(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
28 May 2009 (28.05.2009)

PCT

(10) International Publication Number
WO 2009/066814 A1

(51) International Patent Classification:
C09K 11/06 (2006.01)

(21) International Application Number:
PCT/KR2007/005942

(22) International Filing Date:
23 November 2007 (23.11.2007)

(25) Filing Language: Korean

(26) Publication Language: English

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

WO 2009/066814 A1

(54) **Title:** ORGANIC ELECTROLUMINESCENT COMPOUNDS AND DISPLAY DEVICE CONTAINING THE SAME

(57) **Abstract:** The present invention relates to an organic electroluminescent compound and a display device using the same. The electroluminescent compound according to the present invention has good luminous efficiency and excellent lifetime of the material, so that an OLED device having very good operation lifetime can be prepared.

【DESCRIPTION】

【Invention Title】

ORGANIC ELECTROLUMINESCENT COMPOUNDS AND DISPLAY DEVICE CONTAINING THE SAME

【Technical Field】

The present invention relates to novel organic electroluminescent compound represented and a display device comprising the same.

【Background Art】

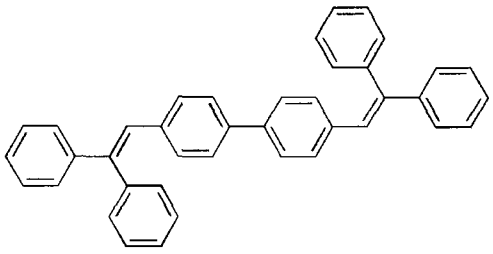
The most important factor to develop an organic electroluminescent (EL) device having high efficiency and long lifetime is development of an electroluminescent material having high performances.

In case of blue luminescence, it becomes advantageous from the aspect of the luminous efficiency, if the light emitting wavelength is shifted a little toward long wavelength. However, it is not easy to apply the material to a display of high quality because of unsatisfactory pure blue color. In addition, there are problems of color purity, efficiency and thermal stability.

For blue materials, a number of materials have been developed and commercialized since the development of DPVBi (Compound a) was disclosed in European Patent Laid-Open

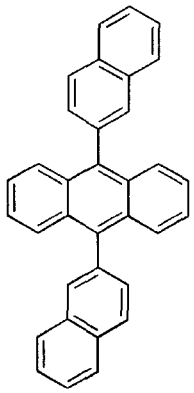
Publication No. 1063869 by Idemitsu-Kosan Company Limited. The distryl compound system by Idemitsu-Kosan, which has been known to have highest efficiency up to now, has 6 lm/W of power efficiency and beneficial device lifetime of more than 30,000 hr. However, when it is applied to a full-colored display, owing to the reduction of color purity over driving time, the lifetime is merely several thousand hours.

[Compound a]



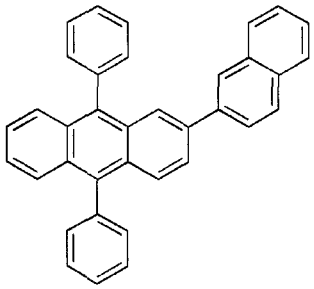
In the meanwhile, dinaphthylanthracene compounds (Compound b) disclosed in US Patent No. 6,465,115 by Kodak are compounds claimed as HTL substances, which have been also utilized as blue electroluminescent compounds. However, those compounds have problems to be solved in view of luminous efficiency and color purity.

[Compound b]



Recently, the electroluminescent derivatives (Compound c) within the similar scope of compound b have been disclosed in WO2006/25700 by LG Chem. However, compound c also has limitations in luminous efficiency and color purity.

[Compound c]

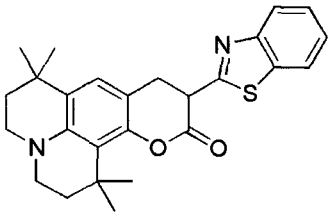


In the meanwhile, as a green fluorescent material, a system wherein a coumarine derivative (Compound d, C545T), a quinacridone derivative (Compound e), DPT (Compound f) or the like is doped to Alq (a host), as a dopant, in a concentration from several % to not more than 20 % has been developed and widely used. However, the conventional electroluminescent materials suffer from significant problem in view of lifetime

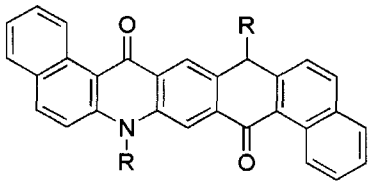
with noticeable reduction of initial efficiency, though they show good performance in view of initial luminous efficiency at the level of practical use. Thus, the materials have limitations to be employed for a high performance panel of larger screen.

It has been reported that this is resulted from short life of cationic species of Alq which was used as a host. In order to overcome the problem, development of a host with amphoteric property, which simultaneously has stability to cationic species and anionic species, is very urgent.

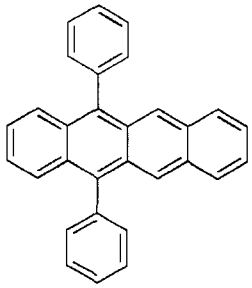
[Compound d]



[Compound e]



[Compound f]



【Disclosure】

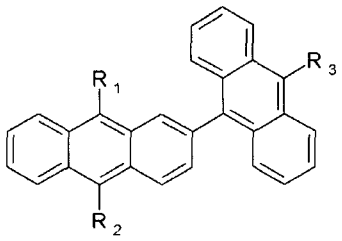
【Technical Problem】

The object of the present invention is to overcome the problems as described above, and to provide electroluminescent compounds having noticeably improved properties of the host which serves as a solvent or an energy carrier in the electroluminescent material, as compared to those of the conventional materials. In addition, the object of the present invention is to provide a blue or green electroluminescent material with improved luminous efficiency and lifetime of the device, and an organic electroluminescent device comprising the same.

【Technical Solution】

The present invention relates to organic electroluminescent compounds represented by Chemical Formula 1:

[Chemical Formula 1]



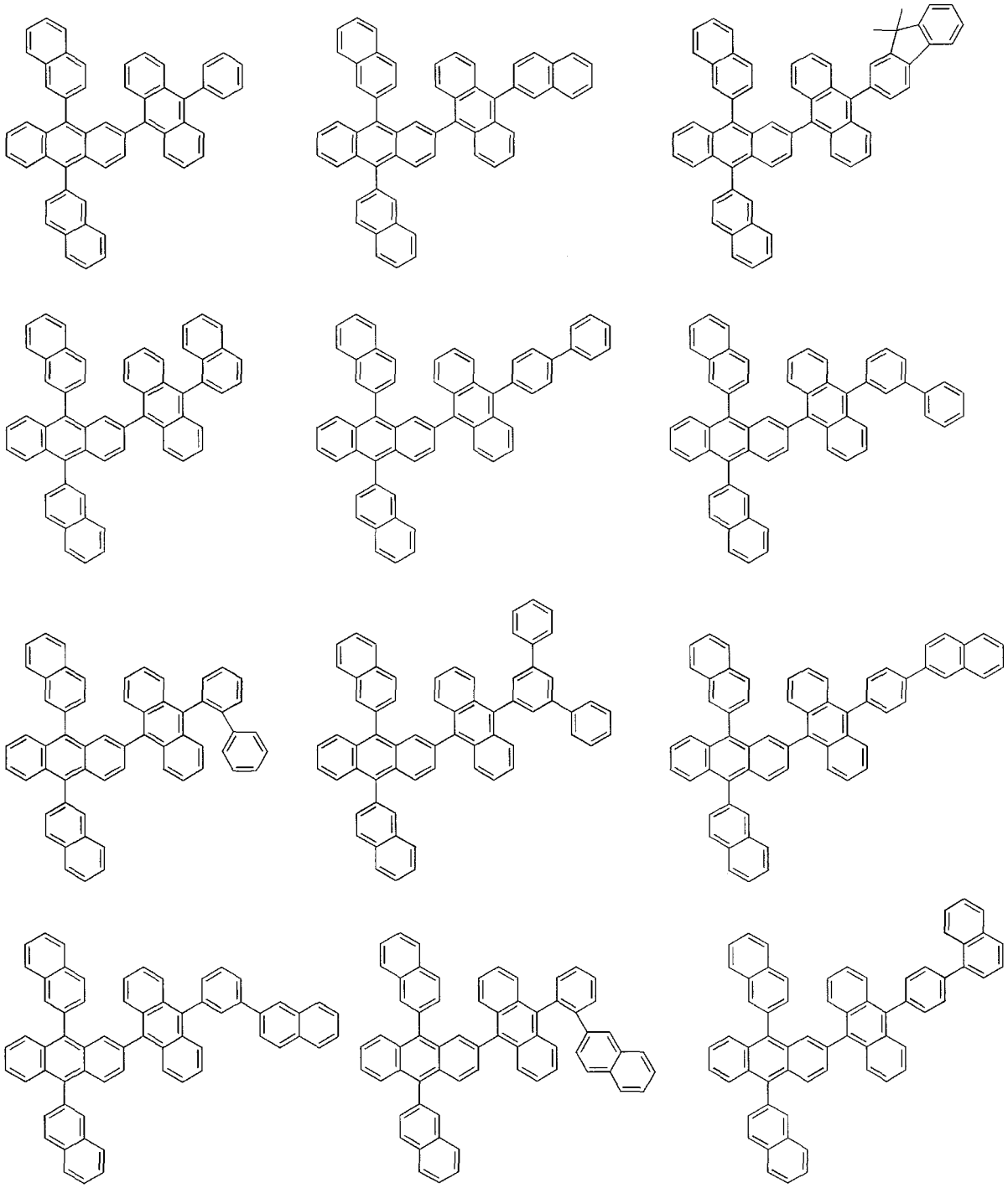
wherein R1 to R3 independently represent phenyl group or C10~C20 fused multi-cyclic aromatic ring, and the phenyl group or C10~C20 fused multi-cyclic aromatic ring of R1 to R3 may be

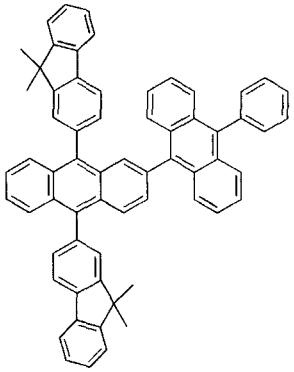
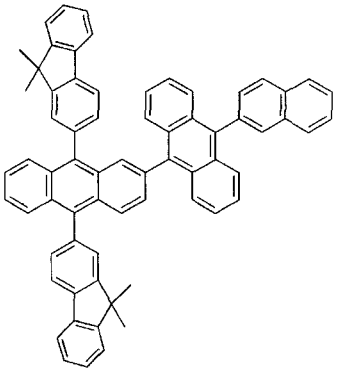
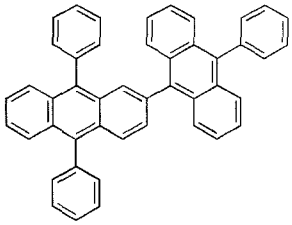
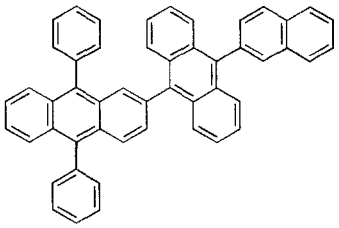
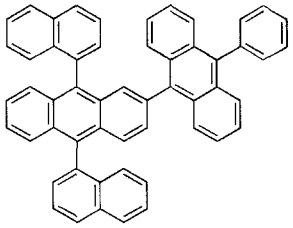
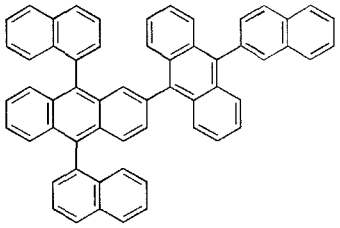
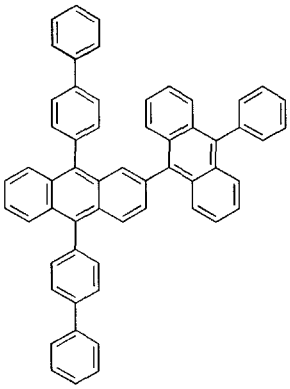
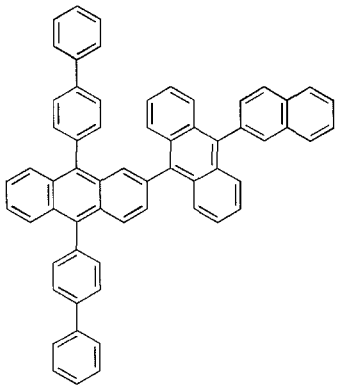
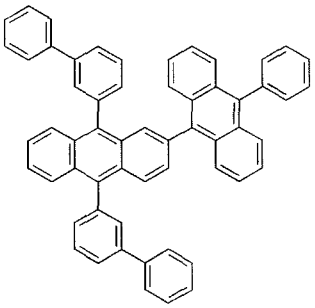
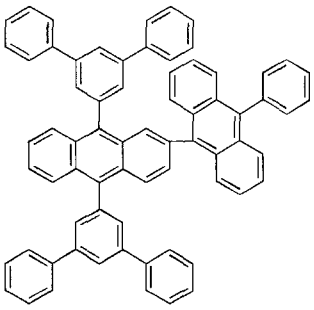
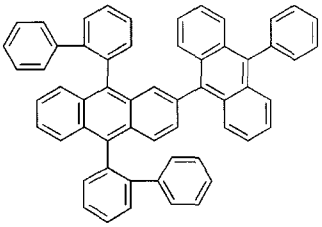
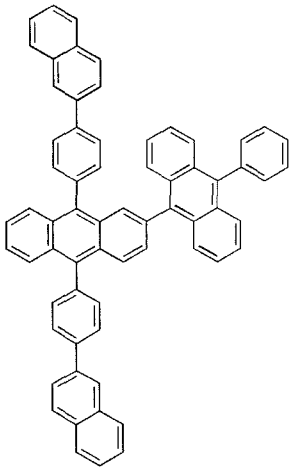
further substituted by C1~C20 alkyl group, C1~C20 alkoxy group, halogen, C5~C7 cycloalkyl group, phenyl group or a fused multi-cyclic aromatic group: and a display device using the same.

