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(54) Title: BENZOCARBAZOLE COMPOUNDS AND ELECTROLUMINESCENT DEVICES INVOLVING THEM

(57) Abstract: The present invention relates to novel organic electroluminescence compounds and an organic electroluminescence device containing the same. The compounds according to the present invention have high luminous efficiency and long operation lifetime. Therefore, they can produce an organic electroluminescence device having enhanced power consumption efficiency.



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Description

BENZOCARBAZOLE COMPOUNDS AND ELECTROLUMINESCENT DEVICES INVOLVING THEM

Technical Field

- [1] The present invention relates to novel organic electroluminescence compounds and organic electroluminescence device comprising the same.

Background Art

- [2] An electroluminescence (EL) device is a self-light-emitting device which has advantages over other types of display devices in that it provides a wider viewing angle, a greater contrast ratio, and has a faster response time. An organic EL device was first developed by Eastman Kodak, by using small molecules which are aromatic diamines, and aluminum complexes as a material for forming a light-emitting layer [Appl. Phys. Lett. 51, 913, 1987].
- [3] The most important factor to determine luminous efficiency in an organic EL device is a light-emitting material. Until now, fluorescent materials have been widely used as a light-emitting material. However, in view of electroluminescent mechanisms, developing phosphorescent materials is one of the best methods to theoretically enhance the luminous efficiency by four (4) times. Iridium(III) complexes have been widely known as phosphorescent materials, including bis(2-(2'-benzothienyl)-pyridinato-N,C3')iridium(acetylacetonate) ((acac)Ir(btp)₂), tris(2-phenylpyridine)iridium (Ir(ppy)₃) and bis(4,6-difluorophenylpyridinato-N,C2)picolate iridium (Firpic) as red, green and blue materials, respectively. Especially, many phosphorescent materials are being researched in Japan, Europe and U.S.A. recently.
- [4] Until now, 4,4'-N,N'-dicarbazol-biphenyl (CBP) is the most widely known host material for phosphorescent substances. Further, an organic EL device using bathocuproine (BCP) and aluminum(III)bis(2-methyl-8-quinolate)(4-phenylphenolate) (BALq) for a hole blocking layer is known, and Pioneer (Japan) et al. developed a high performance organic EL device employing a derivative of BALq as a host material.
- [5] Though these materials provide good light-emitting characteristics, they have the following disadvantages. Due to their low glass transition temperature and poor thermal stability, their degradation may occur during a high-temperature deposition process in a vacuum. The power efficiency of an organic EL device is given by $[(\pi/\text{voltage}) \times \text{current efficiency}]$, and the power efficiency is inversely proportional to

voltage, and thus in order to lower the power consumption, the power efficiency should be raised. Although an organic EL device comprising phosphorescent materials provides much higher current efficiency (cd/A) than one comprising fluorescent materials, an organic EL device using conventional phosphorescent materials such as BAiq or CBP has a higher driving voltage than that using fluorescent materials. Thus, the EL device using the conventional phosphorescent materials has no advantage in terms of power efficiency (lm/W). Further, the operation lifetime of the organic EL device is short.

- [6] Korean Patent Application Laying-Open No. 2010-0023783 discloses a carbazole compound substituted with an amine group and a green fluorescent organic EL device using the carbazole compound as a hole transport material. Further, said document also discloses a benzocarbazole compound substituted with a carbazole group and a phosphorescent organic EL device using the benzocarbazole compound as a host material. However, the device showed green emission.
- [7] Japanese Patent Application Laying-Open No. 2000-286056 discloses a carbazole compound to which an aromatic ring is condensed, and an organic EL device comprising a polymer of the compound. However, the device showed green or orange emission.
- [8] Japanese Patent Application Laying-Open No. 1999-144866 discloses a dicarbazole compound and an organic EL device comprising the same. However, it discloses only the use of the compound as a hole transmitting material.

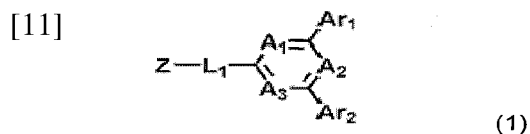
Disclosure of Invention

Technical Problem

- [9] The objective of the present invention is to provide an organic electroluminescence compound imparting high luminous efficiency and a long operation lifetime to a device, and having proper color coordination; and an organic electroluminescence device having high efficiency and a long lifetime, using said compound as a light-emitting material.

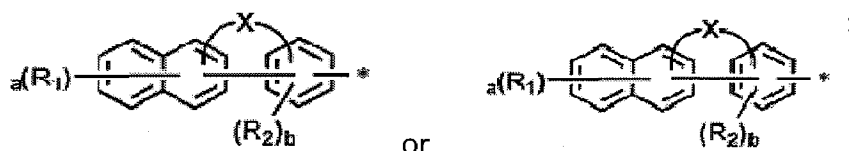
Solution to Problem

- [10] The present inventors found that the above objective can be achieved by a compound represented by the following formula 1:



- [12] wherein

[13]



- [14] L_1 represents a single bond, a substituted or unsubstituted (C6-C30)arylene group, or a substituted or unsubstituted 3- to 30-membered heteroarylene group;
- [15] Ar_1 to Ar_3 each independently represent CR_{11} or N, proviso that Ar_1 to Ar_3 do not simultaneously represent CH;
- [16] X represents -O-, -S-, $-CR_{12}R_{13-}$, or $-NR_{14-}$;
- [17] R_1 , R_2 , R_{11} , Ar_1 and Ar_2 each independently represent hydrogen, deuterium, a halogen, a substituted or unsubstituted (C1-C30)alkyl group, a substituted or unsubstituted (C6-C30)aryl group, a substituted or unsubstituted 3- to 30-membered heteroaryl group, $-NR_{15}R_{16}$, $-SiR_{17}R_{18}R_{19}$, $-SR_{20}$, $-OR_{21}$, a cyano group, or a nitro group;
- [18] R_{12} to R_{14} each independently represent a substituted or unsubstituted (C1-C30)alkyl group, a substituted or unsubstituted (C6-C30)aryl group, or a substituted or unsubstituted 3- to 30-membered heteroaryl group;
- [19] R_{15} to R_{21} each independently represent hydrogen, deuterium, a halogen, a substituted or unsubstituted (C1-C30)alkyl group, a substituted or unsubstituted (C6-C30)aryl group, or a substituted or unsubstituted 3- to 30-membered heteroaryl group; or are linked to an adjacent substituent(s) to form a mono- or polycyclic, (C5-C30)alicyclic or aromatic ring whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen and sulfur;
- [20] a represents an integer of 1 to 6; where a is an integer of 2 or more, each of R_1 is the same or different
- [21] b represents an integer of 1 to 3; where b is an integer of 2 or more, each of R_2 is the same or different;
- [22] the heterocycloalkyl group and the heteroaryl(ene) group contain at least one hetero atom selected from B, N, O, S, P(=O), Si and P.

Advantageous Effects of Invention

- [23] The organic electroluminescence compounds according to the present invention have high luminous efficiency and long operation lifetime. Therefore, they can produce an organic electroluminescence device having enhanced power consumption efficiency.

Mode for the Invention

- [24] Hereinafter, the present invention will be described in detail. However, the following description is intended to explain the invention, and is not meant in any way to restrict the scope of the invention.
- [25] The present invention relates to an organic electroluminescence compound represented by the above formula 1, an organic electroluminescence material comprising

the organic electroluminescence compound, and an organic electroluminescence device comprising the material.

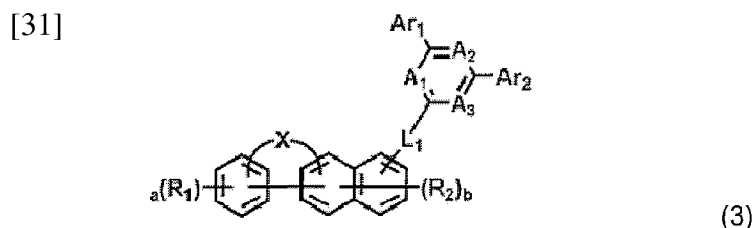
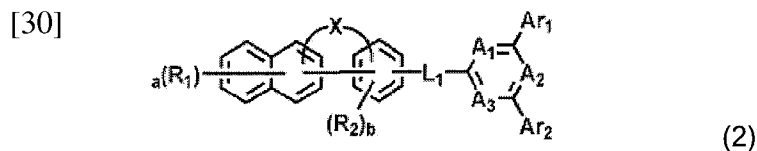
- [26] Herein, “(C1-C30)alkyl(ene)” is meant to be a linear or branched alkyl(ene) having 1 to 30 carbon atoms, in which the number of carbon atoms is preferably 1 to 20, more preferably 1 to 10, and includes methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, etc.; “(C2-C30) alkenyl”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

- [27] Herein, “substituted” in the expression “substituted or unsubstituted” means that a

hydrogen atom in a certain functional group is replaced with another atom or group, i.e., a substituent.

- [28] Substituents of the substituted alkyl group, the substituted aryl(ene) group, the substituted heteroaryl(ene) group, the substituted cycloalkyl(ene) group, the substituted heterocycloalkyl group and the substituted aralkyl group in L_1 , R_1 , R_2 , R_{11} to R_{21} , Ar_1 , and Ar_2 groups of formula 1, each independently are at least one selected from the group consisting of deuterium; a halogen; a (C1-C30)alkyl group substituted or unsubstituted with a halogen; a (C6-C30)aryl group; a 3- to 30-membered heteroaryl group substituted or unsubstituted with a (C1-C30)alkyl and/or a (C6-C30)aryl; a (C3-C30)cycloalkyl group; a 5- to 7-membered heterocycloalkyl group; a tri(C1-C30)alkylsilyl group; a tri(C6-C30)arylsilyl group; a di(C1-C30)alkyl(C6-C30)arylsilyl group; a (C1-C30)alkyldi(C6-C30)arylsilyl group; a (C2-C30)alkenyl group; a (C2-C30)alkynyl group; a cyano group; an N-carbazolyl group; a di(C1-C30)alkylamino group; a di(C6-C30)arylamino group; a (C1-C30)alkyl(C6-C30)arylamino group; a di(C6-C30)arylboronyl group; a di(C1-C30)alkylboronyl group; a (C1-C30)alkyl(C6-C30)arylboronyl group; a (C6-C30)aryl(C1-C30)alkyl group; a (C1-C30)alkyl(C6-C30)aryl group; a carboxyl group; a nitro group; and a hydroxyl group.

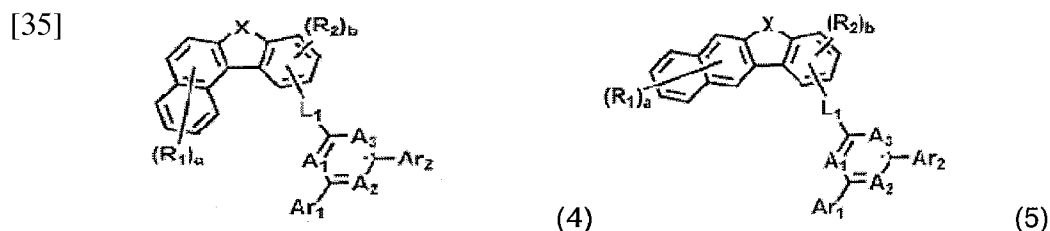
- [29] The organic electroluminescence compound according to the present invention is represented by the following formulae 2 or 3:



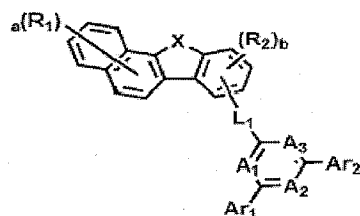
- [32] wherein

- [33] X , R_1 , R_2 , a , b , L_1 , A_1 to A_3 , Ar_1 , and Ar_2 are as defined in formula 1 above.

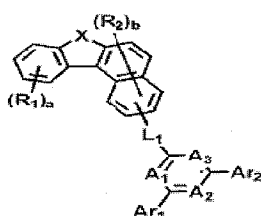
- [34] More specifically, the organic electroluminescence compound according to the present invention is represented by the following formulae 4 to 9:



[36]

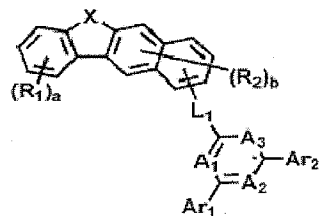


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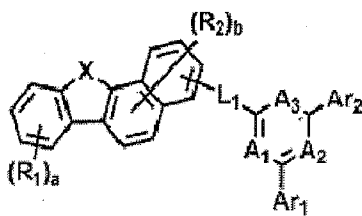


(7)

[37]



(8)



(9)

[38] wherein

[39] X, R₁, R₂, a, b, L₁, A₁ to A₃, Ar₁, and Ar₂ are as defined in formula 1 above.

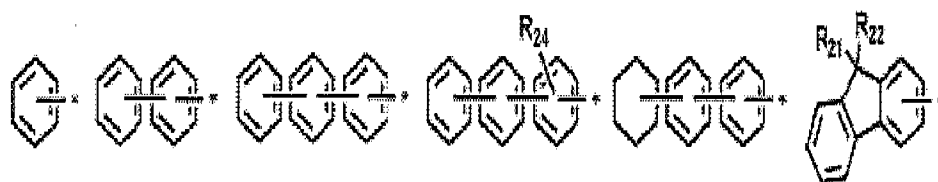
[40] More specifically, L₁ represents a single bond or a (C6-C30)arylene group; Ar₁ to Ar₃ each independently represent CR₁₁ or N, proviso that Ar₁ to Ar₃ do not simultaneously represent CH; X represents -NR₁₄-; R₁₁ represents hydrogen, deuterium, a (C1-C30)alkyl group, a (C6-C30)aryl group, or a 3- to 30-membered heteroaryl group; R₁₄ represents a (C1-C30)alkyl group, a (C6-C30)aryl group, or a 3- to 30-membered heteroaryl group; and R₁, R₂, Ar₁ and Ar₂ each independently represent hydrogen, deuterium, a halogen, a (C1-C30)alkyl group, a (C6-C30)aryl group, or a 3- to 30-membered heteroaryl group. The arylene of L₁, and the alkyl, aryl, and heteroaryl of R₁, R₂, R₁₁, R₁₄, Ar₁ and Ar₂ may be substituted with at least one selected from the group consisting of deuterium, a halogen, a (C1-C30)alkyl, a halo(C1-C30)alkyl, a (C6-C30)aryl, a 3- to 30-membered heteroaryl group, a 3- to 30-membered heteroaryl group substituted with a (C6-C30)aryl and/or a (C1-C30)alkyl, a (C3-C30)cycloalkyl, a tri(C1-C30)alkylsilyl, a tri(C6-C30)arylsilyl group, a di(C1-C30)alkyl(C6-C30)arylsilyl, a (C1-C30)alkyldi(C6-C30)arylsilyl group, a (C6-C30)aryl(C1-C30)alkyl group, and a (C1-C30)alkyl(C6-C30)aryl.

[41] More specifically, L₁ represents a single bond, phenylene, naphthylene, biphenylene, terphenylene, anthrylene, indenylene, fluorenylene, phenanthrylene, triphenylenylene, pyrenylene, perylenylene, crysénylene, naphthacénylene, fluoranthénylene, phenylene-naphthylene, furylene, thiophénylene, pyrrolylene, imidazolylene, pyrazolylene, thiazolylene, thiadiazolylene, isothiazolylene, isoxazolylene, oxazolylene, oxadiazolylene, triazinylene, tetrazinylene, triazolylene, furazanylene, pyridylene, pyrazinylene, pyrimidinylene, pyridazinylene, benzofuranylene, benzothiophénylene, isobenzofuranylene, benzoimidazolylene, benzothiazolylene, benzoisothiazolylene, benzoisoxazolylene, benzoxazolylene, isoindolylene, indolylene, indazolylene, benzothiadiazolylene, quinolylene, isoquinolylene, cinolynylene, quinazolinylene, quinoxalynylene, carbazolylene, phenanthrydinylene, benzodioxolylene, dibenzofuranylene, and dibenzo-

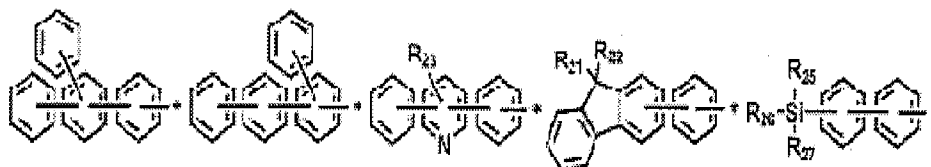
cyophenylene.

