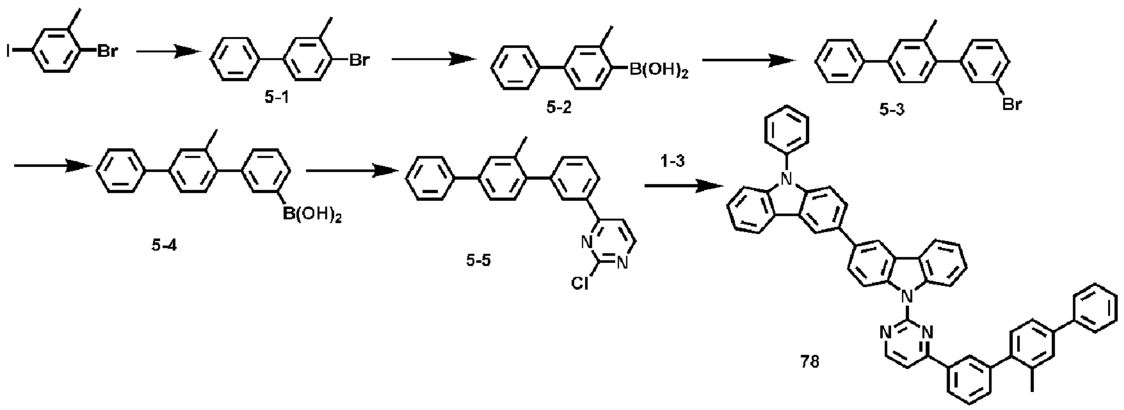
[101] Compound **1-2** 25g(149mmol), 1-bromo-4-fluorobenzene 49ml(448mmol), CuI 23g(120mmol), Cs_2CO_3 146g(449mmol), and EDA 12ml(179mmol) were added to F 750ml, and stirred at 120°C for 12 hours. After the reaction mixture was cooled to room temperature, and extracted with ethyl acetate 500ml, an obtained organic layer was washed with distilled water 100ml twice. The organic layer was drid with anhydrous magnesium sulfate and an organic solvent was removed under reduced pressure. **4-1** Compound 36g(77%) was obtained by separation through column chromatograph using silica gel and recystallization.

[102] After dissolving Compound **4-1** 20g(77mmol) in DMF 200mL, NBS 14g(77mmol) was added to DMF100mL at 0°C. The mixture was stirred at room temperature for 2 hours. Upon completion of the reaction, the reaction mixture was extracted with ethyl acetate 400 mL and an obtained organic layer was washed with distilled water 100mL several times. The organic layer was dried with anhydrousmagnesium sulfate and an organic solvent was removed under reduced pressure to obtain a solid. The obtained solid was treated by column chromatograph using silica gel and recystallization to obtain Compound **4-2** 16g(62%).

[103] Compound **4-3**, Compound **4-4**, and Compound **74** were respectively reacted in the same manner as Compound **1-1,** Compound **1-3,** Compound **6** by using Compound 4-2.

[104] [Preparation Example 5] Preparation of Compound **78**

[105]

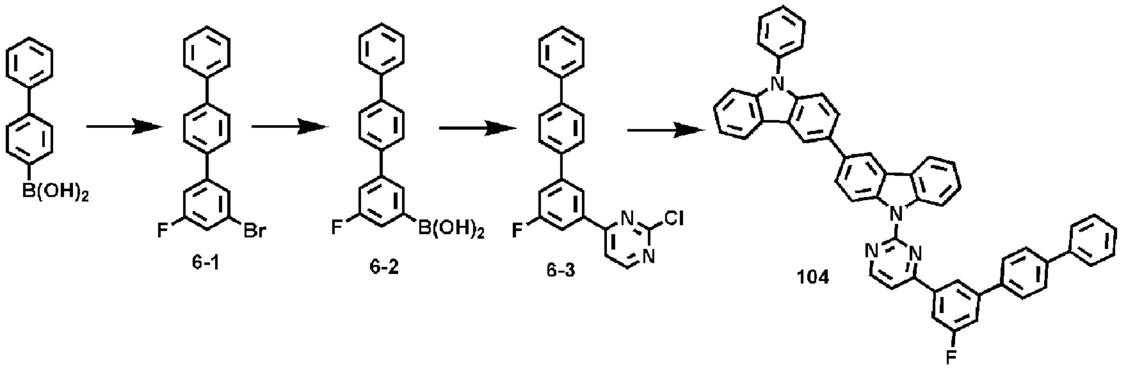


[106] 2-Bromo-5-iodotoluene (15.8g, 53.21mmol), phenylboronic acid (6.4g, 53.21mmol), $PdCl(PPh_3)_2$ (1.8g, 2.66mmol), 2M Na_2CO_3 solution 50ml, and toluene 150ml were added and stirred under reflux. 30 minutes later, the mixture was cooled to room temperature and an organic layer was washed with distilled water. After drying with magnesium sulfate and distilling under reduced pressure, Compound **5-1** (12g, 92%) was obtained via columnn separation.

[107] Compound **78** was reacted in the same manner as Compound **6** by using Compound 5-1.

[108] [Preparation Example 6] Preparation of Compound **104**

[109]

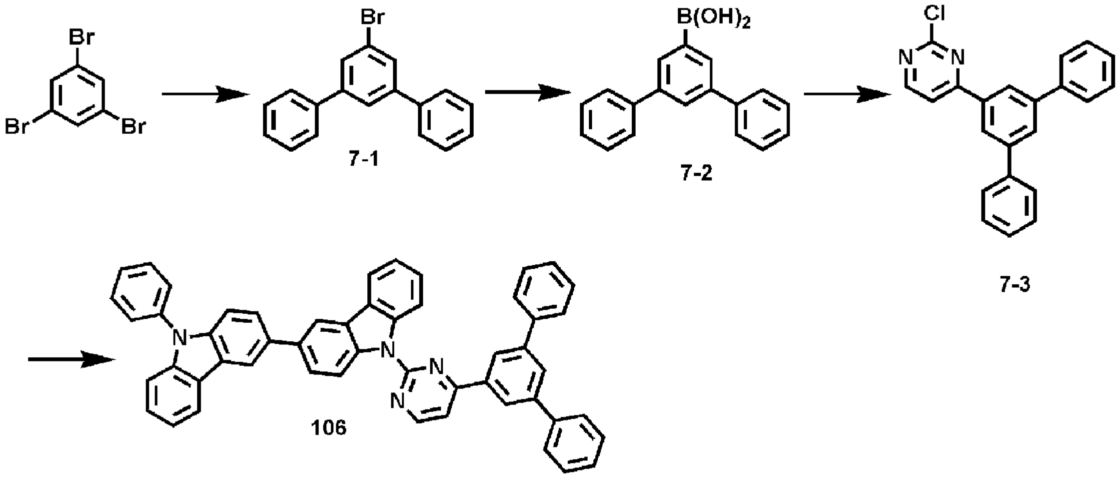


[110] Boronic acid Compound 48g(0.24mol), 1,3-dibromo-5-fluorobenzene 90g(0.35mol), Na_2CO_3 64g(0.6mol), and $PdCl_2(PPh_3)_2$ 5g(0.007mol) were added to Toluene 600mL, EtOH 300mL, and purified water 300mL. The mixture was stirred under reflux for one day and extracted with ethyl acetate 600mL to obtain an organic layer. The organic layer was washed with distilled water 100 mL. The organic layer was dried with anhydrousmagnesium sulfate, and an organic solvent was removed under reduced pressure. The obtained solid was separated via column chromatograph using silica gel and recystallization to obtain Compound **6-1** 16g (20%).

[111] Compound **104** was reacted by using Compound 6-1 in the same manner as Compound **6**.

[112] [Preparation Example 7] Preparation of Compound **106**

[113]