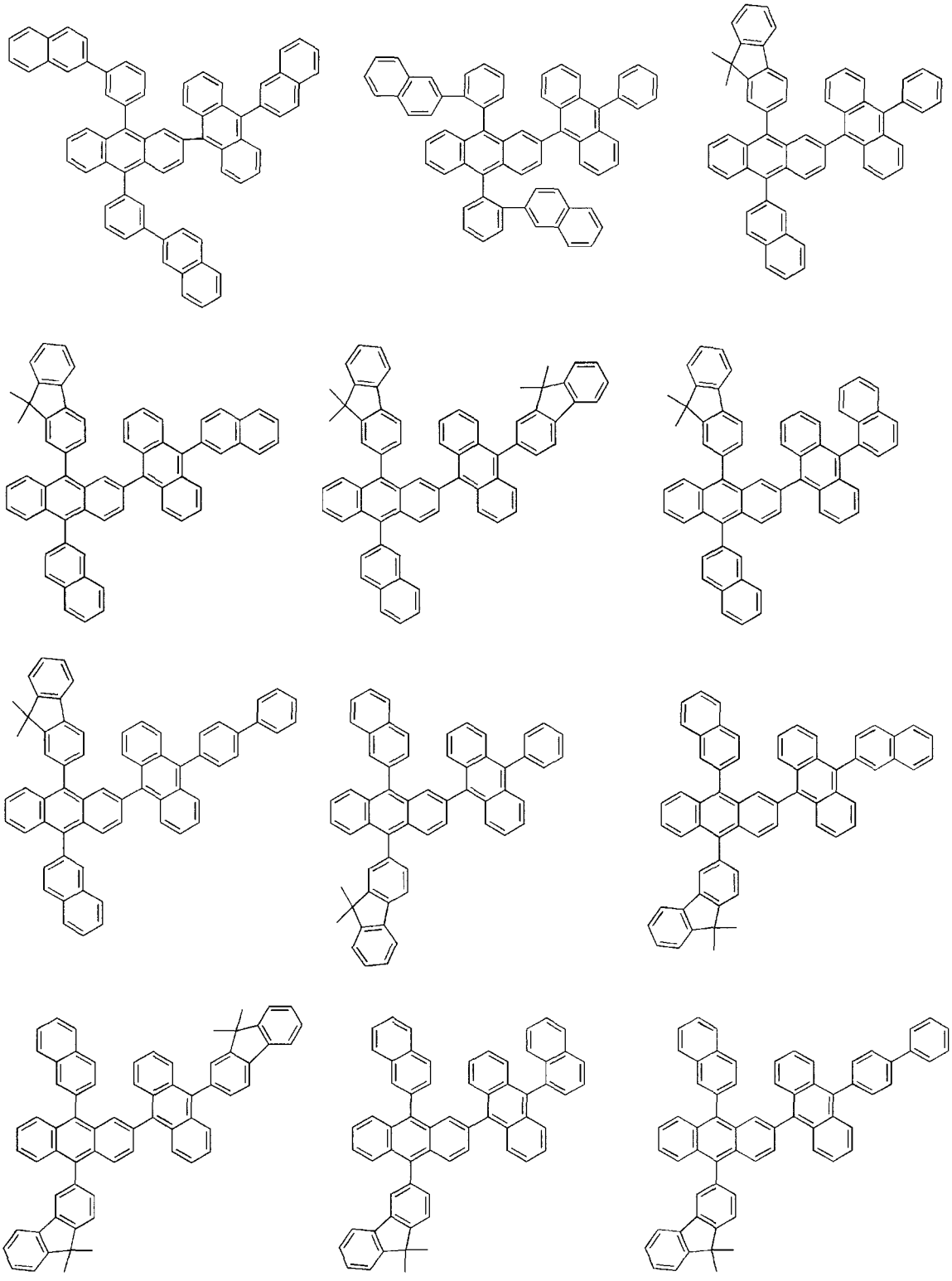
The electroluminescent materials mentioned in the present invention include, in a broad sense, any material employed as the organic substance in an organic electroluminescent device comprised of a first electrode, a second electrode and an organic substance interposed between the first and the second electrode; while they imply, in a narrow sense, what is applied to an electroluminescent host which serves as an electroluminescent medium in an electroluminescent layer.

In the compound represented by Chemical Formula 1 according to the present invention, R1 through R3 are independently selected from the group consisting of phenyl, naphtyl, anthryl, fluorenyl, phenanthryl, fluorancenyl, pyrenyl, perylenyl or naphthacenyl; and phenyl, naphthyl, anthryl, fluorenyl, phenanthryl, flurorancenyl, pyrenyl, perylenyl and naphthacenyl are optionally substituted by C1~C20 alkyl groups, C1~C20 alkoxy groups, halogen atoms, C5~C7 cycloalkyl groups, phenyl group, or a fused multicyclic aromatic group. The organic electroluminescent compounds represented by Chemical Formula 1 according to the present invention can be represented by the following formulas, but these formulas cannot limit the scope of the present

invention:



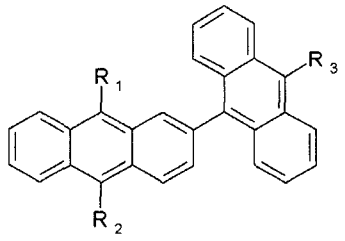















The present invention also provides an organic electroluminescent device comprised of a first electrode; a second electrode; and one or more organic layer(s) interposed

between the first electrode and the second electrode, wherein the organic layer comprises one or more compound(s) represented by Chemical Formula 1:

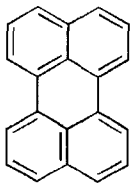
[Chemical Formula 1]



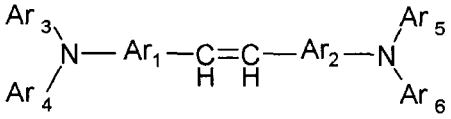
wherein R1 to R3 independently represent phenyl group or C10~C20 fused multi-cyclic aromatic ring, and the phenyl group or C10~C20 fused multi-cyclic aromatic ring of R1 to R3 may be further substituted by C1~C20 alkyl group, C1~C20 alkoxy group, halogen, C5~C7 cycloalkyl group, phenyl group or a fused multi-cyclic aromatic group.

The organic electroluminescent (EL) device according to the present invention is characterized in that the organic layer comprises EL region which comprises one or more EL dopant with one or more compound(s) represented by Chemical Formula (1) as an EL host. The EL dopants applied to the organic EL device of the present invention are not particularly restricted, but exemplified by the compounds represented by one of Chemical Formulas 2 to 4:

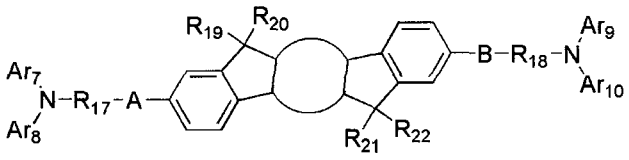
[Chemical Formula 2]



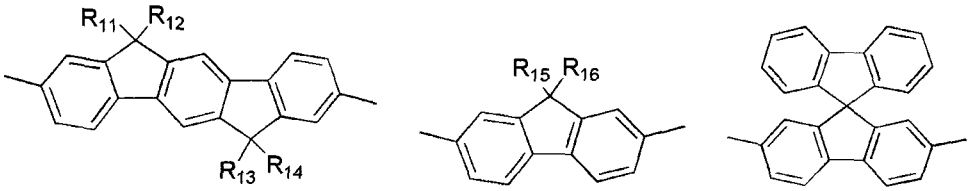
[Chemical Formula 3]



[Chemical Formula 4]



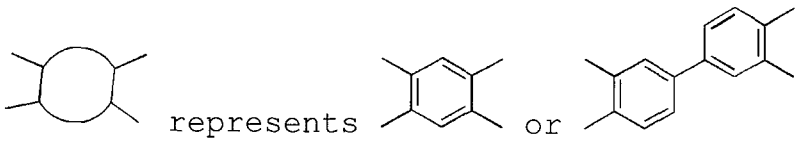
In the Chemical Formula 3 and the Chemical Formula 4, Ar1 and Ar2 are independently indenofluorene, fluorene or spiro-fluorene, represented by following chemical formulas:



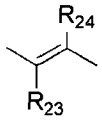
wherein R11 to R16 are independently selected from the group consisting of C1~C20 alkyl, and phenyl or naphthyl with or without C1~C5 alkyl substituent(s); and

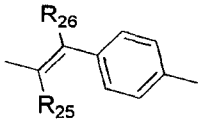
Ar3 to Ar6 are independently selected from C5~C20 aromatic or multi-cyclic aromatic ring; provided that Ar1 and Ar2 are identical, Ar3 and Ar5 are identical, and Ar4 and Ar6

are identical.



represents or ;

A and B independently represent a chemical bond, or 

or  ;

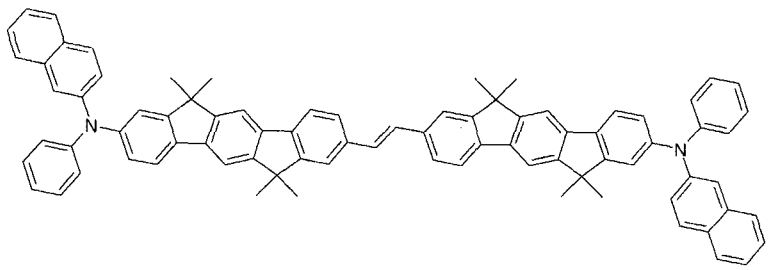
R17 and R18 independently represent an aromatic ring or a multi-cyclic aromatic ring wherein two or more aromatic rings have been fused;

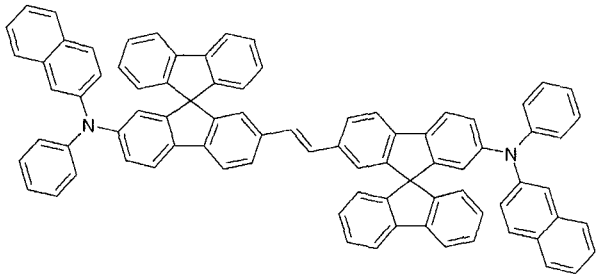
R19 to R22 independently represent a linear or branched C1~C20 alkyl group with or without halogen substituent(s);

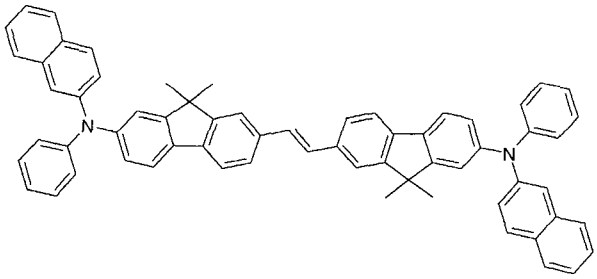
R23 to R26 independently represent hydrogen or an aromatic group; and

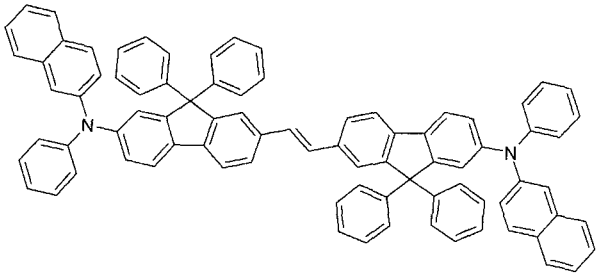
Ar7 to Ar10 independently represent an aromatic ring or a multi-cyclic aromatic ring wherein two or more aromatic rings have been fused.

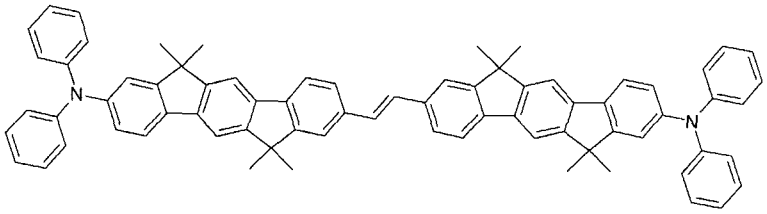
The compounds of Chemical Formula 3 or Chemical Formula 4 may be specifically exemplified by compounds represented by one of the following formulas:

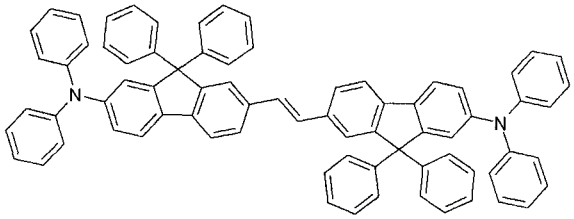


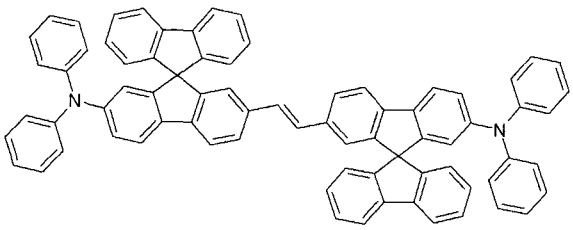


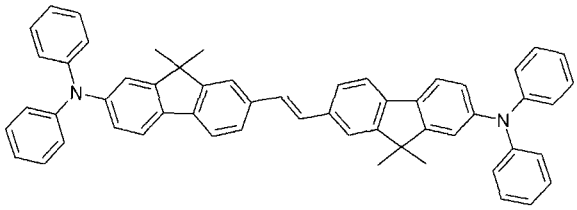


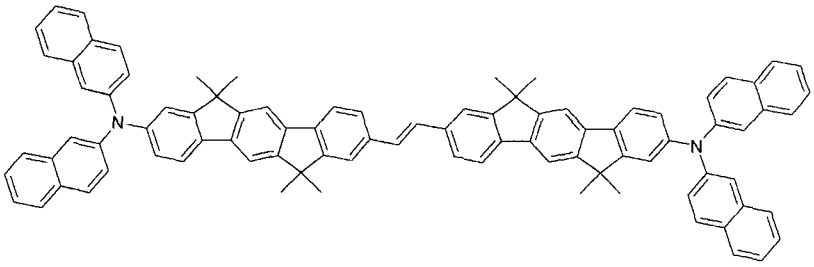


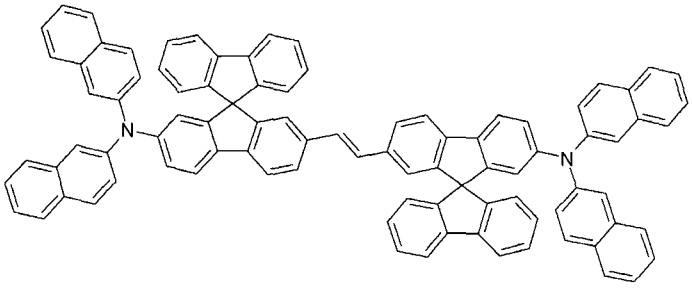


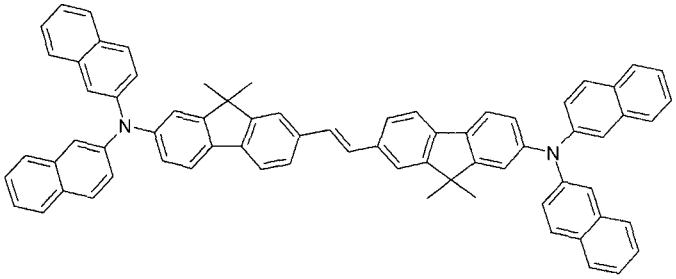


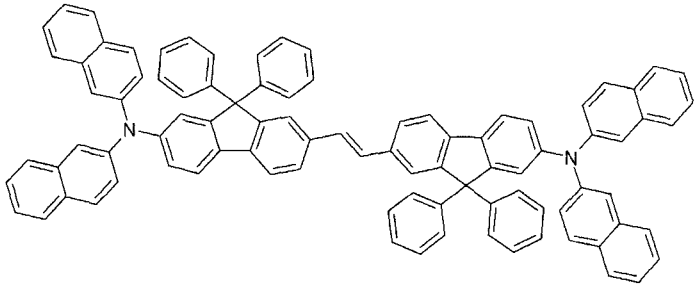












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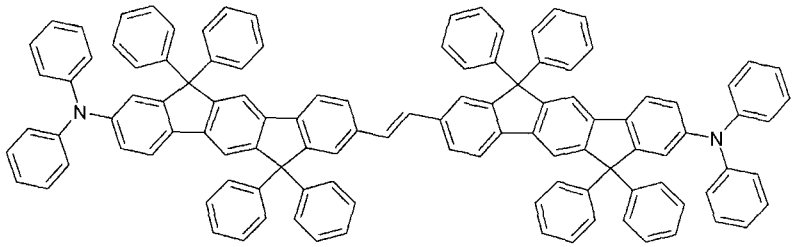
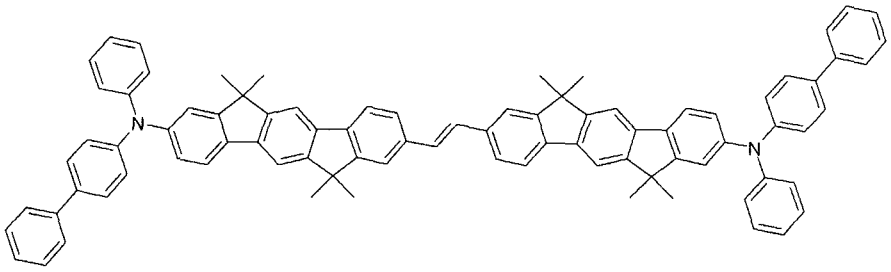
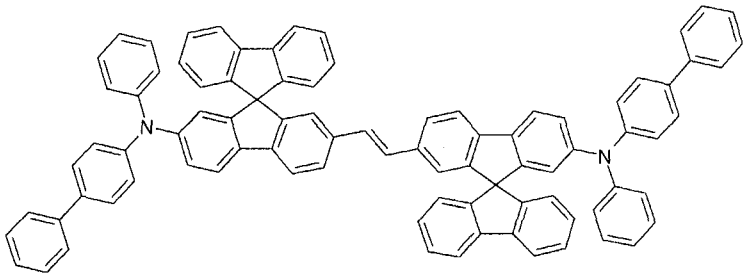
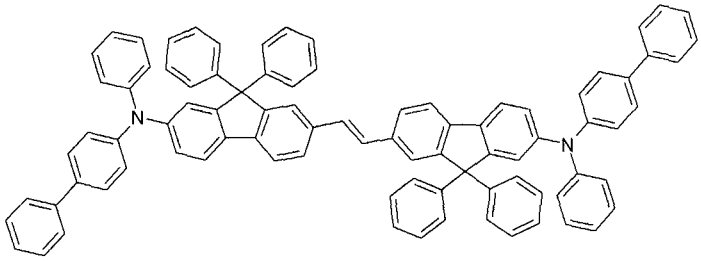
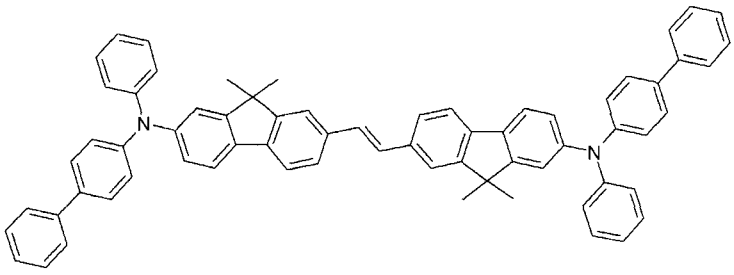
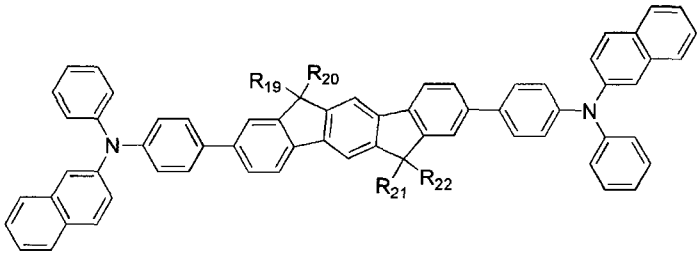