[42] Further, R_1 , R_2 , R_{11} , Ar_1 and Ar_2 each independently represent hydrogen, a halogen, a (C1-C30)alkyl, or a group selected from the following:

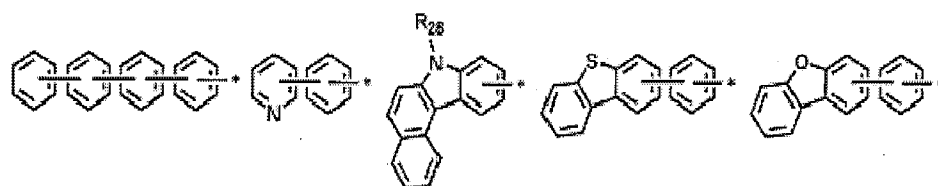
[43]



[44]



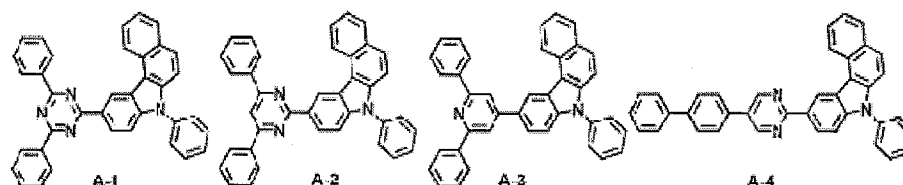
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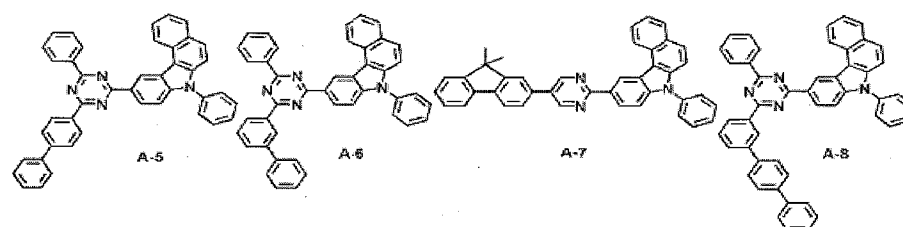
[46] wherein R_{21} to R_{28} each independently represent a halogen, a (C1-C30)alkyl, a (C6-C30)aryl, a 3- to 30-membered heteroaryl, or a (C3-C30)cycloalkyl.

[47] The organic electroluminescence compounds of the present invention include the following compounds:

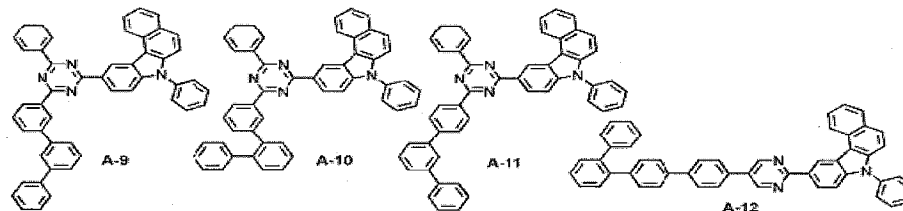
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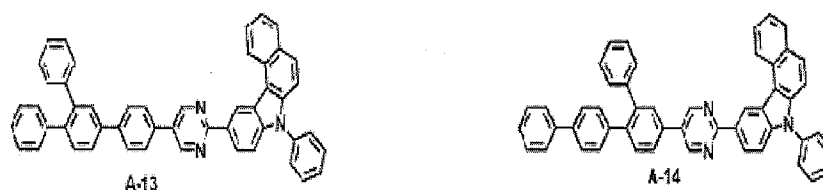
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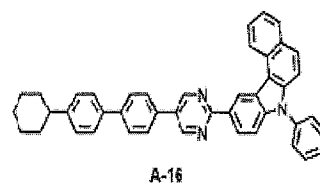
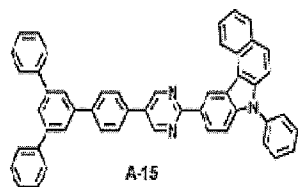
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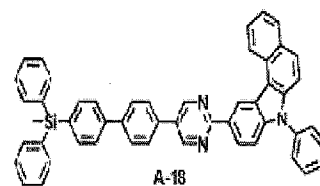
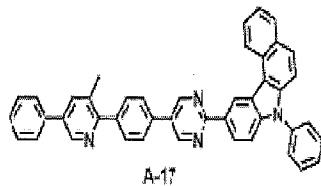
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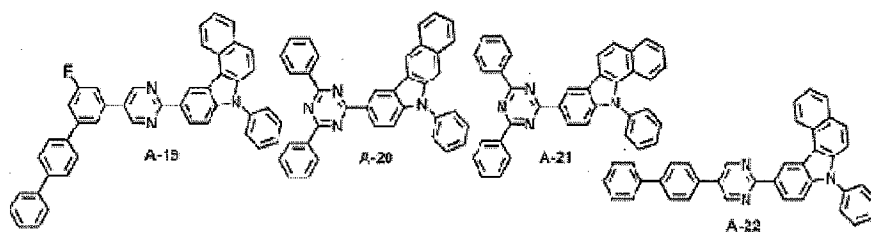
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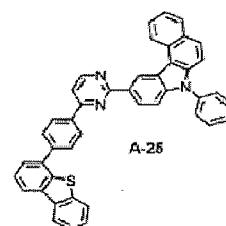
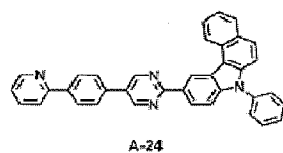
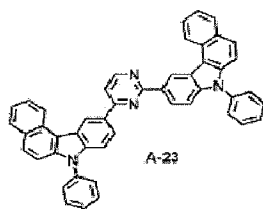
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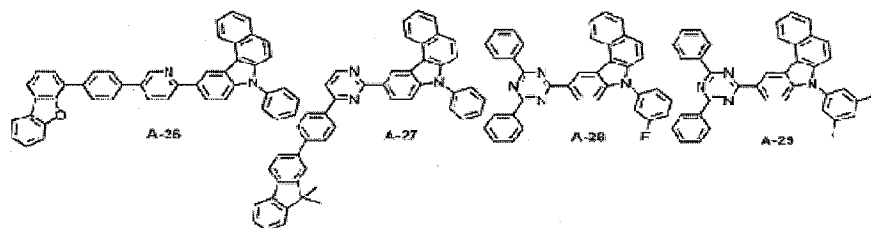
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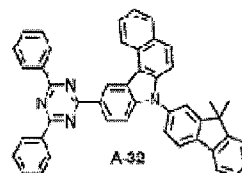
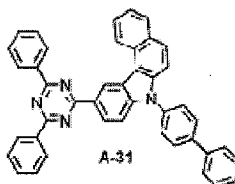
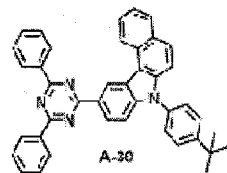
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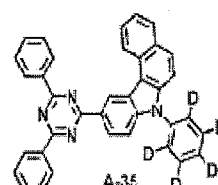
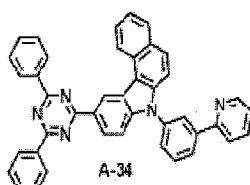
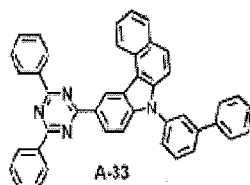
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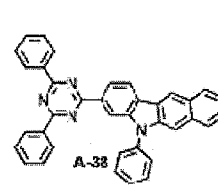
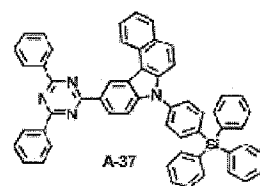
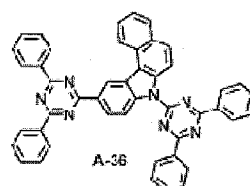
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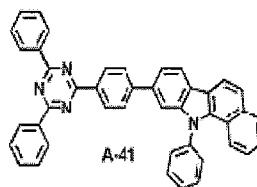
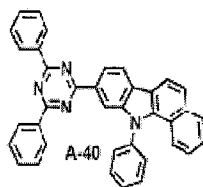
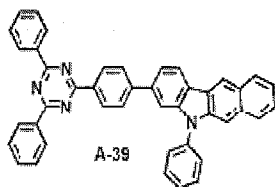
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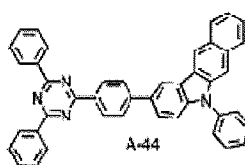
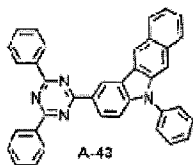
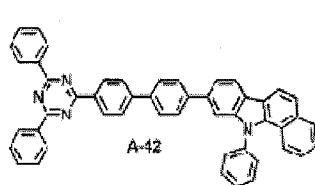
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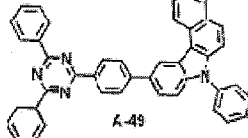
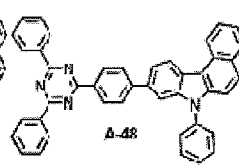
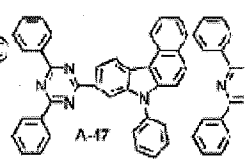
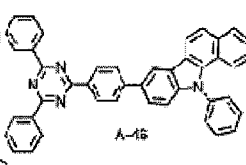
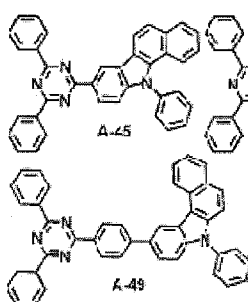
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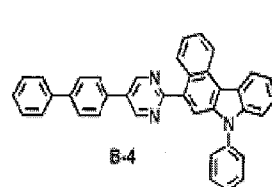
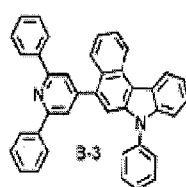
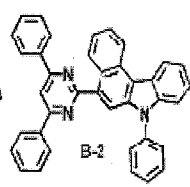
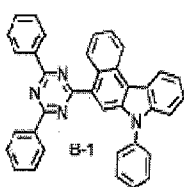
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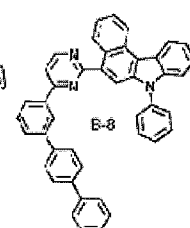
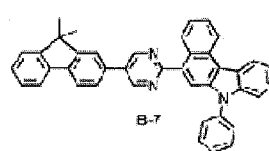
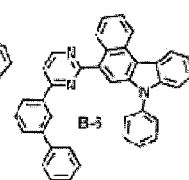
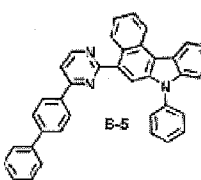
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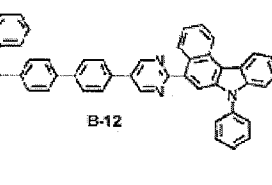
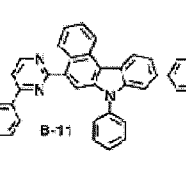
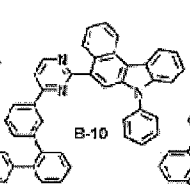
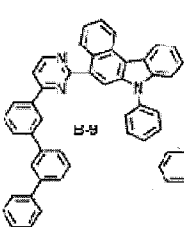
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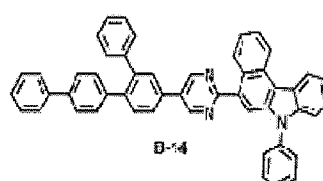
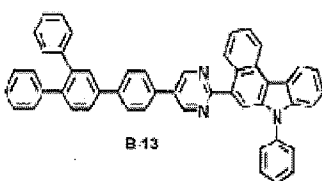
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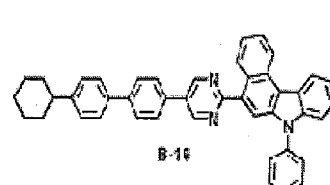
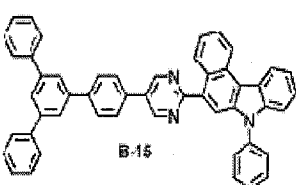
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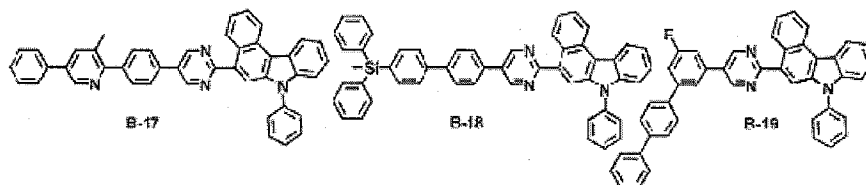
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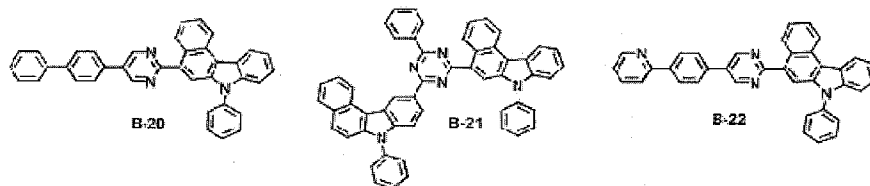
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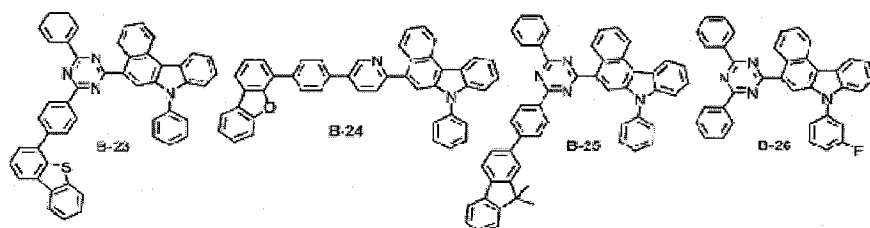
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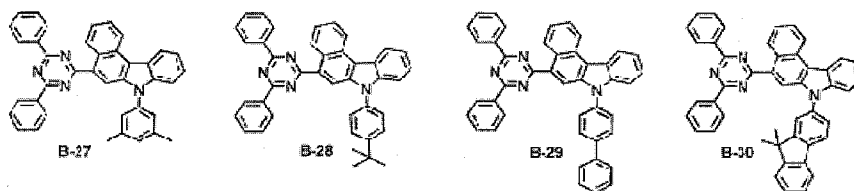
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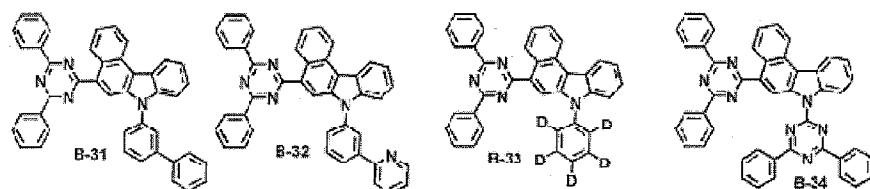
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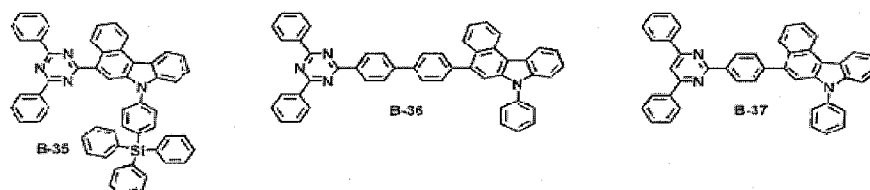
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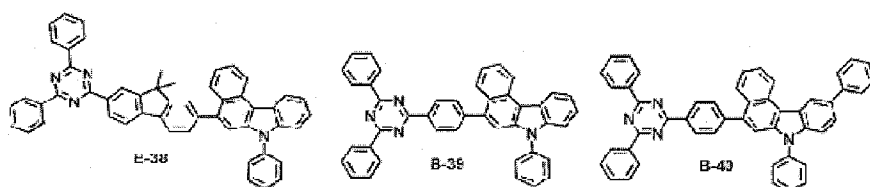
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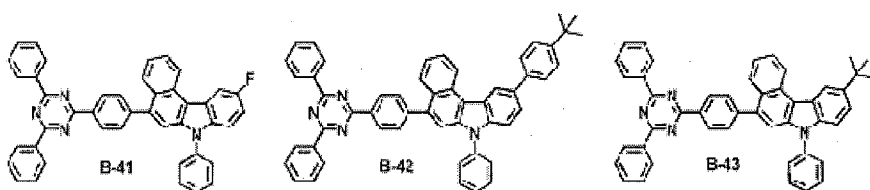
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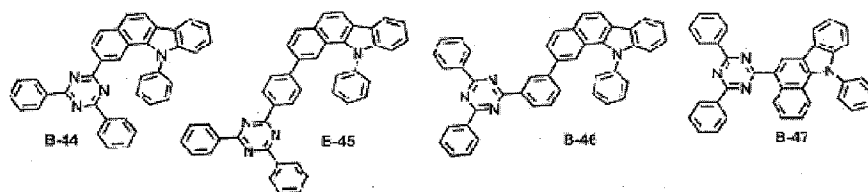
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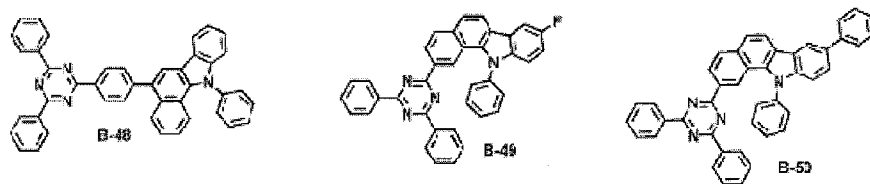
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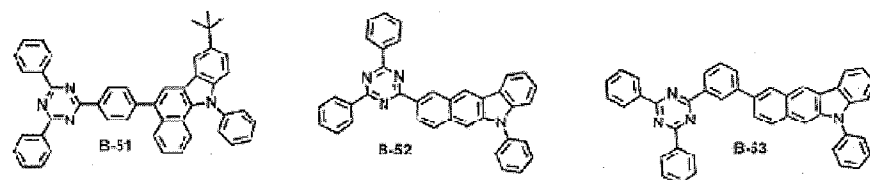
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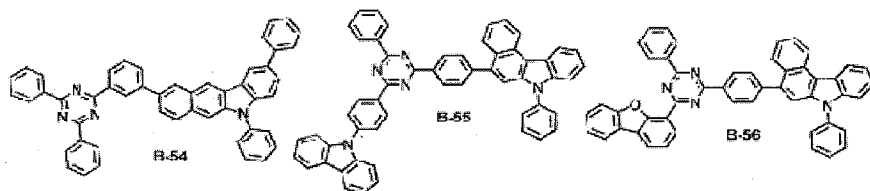
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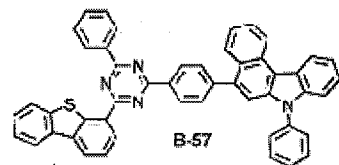
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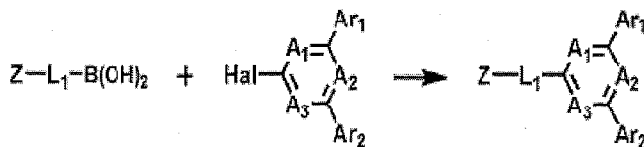
[80]



[81] The organic electroluminescence compounds according to the present invention can be prepared according to the following reaction scheme.