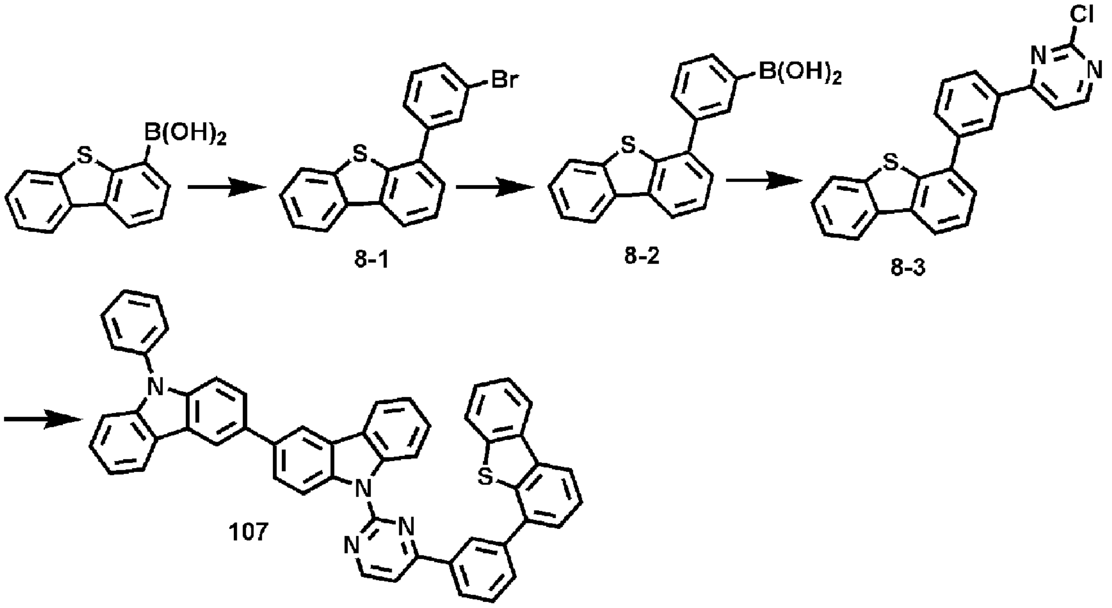


[114] 1,3,5-tribromobenzene 50g(0159mmol), Phenylboronic acid 46g(381mmol), Na_2CO_3 16.8g(1.50mol), and $Pd(PPh_3)_4$ 2g(0.01mol) were added to Toluene 480mL and purified water 159mL. The mixture was stirred under reflux for one day and extracted with ethyl acetate 500mL to obtain an organic layer. The organic layer was washed with distilled water 100 mL and dried with anhydrousmagnesium sulfate. An organic solvent was removed under reduced pressure. An obtained solid was separated via column chromatograph using silica gel and recystallization to obtain Compound **7-1** 23g (47%).

[115] Compound **106** was reacted by using Compound 7-1 in the same manner as Compound **6**.

[116] [Preparation Example 8] Preparation of Compound **107**

[117]



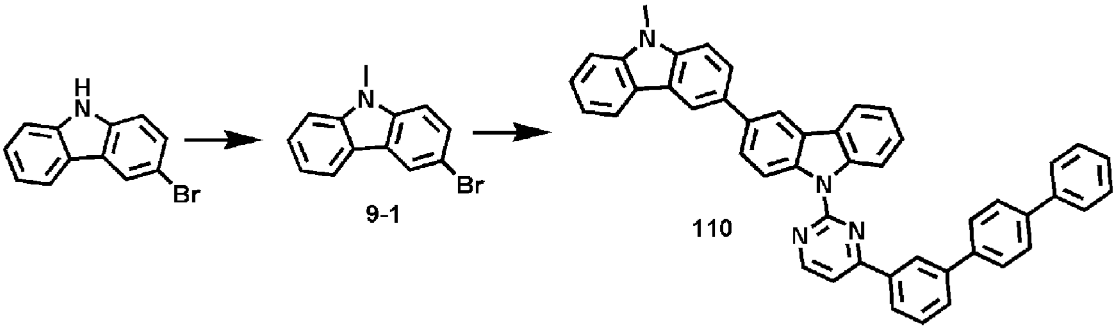
[118] 1,3-dibromobenzene (16.5g, 0.2mol), dibenzo[b,d]thiophen-4-ylboronic acid (15g, 0.06mol), $Pd(PPh_3)_4$ (3.8g, 0.003mol), Na_2CO_3 (14g, 0.13mol), Toluene(330ml), and H_2O (70ml) were added at 80°C for 12 hours. Upon completion of the reaction, the

mixture was extracted with Ethyl Acetate and an organic layer was dried with $MgSO_4$, and filtered. A solvent was removed under reduced pressure to obtain Compound **8-1** (8.4g, 40 %) as a white solid, via Columnn separation. THF (200ml), and Compound **8-1** (8.4g, 0.025mol) were added and mixed under nitrogen atmosphere. n-BuLi (15ml, 2.25M solution in hexane) was slowly added to the mixture at -78℃. After stirring the mixture at -78℃ for 1 hour, B(O-iPr)3 (11.4ml, 0.05mol) was slowly added to the mixture at -78℃. The mixture was heated to room temperature and reacted for 12 hours. Upon completion of the reaction, the mixture was extracted with Ethyl Acetate and an organic layer was dried with $MgSO_4$, and filtered. A solvent was removed under reduced pressure to obtain Compound **8-2** (6g, 80%) as a white solid via Columnn separation. 2,4-dichloropyrimidine (5.9g, 0.04mol), Compound 12-2 (8.3g, 0.03mol), $Pd(PPh_3)_4$ (1.7g, 0.001mol), Na_2CO_3 (8.1g, 0.07mol), Toluene(150ml), EtOH (40ml), and H_2O (40ml) were added and stirred at 80℃ for 12 hours. Upon completion of the reaction, the mixture was extracted with Ethyl Acetate and an organic layer was dried with $MgSO_4$, and filtered. A solvent was removed under reduced pressure to obtain Compound **8-3** (10g, 98%) via column separation.

[119] Compound **107** was reacted using Compound 8-3 in the same manner as Compound **6**.

[120] [Preparation Example 9] Preparation of Compound **110**

[121]



[122] After 3-bromo-9H-carbazole 20g(81mmol) was dissolved in DMF 74mL, NaH 4.3g(106mmol) was slowly added thereto. Afte stirring the mixture for 30 minutes, CH_3Cl Compound 7ml(114mmol) was added to the mixture and stirred for 4 hours. The mixture was slowly added to distilled water 200mL and stirred for 30 minutes to obtain a solid. The obtained solid was separated via column chromatograph using silica gel and recystallization to obtain Compound **9-1** 17g(81%).

[123] Compound **110** was reacted using Compound 9-1 in the same manner as Compound **6**.

[124] Table 1 showed the result of the following Compounds reacted based on Preparation Examples 1-9.

[125] Table 1

[Table 1]

compound	수	mass		UV	PL	mp
1	23%	639.25	638.76	340nm	482nm	175℃
3	52%	639.25	638.76	358nm	482nm	206℃
5	31%	715.28	714.85	347nm	492nm	254℃
6	65%	715.28	714.85	332nm	478nm	200℃
7	36%	715.28	714.85	472nm	308nm	243℃
9	22%	715.28	714.85	347nm	488nm	198℃
10	46%	715.28	714.85	364nm	474nm	120℃
44	38%	791.31	790.95	480nm	308nm	219℃
61	17%	791.31	790.95	354nm	480nm	218℃
67	19%	733.27	732.84	471nm	304nm	230℃
68	43%	791.31	790.95	338nm	485nm	195℃
70	13%	729.3	728.88	478nm	304nm	169℃
74	13%	733.27	732.84	324nm	475nm	234℃
78	47%	729.3	728.88	356nm	494nm	138℃
83	48%	729.26	728.84	352nm	382nm	180℃
84	40%	733.27	732.84	314nm	483nm	207℃
90	35%	755.31	754.92	310nm	481nm	215℃
104	62%	733.27	732.84	334nm	475nm	222℃
105	30%	733.27	732.84	350nm	487nm	213℃
106	38%	715.28	714.85	342nm	479nm	214℃
107	42%	745.24	744.9	344nm	489nm	255℃
108	28%	716.28	715.84	334nm	510nm	
109	11%	792.31	791.94	338nm	511nm	260℃
110	66%	653.27	652.78	344nm	489nm	255℃
111	46%	667.28	666.81	479nm	304nm	230℃
112	25%	729.3	728.88	324nm	482nm	130℃
113	23%	714.29	713.87	345nm	404nm	219℃
114	55%	669.21	668.81	334nm	494nm	220℃
115	51%	679.28	678.82	354nm	478nm	212℃

[126]

[127] [Example 1] Manufacture of OLED device using the organic electroluminescent compound according to the present invention

[128] An OLED device was manufactured using the electroluminescent material according to the present invention. First, a transparent electrode ITO thin film (15 Ω/☐) 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.

[129] Then, an ITO substrate was equipped in a substrate folder of a vacuum vapor deposition apparatus, and N^1,$N^{1'}$-([1,1'-biphenyl]-4,4'-diyl)bis(N^1-(naphthalen-1-yl)-N^4,N^4-diphenylbenzene-1,4-diamine 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 N^1,$N^{1'}$-([1,1'-biphenyl]-4,4'-diyl)bis(N^1-(naphthalen-1-yl)

[130] -N^4,N^4-diphenylbenzene-1,4-diamine, thereby forming a hole injection layer having a thickness of 60 nm on the ITO substrate. Then, N,N'-di(4-biphenyl)-N,N'-di(4-biphenyl)-4,4'-diaminobiphenyl 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.

[131] After forming the hole injection layer and the hole transport layer, an electroluminescent layer was formed thereon as follows. Compound **3** was placed in a cell of a vacuum vapor deposition apparatus as a host, and Compound D1 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 15 wt%. Subsequently, 2-(4-(9,10-di(naphthalen-2-yl)anthracen-2-yl)phenyl)-1-phenyl-1H-benzo[d]imidazole was placed as an electron transport layer on the electroluminescent layer, and Lithium quinolate was placed in another cell. The two materials were evaporated at the same rate such that an electroluminescent layer having a thickness of 30 nm was vapor-deposited at 50 wt%. Then, after vapor-depositing lithium quinolate (Liq) with a thickness of 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.