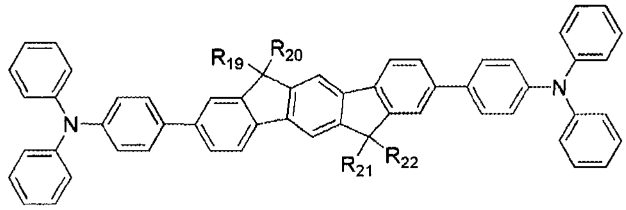


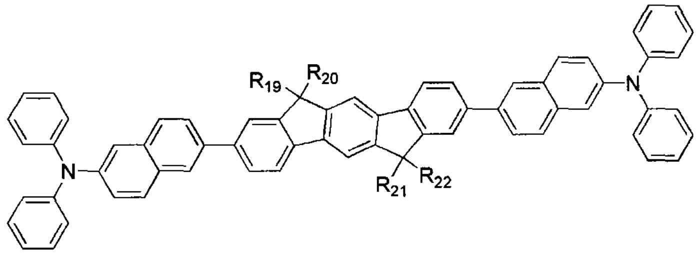


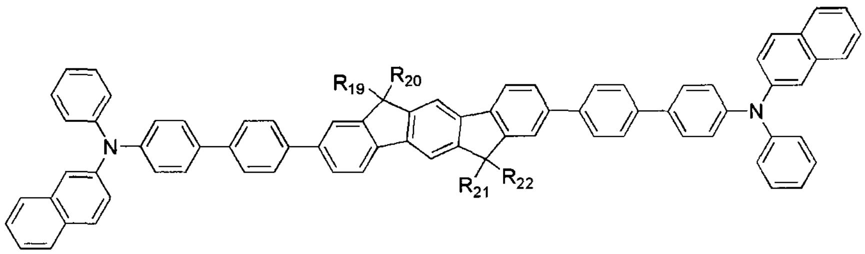


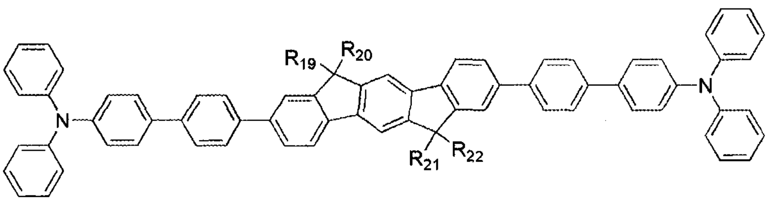


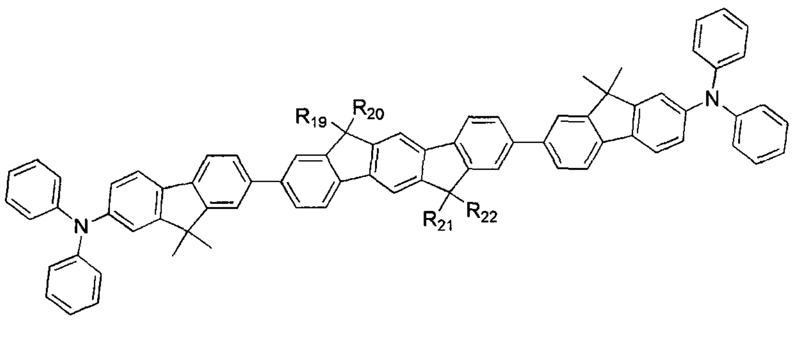

R19
R20
R21
R22

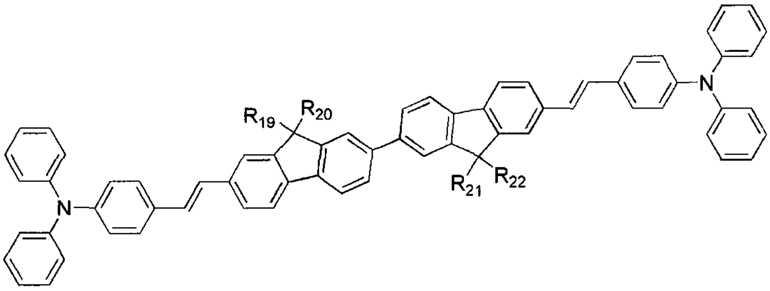

R_{19}
R_{20}
R_{21}
R_{22}
N
N

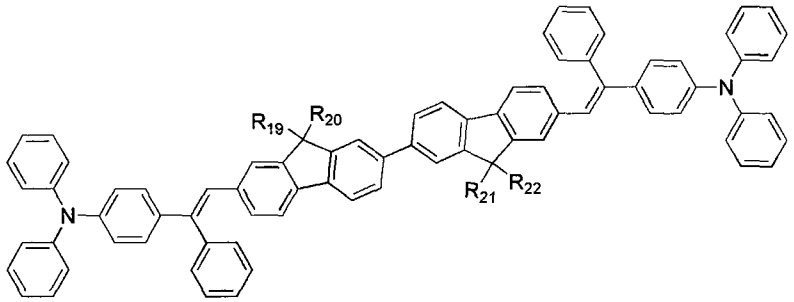

R_{19}
R_{20}
R_{21}
R_{22}
N
N

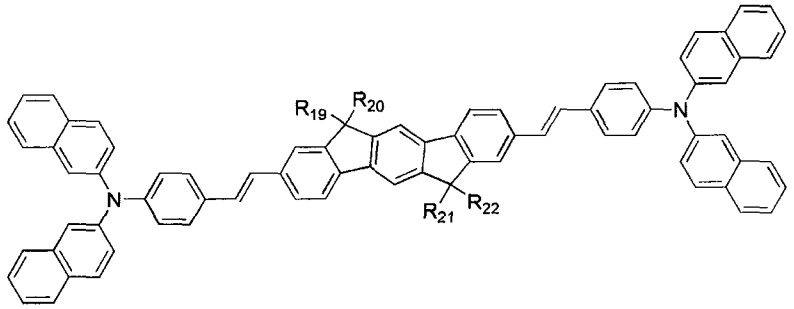

R_{19}
R_{20}
R_{21}
R_{22}
N
N

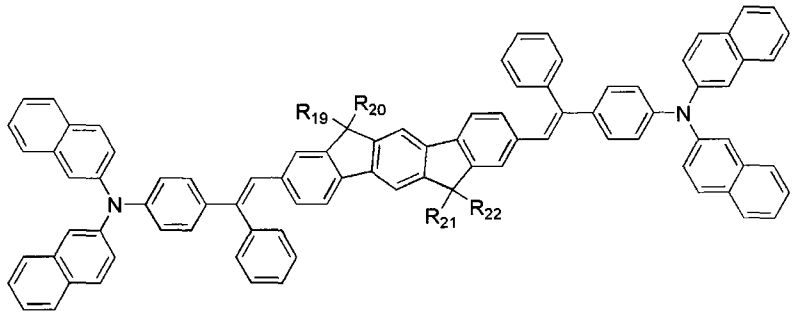

R_{19}
R_{20}
R_{21}
R_{22}
N
N

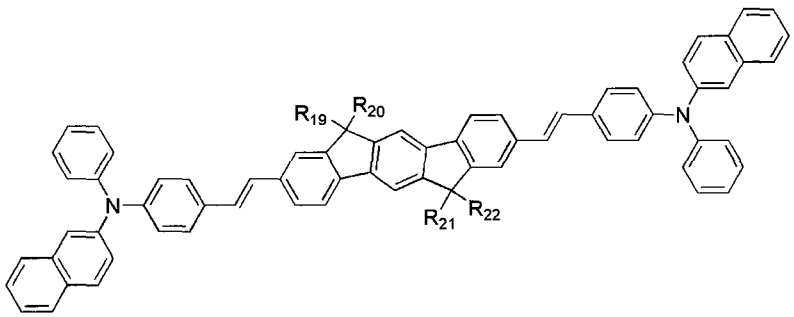

R_{19}
R_{20}
R_{21}
R_{22}
N
N

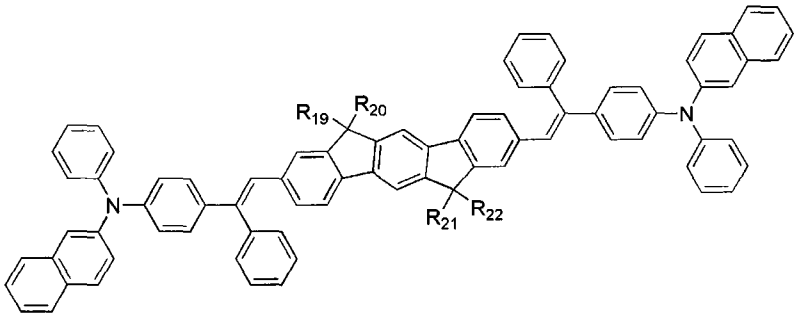

R_{19}
R_{20}
R_{21}
R_{22}
N
N


R19
R20
R21
R22
N

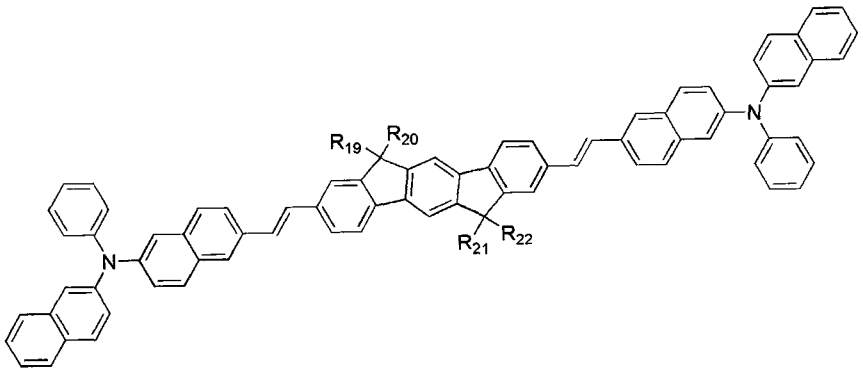

R19
R20
R21
R22
N

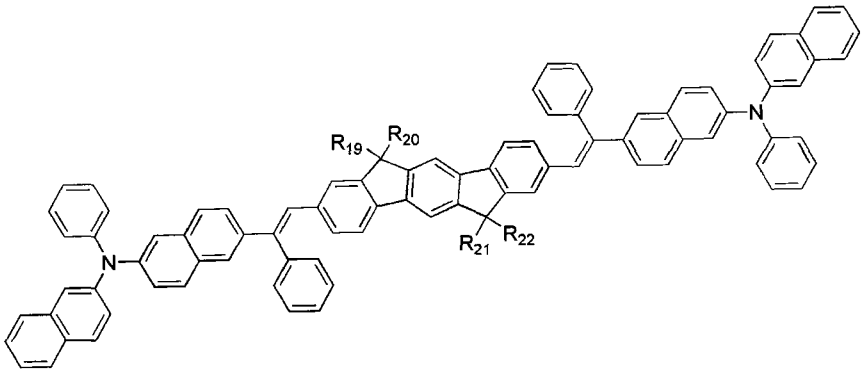

R19
R20
R21
R22
N

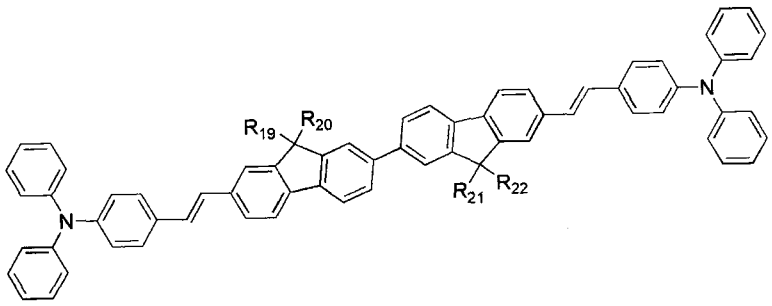

R19
R20
R21
R22
N

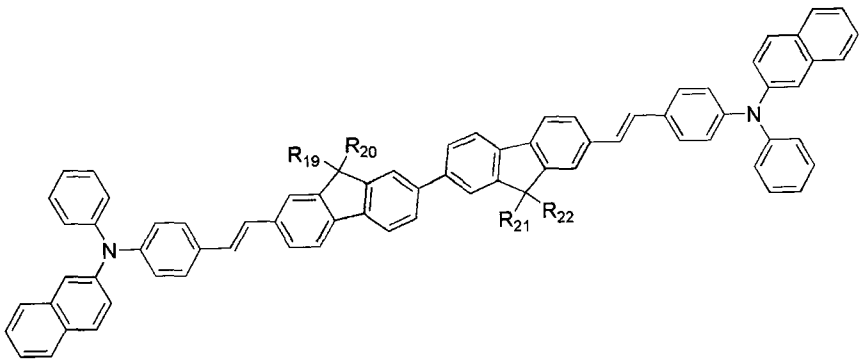

R19
R20
R21
R22
N

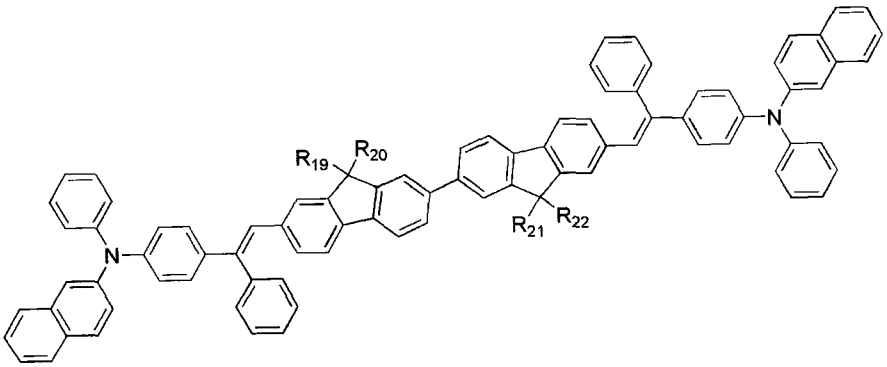
5

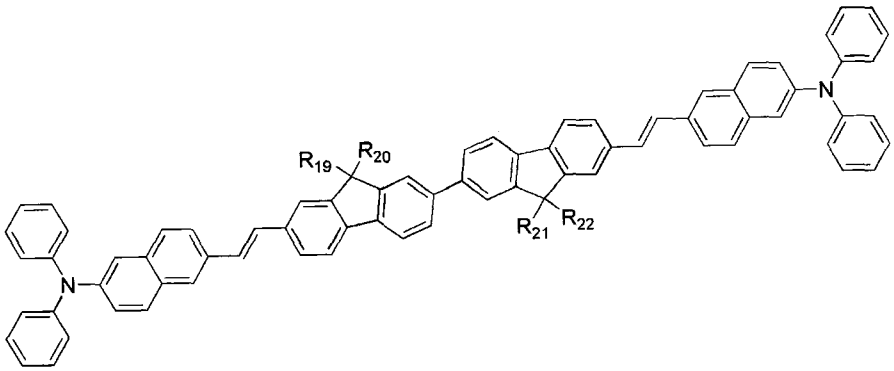

R19
R20
R21
R22
N

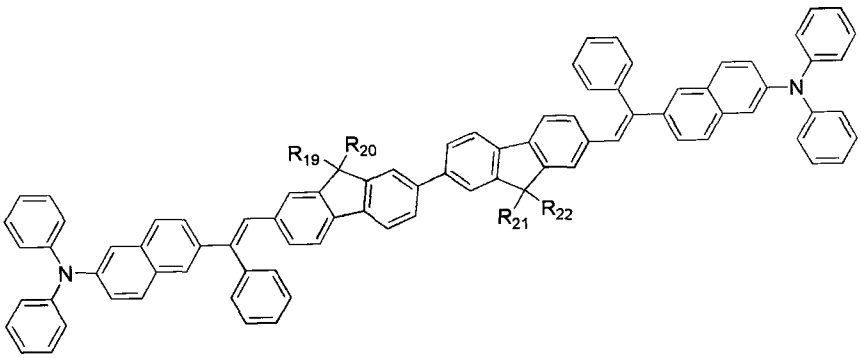

R19
R20
R21
R22
N

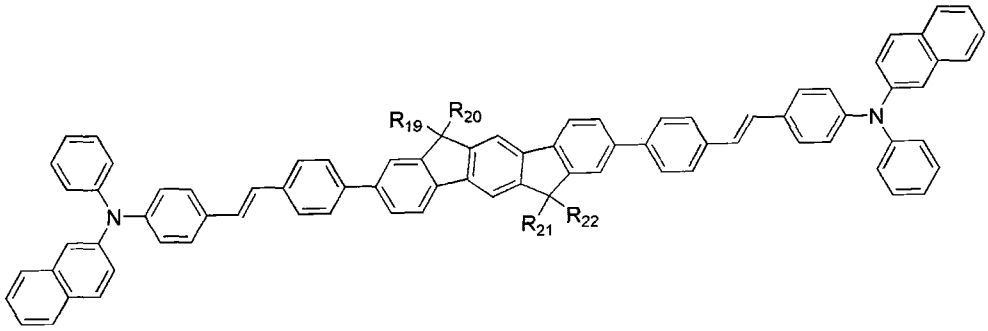

R19
R20
R21
R22
N

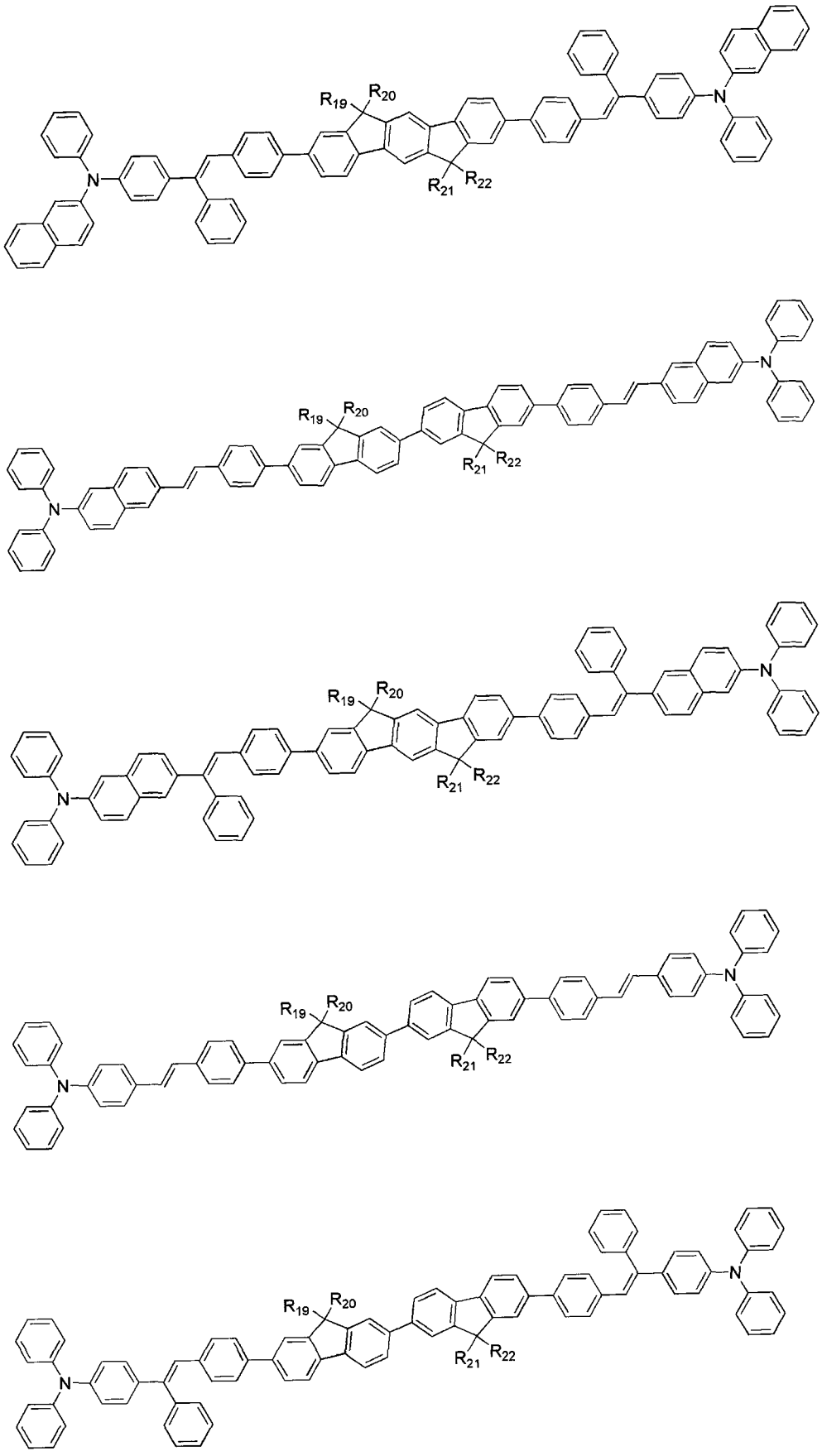

R19
R20
R21
R22
N


R19
R20
R21
R22
N


R19
R20
R21
R22
N


R19
R20
R21
R22
N

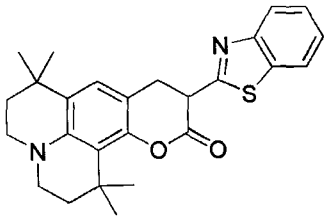

R19
R20
R21
R22
N


R19
R20
R21
R22
N

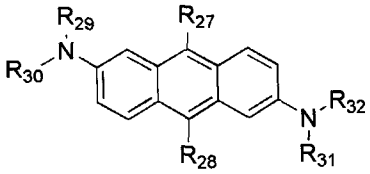
wherein, R19 to R22 represent methyl group or ethyl group.

The green EL compounds can be exemplified by the compounds represented by one of Chemical Formulas 5 to 7:

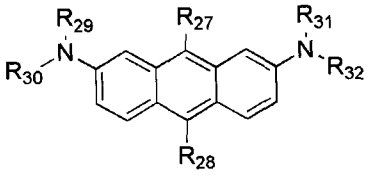
[Chemical Formula 5]



[Chemical Formula 6]



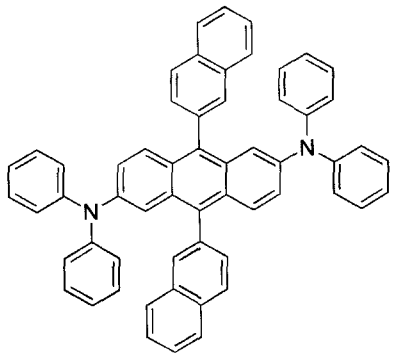
[Chemical Formula 7]

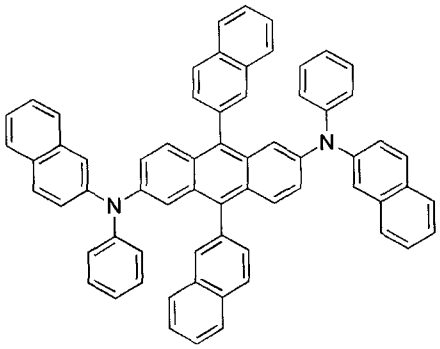


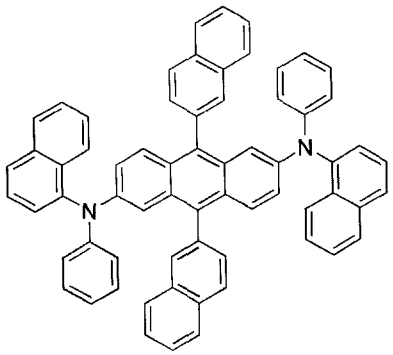
In the Chemical Formula 6 and the Chemical Formula 7, R27 and R28 independently represent a multicyclic aromatic ring wherein two more aromatic rings have been fused; R29 to R32 independently represent an aromatic ring; and each aromatic ring of R27 to R32 may be further substituted by C1~C20 alkyl group(s).