[82] [Reaction Scheme 1]

[83]

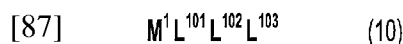


[84] wherein Z, X, R₁, R₂, a, b, L₁, Ar₁ to Ar₃, Ar₁ and Ar₂ are as defined in formula 1 above, and Hal represents a halogen.

[85] In addition, the present invention provides an organic electroluminescence material comprising the organic electroluminescence compound of formula 1, and an organic electroluminescence device comprising the material. The above material can be comprised of the organic electroluminescence compound according to the present invention alone, or can further include conventional materials generally used in organic electroluminescence materials. Said organic electroluminescence device comprises a first electrode, a second electrode, and at least one organic layer between said first and second electrodes. Said organic layer comprises at least one compound of formula 1

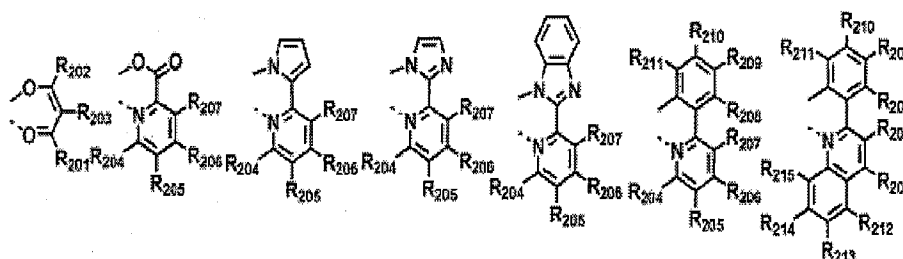
according to the present invention. Further, said organic layer comprises a light-emitting layer in which the compound of formula 1 is comprised as a host material.

- [86] When the organic electroluminescence compounds of formula 1 is used as a host in the light-emitting layer, the layer comprises at least one phosphorescent dopant. The phosphorescent dopant for an organic electroluminescence device of the present invention is not specifically limited, but the phosphorescent dopant, which is used for an organic electroluminescence device according to the present invention, may be selected from compounds represented by the following formula 10:

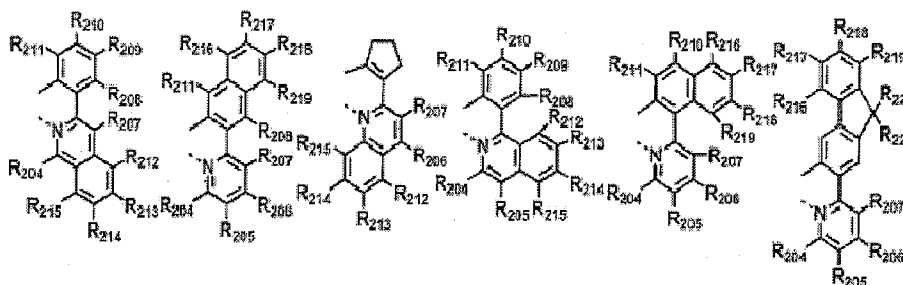


- [88] wherein M^1 is selected from the group consisting of Ir, Pt, Pd and Os; L^{101} , L^{102} and L^{103} are each independently selected from the following structures:

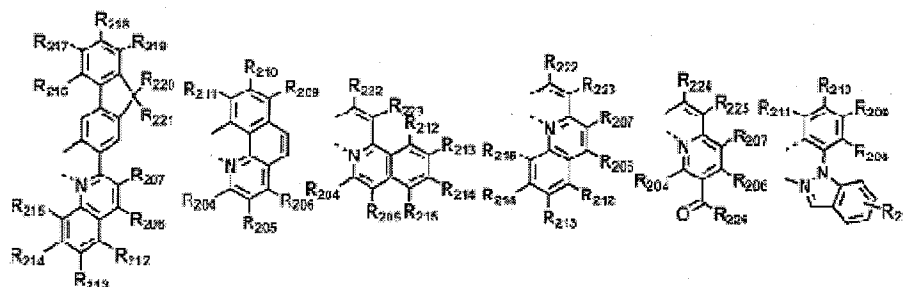
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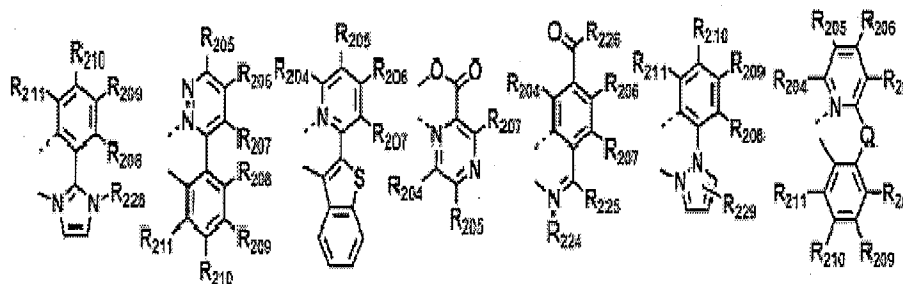
[90]



[91]



[92]

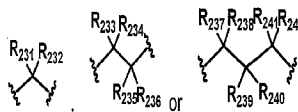


- [93] R_{201} to R_{203} each independently represent hydrogen, deuterium, a (C1-C30)alkyl group unsubstituted or substituted with halogen(s), a (C6-C30)aryl group unsubstituted

or substituted with (C1-C30)alkyl group(s), or a halogen;

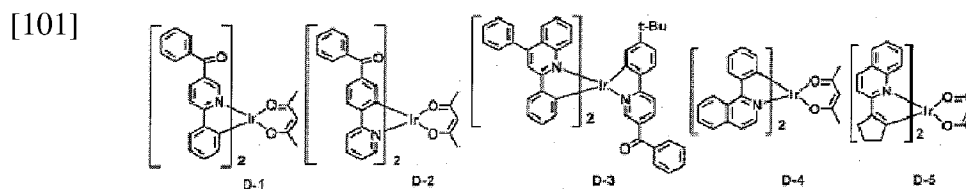
- [94] R_{204} to R_{219} each independently represent hydrogen, deuterium, a substituted or unsubstituted (C1-C30)alkyl group, a substituted or unsubstituted (C1-C30)alkoxy group, a substituted or unsubstituted (C3-C30)cycloalkyl group, a substituted or unsubstituted (C2-C30)alkenyl group, a substituted or unsubstituted (C6-C30)aryl group, a substituted or unsubstituted mono- or di-(C1-C30)alkylamino group, a substituted or unsubstituted mono- or di-(C6-C30)arylamino group, SF_5 , a substituted or unsubstituted tri(C1-C30)alkylsilyl group, a substituted or unsubstituted di(C1-C30)alkyl(C6-C30)arylsilyl group, a substituted or unsubstituted tri(C6-C30)arylsilyl group, a cyano group or a halogen;
- [95] R_{220} to R_{223} each independently represent hydrogen, deuterium, a (C1-C30)alkyl group unsubstituted or substituted with halogen(s), or a (C6-C30)aryl group unsubstituted or substituted with (C1-C30)alkyl group(s);
- [96] R_{224} and R_{225} each independently represent hydrogen, deuterium, a substituted or unsubstituted (C1-C30)alkyl group, a substituted or unsubstituted (C6-C30)aryl group, or a halogen, or R_{224} and R_{225} are linked to an adjacent substituent(s) to form a mono- or polycyclic, (C5-C30)alicyclic or aromatic ring;
- [97] R_{226} represents a substituted or unsubstituted (C1-C30)alkyl group, a substituted or unsubstituted (C6-C30)aryl group, a substituted or unsubstituted 5- or 30-membered heteroaryl group or a halogen;
- [98] R_{227} to R_{229} each independently represent hydrogen, deuterium, a substituted or unsubstituted (C1-C30)alkyl group, a substituted or unsubstituted (C6-C30)aryl group or a halogen;

- [99] Q represents

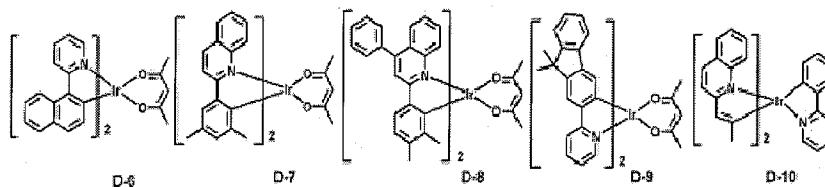


hydrogen, deuterium, a (C1-C30)alkyl group unsubstituted or substituted with halogen(s), a (C1-C30)alkoxy group, a halogen, a substituted or unsubstituted (C6-C30)aryl group, a cyano group, or a substituted or unsubstituted (C5-C30)cycloalkyl group, or each of R_{231} to R_{242} may be linked to an adjacent substituent via alkylene group or alkenylene group to form a spiro ring or a fused ring or may be linked to R_{207} or R_{208} via alkylene group or alkenylene group to form a saturated or unsaturated fused ring.

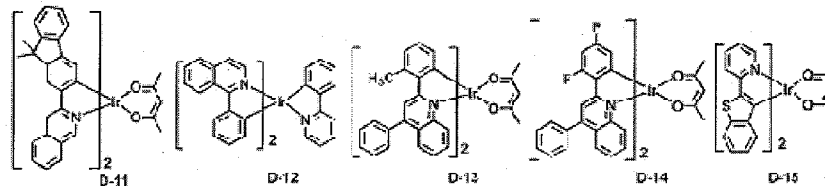
- [100] The dopants of formula 10 preferably include the following:



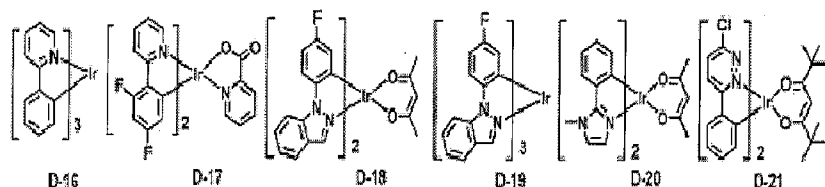
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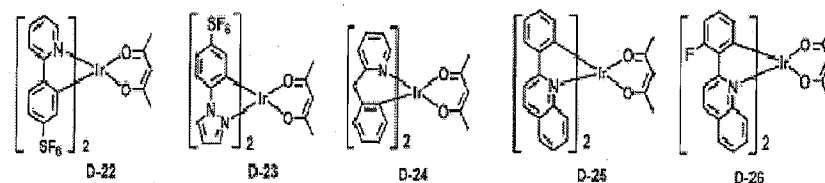
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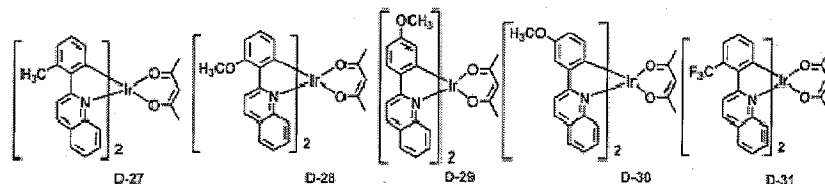
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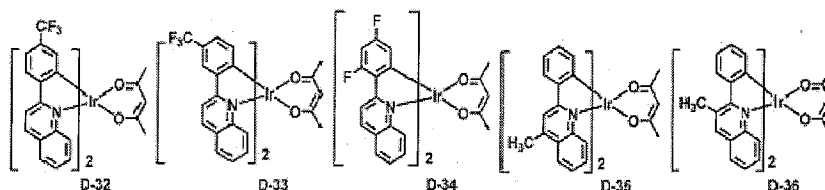
[105]



[106]



[107]



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

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

[110] In addition, the organic electroluminescence device may emit white light by further

comprising at least one light-emitting layer which comprises a blue electroluminescent compound, a red electroluminescent compound or a green electroluminescent compound, besides the compound according to the present invention.

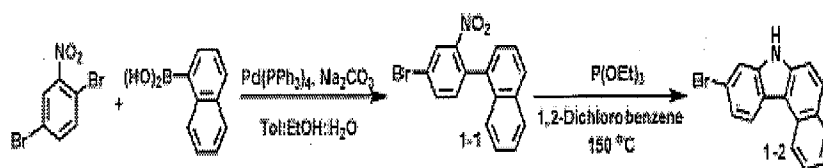
[111] Preferably, in the organic electroluminescence device according to the present invention, at least one layer (hereinafter, "a surface layer") selected from a chalcogenide layer, a metal halide layer and a metal oxide layer may be placed on an inner surface(s) of one or both electrode(s). Specifically, it is preferred that a chalcogenide (includes oxides) layer of silicon or aluminum is placed on an anode surface of an electroluminescent medium layer, and a metal halide layer or metal oxide layer is placed on a cathode surface of an electroluminescent medium layer. Such a surface layer provides operation stability for the organic electroluminescence device. Preferably, said chalcogenide includes SiO_x ($1 \leq x \leq 2$), AlO_x ($1 \leq x \leq 1.5$), SiON , SiAlON , etc.; said metal halide includes LiF , MgF_2 , CaF_2 , a rare earth metal fluoride, etc.; and said metal oxide includes Cs_2O , Li_2O , MgO , SrO , BaO , CaO , etc.

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

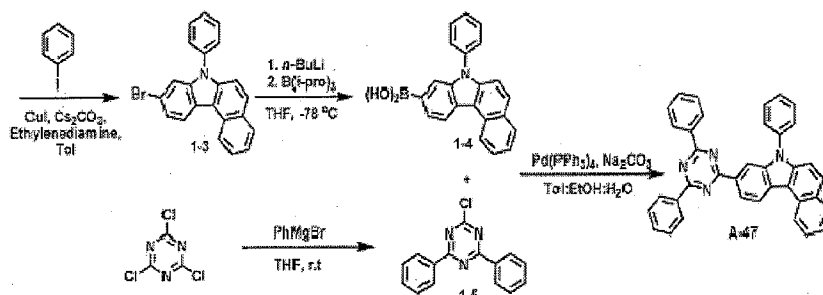
[113] Hereinafter, the organic electroluminescence compound, the preparation method of the compound, and the luminescent properties of the device comprising the compound of the present invention will be explained in detail with reference to the following examples:

[114] Example 1: Preparation of compound A-47

[115]



[116]



[117] Preparation of compound 1-1

[118] After adding 1,4-dibromo-2-nitrobenzene (30.0 g, 106.8 mmol), 1-naphthalene boronic acid (220.0 g, 128.1 mmol), Na_2CO_3 (34.0 g, 320.4 mmol), and tetrakis(triphenylphosphine)palladium(O) [$\text{Pd}(\text{PPh}_3)_4$] (6.17 g, 5.3 mmol) to toluene (640 mL)/EtOH (160 mL), the reaction mixture was stirred for 3 hours at 90°C. After terminating stirring, the reaction was completed by adding purified water (160 mL), was cooled to the room temperature, and was extracted with distilled water and ethylene acetate (EA). The obtained organic layer was concentrated, and was separated through column [methylene chloride/hexane (MC/Hex)] to obtain compound 1-1 (30 g, 86 %).

[119] Preparation of compound 1-2

[120] After mixing compound 1-1 (47.5 g, 144.75 mmol), triethyl phosphite [$\text{P}(\text{OEt})_3$] (300 mL), and 1,2-dichlorobenzene (200 mL), the reaction mixture was stirred for one day at 150°C. After terminating the reaction, the reaction mixture was concentrated under reduced pressure and was extracted with EA, and the organic layer was concentrated. The obtained organic layer was separated through column (MC/Hex) to obtain compound 1-2 (16 g, 37 %).

[121] Preparation of compound 1-3

[122] After adding compound 1-2 (15.5 g, 52.3 mmol), iodobenzene (11.7 mL, 104.7 mmol), CuI (5.0 g, 26.2 mmol), ethylene diamine (EDA) (1.8 mL, 26.2 mmol), and Cs_2CO_3 (51.2 g, 157.0 mmol) to toluene (250 mL), the reaction mixture was stirred for one day. The reaction mixture was extracted with EA, was distilled under reduced pressure, and was separated through column (MC/Hex) to obtain compound 1-3 (7.9 g, 40 %).

[123] Preparation of compound 1-4

[124] After dissolving compound 1-3 (7.84 g, 21.1 mmol) in tetrahydrofuran (THF) (200 mL), and cooling the reaction mixture to -78°C, 2.5 M n-BuLi in hexane (10.1 mL, 25.3 mmol) was slowly added to the reaction mixture, and the reaction mixture was stirred for 1 hour. $\text{B}(\text{Oi-Pr})_3$ (6.3 mL, 27.4 mmol) was added to the reaction mixture at the same temperature, and the reaction mixture was stirred for one day. After terminating stirring, the reaction mixture was quenched by adding 2M HCl, was extracted

with distilled water and EA, and the organic layer was concentrated. The obtained organic layer was recrystallized with MC and Hex to obtain compound 1-4 (5.54 g, 78 %).