[132] Each compound used in the OLED device as an electroluminescent material was purified by vacuum sublimation at 10^{-6} torr.

[133] As a result, it was confirmed that current of 5.84 mA/cm^2 flows and a green light of 2530 cd/m^2 was emitted.

[134] [Example 2] Manufacture of OLED device using the organic electroluminescent compound according to the present invention

[135] An OLED device was manufactured in the same manner as Example 1 except that Compound **6** was used as a host material.

[136] As a result, it was confirmed that current of 12.9 mA/cm^2 flows and a green light of 5280 cd/m^2 was emitted.

[137] [Example 3] Manufacture of OLED device using the organic electroluminescent compound according to the present invention

[138] An OLED device was manufactured in the same manner as Example 1 except that Compound **9** was used as a host material.

[139] As a result, it was confirmed that current of 3.36 mA/cm^2 flows and a green light of 1580 cd/m^2 was emitted.

[140] [Example 4] Manufacture of OLED device using the organic electroluminescent compound according to the present invention

[141] An OLED device was manufactured in the same manner as Example 1 except that Compound **61** was used as a host material.

[142] As a result, it was confirmed that current of 12.5 mA/cm^2 flows and a green light of 4670 cd/m^2 was emitted.

[143] [Example 5] Manufacture of OLED device using the organic electroluminescent compound according to the present invention

[144] An OLED device was manufactured in the same manner as Example 1 except that Compound **74** was used as a host material.

[145] As a result, it was confirmed that current of 4.16 mA/cm^2 flows and a green light of 1750 cd/m^2 was emitted.

[146] [Example 6] Manufacture of OLED device using the organic electroluminescent compound according to the present invention

[147] An OLED device was manufactured in the same manner as Example 1 except that Compound **90** was used as a host material.

[148] As a result, it was confirmed that current of 17.1 mA/cm^2 flows and a green light of 6420 cd/m^2 was emitted.

[149] [Example 7] Manufacture of OLED device using the organic electroluminescent compound according to the present invention

[150] An OLED device was manufactured in the same manner as Example 1 except that Compound **104** was used as a host material.

[151] As a result, it was confirmed that current of 2.32 mA/cm^2 flows and a green light of 940 cd/m^2 was emitted.

[152] [Example 8] Manufacture of OLED device using the organic electroluminescent compound according to the present invention

[153] An OLED device was manufactured in the same manner as Example 1 except that Compound **107** was used as a host material.

[154] As a result, it was confirmed that current of 3.4 mA/cm^2 flows and a green light of 1490 cd/m^2 was emitted.

[155] [Example 9] Manufacture of OLED device using the organic electroluminescent compound according to the present invention

[156] An OLED device was manufactured in the same manner as Example 1 except that Compound **109** was used as a host material.

[157] As a result, it was confirmed that current of 2.37 mA/cm^2 flows and a green light of 890 cd/m^2 was emitted.

[158] [Example 10] Manufacture of OLED device using the organic electroluminescent compound according to the present invention

[159] An OLED device was manufactured in the same manner as Example 1 except that Compound **111** was used as a host material.

[160] As a result, it was confirmed that current of 9.15 mA/cm^2 flows and a green light of 3790 cd/m^2 was emitted.

[161] [Comparative Example 1] Manufacture of OLED device using conventional electroluminescent host material

[162] An OLED device was manufactured as in Example 1 except that an electroluminescent layer was vapor-deposited using 4,4'-N,N'-dicarbazole-biphenyl as a host material and aluminum(III)bis(2-methyl-8-quinolinato) (4-phenylphenolate)) of a 10nm thickness was vapor-deposited on the electroluminescent layer as a hole blocking layer.

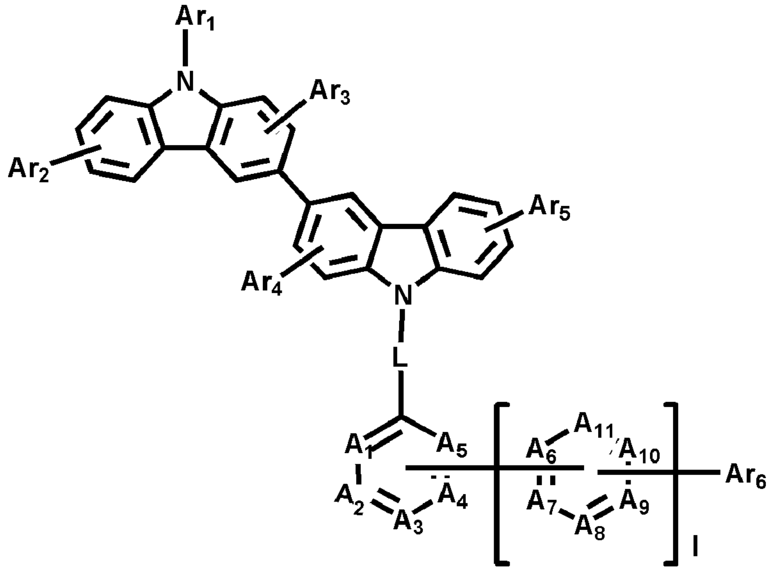
[163] As a result, it was confirmed that current of 5.7 mA/cm^2 flows and a green light of 2000 cd/m^2 was emitted.

[164] 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 has an improved electroluminescent efficiency and consumes less power by improving power efficiency according to decrease of driving voltage.

Claims

[Claim 1] An organic electroluminescent compound represented by Chemical Formula 1:

[Chemical Formula 1]

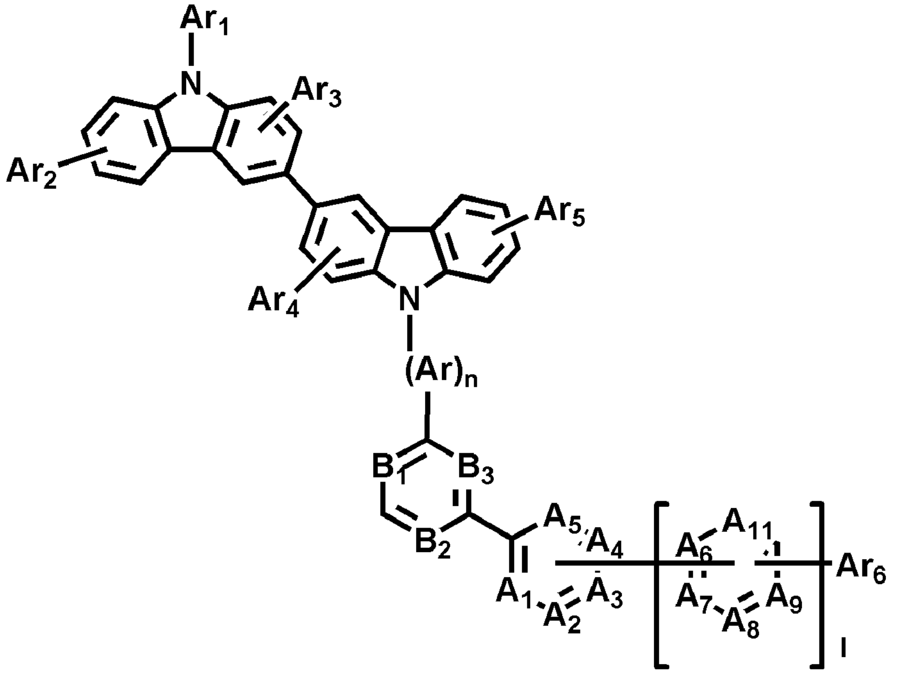


wherein

the l represents an integer of 0 to 2; the L represents (C6-C30)arylene or (C3-C30)heteroarylene; the A_1 to A_{11} independently represent CR7 or N; the R7 and Ar_1 to Ar_6 independently represent any one selected from the group consisting of hydrogen, deuterium, halogen, cyano, nitro, hydroxyl, (C1-C30)alkyl, halo(C1-C30)alkyl, (C3-C30)cycloalkyl, 5- to 7-membered heterocycloalkyl, (C2-C30)alkenyl, (C2-C30)alkynyl, (C6-C30)aryl, (C1-C30)alkoxy, (C6-C30)aryloxy, (C3-C30)heteroaryl, (C6-C30)ar(C1-C30)alkyl, (C6-C30)arylthio, mono or di(C1-C30)alkylamino, mono or di(C6-C30)arylamino, tri(C1-C30)alkylsilyl, di(C1-C30)alkyl(C6-C30)arylsilyl and tri(C6-C30)arylsilyl; each of alkyl, cycloalkyl, heterocycloalkyl, alkenyl, alkynyl, aryl, heteroaryl, arylene, and heteroarylene of the R7, and Ar_1 to Ar_6 is further substituted with one or more selected from the group consisting of deuterium, halogen, cyano, nitro, hydroxyl, (C1-C30)alkyl, halo(C1-C30)alkyl, (C3-C30)cycloalkyl, 5- to 7-membered heterocycloalkyl, (C2-C30)alkenyl, (C2-C30)alkynyl, (C6-C30)aryl, (C1-C30)alkoxy, (C6-C30)aryloxy, (C3-C30)heteroaryl, (C6-C30)ar(C1-C30)alkyl, (C6-C30)arylthio, mono or di(C1-C30)alkylamino, mono or di(C6-C30)arylamino, tri(C1-C30)alkylsilyl, di(C1-C30)alkyl(C6-C30)arylsilyl, (C1-C30)alkyldi(C6-C30)arylsilyl and tri(C6-C30)arylsilyl; carbon atoms of the A_1 to A_{11} and carbon atoms of Ar_6 are linked through a chemical bond, or independently linked via any one selected from the group consisting of $-CR_8R_9-$, -O-, $-NR_{10}-$ and -S- to form a fused ring; and definition on the R_8, R_9, R_{10} and substituents thereof are the same as that of the R7.