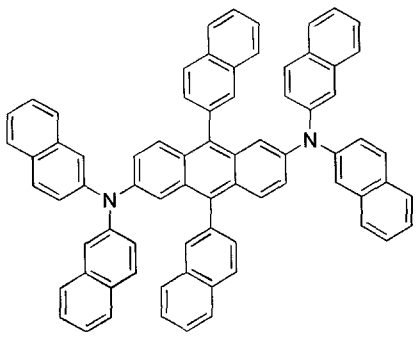
The compounds of Chemical Formula 6 and Chemical

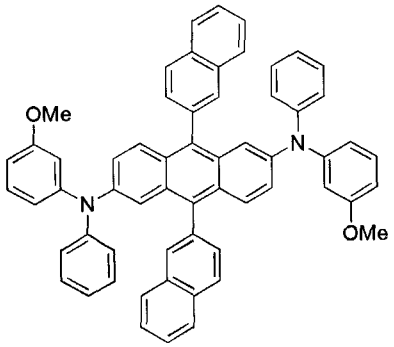
Formula 7 can be specifically exemplified by compounds represented by one of the following formulas:

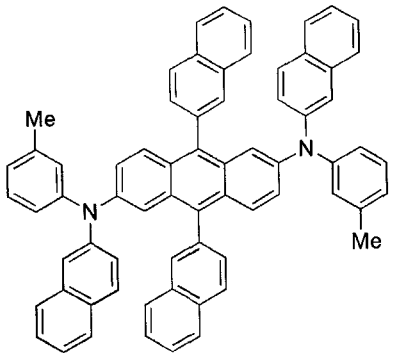


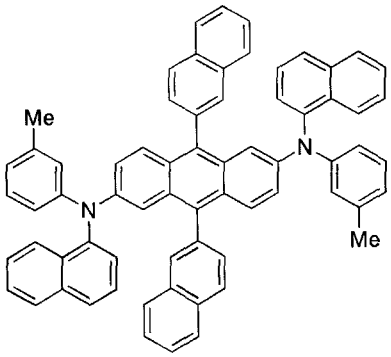


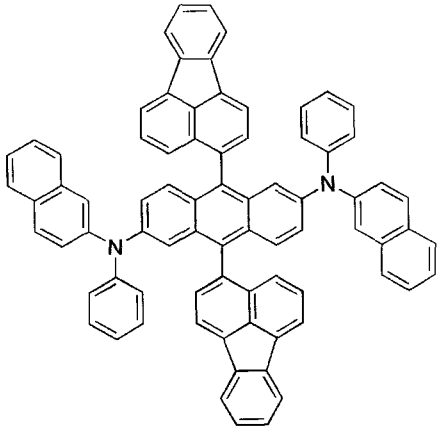


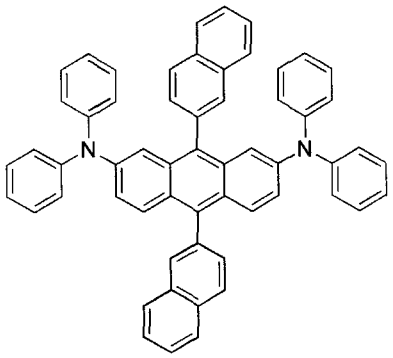


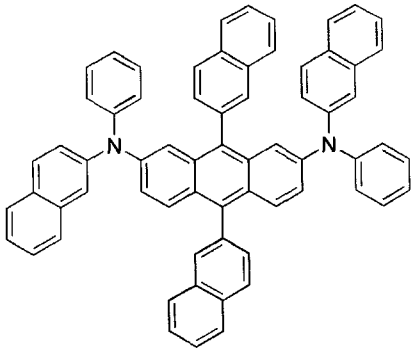

OMe
N
N
OMe

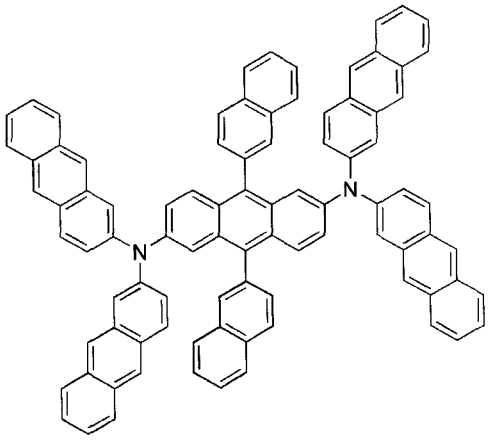

Me
N
N
Me

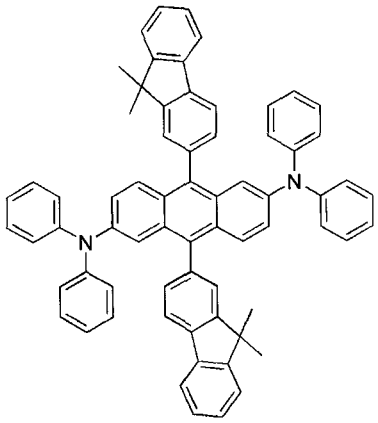

Me
N
N
Me

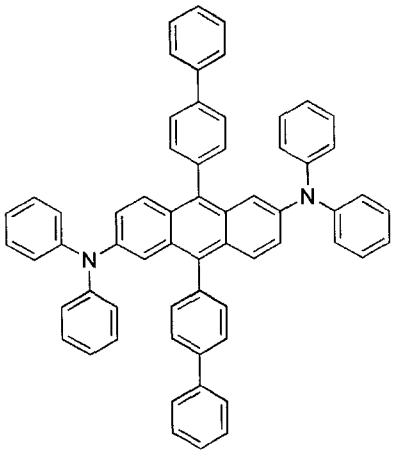

N
N

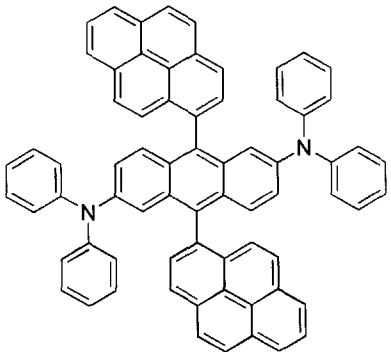












【Description of Drawings】

Fig. 1 shows luminous efficiency - current density property of Comparative Example 1;

Fig. 2 shows current density - voltage property of a blue OLED according to Example 9;

Fig. 3 shows luminous efficiency - current density property of the blue OLED according to Example 9;

Fig. 4 shows luminous efficiency - luminance property of a green OLED, to which conventional electroluminescent material was applied, according to Comparative Example 2;

Fig. 5 shows luminous efficiency - current density property of a green OLED according to Example 22;

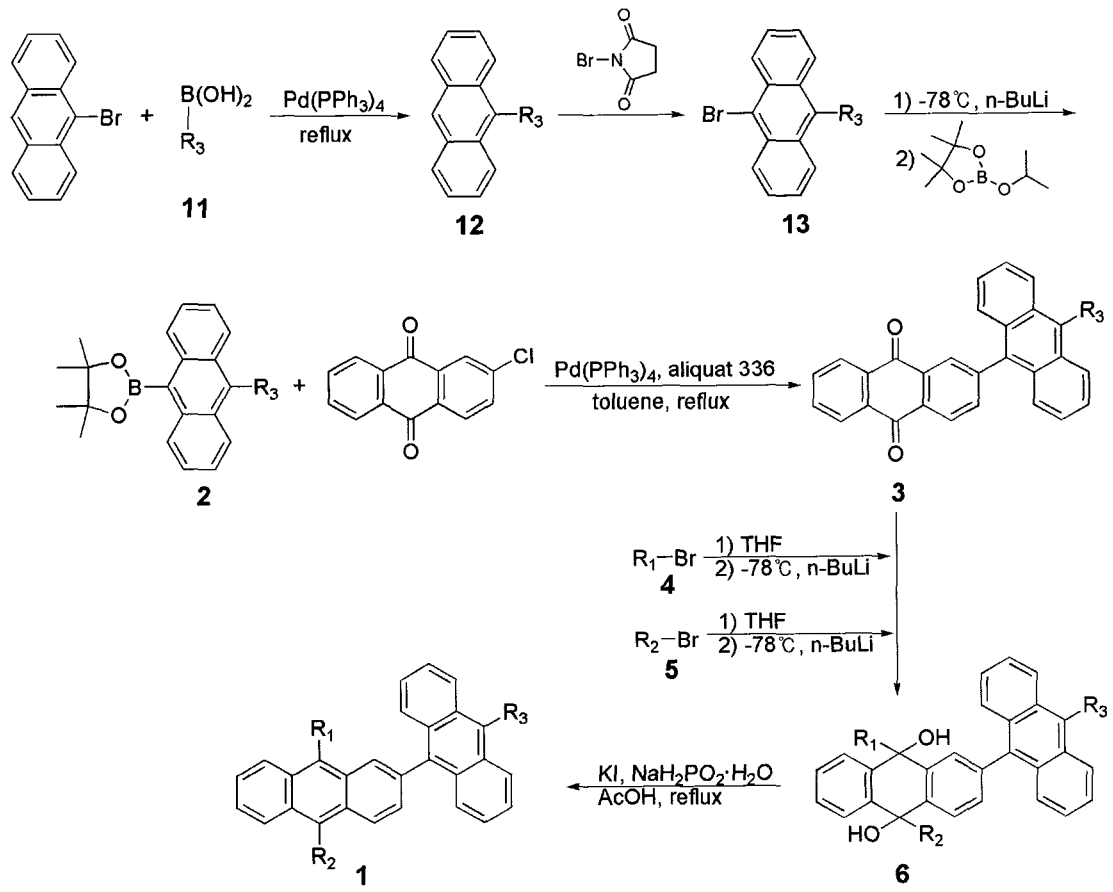
Fig. 6 shows luminous efficiency - current density property of green OLEDs according to Example 22, Comparative Example 3 and Comparative Example 4; and

Fig. 7 is a curve to compare color purity of green OLEDs according to Example 22 and Comparative Example 2.

【Best Mode】

The present invention is further described with respect to the process for preparing novel organic EL compounds according to the present invention, by referring to Examples, which are provided for illustration only but are not intended to limit the scope of the invention by any means.

[Preparation Example] Preparation of Compound represented by Chemical Formula 1



Preparation of Compound 12

In a mixed solution of toluene:ethanol (2:1 v/v), dissolved were 9-bromoanthracene (58.3 mmol), boronic acid derivative (Compound 11, 70.0 mmol) and tetrakis(triphenylphosphine) palladium (0)(Pd(PPh3)4) (5.8 mmol). After adding aqueous 2M sodium carbonate solution thereto, the resultant mixture was stirred under reflux at 120℃ for 5 hours. Then, the temperature was lowered to 25℃, and the reaction was quenched by adding distilled water. Extraction with ethyl acetate, drying under reduced pressure, and recrystallization from tetrahydrofuran and methanol gave

Compound (12).

Preparation of Compound (13)

Under nitrogen atmosphere, dissolved were Compound (12) (46.0 mmol) obtained as above and N-bromosuccinimide (50.6 mmol) in dichloromethane. The resultant solution was then stirred at 25℃ for 5 hours. The reaction was quenched by adding distilled water. Extraction with dichloromethane, drying under reduced pressure, and recrystallization from tetrahydrofuran and methanol gave Compound (13).

Preparation of Compound (2)

In carefully purified tetrahydrofuran, dissolved was Compound (13) (39.0 mmol) obtained as above. The resultant solution was chilled to -78℃, and n-butyl lithium (1.6M in hexane) (46.8 mmol) was slowly added thereto. After stirring the mixture for 1 hour, added was 2-isopropoxy-4,4,5,5-tetramethyl-1,3,2-dioxaborolane (78.0 mmol). The temperature was slowly raised to 25℃, and the mixture was stirred for one day. After quenching the reaction by adding distilled water, the mixture was extracted with ethyl acetate and dried under reduced pressure. Recrystallization from tetrahydrofuran and methanol gave Compound (2).

Preparation of Compound (3)

In toluene, dissolved were 2-chloro-9,10-anthraquinone (29.7 mmol), Compound (2) (35.5 mmol), tetrakis(triphenylphosphine) palladium (0) (Pd(PPh3)4) (3.0 mmol) and Aliquat 336 (3.0 mmol). After adding aqueous 2M potassium carbonate solution thereto, the resultant mixture was stirred under reflux for 3 hours. Then, the temperature was lowered to 25℃, and the reaction was quenched by adding distilled water. Extraction with ethyl acetate, drying under reduced pressure, and recrystallization from methanol and tetrahydrofuran gave Compound (3).

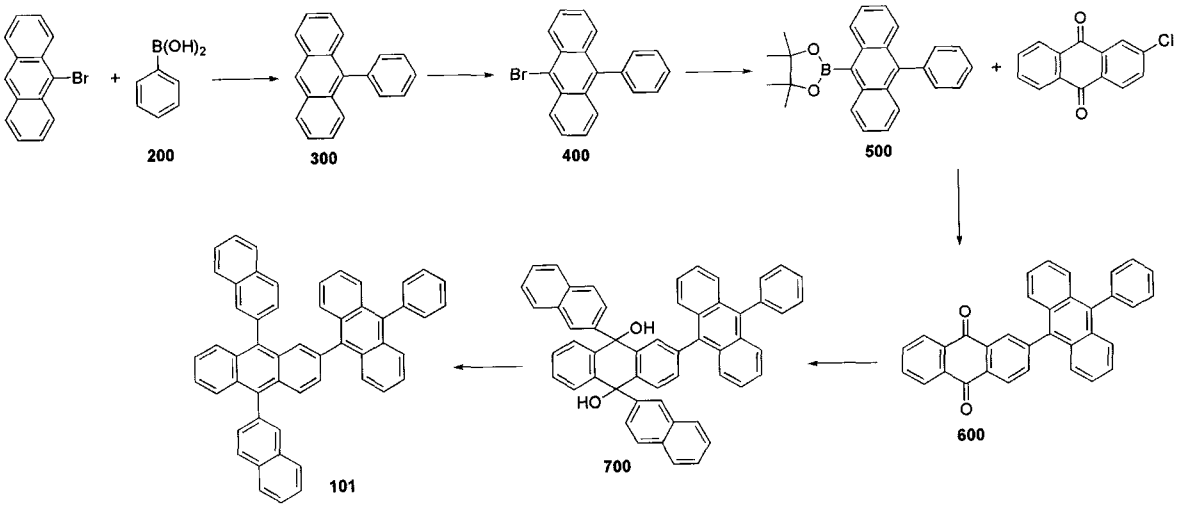
Preparation of Compound (6)

To the bromo-compound (Compound 4 or 5) (54.3 mmol), added was tetrahydrofuran, and the mixture was stirred at 25℃ for 10 minutes to achieve complete dissolution. After chilling to -72℃, n-butyl lithium (2.5M in hexane) (65.1 mmol) was slowly added dropwise. After 1 hour, Compound (3) (21.7 mmol) was added thereto, and the temperature was slowly raised to 25℃. After stirring the reaction mixture for 26 hours, saturated aqueous ammonium chloride solution was added thereto, and the resultant mixture was stirred for 1 hour. Filtration under reduced pressure, separation of organic layer, and evaporation gave Compound (6).