[125] Preparation of compound 1-5

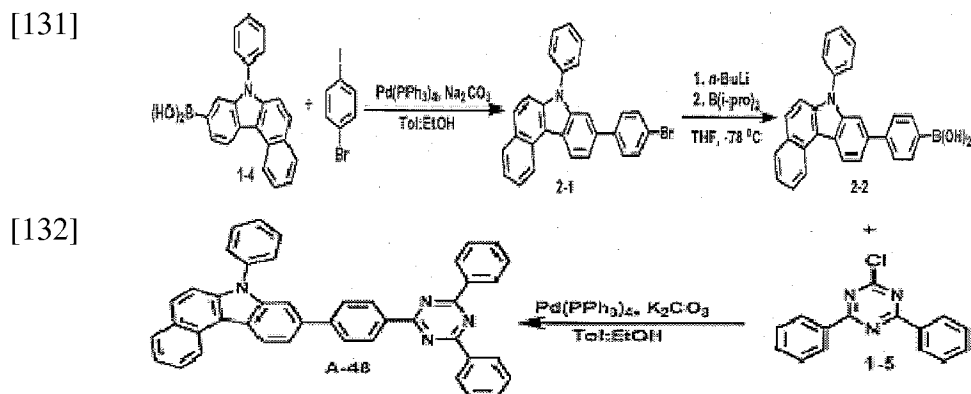
[126] Cyanuric chloride (36 g, 195 mmol) was added to a flask and was dissolved with THF (360 mL). The reaction mixture was cooled to 0°C and PhMgBr (160 mL) was slowly added thereto. After increasing to room temperature, the reaction mixture was stirred for 2 hours and distilled water was added to complete the reaction. The organic layer was extracted with EA, was dried with MgSO₄ to remove the remaining moisture, and was recrystallized with MC/MeOH to obtain compound 1-5 (30 g, 57 %).

[127] Preparation of compound A-47

[128] After dissolving compound 1-4 (3.0 g, 11.2 mmol), compound 1-5 (4.5 g, 13.5 mmol), Pd(PPh₃)₄ (648 mg, 0.561 mmol) and Na₂CO₃ (3.6 g, 33.6 mmol) in toluene (80 mL)/EtOH (20 mL)/distilled water (20 mL), the reaction mixture was stirred for one day under reflux. Purified water was added to the reaction mixture, and the reaction mixture was filtered under reduced pressure. The obtained solid was dissolved with MC, and was separated through column (MC/Hex) to obtain compound A-47 (3.5 g, 60 %).

[129] MS/FAB found 524.61; calculated 524.20

[130] Example 2: Preparation of compound A- 48



[133] Preparation of compound 2-1

[134] Compound 1-4 (7.3 g, 21.65 mmol), 1-bromo-4-iodobenzene (18.3 g, 64.95 mmol), Pd(PPh₃)₄ (1.25 g, 1.08 mmol) and Na₂CO₃ (6.9 g, 64.95 mmol) were added to a flask, were dissolved with THF (200 mL)/EtOH (32 mL), and the reaction mixture was stirred for 3 hours at 90°C. After terminating stirring, distilled water was slowly added to the reaction mixture to complete the reaction, the reaction mixture was cooled to room temperature, and was extracted with distilled water and EA. The obtained organic layer was concentrated and was separated through column to obtain compound

2-1 (6.7 g, 68 %).

[135] Preparation of compound 2-2

[136] Compound 2-1 (6.7 g, 14.94 mmol) was added to a flask, was dissolved with THF (100 mL), and the reaction mixture was cooled to -78°C . After 10 minutes, 2.5 M n-BuLi in hexane (7.1 mL, 17.93 mmol) was slowly added to the flask, and the reaction mixture was stirred for 1 hour. At the same temperature, $\text{B}(\text{Oi-Pr})_3$ (5.15 mL, 22.4 mmol) was slowly added to the reaction mixture and the reaction mixture was stirred for 24 hours. After completing stirring, the reaction mixture was quenched by adding 1M HCl, and was extracted with distilled water and EA. The obtained organic layer was concentrated and was recrystallized with MC and Hex to obtain compound 2-2 (4 g, 65 %).

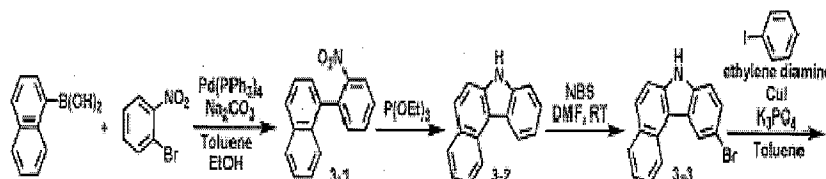
[137] Preparation of compound A-48

[138] Compound 2-2 (2.39 g, 8.95 mmol), compound 1-5 (4.079 g, 9.84 mmol), $\text{Pd}(\text{PPh}_3)_4$ (0.516 g, 0.44 mmol) and K_2CO_3 (3.7 g, 26.7 mmol) were added to a flask, were dissolved with toluene (50 mL)/EtOH (13 mL), and the reaction mixture was refluxed for 24 hours at 120°C . After completing the reaction by adding distilled water, the reaction mixture was cooled to room temperature and was extracted with distilled water and EA. The obtained organic layer was concentrated and was recrystallized with EA and MeOH to obtain compound A-48 (1.8 g, 35 %).

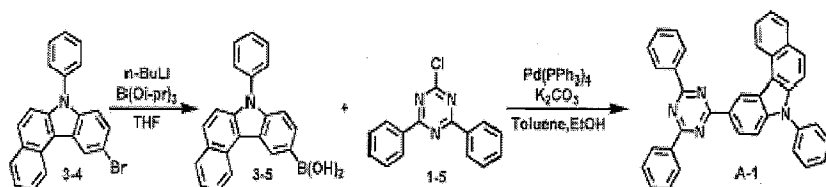
[139] MS/FAB found 600.71; calculated 600.23

[140] Example 3: Preparation of compound A-1

[141]



[142]



[143] Preparation of compound 3-1

[144] After adding 1-bromo-2-nitrobenzene (100 g, 495 mmol), 1-naphthalene boronic acid (102 g, 593 mmol), $\text{Pd}(\text{PPh}_3)_4$ (23 g, 19.9 mmol) and K_2CO_3 (171 g, 1237 mmol) to a flask and dissolving the reaction mixture by adding toluene (1.2 L)/EtOH (600 mL), the reaction mixture was stirred for 3 hours at 90°C . After terminating stirring, the reaction was completed by slowly adding purified water, and the organic layer was extracted EA and was dried with MgSO_4 to remove the remaining moisture. The obtained organic layer was separated through column to obtain compound 3-1 (106 g,

86 %).

[145] Preparation of compound 3-2

[146] After adding compound 3-1 (106 g, 425 mmol) to a flask and dissolving the compound by adding triethyl phosphite (500 mL), the reaction mixture was stirred for 24 hours at 150°C. After completing the reaction, the remaining solvent was removed by a distillation device and was separated through column to obtain compound 3-2 (55 g, 60 %).

[147] Preparation of compound 3-3

[148] After dissolving compound 3-2 (20 g, 92 mmol) in dimethylformamide (DMF) at 0°C, N-bromosuccinimide (NBS) (16.3 g, 92 mmol) was slowly added to the reaction mixture and the reaction mixture was stirred for 24 hours. After completing the reaction, the organic layer was extracted EA and was dried with MgSO₄ to remove the remaining moisture. The obtained organic layer was separated through column to obtain compound 3-3 (23.5 g, 87 %).

[149] Preparation of compound 3-4

[150] After adding compound 3-3 (20 g, 6.5 mmol), iodobenzene (15 mL, 135 mmol), CuI (6.4 g, 33.6 mmol), ethylenediamine (2.3 mL, 33.6 mmol) and K₂PO₄ (43 g, 202.5 mmol) to a flask and dissolving the reaction mixture by adding toluene (300 mL), the reaction mixture was stirred for 24 hours at 120°C. After completing the reaction, the organic layer was extracted EA and was dried with MgSO₄ to remove the remaining moisture. The obtained organic layer was separated through column to obtain compound 3-4 (19 g, 76 %).

[151] Preparation of compound 3-5

[152] Compound 3-4 (19 g, 51 mmol) was added to a flask, was dissolved with THF (300 mL), and the reaction mixture was cooled to -78°C. After 10 minutes, 2.5 M n-BuLi in hexane (24.4 mL, 61.2 mmol) was slowly added to the flask, and the reaction mixture was stirred for 1 hour. At the same temperature, triisopropyl borate (14.1 mL, 61.2 mmol) was slowly added to the reaction mixture and the reaction mixture was stirred for 24 hours. After completing stirring, the reaction mixture was quenched by adding 1M HCl, was extracted with distilled water and EA, and was dried with MgSO₄ to remove the remaining moisture. The obtained organic layer was concentrated and was recrystallized with MC and Hex to obtain compound 3-5 (12 g, 70 %).

[153] Preparation of compound A-1

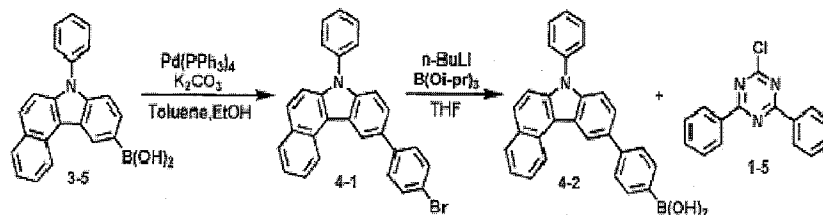
[154] Compound 3-5 (8.2 g, 24.3 mmol), compound 1-5 (5.43 g, 20.1 mmol), Pd(PPh₃)₄ (0.93 g, 0.81 mmol) and K₂CO₃ (8.4 g, 60.8 mmol) were added to a flask, were dissolved with toluene (70 mL)/EtOH (30 mL), and the reaction mixture was stirred for 24 hours at 120°C. After completing the reaction by adding distilled water, the organic layer was extracted with EA, and was dried with MgSO₄ to remove the remaining

moisture. The obtained organic layer was recrystallized with EA and MeOH to obtain compound A-1 (2.3 g, 23 %).

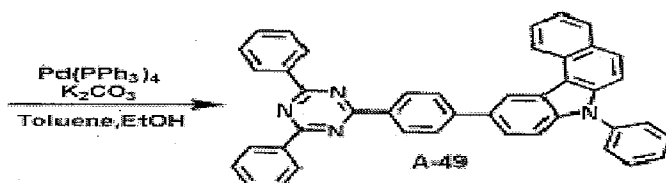
[155] MS/FAB found 524.61; calculated 524.20

[156] Example 4: Preparation of compound A-49

[157]



[158]



[159] Preparation of compound 4-1

[160] After adding compound 3-5 (22 g, 65 mmol), 1-bromo-4-iodobenzene (28 g, 98.95 mmol), Pd(PPh₃)₄ (3.7 g, 3.2 mmol) and Na₂CO₃ (20.7 g, 195 mmol) to a flask and dissolving the reaction mixture by adding toluene (330 mL)/EtOH (150 mL), the reaction mixture was stirred for 3 hours at 90°C. After terminating stirring, the reaction was completed by adding purified water, and the organic layer was extracted EA and was dried with MgSO₄ to remove the remaining moisture. The obtained organic layer was separated through column to obtain compound 4-1 (25 g, 86 %).

[161] Preparation of compound 4-2

[162] After dissolving compound 4-1 (25 g, 55.7 mmol) in tetrahydrofuran (THF) (300 mL) in a flask, and cooling the reaction mixture to -78°C. After 10 minutes, 2.5 M n-BuLi in hexane (29 mL, 72.41 mmol) was slowly added to the reaction mixture, and the reaction mixture was stirred for 1 hour. At the same temperature, triisopropyl borate (19.2 mL, 83.5 mmol) was slowly added to the reaction mixture and the reaction mixture was stirred for 24 hours. After completing stirring, the reaction mixture was quenched by adding 1M HCl, and the organic layer was extracted with distilled water and EA, and was dried with MgSO₄ to remove the remaining moisture. The obtained organic layer was recrystallized with MC and Hex to obtain compound 4-2 (16.5 g, 71 %).

[163] Preparation of compound A- 49

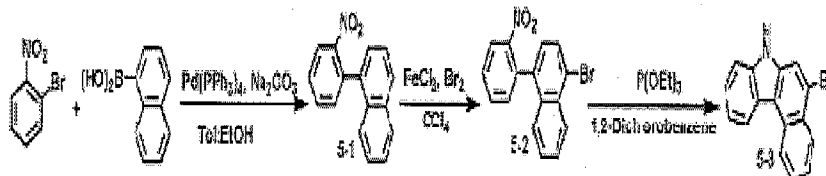
[164] Compound 4-2 (16.5 g, 40 mmol), compound 1-5 (8 g, 29.8 mmol), Pd(PPh₃)₄ (1.7 g, 1.5 mmol) and K₂CO₃ (12.4 g, 89.4 mmol) were added to a flask, were dissolved with toluene (150 mL)/EtOH (75 mL), and the reaction mixture was refluxed for 24 hours at 120°C. After completing the reaction by adding distilled water, the organic layer was

extracted with EA, and was dried with MgSO_4 to remove the remaining moisture. The obtained organic layer was recrystallized with EA and MeOH to obtain compound A-49 (6 g, 32 %).

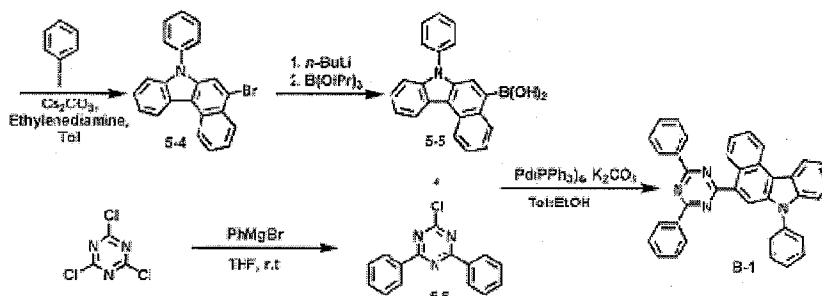
[165] MS/FAB found 600.71; calculated 600.23

[166] Example 5: Preparation of compound B-1

[167]



[168]



[169] Preparation of compound 5-1

[170] After adding 2-bromonitrobenzene (29.3 g, 145 mmol), 1-naphthaleneboronic acid (30 g, 174 mmol), $\text{Pd(PPh}_3)_4$ (6.7 g, 5.8 mmol) and Na_2CO_3 (38 g, 362 mmol) to toluene (550 mL)/EtOH (180 mL)/distilled water (180 mL), the reaction mixture was stirred for 2 hours at 110°C . After cooling to room temperature, the reaction mixture was extracted with distilled water and EA, and was dried with MgSO_4 to remove the remaining moisture. The obtained organic layer was concentrated and was separated through column (MC/Hex) to obtain compound 5-1 (30 g, 82 %).

[171] Preparation of compound 5-2

[172] Compound 5-1 (26.5 g, 106 mmol) and CCl_4 (250 mL) were mixed, were cooled to -5°C , were added with FeCl_3 (1.7 g, 10.6 mmol) and were dropwise added with Br_2 (17 g, 176 mmol). After stirring overnight, the reaction mixture was quenched with aqueous $\text{Na}_2\text{S}_2\text{O}_3$ solution, was washed with aqueous 2M NaOH solution, was extracted with distilled water and MC, and was dried with MgSO_4 to remove the remaining moisture. The obtained organic layer was concentrated and was separated through column (MC/Hex) to obtain compound 5-2 (31 g, 90 %).

[173] Preparation of compound 5-3

[174] Compound 5-2 (31 g, 95 mmol), P(OEt)_3 (150 mL), and 1,2-dichlorobenzene (150 mL) were mixed, and were stirred overnight at 140°C . After completing the reaction, the reaction mixture was concentrated under reduced pressure and was extracted with EA. The obtained organic layer was concentrated and was separated through column (MC/Hex) to obtain compound 5-3 (15 g, 52 %).

[175] Preparation of compound 5-4

[176] After adding compound 5-3 (7.5 g, 25.3 mmol), iodobenzene (7.5 mL, 51 mmol), CuI (5.4 g, 12.7 mmol), ethylenediamine (EDA) (0.88 mL, 12.7 mmol) and Cs_2CO_3 (23 g, 76 mmol) to toluene (125 mL), the reaction mixture was stirred for one day at 120°C. The reaction mixture was extracted with distilled water and EA, and was dried with MgSO_4 to remove the remaining moisture. The obtained organic layer was concentrated and was separated through column (MC/Hex) to obtain compound 5-4 (7.9 g, 84 %).

[177] Preparation of compound 5-5

[178] After dissolving compound 5-4 (7.5 g, 79 mmol) THF (75 mL), the reaction mixture was cooled to -78°C, 2.5 M n-BuLi in hexane (10 mL, 103 mmol) was slowly added to the reaction mixture, and the reaction mixture was stirred for 1 hour. At the same temperature, $\text{B}(\text{Oi-Pr})_3$ (6.8 mL, 119 mmol) was added to the reaction mixture and the reaction mixture was stirred for one day. After completing stirring, the reaction mixture was quenched by adding 2M HCl, was extracted with distilled water and EA. The obtained organic layer was concentrated and was recrystallized with MC and Hex to obtain compound 5-5 (5 g, 75 %).