[Claim 2] The organic electroluminescent compound of claim 1, which is represented by Chemical Formula 2:

[Chemical Formula 2]

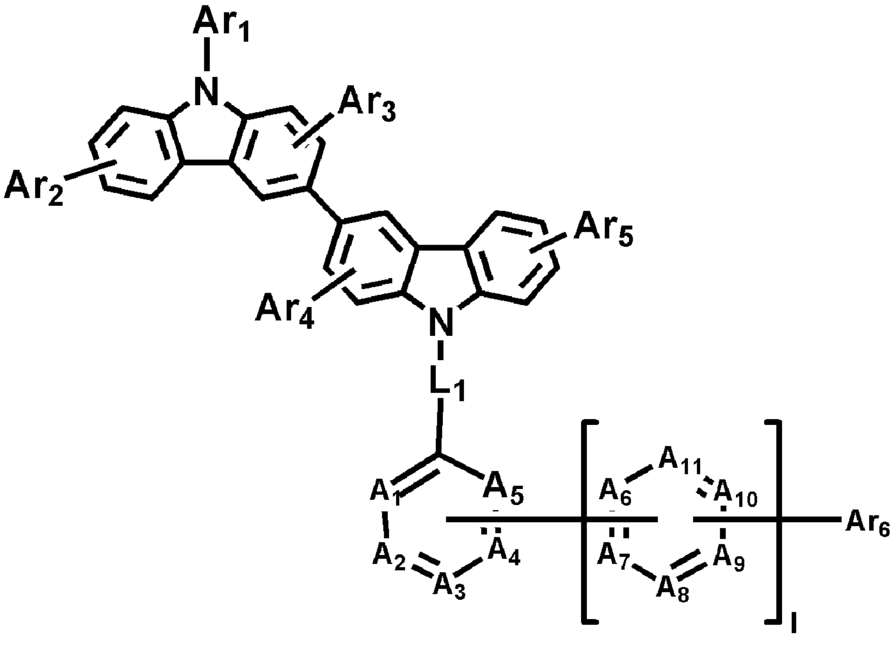


wherein

the l represents an integer of 1 to 2; the Ar represents (C6-C30)arylene, n represents an integer of 1 to 2; the A_1 to A_{11} independently represent CR7 or N; the R7 and Ar_1 to Ar_6 independently represent any one selected from the group consisting of hydrogen, deuterium, halogen, cyano, nitro, hydroxyl, (C1-C30)alkyl, halo(C1-C30)alkyl, (C3-C30)cycloalkyl, 5- to 7-membered heterocycloalkyl, (C2-C30)alkenyl, (C2-C30)alkynyl, (C6-C30)aryl, (C1-C30)alkoxy, (C6-C30)aryloxy, (C3-C30)heteroaryl, (C6-C30)ar(C1-C30)alkyl, (C6-C30)arylthio, mono or di(C1-C30)alkylamino, mono or di(C6-C30)arylamino, tri(C1-C30)alkylsilyl, di(C1-C30)alkyl(C6-C30)arylsilyl and tri(C6-C30)arylsilyl; the B_1, B_2 and B_3 independently represent CH or N, but they do not represent CH at the same time; each of alkyl, cycloalkyl, heterocycloalkyl, alkenyl, alkynyl, aryl and heteroaryl of the R7, Ar_1 to Ar_6 is further substituted with one or more selected from the group consisting of deuterium, halogen, cyano, nitro, hydroxyl, (C1-C30)alkyl, halo(C1-C30)alkyl, (C3-C30)cycloalkyl, 5- to 7-membered heterocycloalkyl,(C2-C30)alkenyl, (C2-C30)alkynyl, (C6-C30)aryl, (C1-C30)alkoxy, (C6-C30)aryloxy, (C3-C30)heteroaryl, (C6-C30)ar(C1-C30)alkyl, (C6-C30)arylthio, mono or di(C1-C30)alkylamino, mono or di(C6-C30)arylamino, tri(C1-C30)alkylsilyl, di(C1-C30)alkyl(C6-C30)arylsilyl, (C1-C30)alkyldi(C6-C30)arylsilyl and tri(C6-C30)arylsilyl; carbon atoms of the A_1 to A_{11} and carbon atoms of Ar_6 are linked through a chemical bond, or independently linked via any one selected from the group consisting of $-CR_8R_9-$, -O-, $-NR_{10}-$ and -S- to form a fused ring; and definition on the R_8, R_9, R_{10} and substituents thereof is the same as that of the R7.

[Claim 3] The organic electroluminescent compound of claim 1, which is represented by Chemical Formula 3.

[Chemical Formula 3]

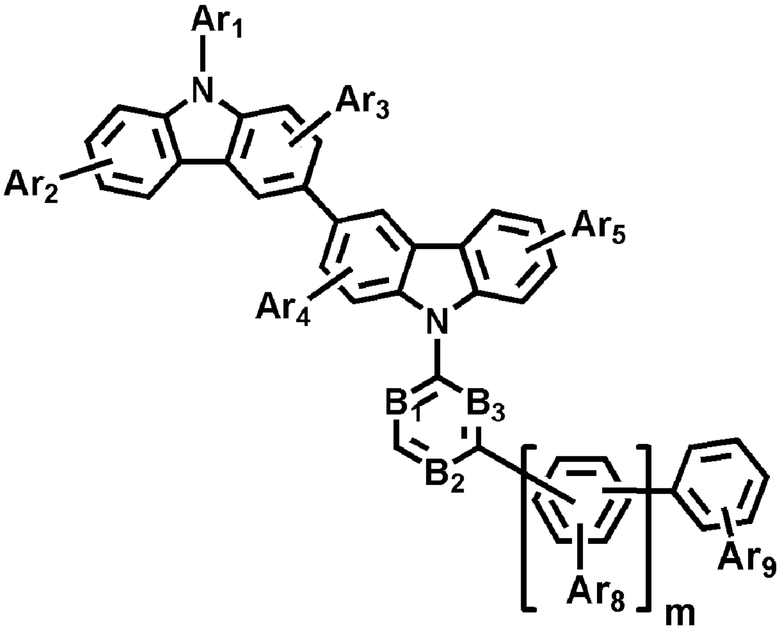


wherein

the L_1 represents (C3-C30)heteroarylene; definition on Ar_1 to Ar_6 and substituents of Ar_1 to Ar_6 is the same as htat of Ar_1 to Ar_6 in Chemical Formula 1, and definition on A_1 to A_{11} is the same as that of A_1 to A_{11} in Chemical Formula 1; and the l is an integer of 1 to 2.

[Claim 4] The organic electroluminescent compound of claim 1, which is represented by Chemical Formula 4.

[Chemical Formula 4]

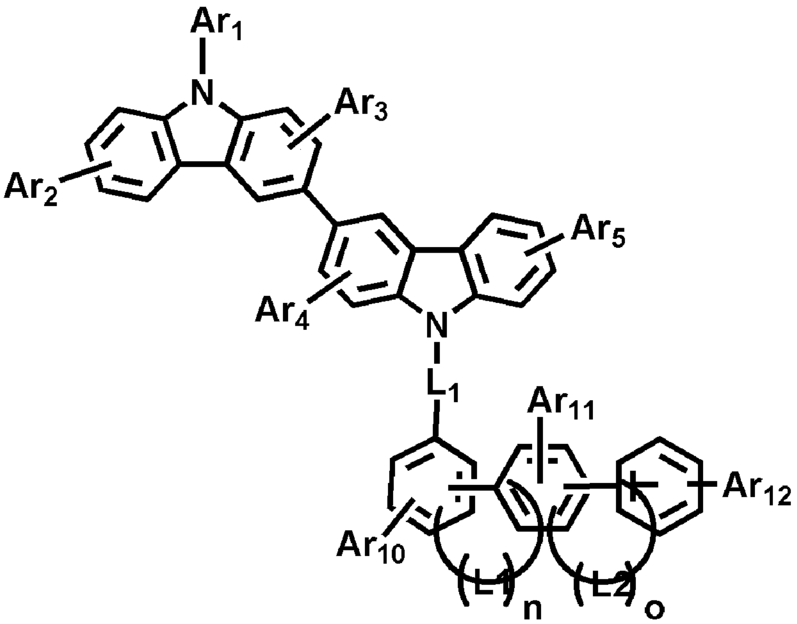


wherein

definition on Ar_1 to Ar_5, Ar_8 to Ar_9 and substituents thereof is the same as that of Ar_1 to Ar_6 in Chemical Formula 1; and the m represents an integer of 1 to 2, and the B_1, B_2 and B_3 independently represent CH or N, but they are not CH at the same time.