Preparation of Compound (1)

Compound (6) (21.7 mmol) obtained as above, potassium iodide (KI) (86.8 mmol) and sodium phosphate monohydrate (NaH2PO2· H2O) (130.2 mmol) were dissolved in acetic acid, and the solution was stirred under reflux for 21 hours. After cooling the solution to 25℃, water was added with stirring, and the solid generated was filtered. The solid obtained was washed sequentially with methanol, ethyl acetate and tetrahydrofuran, to provide the target compound (1) as pale ivory solid.

[Preparation Example 1] Preparation of Compound (101)



Preparation of Compound (300)

In a mixed solution of toluene (300 mL) and ethanol (150 mL), dissolved were 9-bromoanthracene (15.0 g, 58.3 mmol), phenylboronic acid (Compound 200) (8.5 g, 70.0 mmol) and tetrakis(triphenylphosphine) palladium (0) (Pd(PPh3)4) (6.7 g, 5.8 mmol). After adding aqueous 2M sodium carbonate solution (145 mL) thereto, the resultant mixture was stirred under

reflux at 120℃ for 5 hours. Then, the temperature was lowered to 25℃, and the reaction was quenched by adding distilled water (150 mL). Extraction with ethyl acetate (200 mL), drying under reduced pressure, and recrystallization from tetrahydrofuran (20 mL) and methanol (300 mL) gave Compound (300) (12.0 g, 47.2 mmol).

Preparation of Compound (400)

Under nitrogen atmosphere, Compound (300) (11.7 g, 46.0 mmol) and N-bromosuccinimide (9.0 g, 50.6 mmol) were dissolved in dichloromethane (360 mL). The resultant solution was then stirred at 25℃ for 5 hours. The reaction was quenched by adding distilled water (300 mL). Extraction with dichloromethane (200 mL), drying under reduced pressure, and recrystallization from tetrahydrofuran (20 mL) and methanol (200 mL) gave the target compound (400) (13.0 g, 39.0 mmol).

Preparation of Compound (500)

In carefully purified tetrahydrofuran (200 mL), Compound (400) (13.0 g, 39.0 mmol) was dissolved. The resultant solution was chilled to -78℃, and n-butyl lithium (1.6M in hexane) (29.3 mL, 46.8 mmol) was slowly added thereto. After stirring the mixture for 1 hour, added was 2-isopropoxy-4,4,5,5-tetramethyl-1,3,2-dioxaborolane (15.9 mL, 78.0 mmol). The temperature was slowly raised to 25℃, and the mixture was

stirred for one day. After quenching the reaction by adding distilled water (200 mL), the mixture was extracted with ethyl acetate (300 mL) and dried under reduced pressure. Recrystallization from tetrahydrofuran (20 mL) and methanol (200 mL) gave the target compound (500) (13.5 g, 35.5 mmol).

Preparation of Compound (600)

In toluene (300 mL), dissolved were 2-chloro-9,10-anthraquinone (7.2 g, 29.7 mmol), Compound (500) (13.5 g, 35.5 mmol), tetrakis(triphenylphosphine) palladium (0) (Pd(PPh3)4) (3.5 g, 3.0 mmol) and Aliquat 336 (1.4 mL, 3.0 mmol). After adding aqueous 2M potassium carbonate solution (150 mL) thereto, the resultant mixture was stirred under reflux for 3 hours. Then, the temperature was lowered to 25℃, and the reaction was quenched by adding distilled water (100 mL). Extraction with ethyl acetate (200 mL), drying under reduced pressure, and recrystallization from methanol (200 mL) and tetrahydrofuran (50 mL) gave the target compound (600) (10.0 g, 21.7 mmol).

Preparation of Compound (700)

Tetrahydrofuran (250 mL) was added to 2-bromonaphthalene (11.2 g, 54.3 mmol), and the mixture was stirred at 25℃ for 10 minutes to achieve complete dissolution. After chilling to -72℃, n-butyl lithium (2.5M in hexane) (26.0 mL, 65.1 mmol) was

slowly added dropwise. After 1 hour, Compound (600) (10.0 g, 21.7 mmol) was added thereto, and the temperature was slowly raised to 25℃. After stirring the reaction mixture for 26 hours, saturated aqueous ammonium chloride solution was added thereto, and the resultant mixture was stirred for 1 hour. Filtration under reduced pressure, separation of organic layer, and evaporation gave the target compound (700) (15.6 g, 21.7 mmol).

Preparation of Compound (101)

Compound (700) (15.6 g, 21.7 mmol), potassium iodide (KI) (14.4 g, 86.8 mmol) and sodium phosphate monohydrate (NaH2PO2· H2O) (13.8 g, 130.2 mmol) were dissolved in acetic acid (250 mL), and the solution was stirred under reflux for 21 hours. After cooling the solution to 25℃, water (400 mL) was added with stirring, and the solid generated was filtered. The solid obtained was washed sequentially with methanol (300 mL), ethyl acetate (100 mL) and tetrahydrofuran (50 mL), to provide the target compound (101) (10.0 g, 68%) as pale ivory solid.

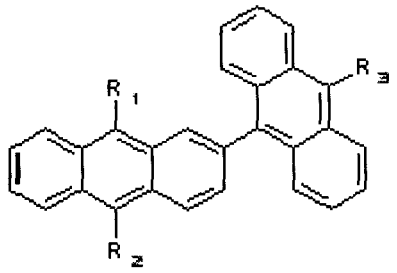
^{1}H NMR (CDCl3, 200 MHz) δ = 7.22 (m, 1H), 7.32-7.35 (m, 12H), 7.48-7.54 (m, 5H), 7.67-7.73 (m, 13H), 7.89 (m, 3H)

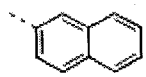
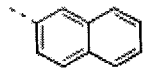
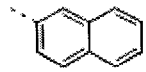
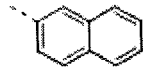
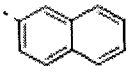
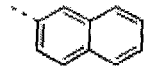
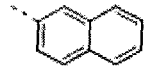
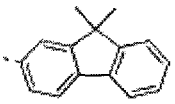
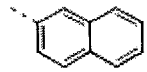
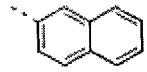
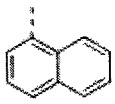
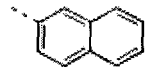
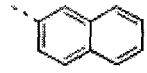
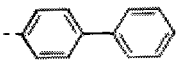
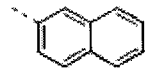
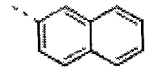
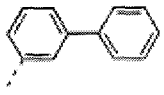
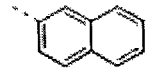
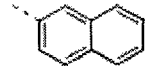
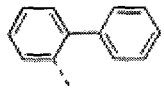
MS/FAB: 682 (found), 682.85 (calculated)

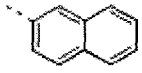
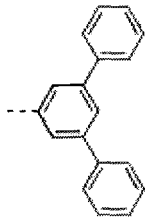
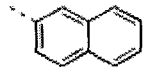
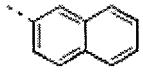
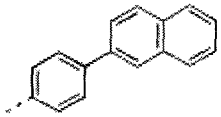
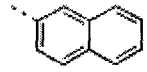
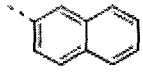
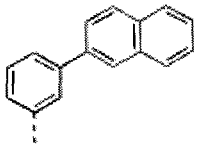
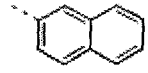
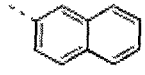
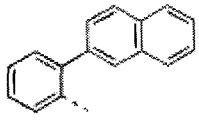
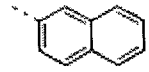
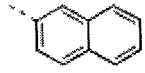
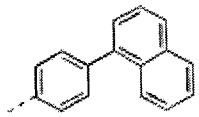
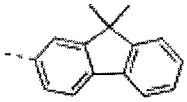
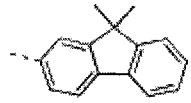
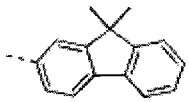
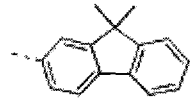
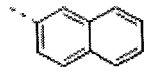
[Preparation Example 2~36]

Organic EL compounds shown in Table 1 were prepared according to the procedure described in Preparation Example 1. The NMR data of each compound are shown in Table 2.

[Table 1]



Preparation Ex.	Compound No.	R1	R2	R3
1	101			
2	102			
3	103			
4	104			
5	105			
6	106			
7	107			

8	108			
9	109			
10	110			
11	111			
12	112			
13	113			
14	114			
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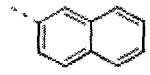
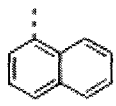
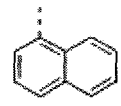
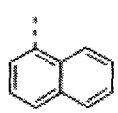
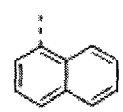
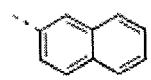
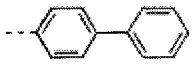
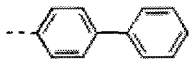
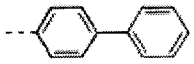
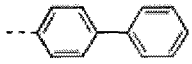
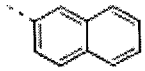
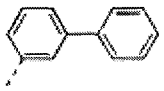
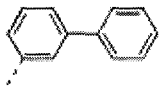
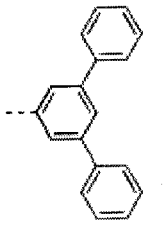
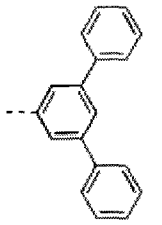
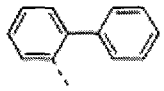
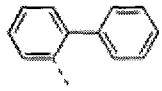
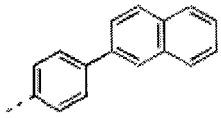
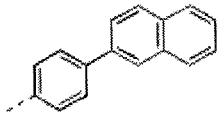
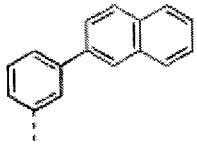
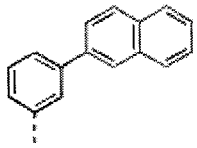
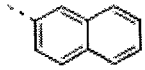
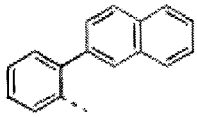
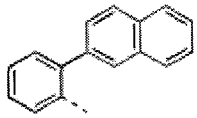
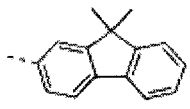
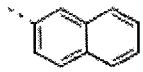
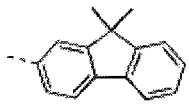
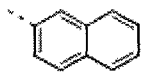
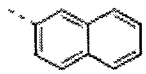
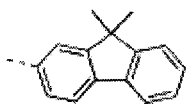
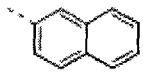
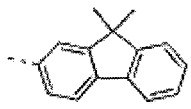
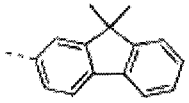
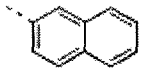
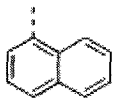
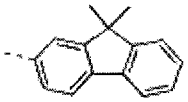
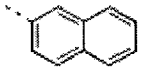
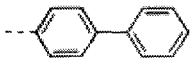
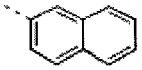
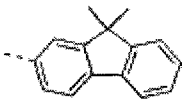
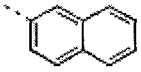
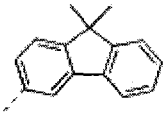
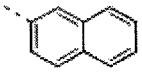
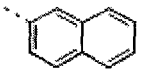
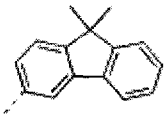
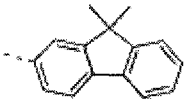
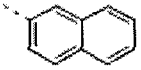
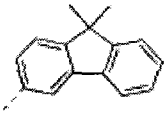
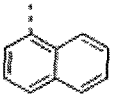
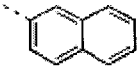
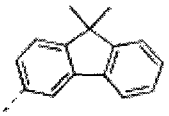
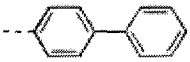
16	116			
17	117			
18	118			

19	119			
20	120			
21	121			
22	122			
23	123			
24	124			
25	125			
26	126			
27	127			
28	128			
29	129			

30	130			
31	131			
32	132			
33	133			
34	134			
35	135			
36	136			

[Table 2]

Compound No.	1H NMR(CDCl3, 200 MHz)	MS/FAB	
		found	calculated
101	δ 7.22(m, 1H), 7.32-7.35(m, 12H), 7.48-7.54(m, 5H), 7.67-7.73(m, 13H), 7.89(m, 3H)	682	682.85
102	δ 7.32(m, 12H), 7.54-7.57(m, 4H), 7.67-7.73(m, 16H), 7.88(m, 4H)	732	732.91
103	δ 1.67(s, 6H), 7.28-7.33(m, 12H), 7.54-7.77(m, 19H), 7.84-7.90(m, 5H)	798	799.01
104	δ 7.32-7.38(m, 13H), 7.54-7.56(m, 4H), 7.67-7.73(m, 16H), 7.86(m, 3H)	733	732.91