[179] Preparation of compound 5-6

[180] Cyanuric chloride (50 g, 91 mmol) was added to a flask and was dissolved with THF (1.3 L). The reaction mixture was cooled to 0°C and 3M solution of PhMgBr (225 mL) in diethyl ether was slowly added thereto. After increasing to room temperature, the reaction mixture was stirred for 3 hours and added with distilled water to complete the reaction. The organic layer was extracted with EA, was dried with MgSO_4 to remove the remaining moisture, and was distilled under reduced pressure. The crude product 5-6 (37 g, 63 %) was obtained by filtering the mixture under silica by using MC as an elution solvent, which showed a high purity sufficient to be used in next steps.

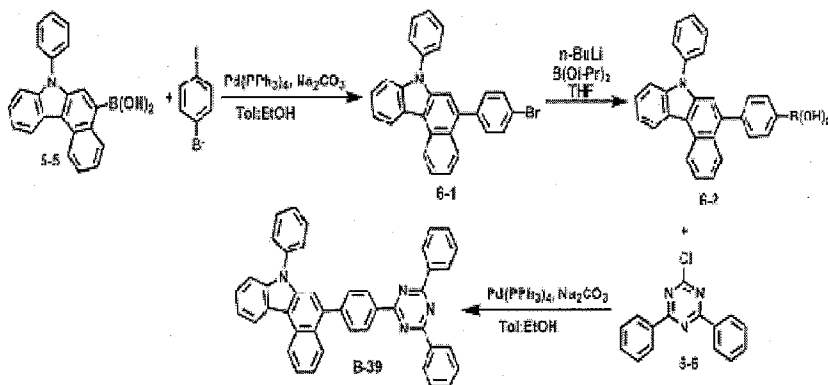
[181] Preparation of compound B-1

[182] After dissolving compound 5-5 (6.5 g, 19.2 mmol), compound 5-6 (4.3 g, 16 mmol), $\text{Pd}(\text{PPh}_3)_4$ (0.9 g, 0.8 mmol) and K_2CO_3 (6.6 g, 48 mmol) to toluene (100 mL)/EtOH (24 mL)/distilled water (24 mL), the reaction mixture was stirred for one day at 100°C. After adding distilled water and filtering under reduced pressure, the obtained solid was dissolved with MC and was separated through column (MC/Hex) to obtain compound B-1 (5.4 g, 64 %).

[183] MS/FAB found 524.61; calculated 524.20

[184] Example 6: Preparation of compound B-39

[185]



[186] Preparation of compound 6-1

[187] After adding compound 5-5 (22 g, 65 mmol), 1-bromo-4-iodobenzene (28 g, 98.95 mmol), Pd(PPh₃)₄ (3.7 g, 3.2 mmol) and Na₂CO₃ (20.7 g, 195 mmol) to a flask, and dissolving the mixture by adding toluene (330 mL)/EtOH (150 mL), the reaction mixture was stirred for 3 hours at 90°C. After completing stirring, the reaction was completed by slowly adding distilled water thereto, was cooled to room temperature, and was extracted with distilled water and EA. The obtained organic layer was concentrated and separated through column to obtain compound 6-1 (25 g, 86 %).

[188] Preparation of compound 6-2

[189] Compound 6-1 (25 g, 55.7 mmol) was added to a flask, was dissolved with THF (300 mL), and the reaction mixture was cooled to -78°C. After 10 minutes, 2.5 M n-BuLi in hexane (29 mL, 72.4 mmol) was slowly added to the flask, and the reaction mixture was stirred for 1 hour. At the same temperature, B(Oi-Pr)₃ (19.2 mL, 83.5 mmol) was slowly added to the reaction mixture and the reaction mixture was stirred for 24 hours. After completing stirring, the reaction mixture was quenched by adding 1M HCl, was extracted with distilled water and EA. The obtained organic layer was concentrated and was recrystallized with MC and Hex to obtain compound 6-2 (16.5 g, 71 %).

[190] Preparation of compound B-39

[191] After adding compound 6-2 (16.5 g, 40 mmol), compound 5-6 (8 g, 29.8 mmol), Pd(PPh₃)₄ (1.7 g, 1.5 mmol) and K₂CO₃ (12.4 g, 89.4 mmol) to a flask, and dissolving the mixture by adding toluene (150 mL)/EtOH (75 mL), the reaction mixture was stirred for 24 hours at 120°C. The reaction was completed by slowly adding distilled water, was cooled to room temperature, and was extracted with distilled water and EA. The obtained organic layer was concentrated and was recrystallized with EA and MeOH to obtain compound B-39 (6 g, 32 %).

[192] MS/FAB found 600.71; calculated 600.23

[193] Device Example 1: Production of an OLED device using the compound according to the present invention

[194] An OLED device was produced using the compound according to the present

invention. A transparent electrode indium tin oxide (ITO) thin film (15 Ω/sq) on a glass substrate for an organic light-emitting diode (OLED) device (Samsung Corning, Republic of Korea) was subjected to an ultrasonic washing with trichloroethylene, acetone, ethanol and distilled water, sequentially, and then was stored in isopropanol. Then, the ITO substrate was mounted on a substrate holder of a vacuum vapor depositing apparatus. N1,N1'-([1,1'-biphenyl]-4,4'-diyl)bis(N1-(naphthalen-1-yl)-N⁴,N⁴-diphenylbenzene-1,4-diamine) was introduced into a cell of said vacuum vapor depositing apparatus, and then the pressure in the chamber of said apparatus was controlled to 10^{-6} torr. Thereafter, an electric current was applied to the cell to evaporate the above introduced material, thereby forming a hole injection layer having a thickness of 60 nm on the ITO substrate. Then, N,N'-di(4-biphenyl)-N,N'-di(4-biphenyl)-4,4'-diaminobiphenyl was introduced into another cell of said vacuum vapor depositing apparatus, and was evaporated by applying electric current to the cell, thereby forming a hole transport layer having a thickness of 20 nm on the hole injection layer. Thereafter, compound **A-1** was introduced into one cell of the vacuum vapor depositing apparatus, as a host material, and compound **D-7** was introduced into another cell as a dopant. The two materials were evaporated at different rates and deposited in a doping amount of 4 wt% of the dopant, based on the total weight of the host and dopant, to form a light-emitting layer having a thickness of 30 nm on the hole transport layer. Then, 2-(4-(9,10-di(naphthalen-2-yl)anthracen-2-yl)phenyl)-1-phenyl-1H-benzo[d]imidazole was introduced into one cell and lithium quinolate (Liq) was introduced into another cell. The two materials were evaporated at the same rate and were respectively deposited in a doping amount of 50 wt% to form an electron transport layer having a thickness of 30 nm on the light-emitting layer. Then, after depositing lithium quinolate as an electron injection layer having a thickness of 2 nm on the electron transport layer, an Al cathode having a thickness of 150 nm was deposited by another vacuum vapor deposition apparatus on the electron injection layer. Thus, an OLED device was produced. All the materials used for producing the OLED device were purified by vacuum sublimation at 10^{-6} torr prior to use.

- [195] The produced OLED device showed red emission having a luminance of 740 cd/m^2 and a current density of 5.3 mA/cm^2 at a driving voltage of 5.9 V. Further, the time taken to be reduced to 90 % of the luminance at a luminance of 5,000 nit was at least 100 hours.
- [196] Device Example 2: Production of an OLED device using the compound according to the present invention
- [197] An OLED device was produced in the same manner as in Device Example 1, except for using compound **A-47** as a host material and compound **D-7** as a dopant.

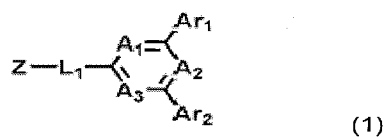
- [198] The produced OLED device showed red emission having a luminance of 1430 cd/m² and a current density of 12.31 mA/cm² at a driving voltage of 3.5 V. Further, the time taken to be reduced to 90 % of the luminance at a luminance of 5,000nit was at least 80 hours.
- [199] Device Example 3: Production of an OLED device using the compound according to the present invention
- [200] An OLED device was produced in the same manner as in Device Example 1, except for using compound **A-48** as a host material and compound **D-11** as a dopant.
- [201] The produced OLED device showed red emission having a luminance of 835 cd/m² and a current density of 13.6 mA/cm² at a driving voltage of 3.0 V. Further, the time taken to be reduced to 90 % of the luminance at a luminance of 5,000nit was at least 30 hours.
- [202] Device Example 4: Production of an OLED device using the compound according to the present invention
- [203] An OLED device was produced in the same manner as in Device Example 1, except for using compound **A-49** as a host material and compound **D-7** as a dopant.
- [204] The produced OLED device showed red emission having a luminance of 2100 cd/m² and a current density of 16.2 mA/cm² at a driving voltage of 6.1 V. Further, the time taken to be reduced to 90 % of the luminance at a luminance of 5,000nit was at least 70 hours.
- [205] Device Example 5: Production of an OLED device using the compound according to the present invention
- [206] An OLED device was produced in the same manner as in Device Example 1, except for using compound **B-1** as a host material and compound **D-7** as a dopant.
- [207] The produced OLED device showed red emission having a luminance of 1010 cd/m² and a current density of 6.6 mA/cm² at a driving voltage of 3.8 V. Further, the time taken to be reduced to 90 % of the luminance at a luminance of 5,000nit was at least 50 hours.
- [208] Device Example 6: Production of an OLED device using the compound according to the present invention
- [209] An OLED device was produced in the same manner as in Device Example 1, except for using compound **B-39** as a host material and compound **D-11** as a dopant.
- [210] The produced OLED device showed red emission having a luminance of 420 cd/m² and a current density of 5.46 mA/cm² at a driving voltage of 2.9 V. Further, the time taken to be reduced to 90 % of the luminance at a luminance of 5,000nit was at least 20 hours.
- [211] Comparative Example 1: Production of an OLED device using conventional electro-luminescent compounds

- [212] An OLED device was produced in the same manner as in Device Example 1, except that a light-emitting layer was deposited by using 4,4'-bis(carbazol-9-yl)biphenyl (CBP) as a host material and compound **D-7** as a dopant, and between the light-emitting layer and the electron transport layer, a hole blocking layer having a thickness of 10 nm was deposited by using bis(2-methyl-8-quinolinato)(p-phenylphenolato)aluminum(III) (Balq).
- [213] The produced OLED device showed red emission having a luminance of 1000 cd/m² and a current density of 14.1 mA/cm² at a driving voltage of 7.8 V.
- [214] Comparative Example 2: Production of an OLED device using conventional electro-luminescent compounds
- [215] An OLED device was produced in the same manner as in Device Example 1, except that a light-emitting layer was deposited by using 4,4'-bis(carbazol-9-yl)biphenyl (CBP) as a host material and compound **D-11** as a dopant, and between the light-emitting layer and the electron transport layer, a hole blocking layer having a thickness of 10 nm was deposited by using bis(2-methyl-8-quinolinato)(p-phenylphenolato)aluminum(III) (Balq).
- [216] The produced OLED device showed red emission having a luminance of 1000 cd/m² and a current density of 20.4 mA/cm² at a driving voltage of 8.2 V. Further, the time taken to be reduced to 90 % of the luminance at a luminance of 5,000nit was at least 10 hours.
- [217] The organic electroluminescence compounds of the present invention have superior luminous characteristics than the conventional materials. In addition, a device using the organic electroluminescence compounds according to the present invention as a host material not only has excellent luminous characteristics, but also increases power efficiency by reducing the driving voltage.

Claims

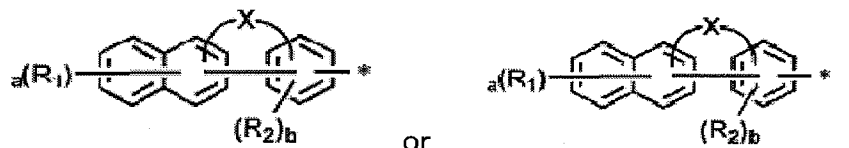
[Claim 1]

An organic electroluminescence compound represented by the following formula 1:



wherein

Z represents



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

Ar_1 to Ar_3 each independently represent CR_{11} or N, proviso that Ar_1 to Ar_3 simultaneously do not represent CH;

X represents -O-, -S-, $-CR_{12}R_{13}-$, or $-NR_{14}-$;

R_1 , R_2 , R_{11} , Ar_1 and Ar_2 each independently represent hydrogen, deuterium, a halogen, a substituted or unsubstituted (C1-C30)alkyl group, a substituted or unsubstituted (C6-C30)aryl group, a substituted or unsubstituted 3- to 30-membered heteroaryl group, $-NR_{15}R_{16}$, $-SiR_{17}R_{18}R_{19}$, $-SR_{20}$, $-OR_{21}$, a cyano group, or a nitro group;

R_{12} to R_{14} each independently represent a substituted or unsubstituted (C1-C30)alkyl group, a substituted or unsubstituted (C6-C30)aryl group, a substituted or unsubstituted 3- to 30-membered heteroaryl group;

R_{15} to R_{21} each independently represent hydrogen, deuterium, a halogen, a substituted or unsubstituted (C1-C30)alkyl group, a substituted or unsubstituted (C6-C30)aryl group, or a substituted or unsubstituted 3- to 30-membered heteroaryl group; or are linked to an adjacent substituent(s) to form a mono- or polycyclic, (C5-C30)alicyclic or aromatic ring whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen and sulfur;

a represents an integer of 1 to 6; where a is an integer of 2 or more, each of R_1 is the same or different

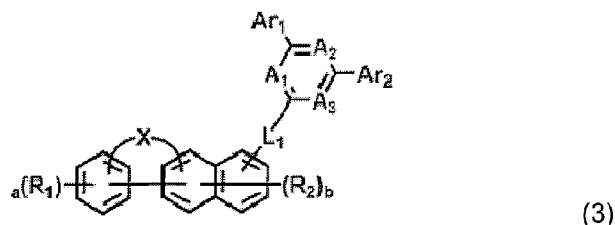
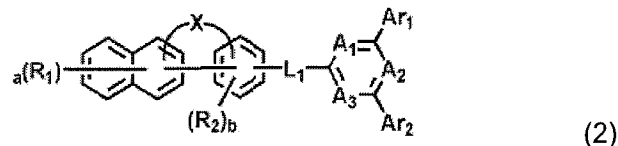
b represents an integer of 1 to 3; where b is an integer of 2 or more,

each of R_2 is the same or different;

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

[Claim 2]

The organic electroluminescence compound according to claim 1, which is selected from the group consisting of following formulae 2 and 3:



wherein

X, R_1 , R_2 , a, b, L_1 , A_1 to A_3 , Ar_1 , and Ar_2 are as defined in claim 1.

[Claim 3]

The organic electroluminescence compound according to claim 1, wherein the substituents of the substituted alkyl group, the substituted aryl(ene) group, the substituted heteroaryl(ene) group, the substituted cycloalkyl(ene) group, the substituted heterocycloalkyl group and the substituted aralkyl group in L_1 , R_1 , R_2 , R_{11} to R_{21} , Ar_1 , and Ar_2 of formula 1 each independently are at least one selected from the group consisting of deuterium; a halogen; a (C1-C30)alkyl group substituted or unsubstituted with a halogen; a (C6-C30)aryl group; a 3- to 30-membered heteroaryl group substituted or unsubstituted with a (C1-C30)alkyl or a (C6-C30)aryl; a (C3-C30)cycloalkyl group; a 5- to 7-membered heterocycloalkyl group; a tri(C1-C30)alkylsilyl group; a tri(C6-C30)arylsilyl group; a di(C1-C30)alkyl(C6-C30)arylsilyl group; a (C1-C30)alkyldi(C6-C30)arylsilyl group; a (C2-C30)alkenyl group; a (C2-C30)alkynyl group; a cyano group; an N-carbazolyl group; a di(C1-C30)alkylamino group; a di(C6-C30)arylamino group; a (C1-C30)alkyl(C6-C30)arylamino group; a di(C6-C30)arylboronyl group; a di(C1-C30)alkylboronyl group; a (C1-C30)alkyl(C6-C30)arylboronyl group; a (C6-C30)aryl(C1-C30)alkyl group; a (C1-C30)alkyl(C6-C30)aryl group; a carboxyl group; a nitro group; and a hydroxyl group.