[Claim 5] The organic electroluminescent compound of claim 1, which is represented by Chemical Formula 5.

[Chemical Formula 5]

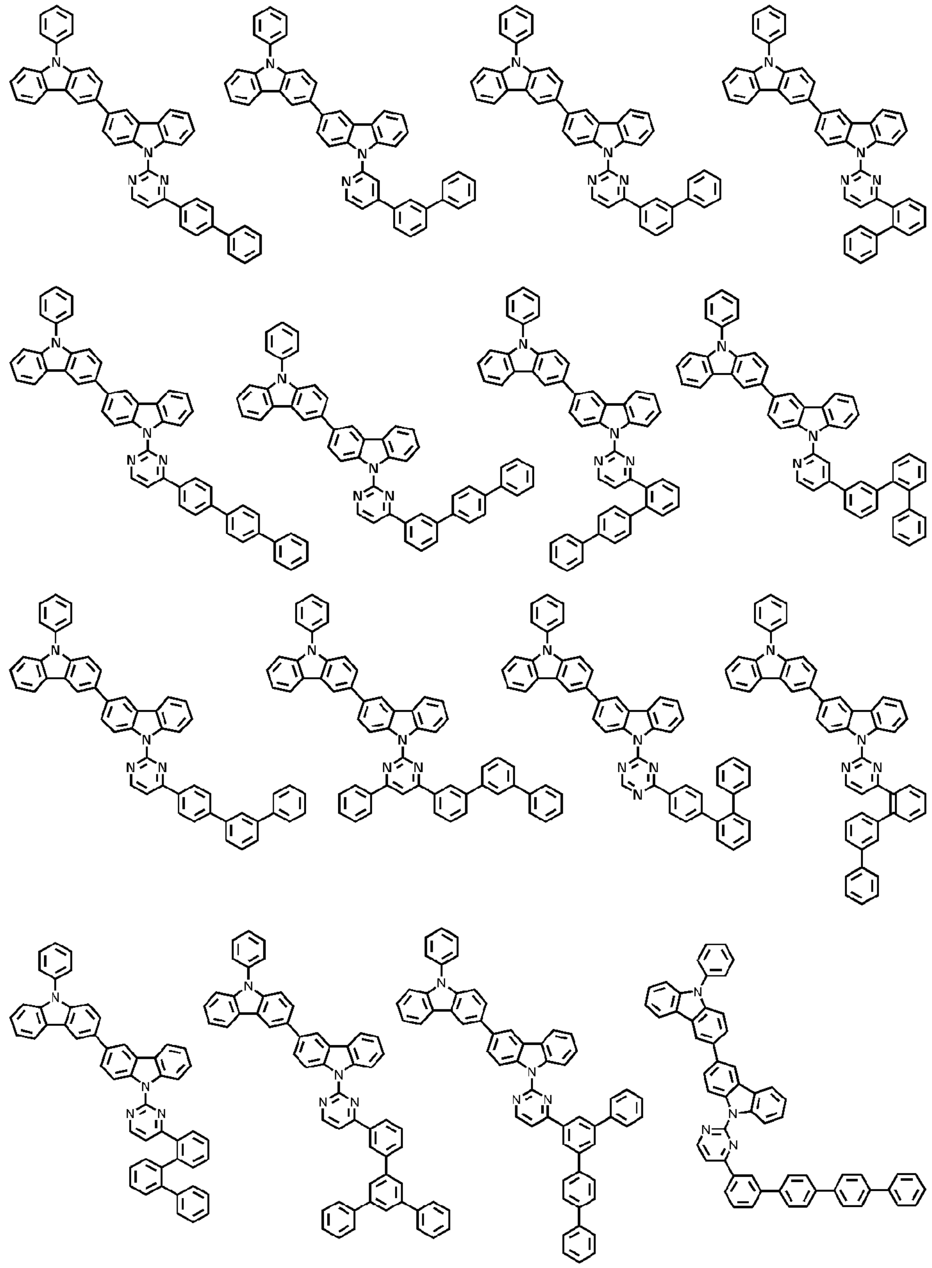


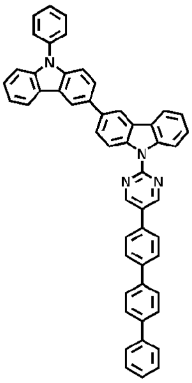
wherein

L_1 represents (C3-C30)heteroarylene; definition on Ar_1 to Ar_5, Ar_{10} to Ar_{12} and substituents thereof is the same as that of Ar_1 to Ar_6 in Chemical Formula 1;

the L1 to L2 independently represent any one selected from the group consisting of $-CR_8R_9-$, -O-, $-NR_{10}-$ and -S-; definition on the R_8, R_9, R_{10} and substituents thereof is the same as that of R7 in Chemical Formula 1; and the n and o independently represent an integer of 0 to 1, and n+o=1.

[Claim 6] The organic electroluminescent compound of claim 1, which is selected from following compounds:

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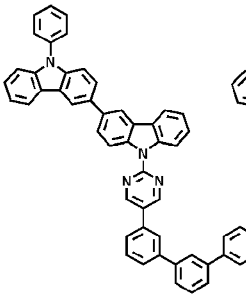
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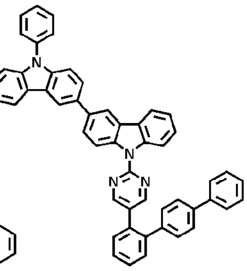
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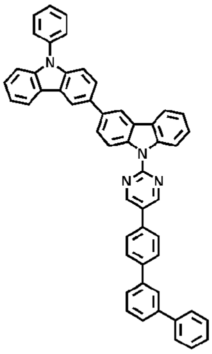
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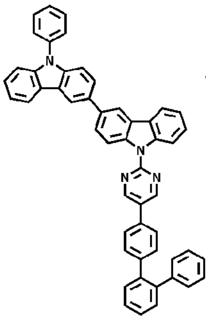
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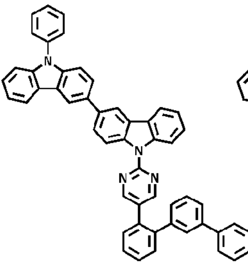
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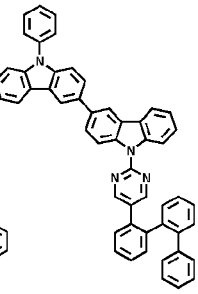
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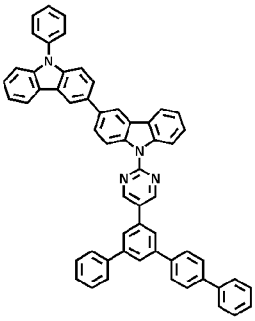
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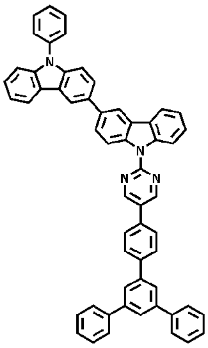
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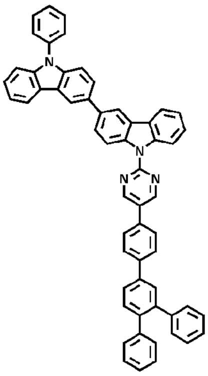
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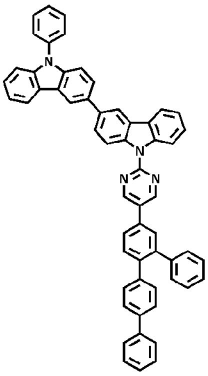
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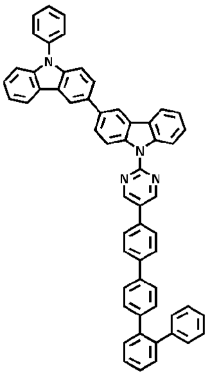
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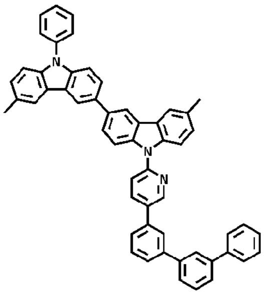
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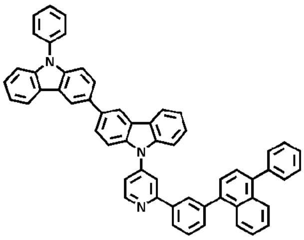
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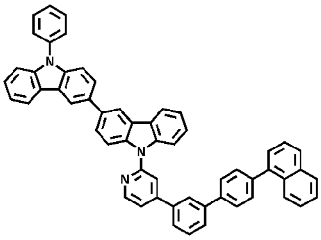
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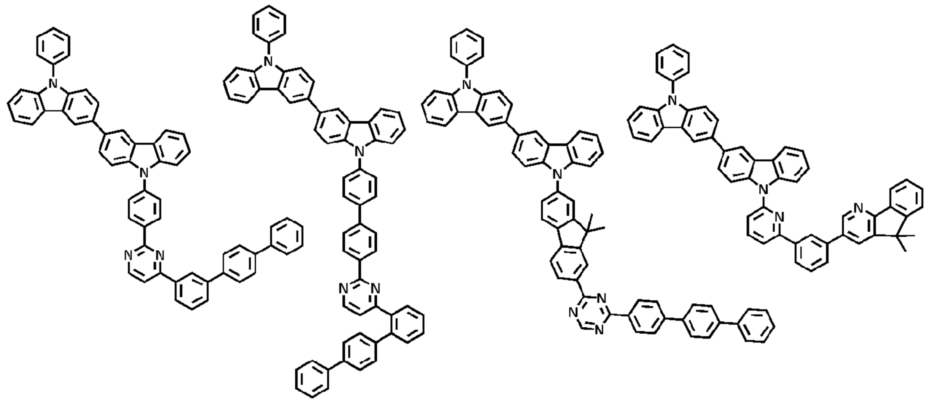