105	δ 7.22(m, 1H) 7.32-7.34(m, 12H), 7.48-7.54(m, 9H), 7.65-7.73(m, 13H), 7.88(m, 3H)	758	758.94
106	δ 7.21(m, 1H) 7.32-7.54(m, 20H), 7.67-7.73(m, 14H), 7.90(m, 3H)	759	759.94
107	δ 7.28-7.34(m, 15H), 7.48-7.54(m, 7H), 7.68-7.74(m, 13H), 7.87(m, 3H)	758	758.94
108	δ 7.24(m, 2H) 7.33-7.34(m, 14H), 7.48-7.54(m, 7H), 7.66-7.73(m, 16H), 7.89(m, 3H)	834	835.04
109	δ 7.30-7.33(m, 12H), 7.52-7.54(m, 8H), 7.67-7.74(m, 16H), 7.86(m, 3H)	808	809.00
110	δ 7.32-7.38(m, 15H), 7.54(m, 4H), 7.67-7.75(m, 17H), 7.88(m, 4H)	810	809.00
111	δ 7.28-7.32(m, 14H), 7.54-7.56(m, 6H), 7.67-7.74(m, 16H), 7.91(m, 4H)	808	809.00
112	δ 7.32-7.38(m, 13H), 7.52-7.55(m, 8H), 7.65-7.75(m, 16H), 7.87(m, 3H)	810	809.00
113	δ 1.68(s, 12H) 7.28-7.38(m, 13H), 7.48-7.77(m, 16H), 7.84-7.90(m, 5H)	814	815.05
114	δ 1.67(s, 12H) 7.28-7.35(m, 12H), 7.54-7.77(m, 18H), 7.84-7.90(m, 6H)	864	865.11
115	δ 7.22-7.32(m, 15H), 7.48-7.54(m, 7H), 7.65-7.75(m, 7H), 7.89(s, 1H)	582	582.73
116	δ 7.22(m, 2H) 7.32-7.35(m, 12H), 7.49-7.55(m, 6H), 7.65-7.72(m, 10H), 7.88(s, 2H)	633	632.79
117	δ 7.21(m, 1H) 7.32-7.40(m, 14H), 7.45-7.55(m, 5H), 7.63-7.67(m, 13H), 7.87(s, 1H)	683	682.85
118	δ 7.30-7.38(m, 14H), 7.54(m, 4H), 7.63-7.73(m, 16H), 7.89(s, 2H)	732	732.91
119	δ 7.22-7.32(m, 15H), 7.48-7.54(m, 15H), 7.67-7.73(m, 7H), 7.86(s, 1H)	734	734.92
120	δ 7.20(m, 2H) 7.32(m, 12H), 7.46-7.56(m, 14H), 7.65-7.74(m, 10H), 7.89(m, 2H)	784	784.98
121	δ 7.20-7.38(m, 17H), 7.44-7.54(m, 11H), 7.67-7.70(m, 9H), 7.89(s, 1H)	735	734.92
122	δ 7.22-7.34(m, 21H), 7.46-7.53(m, 11H), 7.66-7.74(m, 13H), 7.85(s, 1H)	886	887.11
123	δ 7.28-7.32(m, 19H), 7.50-7.54(m, 11H), 7.65-7.67(m, 7H), 7.88(s, 1H)	734	734.92
124	δ 7.20(m, 1H) 7.32-7.35(m, 12H), 7.46-7.54(m, 13H), 7.65-7.72(m, 13H),	834	835.04

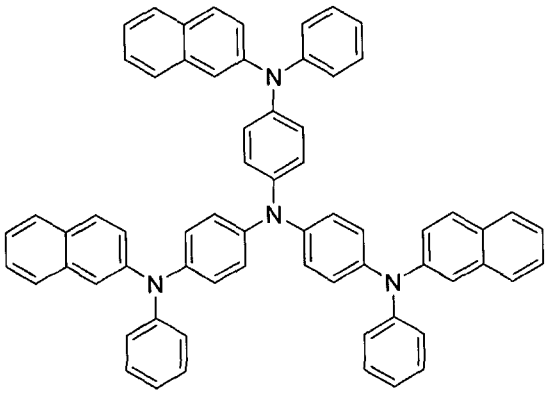
	7.90(m, 3H)		
125	δ 7.32-7.44(m, 18H), 7.54(m, 4H), 7.67-7.70(m, 18H), 7.88(s, 4H)	886	885.10
126	δ 7.28-7.32(m, 17H), 7.48-7.54(m, 9H), 7.67-7.73(m, 13H), 7.87(m, 3H)	834	835.04
127	δ 1.67(s, 6H) 7.22-7.33(m, 13H), 7.48-7.73(m, 17H), 7.84-7.90(m, 4H)	748	748.95
128	δ 1.68(s, 6H), 7.28-7.38(m, 12H), 7.55-7.73(m, 19H), 7.84-7.90(m, 5H)	798	799.01
129	δ 1.67(s, 12H) 7.21-7.38(m, 12H), 7.55-7.73(m, 18H), 7.85-7.91(m, 6H)	864	865.11
130	δ 1.67(s, 6H), 7.32-7.38(m, 13H), 7.54-7.74(m, 19H), 7.84-7.93(m, 4H)	798	799.01
131	δ 1.68(s, 6H) 7.23-7.40(m, 13H), 7.48-7.60(m, 10H), 7.67-7.77(m, 11H), 7.85-7.90(m, 4H)	824	825.04
132	δ 1.67(s, 6H) 7.22-7.33(m, 13H), 7.48-7.73(m, 17H), 7.84-7.90(m, 4H)	748	748.95
133	δ 1.68(s, 6H), 7.28-7.38(m, 12H), 7.55-7.73(m, 19H), 7.84-7.90(m, 5H)	798	799.01
134	δ 1.67(s, 12H) 7.21-7.38(m, 12H), 7.55-7.73(m, 18H), 7.85-7.91(m, 6H)	864	865.11
135	δ 1.67(s, 6H), 7.32-7.38(m, 13H), 7.54-7.74(m, 19H), 7.84-7.93(m, 4H)	798	799.01
136	δ 1.68(s, 6H) 7.23-7.40(m, 13H), 7.48-7.60(m, 10H), 7.67-7.77(m, 11H), 7.85-7.90(m, 4H)	824	825.04

[Example 1~13] Manufacture of OLED device by employing the compounds according to the present invention

An OLED device was made by using the electroluminescent material according to the present invention.

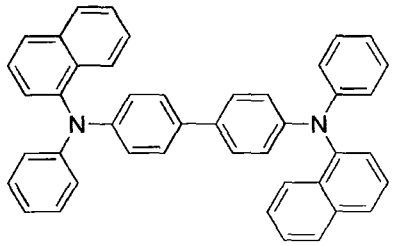
First, a transparent electrode ITO thin film (15 Ω/□) obtained from glass for OLED (manufactured by Samsung-Corning) was subjected to ultrasonic washing with trichloroethylene, acetone, ethanol and distilled water, sequentially, and stored in isopronanol before use.

Then, an ITO substrate was equipped in a substrate folder of vacuum vapor-deposit device, and 4,4',4"-tris(N,N-(2-naphthyl)-phenylamino)triphenylamine (2-TNATA) represented by following chemical formula was placed in a cell of the vacuum vapor-deposit device, which was then ventilated up to 10-6 torr of vacuum in the chamber. Electric current was applied to the cell to evaporate 2-TNATA to vapor-deposit a hole injection layer having 60 nm of thickness on the ITO substrate.



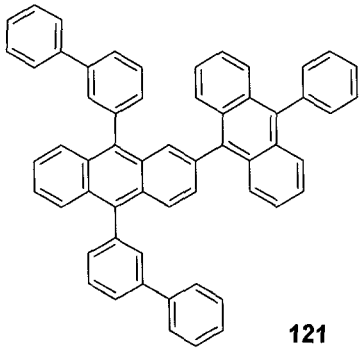
2-TNATA

Then, to another cell of the vacuum vapor-deposit device, charged was N,N'-bis(α-naphthyl)-N,N'-diphenyl-4,4'-diamine (NPB) represented by following chemical formula, and electric current was applied to the cell to evaporate NPB to vapor-deposit a hole transport layer having 20 nm of thickness on the hole injection layer.

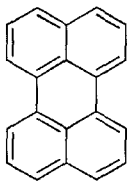


NPB

After forming the hole injection layer and the hole transport layer, an electroluminescent layer was vapor-deposited thereon as follows. In one cell of the vacuum vapor-deposit device, charged was a compound according to the present invention (for example, Compound 121), and in another cell charged was perylene, having the structure shown below, as a dopant material. By evaporating the two substances in a different rate, an electroluminescent layer was vapor-deposited by doping of perylene in a concentration from 2 to 5 mol% with a thickness of 35 nm, on the hole transport layer.



121

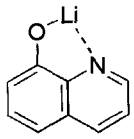


perylene

Then, tris(8-hydroxyquinoline)aluminum (III) (Alq) represented by following chemical formula was vapor-deposited as an electron transport layer with a thickness of 20 nm, and

lithium quinolate (Liq) represented by following chemical formula was vapor-deposited as an electron injection layer with a thickness from 1 to 2 nm. Thereafter, an Al cathode was vapor-deposited with a thickness of 150 nm by using another vapor-deposit device, to manufacture an OLED.

Alq



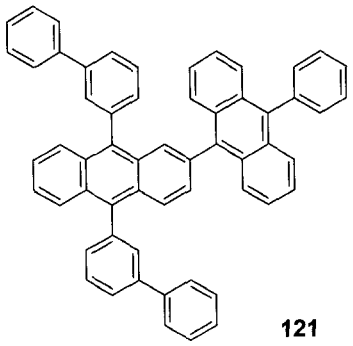
Liq

Each substance employed in the OLED device was used after being purified by sublimation in vacuo at 10-6 torr.

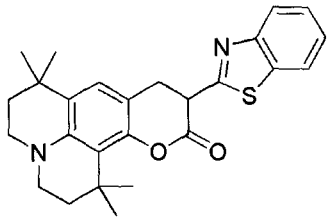
[Example 14~26]

Manufacture of OLED device by employing the compounds according to the invention

A hole injection layer and a hole transport layer were formed as in Example 1, and an EL layer was vapor-deposited thereon as follows. In one cell of the vacuum vapor-deposit device, charged was a compound according to the present invention (for example, Compound 121), and in another cell charged was Coumarin 545T (C545T), having the structure shown below. By evaporating the two substances in a different rate, an EL layer was vapor-deposited by doping of Coumarine 545T (C545T) in a concentration from 2 to 5 mol% with a thickness of 35 nm, on the hole transport layer.



121

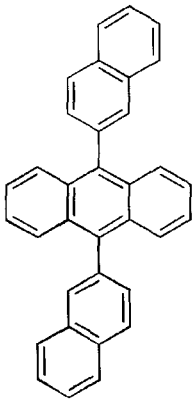


C545T

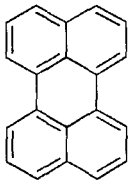
According to the same procedure as in Example 1, an electron transport layer and an electron injection layer were vapor-deposited, and Al cathode was vapor-deposited with a thickness of 150 nm by using another vapor-deposition device, to manufacture an OLED.

[Comparative Example 1] Manufacture of OLED device by using conventional EL material

A hole injection layer and a hole transport layer were formed as in Example 1. In one cell of the vacuum vapor-deposit device, charged was dinaphthylanthracene (DNA) as a blue EL material, and in another cell charged was perylene as another blue EL material. An electroluminescent layer was vapor-deposited with a thickness of 35 nm, on the hole transport layer by using the vapor-deposit rate of 100:1.



DNA

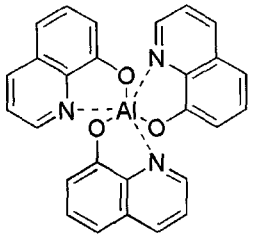


perylene

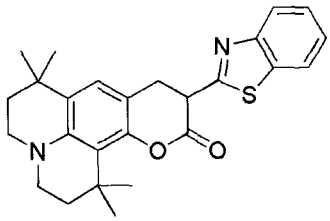
According to the same procedure as in Example 1, an electron transport layer and an electron injection layer were vapor-deposited, and Al cathode was vapor-deposited in a thickness of 150 nm by using another vapor-deposition device, to manufacture an OLED.

[Comparative Example 2] Manufacture of OLED device by using conventional EL material

A hole injection layer and a hole transport layer were formed as in Example 1. To another cell in the vapor-deposition device, charged was tris(8-hydroxyquinoline)aluminum (III) (Alq) as an EL host material, and to still another cell, charged was Coumarin 545T (C545T). By evaporating the two substances in a different rate, an EL layer was vapor-deposited by doping with a thickness of 30 nm, on the hole transport layer. The doping concentration was preferably from 2 to 5 mol% on the basis of Alq.



Alq



C545T

According to the same procedure as in Example 1, an electron transport layer and an electron injection layer were vapor-deposited, and Al cathode was vapor-deposited in a thickness of 150 nm by using another vapor-deposition device, to manufacture an OLED.

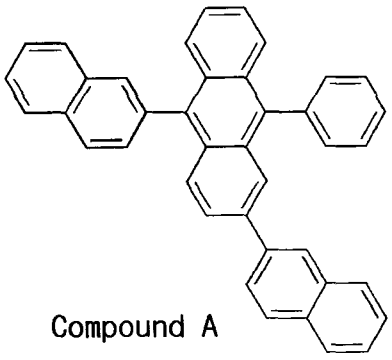
[Comparative Example 3] Manufacture of OLED device by using conventional EL material

A hole injection layer and a hole transport layer were formed as in Example 1. To another cell in the vapor-deposition device, charged was dinaphthylanthracene (DNA) as a blue EL material, and to still another cell, charged was Coumarin 545T (C545T). By evaporating the two substances in a different rate, an EL layer was vapor-deposited by doping, with a thickness of 30 nm, on the hole transport layer. The doping concentration was preferably from 2 to 5 mol% on the basis of Alq.

[Comparative Example 4] Manufacture of OLED device by

using conventional EL material

A hole injection layer and a hole transport layer were formed as in Example 1. To another cell in the vapor-deposition device, charged was Compound (A) disclosed by US Patent Publication No. 20060046097A1, having the structure shown below as a blue EL material, and to still another cell, charged was Coumarin 545T (C545T). By evaporating the two substances in a different rate, an EL layer was vapor-deposited by doping, with a thickness of 30 nm, on the hole transport layer. The doping concentration was preferably from 2 to 5 mol% on the basis of Alq.



Compound A

According to the same procedure as in Example 1, an electron transport layer and an electron injection layer were vapor-deposited, and Al cathode was vapor-deposited in a thickness of 150 nm by using another vapor-deposition device, to manufacture an OLED.

[Experimental Example 1] Blue EL property of the OLED devices manufactured

Blue luminous efficiencies of OLEDs manufactured from Examples 1 to 13 and Comparative Example 1, comprising an organic EL compound according to the present invention and a conventional electroluminescent compound, respectively, were measured at 500 cd/m2 and 2,000 cd/m2, individually, of which the results are shown in Table 3.

[Table 3]

No.	Host	Dopant	Doping conc. (mol%)	Luminous efficiency (cd/A)		Color coordinate
				@500 cd/m2	@2,000 cd/m2	
Ex. 1	Compound 101	perylene	2.0	5.72	5.30	(0.16, 0.21)
Ex. 2	Compound 102	perylene	2.0	5.43	5.04	(0.16, 0.22)
Ex. 3	Compound 103	perylene	3.0	5.60	5.17	(0.16, 0.21)
Ex. 4	Compound 107	perylene	3.0	5.93	5.46	(0.16, 0.21)
Ex. 5	Compound 109	perylene	3.0	6.27	5.88	(0.16, 0.22)
Ex. 6	Compound 113	perylene	5.0	5.36	4.97	(0.15, 0.18)
Ex. 7	Compound 115	perylene	3.0	5.26	4.80	(0.15, 0.17)
Ex. 8	Compound 120	perylene	3.0	5.54	5.12	(0.16, 0.20)
Ex. 9	Compound 121	perylene	3.0	6.30	5.86	(0.15, 0.19)
Ex. 10	Compound 122	perylene	3.0	5.80	5.42	(0.16, 0.20)
Ex. 11	Compound 126	perylene	3.0	6.03	5.63	(0.15, 0.19)
Ex. 12	Compound 129	perylene	3.0	5.99	5.64	(0.15, 0.19)
Ex. 13	Compound 136	perylene	3.0	5.88	5.51	(0.15, 0.18)
Comp.Ex. 1	DNA	perylene	2.0	4.45	3.62	(0.16, 0.20)

Table 3 shows the results of applying the material according to the present invention to a blue EL device. As can be seen from Table 3, the luminous efficiency of the EL material according to the invention was 5.26~6.30 cd/A at low luminance, and 4.80~5.88 cd/A at high luminance, while that of the EL material of Comparative Example 1 was 4.45 cd/A and 3.6 cd/A at low luminance and high luminance, respectively. Thus, the EL device employing the organic EL compound according to the present invention showed higher luminous efficiency by 1.5 cd/A or more, as compared to that of Comparative Example. In particular, improvement in luminous efficiency by 2 cd/A or more was confirmed at high luminance for each compound.