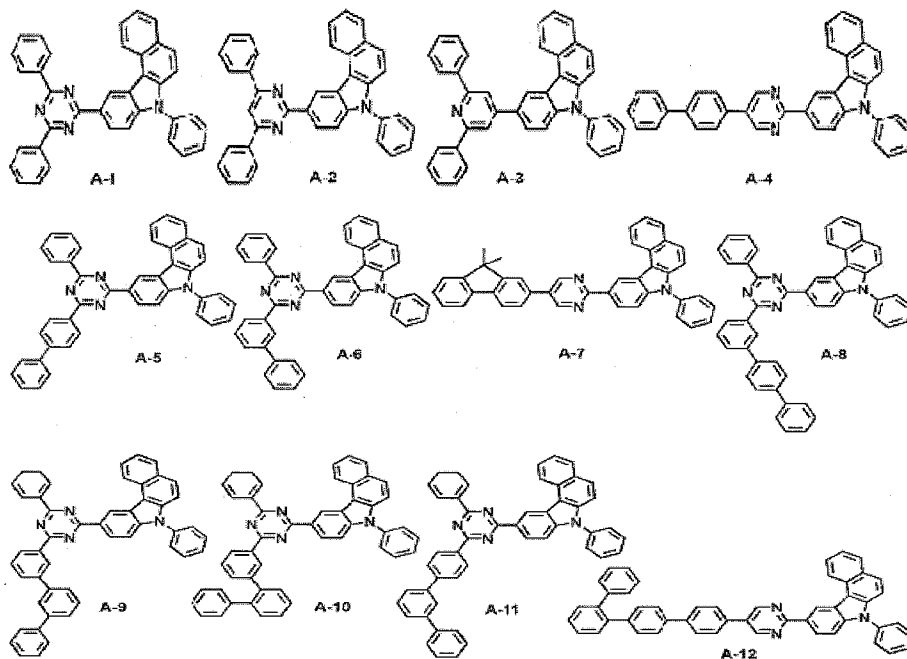
[Claim 4]

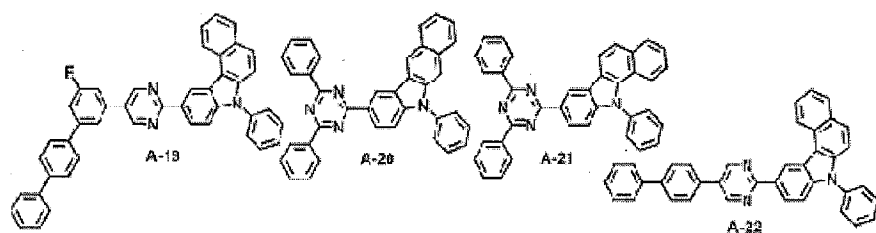
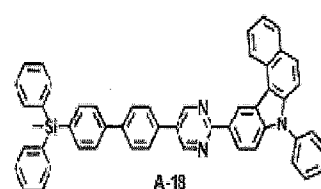
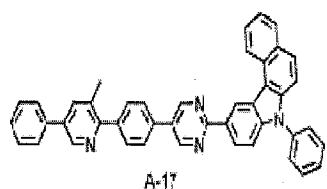
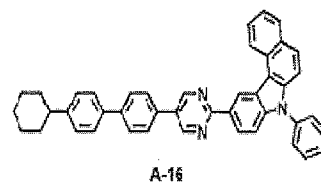
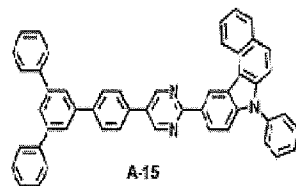
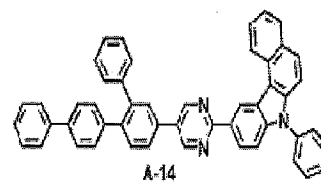
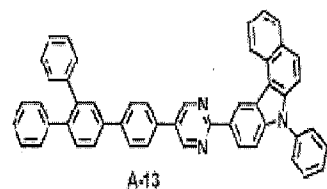
The organic electroluminescence compound according to claim 1,

wherein L_1 represents a single bond or a (C6-C30)arylene group; Ar_1 to Ar_3 each independently represent CR_{11} or N, proviso that Ar_1 to Ar_3 do not simultaneously represent CH; X represents $-NR_{14}-$; R_{11} represents hydrogen, deuterium, a (C1-C30)alkyl group, a (C6-C30)aryl group, or a 3- to 30-membered heteroaryl group; R_{14} represents a (C1-C30)alkyl group, a (C6-C30)aryl group, or a 3- to 30-membered heteroaryl group; and R_1 , R_2 , Ar_1 and Ar_2 each independently represent hydrogen, deuterium, a halogen, a (C1-C30)alkyl group, a (C6-C30)aryl group, or a 3- to 30-membered heteroaryl group; the arylene of L_1 , and the alkyl, aryl, and heteroaryl of R_1 , R_2 , R_{11} , R_{14} , Ar_1 and Ar_2 may be substituted with at least one selected from the group consisting of deuterium, a halogen, a (C1-C30)alkyl, a halo(C1-C30)alkyl, a (C6-C30)aryl, a 3- to 30-membered heteroaryl group, a 3- to 30-membered heteroaryl group substituted with a (C6-C30)aryl and/or a (C1-C30)alkyl, a (C3-C30)cycloalkyl, a tri(C1-C30)alkylsilyl, a tri(C6-C30)arylsilyl group, a di(C1-C30)alkyl(C6-C30)arylsilyl, a (C1-C30)alkyldi(C6-C30)arylsilyl group, a (C6-C30)aryl(C1-C30)alkyl group, and a (C1-C30)alkyl(C6-C30)aryl.

[Claim 5]

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

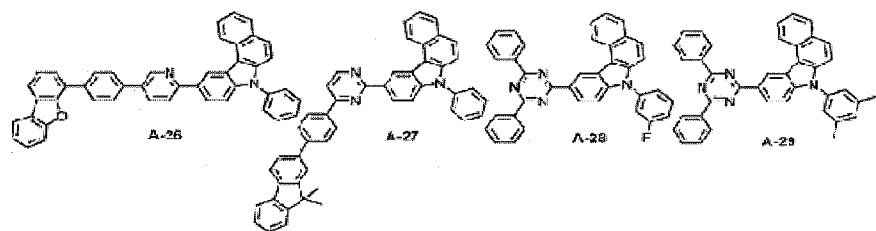
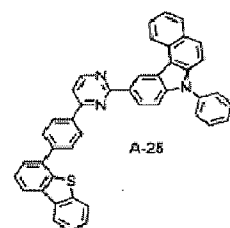
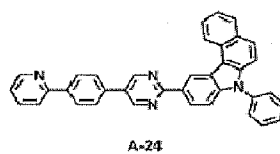
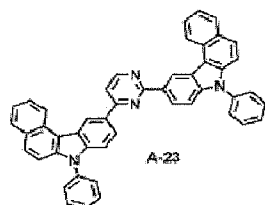




A-20

A-21

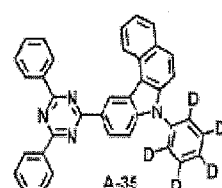
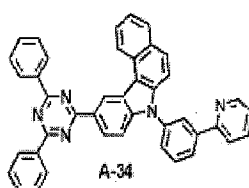
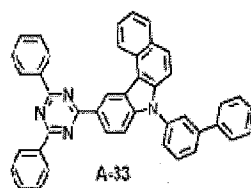
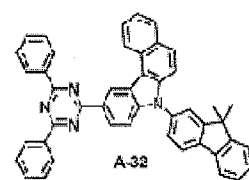
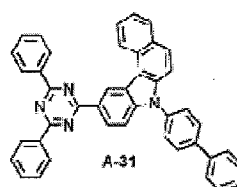
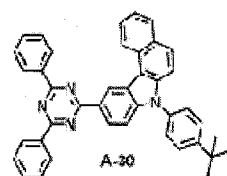
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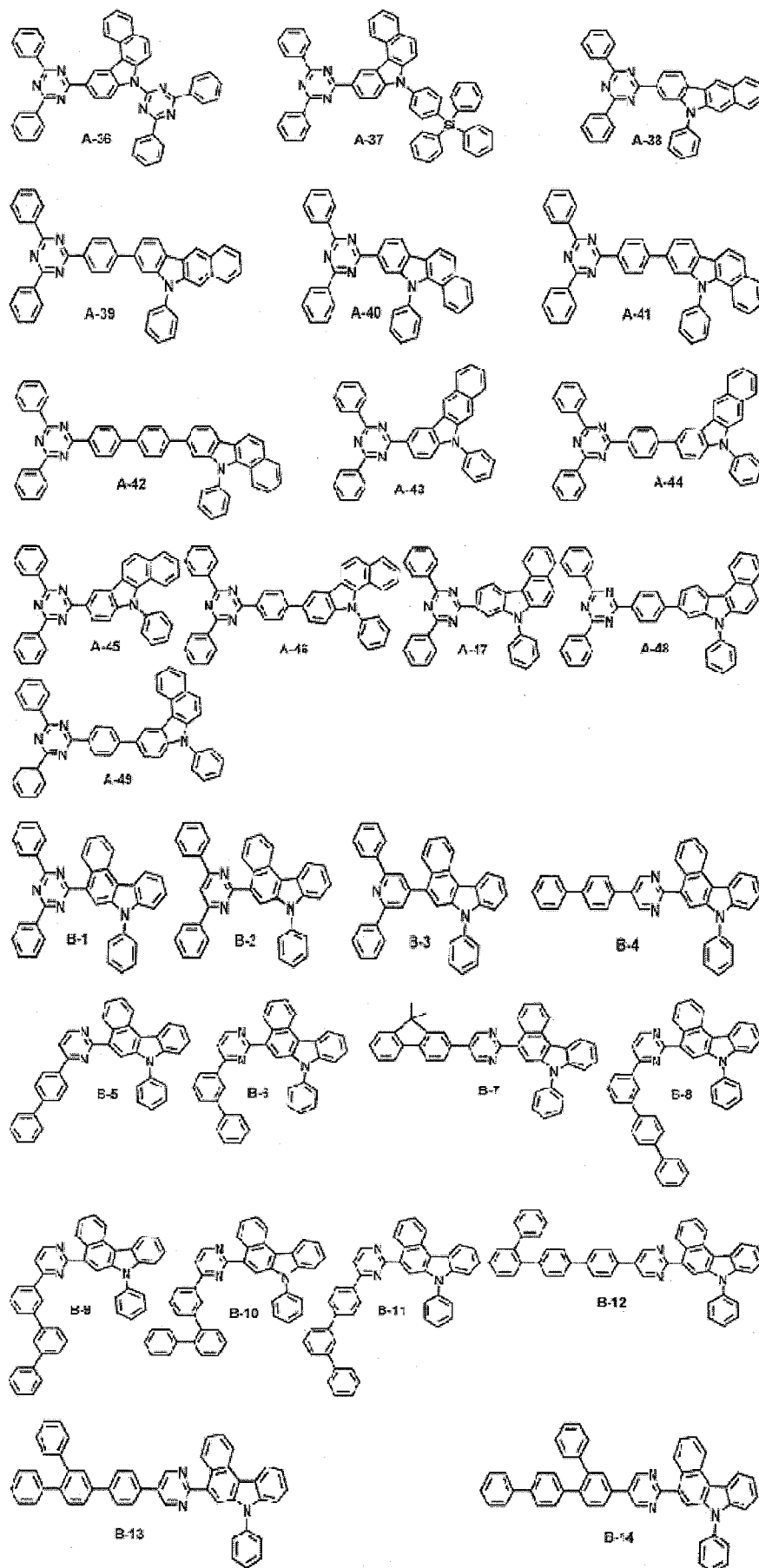


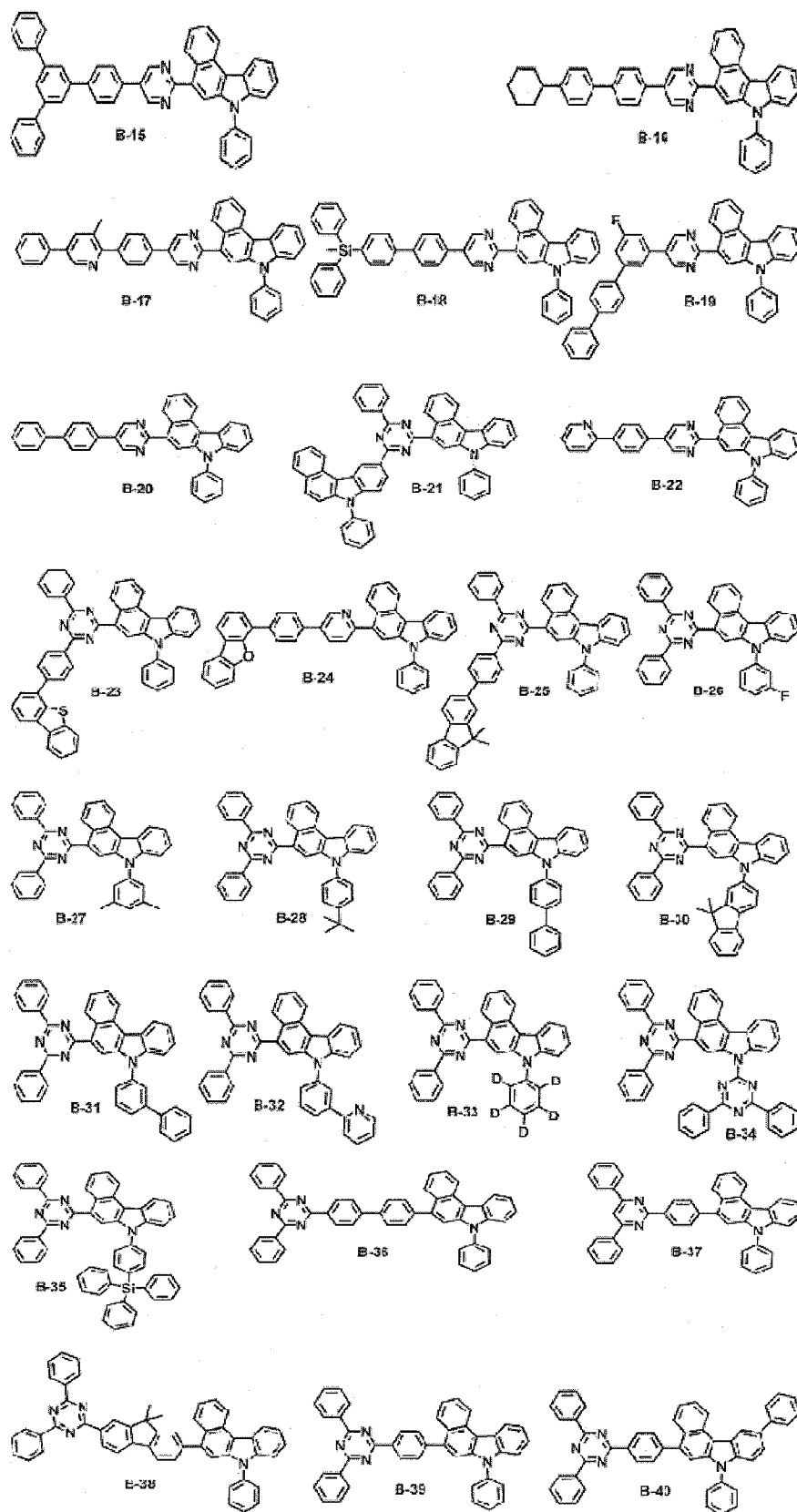
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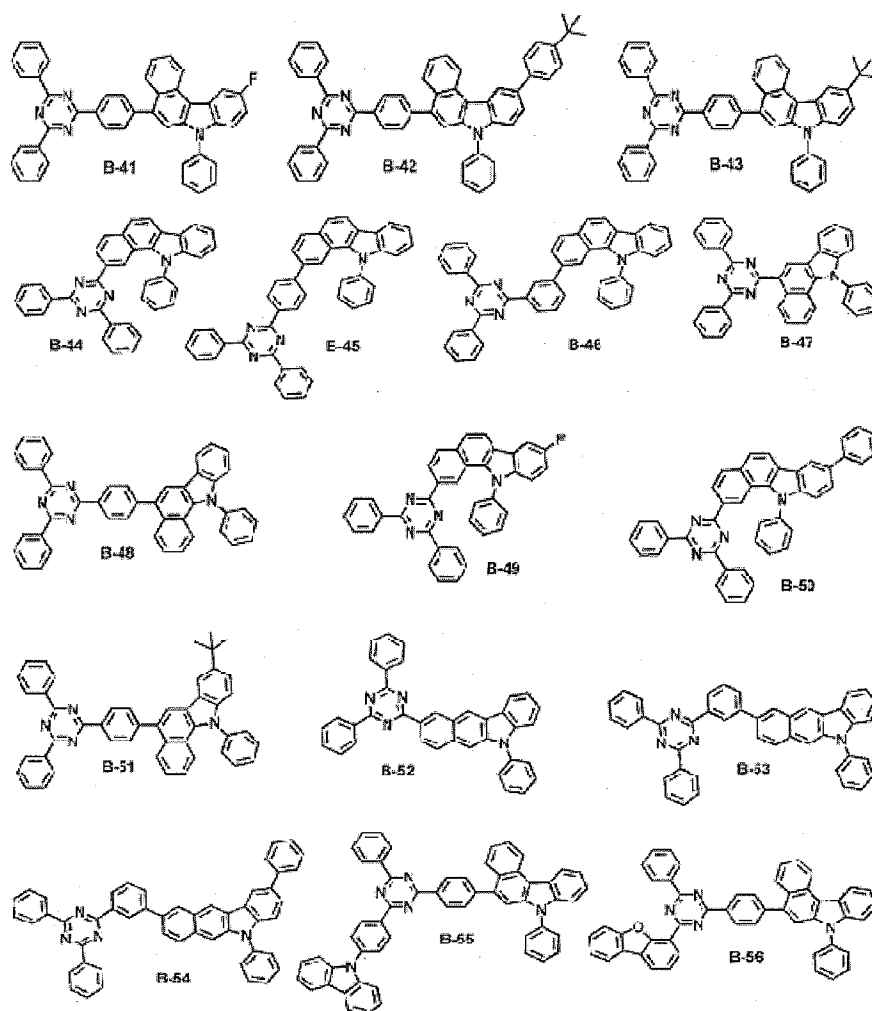
A-28

A-29

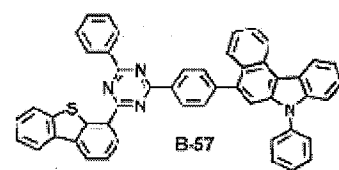








and



[Claim 6]

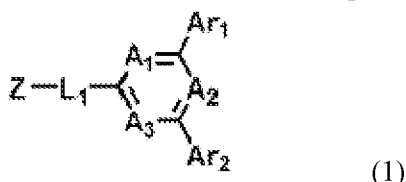
An organic electroluminescence device comprising the compound according to claim 1.