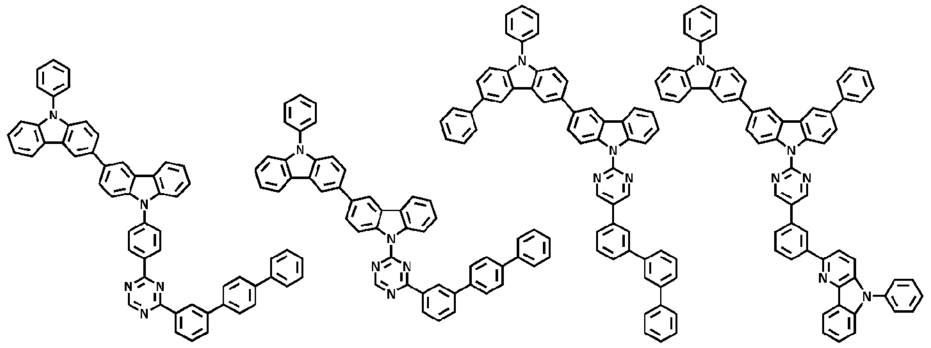

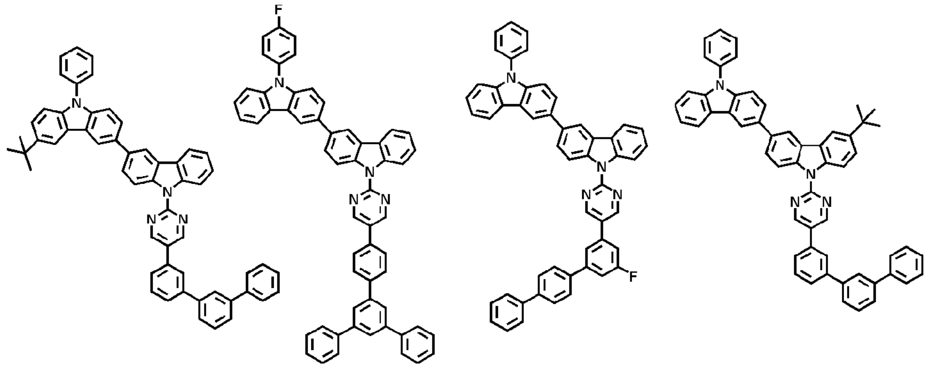

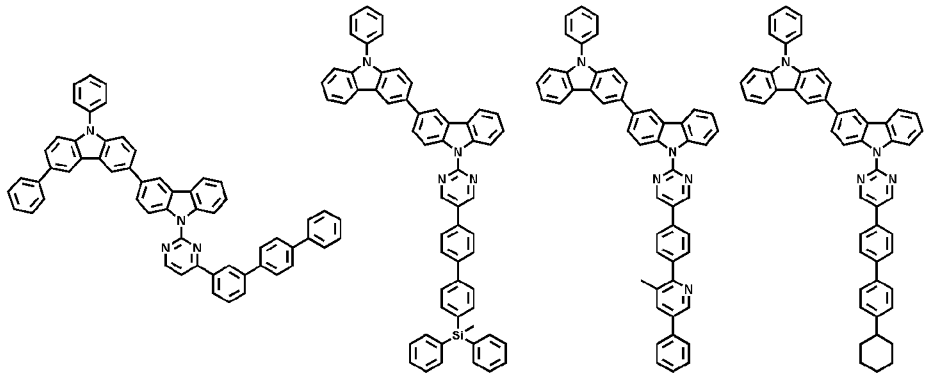

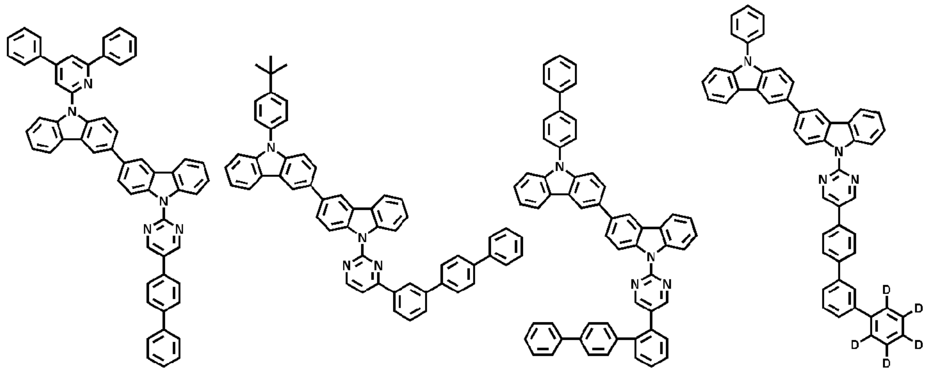
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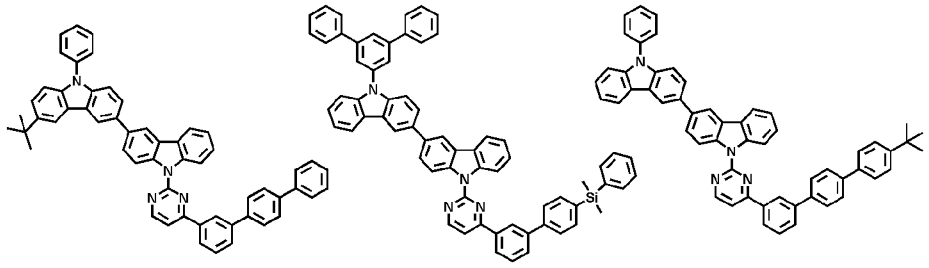
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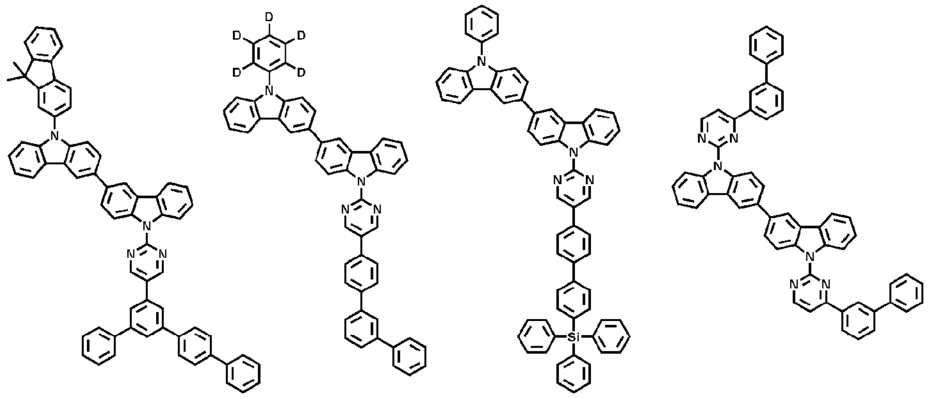
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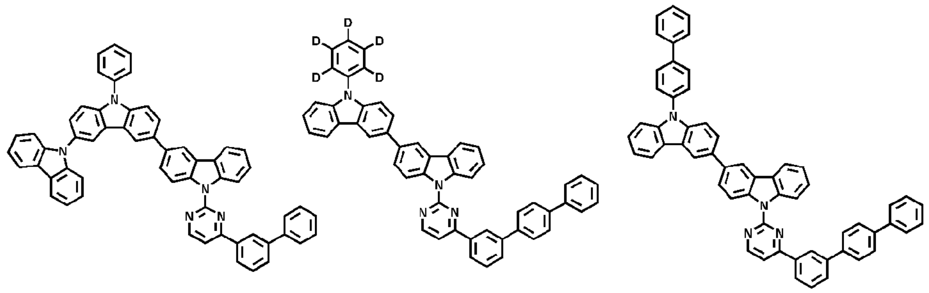
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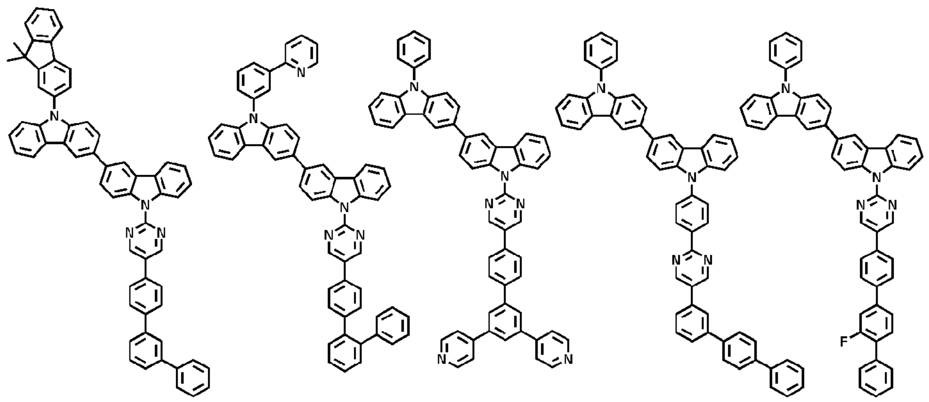
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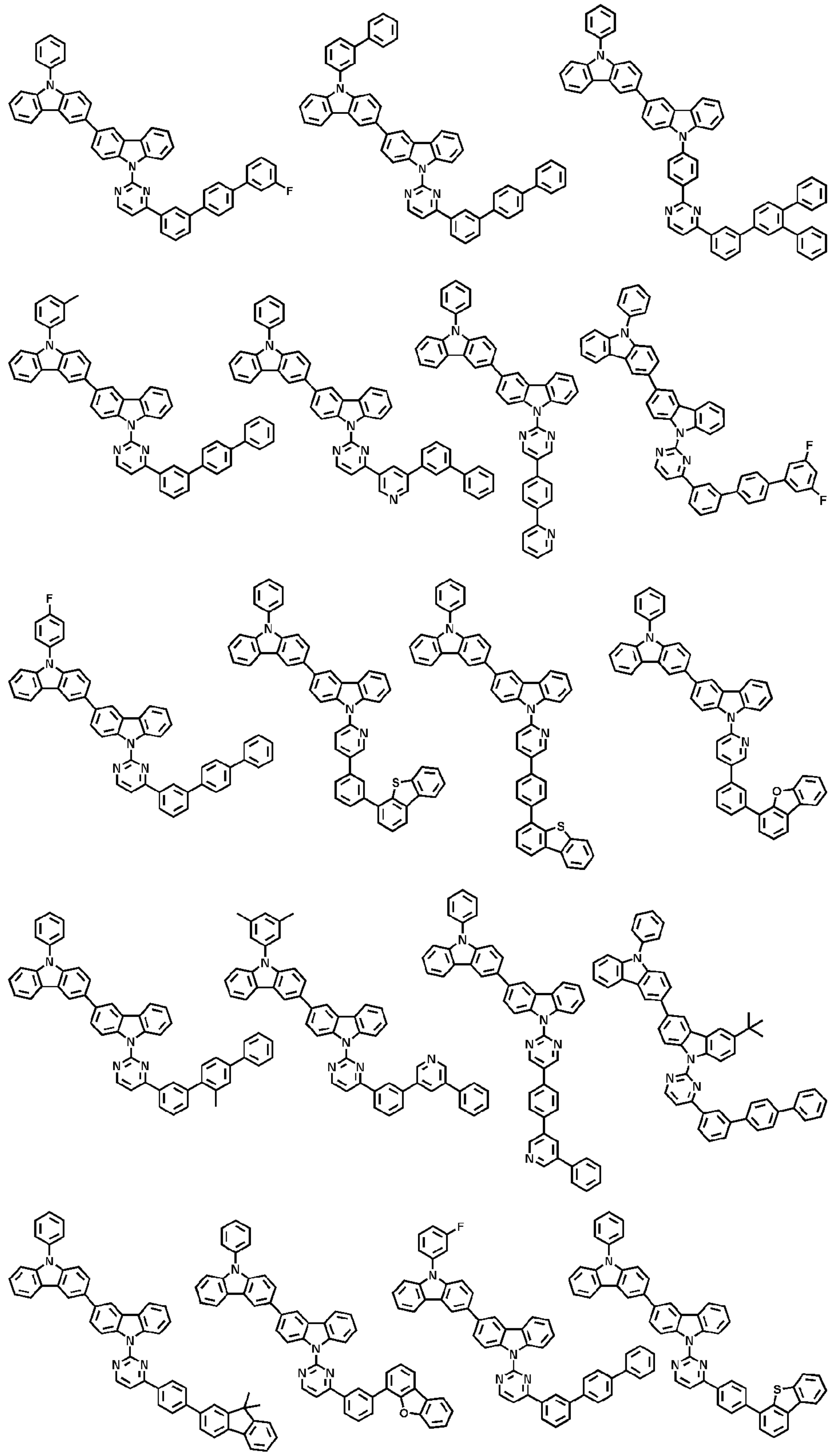

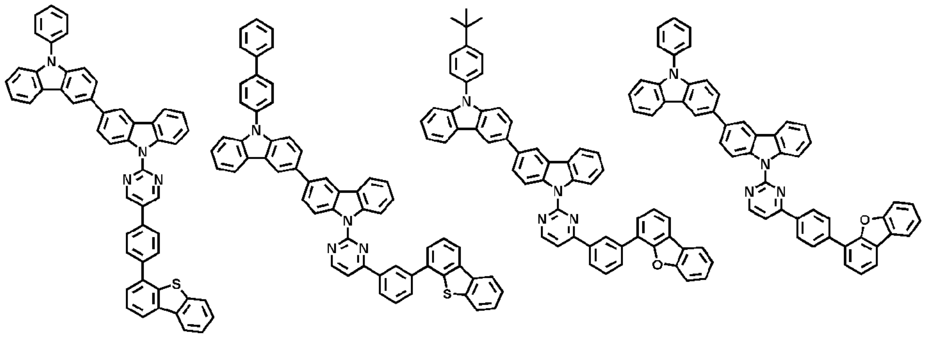

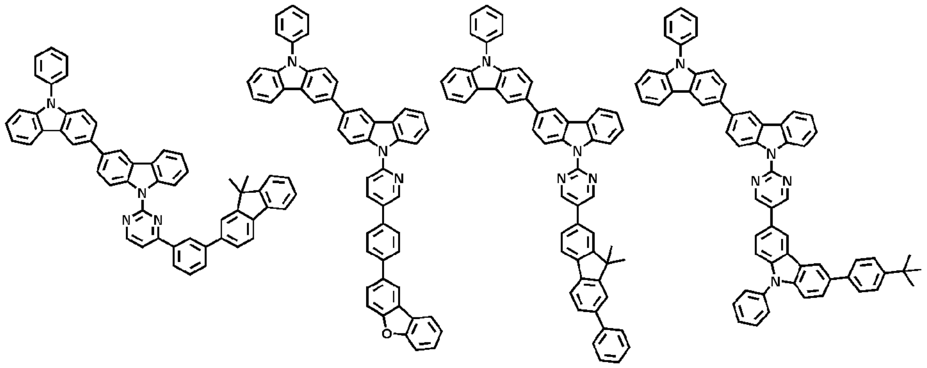

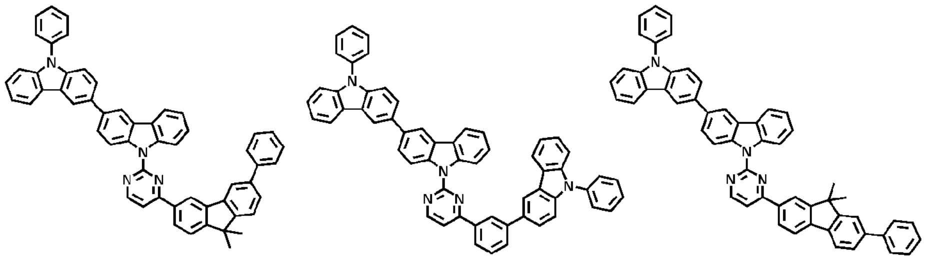

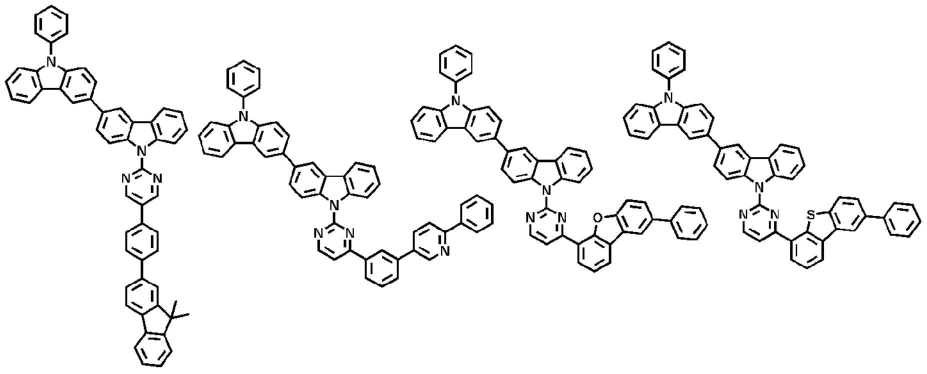

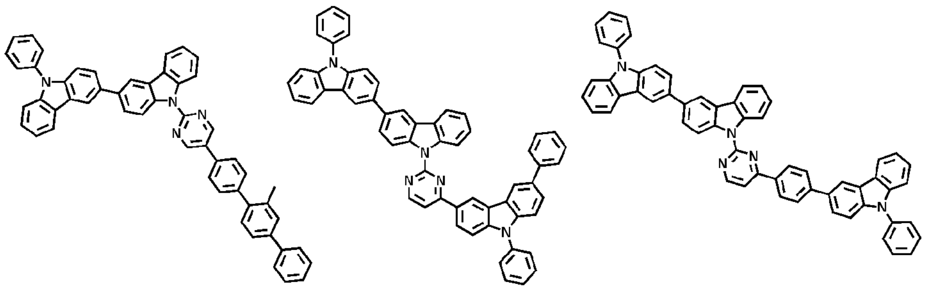

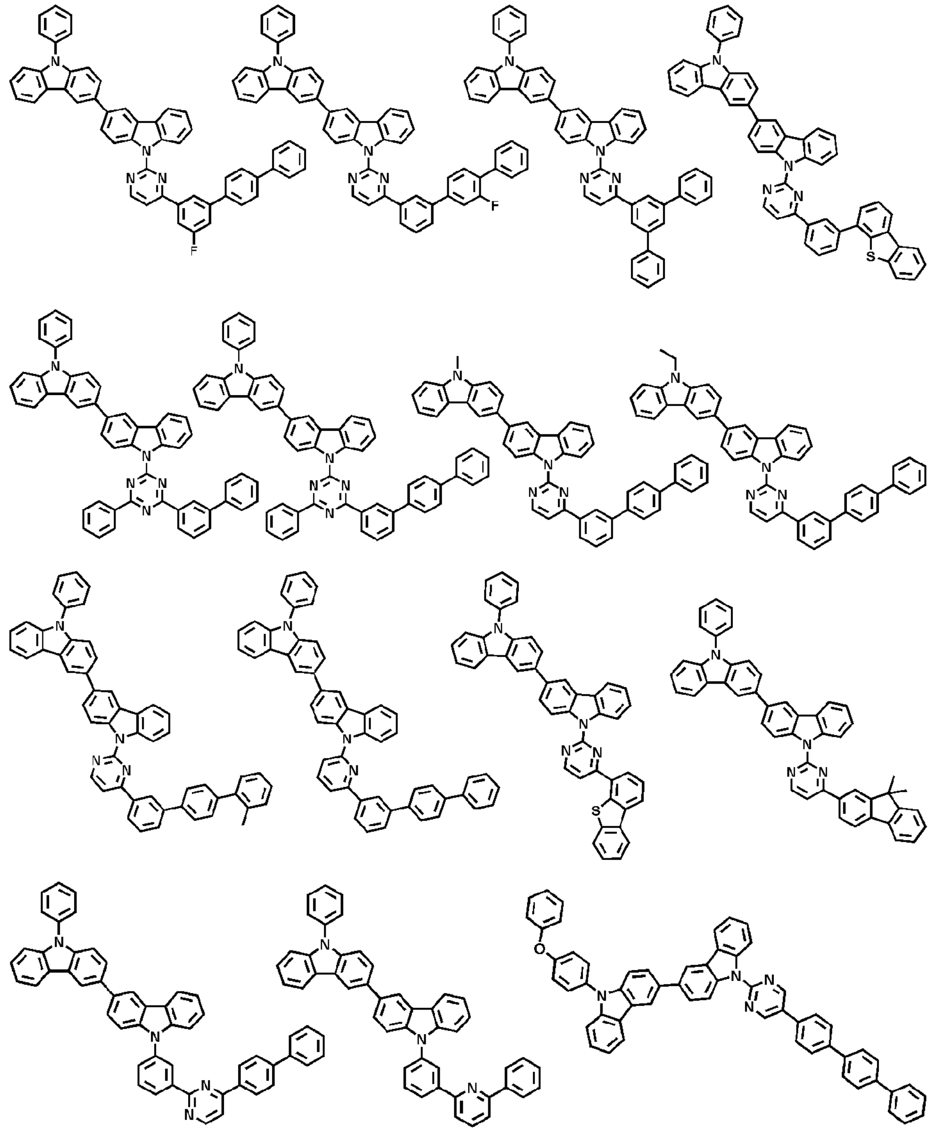

[Claim 7] An organic electroluminescent device comprising the organic electroluminescent compound according to any one selected from claims 1 to 6.

[Claim 8] The organic electroluminescent device of claim 7, which comprises a first electrode; a second electrode; and one or more organic layers interposed between the first electrode and the second electrode, wherein the organic layer comprises one or more organic electroluminescent compounds and one or more phosphorescent dopants.

[Claim 9] The organic electroluminescent device according to claim 8, wherein the organic layer further comprises one or more amine compound(s) (A) selected from the group consisting of arylamine compounds and styrylarylamine compounds; one or more metal(s) selected from the 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)(B) comprising the metal; or one or more selected from (A) and (B).

[Claim 10] The organic electroluminescent device of claim 8, which is a white light-emitting organic electroluminescent device wherein the organic layer comprises an electroluminescent layer and a charge generating layer, or further comprises one or more organic electroluminescent layers emitting blue, red or green light.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2011/009896

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

C09K 11/06 (2006.01)	***C07D 407/14*** (2006.01)	***H01L 51/50*** (2006.01)
C07D 403/14 (2006.01)	***C07D 409/14*** (2006.01)	

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Registry, CAPlus, Marpat: Substructure search based upon chemical formula 1

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2010/095621 A1 (IDEMITSU KOSAN CO. LTD.) 26 August 2010 Page 19 – (from left to right) the 1st, 2nd, 4th-7th and 9th-10th compounds; compound H8 (page 60); abstract; examples; table 1 and claim 26	1, 7-10
P,X	WO 2011/139055 A2 (CHEIL INDUSTRIES INC.) 10 November 2011 Compound 34; abstract	1