AMENDED CLAIMS

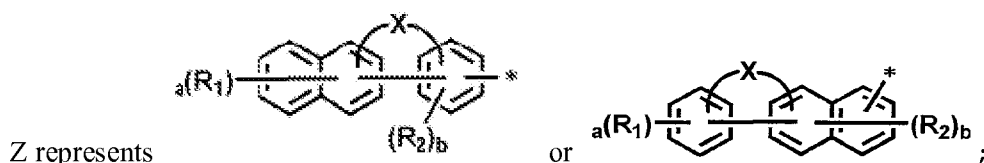
received by the International Bureau on 16 January 2013 (16.01.2013)

What is claimed is:

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



wherein



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

A_1 to A_3 each independently represent CR_{11} or N, proviso that A_1 to A_3 simultaneously do not represent CH;

X represents -O-, -S-, $-CR_{12}R_{13}-$, or $-NR_{14}-$;

R_1 , R_2 , R_{11} , Ar_1 and Ar_2 each independently represent hydrogen, deuterium, a halogen, a substituted or unsubstituted (C1-C30)alkyl group, a substituted or unsubstituted (C6-C30)aryl group, a substituted or unsubstituted 3- to 30-membered heteroaryl group, $-NR_{15}R_{16}$, $-SiR_{17}R_{18}R_{19}$, $-SR_{20}$, $-OR_{21}$, a cyano group, or a nitro group;

R_{12} to R_{14} each independently represent a substituted or unsubstituted (C1-C30)alkyl group, a substituted or unsubstituted (C6-C30)aryl group, a substituted or unsubstituted 3- to 30-membered heteroaryl group;

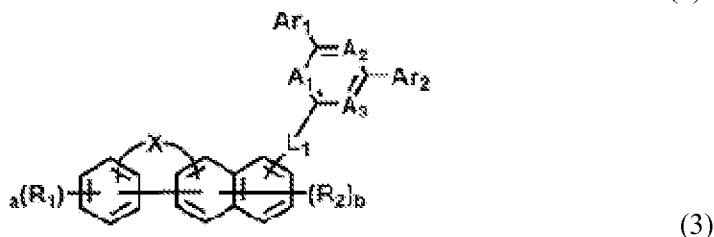
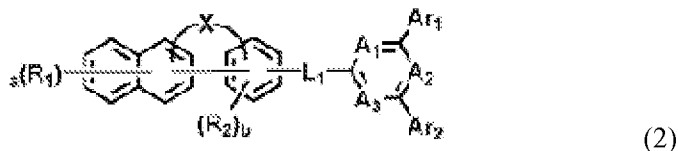
R_{15} to R_{21} each independently represent hydrogen, deuterium, a halogen, a substituted or unsubstituted (C1-C30)alkyl group, a substituted or unsubstituted (C6-C30)aryl group, or a substituted or unsubstituted 3- to 30-membered heteroaryl group; or are linked to an adjacent substituent(s) to form a mono- or polycyclic, (C5-C30)alicyclic or aromatic ring whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen and sulfur;

a represents an integer of 1 to 6; where a is an integer of 2 or more, each of R_1 is the same or different

b represents an integer of 1 to 3; where b is an integer of 2 or more, each of R_2 is the same or different;

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

2. The organic electroluminescence compound according to claim 1, which is selected from the group consisting of following formulae 2 and 3:



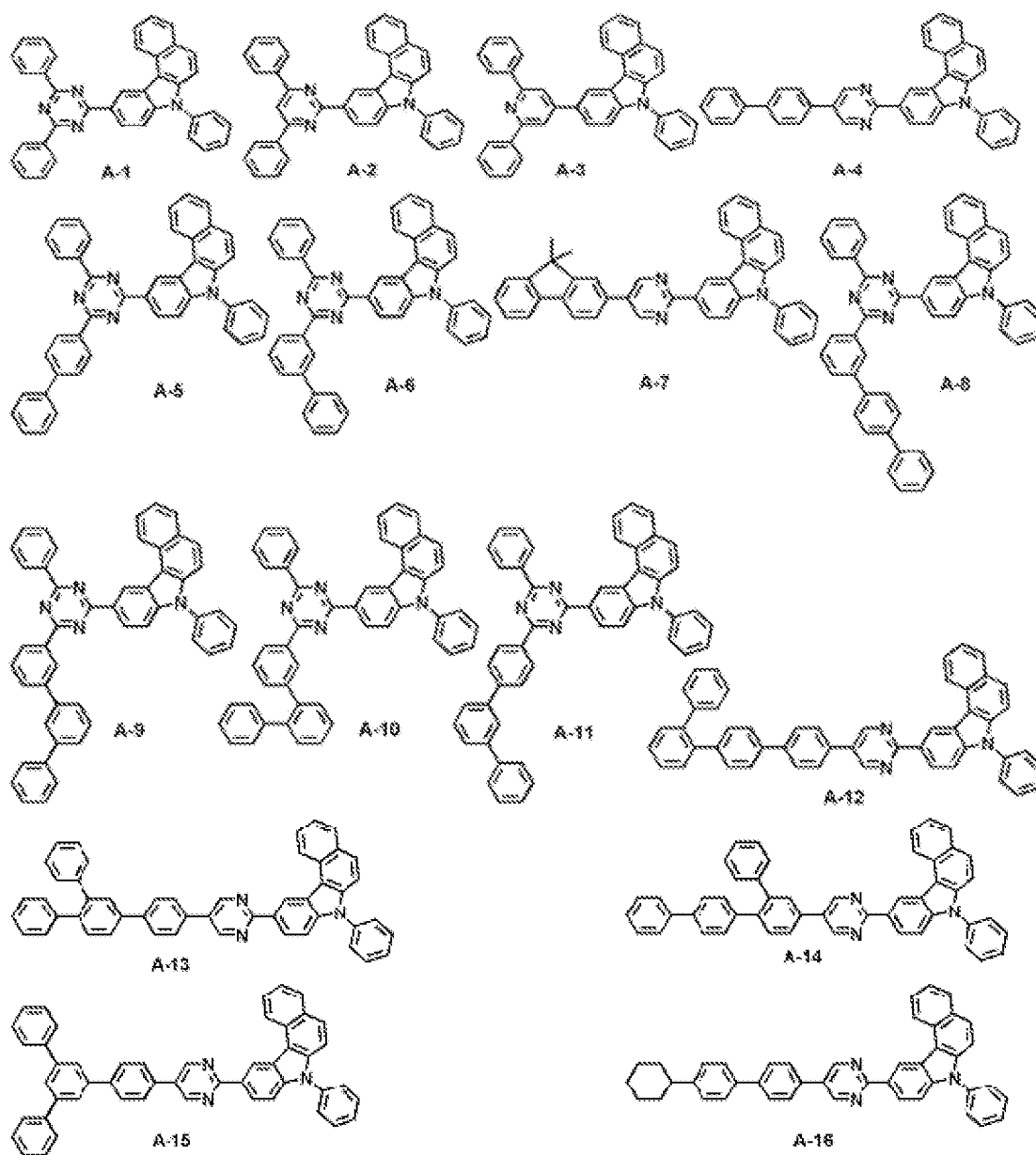
wherein

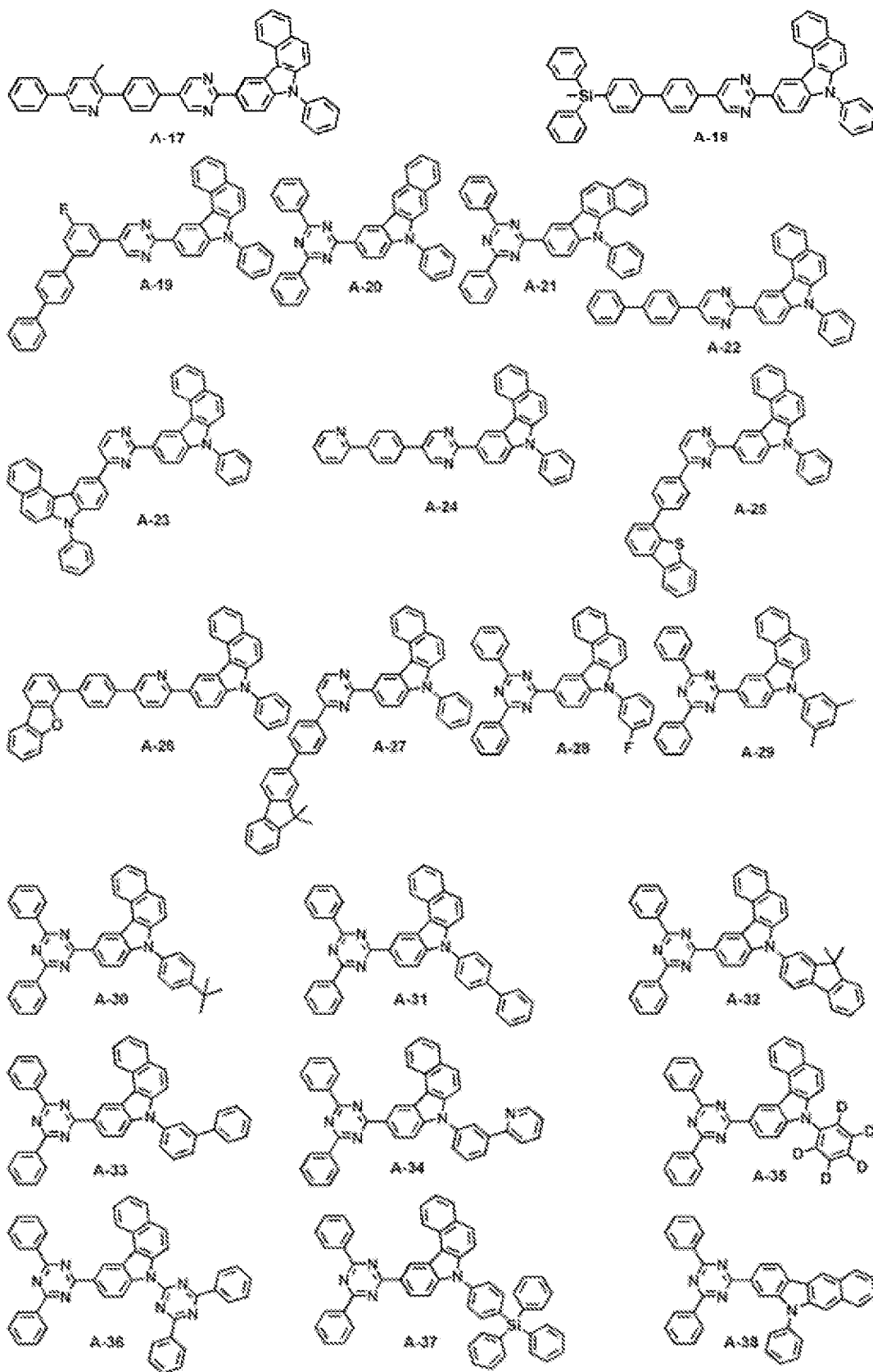
X, R₁, R₂, a, b, L₁, A₁ to A₃, Ar₁, and Ar₂ are as defined in claim 1.

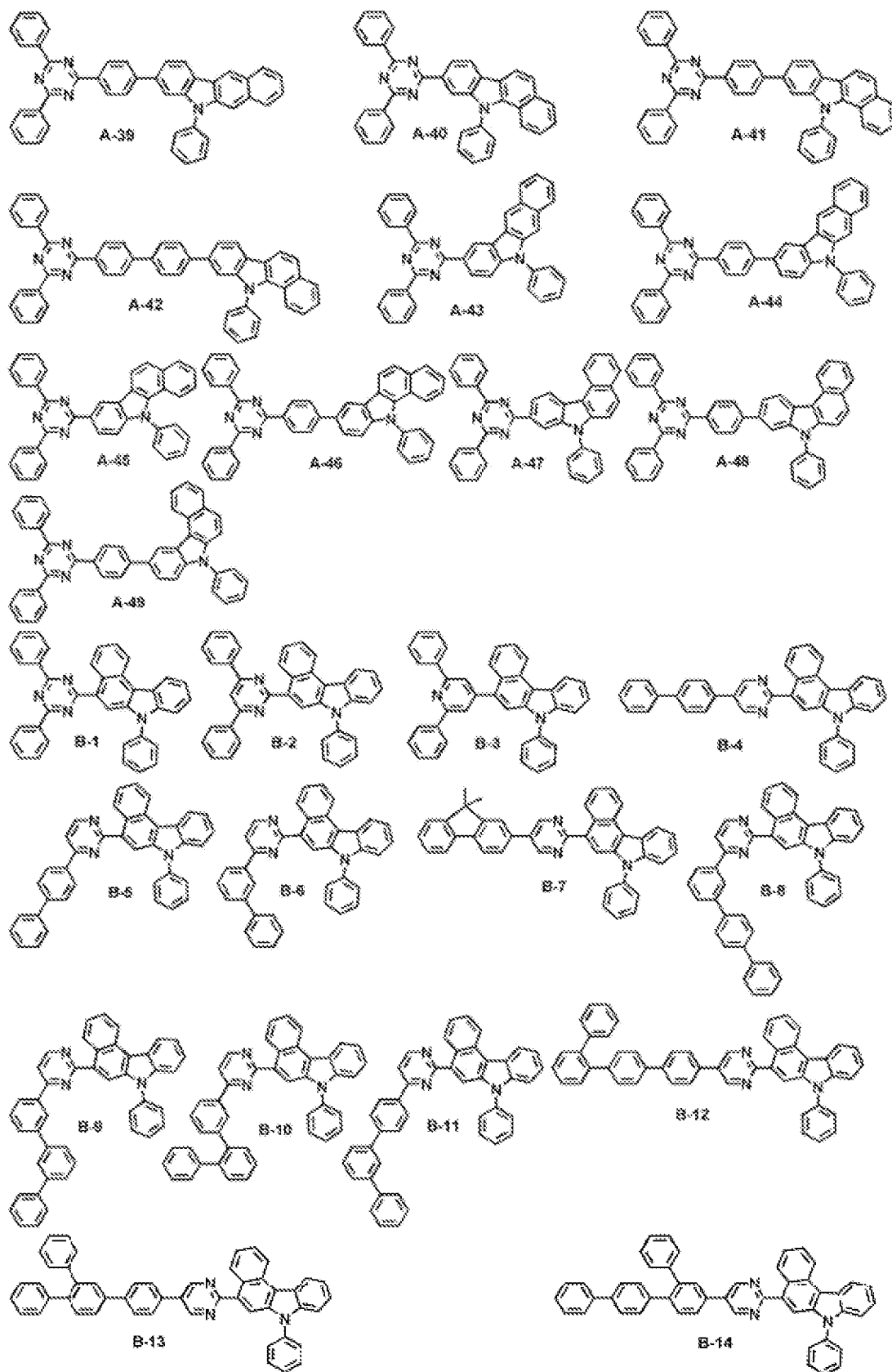
3. The organic electroluminescence compound according to claim 1, wherein the substituents of the substituted alkyl group, the substituted aryl(ene) group, the substituted heteroaryl(ene) group, the substituted cycloalkyl(ene) group, the substituted heterocycloalkyl group and the substituted aralkyl group in L₁, R₁, R₂, R₁₁ to R₂₁, Ar₁, and Ar₂ of formula 1 each independently are at least one selected from the group consisting of deuterium; a halogen; a (C1-C30)alkyl group substituted or unsubstituted with a halogen; a (C6-C30)aryl group; a 3- to 30-membered heteroaryl group substituted or unsubstituted with a (C1-C30)alkyl or a (C6-C30)aryl; a (C3-C30)cycloalkyl group; a 5- to 7-membered heterocycloalkyl group; a tri(C1-C30)alkylsilyl group; a tri(C6-C30)arylsilyl group; a di(C1-C30)alkyl(C6-C30)arylsilyl group; a (C1-C30)alkyldi(C6-C30)arylsilyl group; a (C2-C30)alkenyl group; a (C2-C30)alkynyl group; a cyano group; an N-carbazolyl group; a di(C1-C30)alkylamino group; a di(C6-C30)arylamino group; a (C1-C30)alkyl(C6-C30)arylamino group; a di(C6-C30)arylboronyl group; a di(C1-C30)alkylboronyl group; a (C1-C30)alkyl(C6-C30)arylboronyl group; a (C6-C30)aryl(C1-C30)alkyl group; a (C1-C30)alkyl(C6-C30)aryl group; a carboxyl group; a nitro group; and a hydroxyl group.
4. The organic electroluminescence compound according to claim 1, wherein L₁ represents a single bond or a (C6-C30)arylene group; A₁ to A₃ each independently represent CR₁₁ or N, proviso that A₁ to A₃ do not simultaneously represent CH; X represents -NR₁₄-; R₁₁ represents hydrogen, deuterium, a (C1-C30)alkyl group, a (C6-C30)aryl group, or a 3- to 30-membered heteroaryl group; R₁₄ represents a (C1-C30)alkyl group, a (C6-C30)aryl group, or a 3- to 30-membered heteroaryl group; and R₁, R₂, Ar₁ and Ar₂ each independently represent hydrogen, deuterium, a halogen, a (C1-C30)alkyl group, a (C6-C30)aryl group, or a 3- to 30-membered heteroaryl group; the arylene of L₁, and the alkyl, aryl, and heteroaryl of R₁, R₂, R₁₁, R₁₄, Ar₁ and Ar₂ may be substituted with at least one selected from the group consisting of deuterium, a halogen, a (C1-

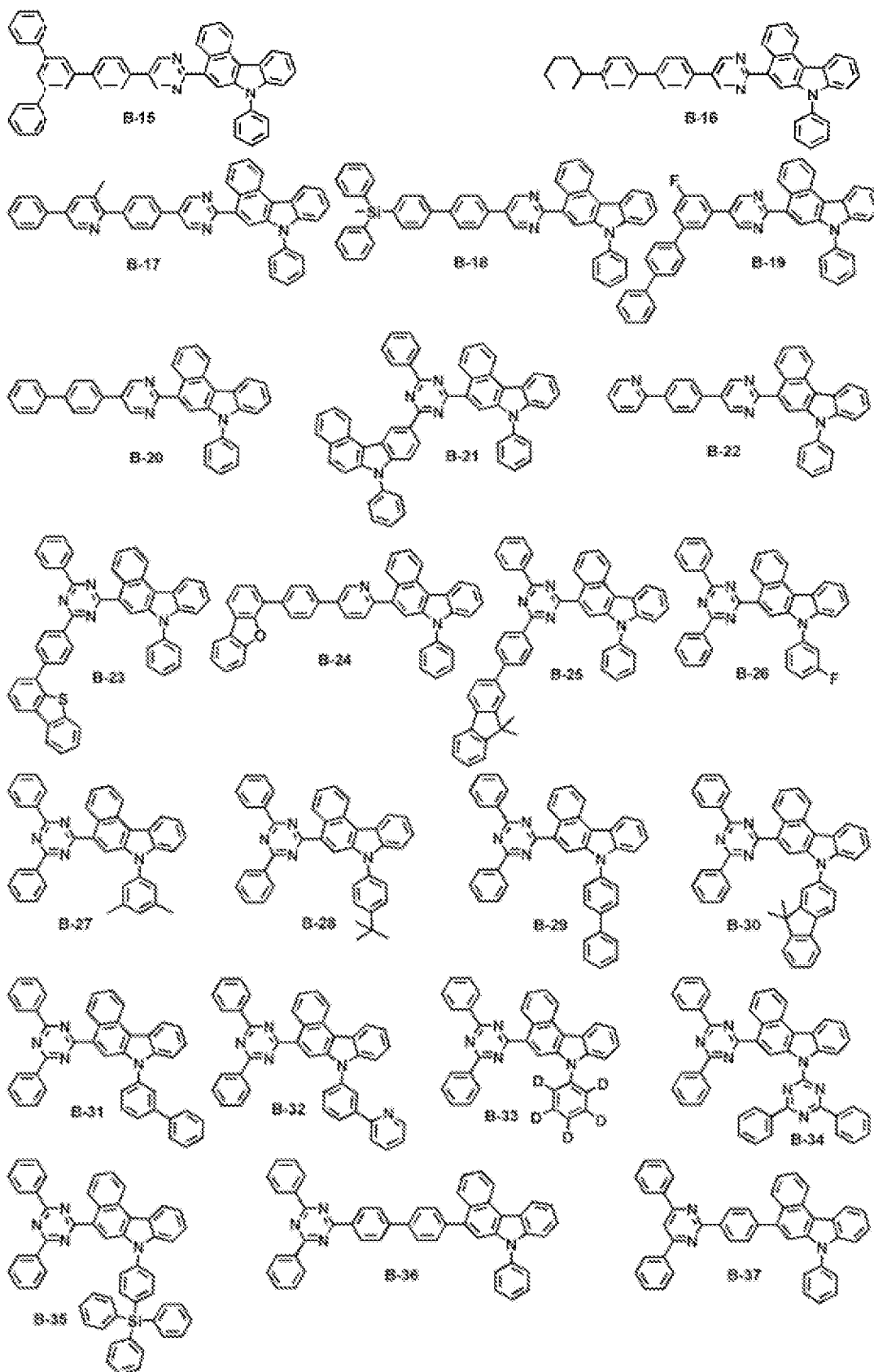
C30)alkyl,; a halo(C1-C30)alkyl, a (C6-C30)aryl, a 3- to 30-membered heteroaryl group, a 3- to 30-membered heteroaryl group substituted with a (C6-C30)aryl and/or a (C1-C30)alkyl, a (C3-C30)cycloalkyl, a tri(C1-C30)alkylsilyl, a tri(C6-C30)arylsilyl group, a di(C1-C30)alkyl(C6-C30)arylsilyl, a (C1-C30)alkyldi(C6-C30)arylsilyl group, a (C6-C30)aryl(C1-C30)alkyl group, and a (C1-C30)alkyl(C6-C30)aryl.

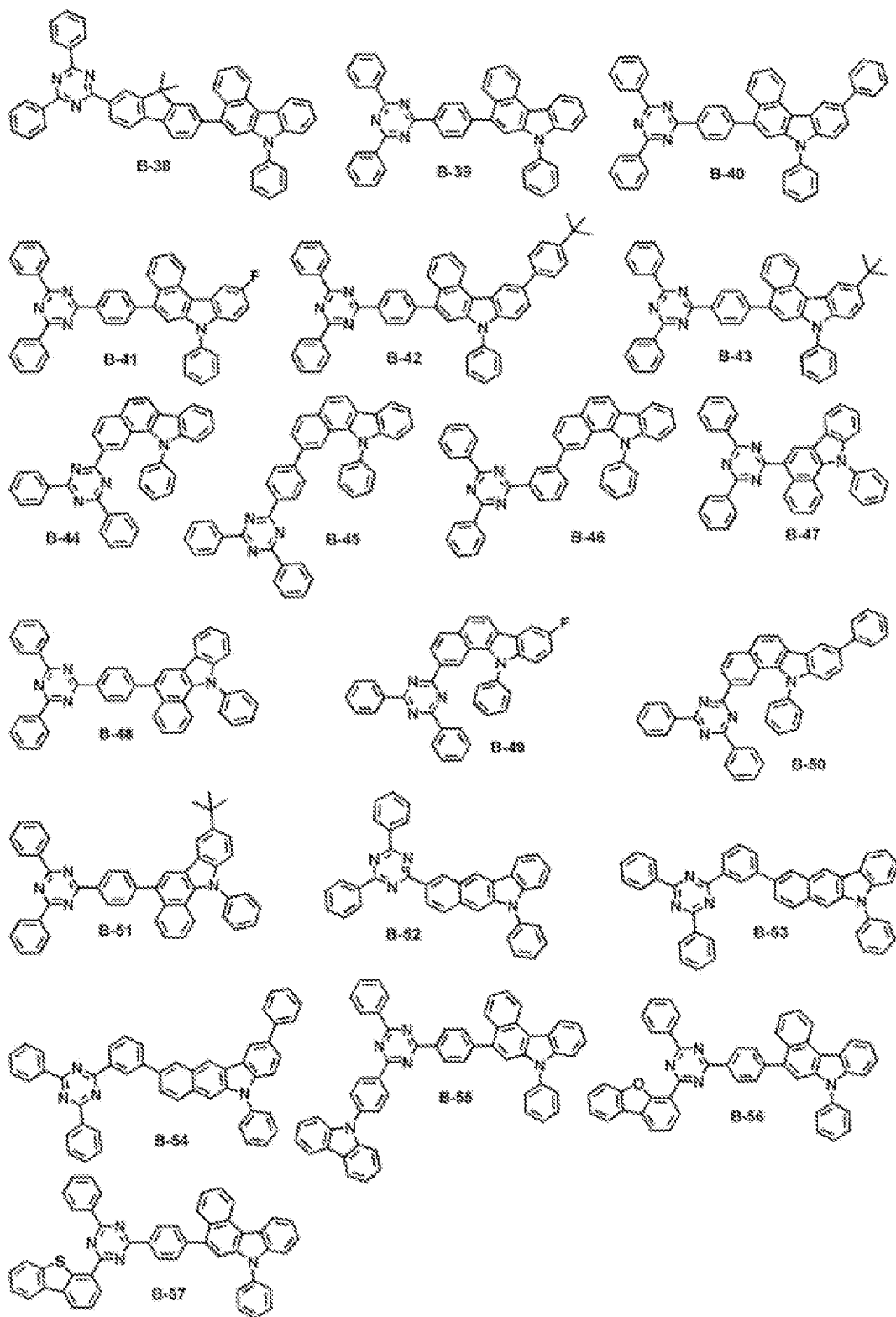
5. The organic electroluminescence compound according to claim 1, wherein the compound represented by formula 1 is selected from the group consisting of:











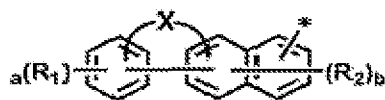
6. An organic electroluminescence device comprising the compound according to claim 1.

Statement under Article 19

This amendment corrects obvious typographical errors.

Amended claims 1 and 4 of International Application No. PCT/KR2012/007022 are supported by the specification and claims in the original PCT application.

In the amendment, the original claim 1 has been amended to recite the structure:



in radical Z, which is supported by formula (3) of claim 2; and to correct "Ar₁ to Ar₃" on lines 10-11 to "A₁ to A₃," which is supported by the six-membered heteroaryl core of the compounds of formula (1) as exemplified in claim 5.

The original claim 4 has been amended into claim 4 to correct "Ar₁ to Ar₃" on lines 2-3 to "A₁ to A₃," which is supported by the six-membered heteroaryl core of the compounds of formula (1) as exemplified in claim 5.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2012/007022

A. CLASSIFICATION OF SUBJECT MATTER

C07D 403/04 (2006.01) C07D 401/14 (2006.01) C07D 401/10 (2006.01) C07D 407/14 (2006.01) C07D 401/14 (2006.01)
C07D 405/14 (2006.01) C07D 403/14 (2006.01) C07F 7/10 (2006.01) C09K 11/06 (2006.01) C07D 401/04 (2006.01)
C07D 403/14 (2006.01) C07D 403/10 (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)

CAplus: structure based on formula (1) of claim 1

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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



Further documents are listed in the continuation of Box C



See patent family annex

* "A"	Special categories of cited documents: 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 16 November 2012	Date of mailing of the international search report 16 November 2012
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustalia.gov.au Facsimile No.: +61 2 6283 7999	Authorised officer Gavin Thompson AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. 0262832240

INTERNATIONAL SEARCH REPORT		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		PCT/KR2012/007022
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 2011/065983 A (LG Display Co.) 16 June 2011 RNs 1313430-86-2, 1313430-89-5, 1313430-93-1, 1313431-24-1, 1313431-31-0; abstract inter alia.	1-4, 6
X	KR 2011/065978 A (LG Display Co.) 16 June 2011 1313232-03-9, 1313232-06-2, 1313232-10-8, 1313232-24-4, 1313232-27-7, 1313232-31-3, 1313232-33-5, 1313232-60-8, 1313232-63-1, 1313232-67-5, 1313232-81-3, 1313232-84-6, 1313232-88-0, 1313232-90-4; and see abstract inter alia.	1-4, 6
X	WO 2011/068204 A1 (JNC Corporation, Japan) 09 June 2011 All compounds of pages 25-26, 28-31, 33-34, 36-37, 39, 41, 43-45, 48-50, 52-54, 57-58, 61-63, 65-66; compounds 1-1, 1-3, 1-4, 1-6, 1-7, 1-9, 1-10, 1-12, 1-13, 1-15, 1-16, 1-18, 1-19 of page 23; compounds 1-21, 1-22, 1-24, 1-25, 1-27, 1-28, 1-30; compounds 1-567, 1-569, 1-570, 1-571, 1-572, 1-573, 1-574, 1-575, 1-577, 1-578, 1-580, 1-581, 1-583, 1-584, 1-586, 1-587 of page 27; all compounds of page 28 except 1-593, 1-596, 1-599; all compounds of page 32 except 1-677, 1-680, 1-683, 1-869; all compounds of page 35 except 1-743; all compounds of page 38 except 1-818; all compounds of page 40 except 1-851; all compounds of page 42 except 1-7835, 1-7847; all compounds of page 46 except 1-8398, 1-8415; all compounds of page 47 except 1-8423, 1-8426, 1-8429; all compounds of page 51 except 1-8507, 1-8510, 1-8513, 1-8519, 1-8522; all compounds of page 52 except 1-8525; all compounds of page 53 except 1-8705, 1-8711, 1-8714, 1-8717; all compounds of 56 except 1-8729; all compounds of page 59 except 1-9268, 1-9276, 1-9282, 1-9285; all the compounds of page 60 except 1-9290, 1-9293, 1-9296, 1-9299; all compounds of page 64 except 1-9377, 1-9380, 1-9389, 1-9392; all the compounds of page 67 except 1-9443; and abstract.	1-4, 6
X	WO 2011/055914 A1 (Rohm and Haas Electronic Materials Korea Ltd.) 12 May 2011 Abstract and Compound 36, page 10 inter alia.	1-4, 6
X	WO 2011/019156 A1 (Rohm and Haas Electronic Materials Korea Ltd.) 17 February 2011 Compounds 18-20, page 7; compounds 21-25, 28-34, page 8; compound 68, page 9; and abstract inter alia.	1-4, 6
X	WO 2011/010843 A1 (Rohm and Haas Electronic Materials Korea Ltd.) 27 January 2011 Compound 6, page 8; compound 55, page 9; and abstract inter alia.	1-4, 6
X	WO 2011/010839 A1 (Rohm and Haas Electronic Materials Korea Ltd.) 27 January 2011 Compounds 19- 20, page 9; compounds 66-67 and 70-71, page 10; compounds 98-99 and 113-114, page 11; and abstract inter alia.	1-4, 6
X	WO 2010/114266 A2 (Dow Advanced Display Materials, Ltd.) 07 October 2010 Compounds 11, 25, 34, page 9; compound 118, page 12; and abstract inter alia.	1-4, 6
X	WO 2010/114264 A2 (Dow Advanced Display Materials, Ltd.) 07 October 2010 Compounds 11-16, 18-25, page 11; compounds 26-28, 33-34, 36-42, 47-48; page 12; compound 105, page 13; compounds 120, 123, page 14; and abstract inter alia.	1-4, 6
X	WO 2010/021524 A2 (LG Chem, Ltd.) 25 February 2010 RNs 1120467-89-2, 1210468-07-7, 1210468-44-2; and abstract inter alia.	1-4, 6
P,X	WO 2012/073541 A1 (JNC Corporation) 07 June 2012 Abstract; RNs 1379750-99-8, 1379751-00-4, 1379751-01-5...	1-4, 6
Form PCT/ISA/210 (fifth sheet) (July 2009)		

INTERNATIONAL SEARCH REPORT		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		PCT/KR2012/007022
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 2012/015274 A2 (Rohm and Haas Electronic Materials Korea Ltd.) 02 February 2012 Most compounds of pages 20 to 97, abstract inter alia.	1-4, 6
Form PCT/ISA/210 (fifth sheet) (July 2009)		

INTERNATIONAL SEARCH REPORT		International application No.	
Information on patent family members		PCT/KR2012/007022	
This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.			
Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	Publication Date	Publication Number	Publication Date
KR 2011/065983 A	16 Jun 2011	None	
KR 2011/065978 A	16 Jun 2011	None	
WO 2011/068204 A1	09 Jun 2011	CN 102639525 A	15 Aug 2012
		JP 2011136989 A	14 Jul 2011
		TW 201136913 A	01 Nov 2011
		WO 2011068204 A1	09 Jun 2011
WO 2011/055914 A1	12 May 2011	KR 20110049012 A	12 May 2011
		WO 2011055914 A1	12 May 2011
WO 2011/019156 A1	17 Feb 2011	KR 20110015836 A	17 Feb 2011
		TW 201120186 A	16 Jun 2011
		US 2012235123 A1	20 Sep 2012
		WO 2011019156 A1	17 Feb 2011
WO 2011/010843 A1	27 Jan 2011	KR 20110008892 A	27 Jan 2011
		TW 201111474 A	01 Apr 2011
		WO 2011010843 A1	27 Jan 2011
WO 2011/010839 A1	27 Jan 2011	KR 20110008619 A	27 Jan 2011
		TW 201111473 A	01 Apr 2011
		WO 2011010839 A1	27 Jan 2011
WO 2010/114266 A2	07 Oct 2010	CN 102449109 A	09 May 2012
		JP 2012522042 A	20 Sep 2012
		KR 20100109060 A	08 Oct 2010
		TW 201105777 A	16 Feb 2011
		US 2012091885 A1	19 Apr 2012
		WO 2010114266 A2	07 Oct 2010
WO 2010/114264 A2	07 Oct 2010	KR 20100108924 A	08 Oct 2010
		TW 201105774 A	16 Feb 2011
		WO 2010114264 A2	07 Oct 2010
WO 2010/021524 A2	25 Feb 2010	CN 102197027 A	21 Sep 2011
		EP 2332911 A2	15 Jun 2011
		JP 2012500789 A	12 Jan 2012
		KR 20100023783 A	04 Mar 2010
		US 2011210318 A1	01 Sep 2011
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.			

INTERNATIONAL SEARCH REPORT Information on patent family members		International application No. PCT/KR2012/007022	
This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.			
Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	Publication Date	Publication Number	Publication Date
		WO 2010021524 A2	25 Feb 2010
WO 2012/073541 A1	07 Jun 2012	JP 2012136498 A	19 Jul 2012
		TW 201224109 A	16 Jun 2012
		WO 2012073541 A1	07 Jun 2012
WO 2012/015274 A2	02 Feb 2012	KR 20120012431 A	09 Feb 2012
		WO 2012015274 A2	02 Feb 2012
End of Annex			
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001. Form PCT/ISA/210 (Family Annex)(July 2009)			