P,X	WO 2011/125680 A1 (IDEMITSU KOSAN CO. LTD.) 13 October 2011 Compounds 5, 10-13, 15-20, 24, 77-79, 104-106, 108-109, 111, 113-116, 119-121, 160, 162, 165, 167, 174 and 194-200; abstract; examples	1, 3, 5, 7-10

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

*	Special categories of cited documents:		
"A"	document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 1 March 2012	Date of mailing of the international search report 1 March 2012
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. +61 2 6283 7999	Authorized officer **GAVIN BARTELL** AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No : +61 2 6222 3647

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/KR2011/009896**

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

Patent Document Cited in Search Report		Patent Family Member					
WO	2010095621	CN	102325751	EP	2399906	KR	20110117168
		TW	201035082	US	2011297924		
WO	2011139055	KR	20110122051				
WO	2011125680	US	2011278552	WO	2011122132		

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

END OF ANNEX

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	EP2640806A4	公开(公告)日	2014-05-14
申请号	EP2011851418	申请日	2011-12-21
[标]申请(专利权)人(译)	罗门哈斯电子材料有限公司		
申请(专利权)人(译)	罗门哈斯电子材料KOREA LTD.		
当前申请(专利权)人(译)	罗门哈斯电子材料KOREA LTD.		
[标]发明人	LEE SU HYUN HWANG SOO JIN LEE SEON WOO MOON DOO HYEON LEE HYO JUNG YANG SOO JIN PARK KYOUNG JIN KIM CHI SIK CHO YOUNG JUN KWON HYUCK JOO LEE KYUNG JOO KIM BONG OK		
发明人	LEE, SU HYUN HWANG, SOO-JIN LEE, SEON-WOO MOON, DOO-HYEON LEE, HYO JUNG YANG, SOO JIN PARK, KYOUNG-JIN KIM, CHI SIK CHO, YOUNG JUN KWON, HYUCK JOO LEE, KYUNG JOO KIM, BONG OK		
IPC分类号	C09K11/06 C07D407/14 H01L51/50 C07D403/14 C07D409/14		
CPC分类号	H01L51/0067 C07D403/14 C07D405/14 C07D409/14 C09K11/06 C09K2211/1007 C09K2211/1011 C09K2211/1014 C09K2211/1044 C09K2211/1059 C09K2211/1088 H01L51/0072 H01L51/0074 H01L51/5024 H05B33/10		
优先权	1020100131734 2010-12-21 KR 1020110135025 2011-12-15 KR		
其他公开文献	EP2640806A1		
外部链接	Espacenet		

摘要(译)

提供了新型有机电致发光化合物和使用其的有机电致发光器件。由于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，因此可以用于制造具有优异的操作寿命并且由于提高的功率效率而消耗更少功率的OLED器件。