Further, when the host material of the present invention was applied, somewhat improvement was observed in terms of color purity. The result of simultaneous improvement in color purity and luminous efficiency as shown above proves that the EL material according to the present invention has excellent properties.

Fig. 1 shows luminous efficiency - current density property of Comparative Example 1 employing DNA:perylene as a conventional EL material, and Fig. 2 and Fig. 3 show current density - voltage property and luminous efficiency - current density property of Example 9 employing Compound (121) according to the present invention as an EL material. The results shown in the figures confirmed noticeable improvement

in performances.

[Experimental Example 2] Green EL property of the OLED devices manufactured

Green luminous efficiencies of OLEDs manufactured from Examples 14 to 26 and Comparative Example 1, comprising an organic EL compound according to the invention and a conventional electroluminescent compound, respectively, were measured at 5,000 cd/m2 and 20,000 cd/m2, individually, of which the results are shown in Table 4.

[Table 4]

No.	Host	Dopant	Doping conc. (mol%)	Luminous efficiency (cd/A)		Color coordinate
				@5,000 cd/m2	@20,000 cd/m2	
Ex. 14	Compound 101	C545T	2.0	17.5	17.0	(0.28, 0.64)
Ex. 15	Compound 102	C545T	2.0	17.2	16.8	(0.28, 0.64)
Ex. 16	Compound 103	C545T	3.0	18.2	17.7	(0.28, 0.64)
Ex. 17	Compound 107	C545T	3.0	18.5	17.9	(0.28, 0.64)
Ex. 18	Compound 109	C545T	3.0	18.7	18.0	(0.27, 0.63)
Ex. 19	Compound 113	C545T	5.0	17.2	16.8	(0.26, 0.64)
Ex. 20	Compound 115	C545T	3.0	17.3	16.8	(0.26, 0.62)
Ex. 21	Compound 120	C545T	3.0	19.2	18.4	(0.27, 0.64)
Ex. 22	Compound 121	C545T	3.0	20.1	19.5	(0.27, 0.64)
Ex. 23	Compound 122	C545T	3.0	17.9	16.7	(0.28, 0.65)
Ex. 24	Compound	C545T	3.0	18.0	17.4	(0.27, 0.63)

	126					
Ex. 25	Compound 129	C545T	3.0	18.7	18.0	(0.28, 0.63)
Ex. 26	Compound 136	C545T	3.0	18.6	17.9	(0.28, 0.63)
Comp.Ex. 2	Alq	C545T	2.0	10.3	9.1	(0.29, 0.65)
Comp.Ex. 3	DNA	C545T	2.0	15.8	14.0	(0.27, 0.61)
Comp.Ex. 4	Compound A	C545T	2.0	16.7	14.8	(0.25, 0.62)

Table 4 shows the results of properties from the green EL device to which the material according to the present invention was applied. Alike the blue EL devices according to Experimental Example 1, excellent properties were confirmed at low luminance and high luminance, as compared to conventional EL material.

Improvements in efficiency by 70% or more as compared to Alq host of Comparative Example 2, and by 40% or more as compared to conventional host of Comparative Example 3 were confirmed. This result shows prominent overcoming of limitations of conventional green EL materials. In particular, it is estimated that the excellent improvement of performance at high luminance sufficiently enables the compounds to be used in practical use for large screen OLED's, or manual OLED's of 2-inch level which require critical properties.

With respect to color coordinate, there was no significant difference. Thus the EL material of the present invention having improved luminous efficiency while maintaining the color purity as such can be referred to as an

epoch-making invention which surpasses one stage beyond the conventional materials.

Fig. 4 shows luminous efficiency - luminance property of Comparative Example 2 employing Alq:C545T as a conventional green EL material, and Fig. 5 shows luminous efficiency - current density property of the green EL device of Example 22 employing Compound (121) according to the present invention as an EL material. Fig. 6 shows luminous efficiency - current density property of the green EL devices of Comparative Example 3 and 4 employing conventional EL material, and Example 22 employing Compound (121) according to the present invention as an EL material.

The EL material according to the present invention can be applied to both a blue OLED and a green OLED, and showed excellent results in view of performances. Those results show prominent characteristics of excellent EL material. The invention of the material having those characteristics leads simplification of the structure of an OLED panel, to result in subsidiary result of reducing the production cost of an OLED. Due to the excellent features, innovative results may occur in development in the field of OLED's.

Fig. 7 shows the comparison of color purity of a green EL device according to Example 22 employing Compound (121) of the present invention as an EL material with that of a green EL device according to Comparative Example 2. The EL material of

the invention showed good EL color property, as showing no significant difference as compared to a conventional pure green EL material. In the EL spectrum of the EL device according to Example 22, a typical green EL peak at 520 nm was confirmed. This exhibits the fact that the organic EL compound having blue EL property according to the present invention has very good electric property to induce the feature of an EL dopant up to a maximum level.

Among others, excellent life property of the material according to the invention as compared to conventional EL materials achieves utmost benefit of the inventive material, in contrast with conventional materials having good electron conductivity.

By incorporating 10-position of 9-arylanthryl to 2-position of anthracene, the overlapping effect of intermolecular orbitals is improved, and the relation of energy level with the dopant is made more advantageous, to make up the disadvantages of the simple conventional 9,10-diarylanthracene structure.

【Industrial Applicability】

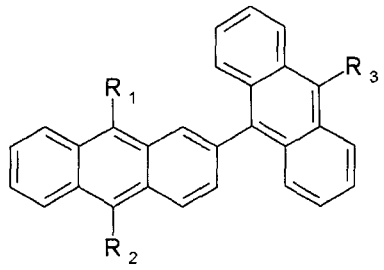
The electroluminescent compound according to the invention has good luminous efficiency and excellent lifetime of the material, so that an OLED device having very good operation lifetime can be prepared.

【CLAIMS】

【Claim 1】

An organic electroluminescent material represented by following Chemical Formula 1:

[Chemical Formula 1]



wherein R1 through R3 independently represent phenyl group or C10~C20 fused multi-cyclic aromatic ring, and the phenyl group or C10~C20 fused multi-cyclic aromatic ring of R1 to R3 may be further substituted by C1~C20 alkyl group, C1~C20 alkoxy group, halogen, C5~C7 cycloalkyl group, phenyl group or a fused multi-cyclic aromatic group.

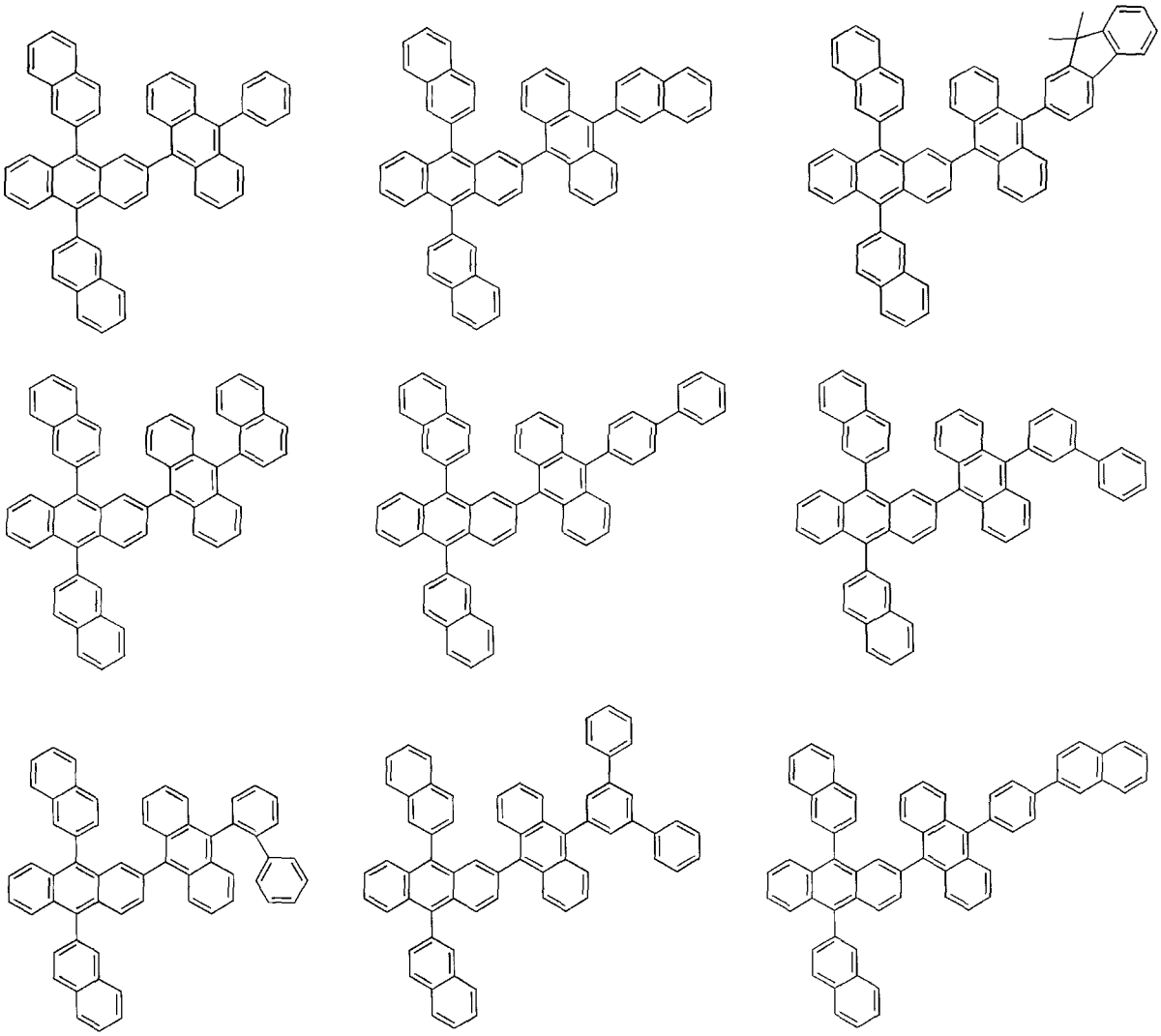
【Claim 2】

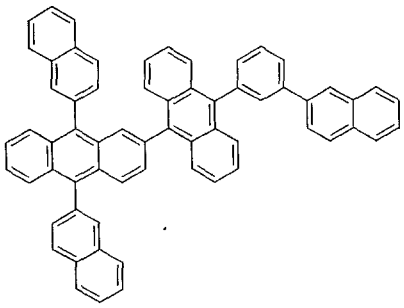
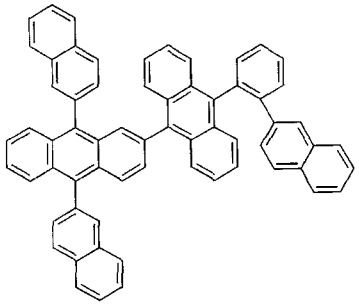
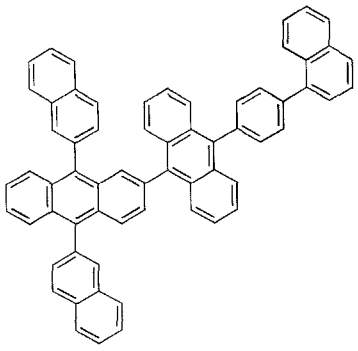
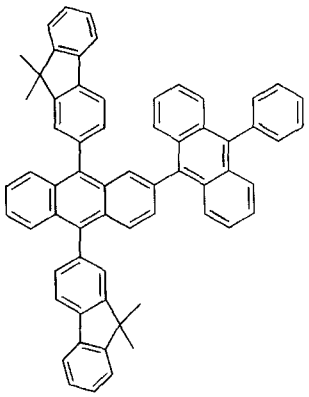
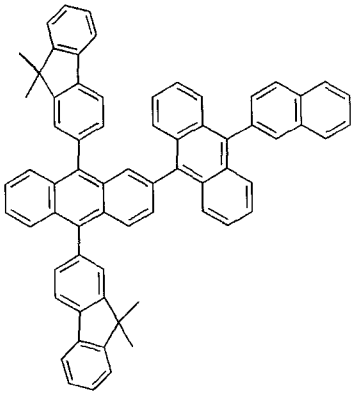
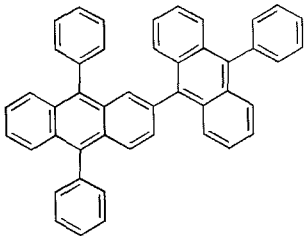
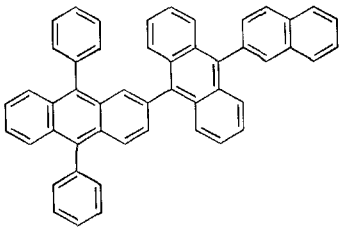
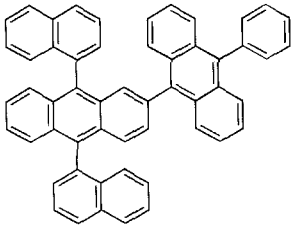
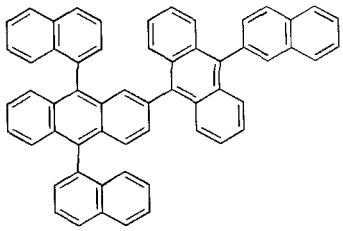
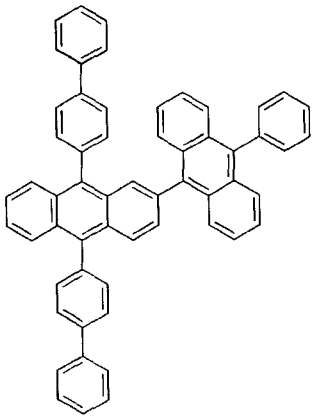
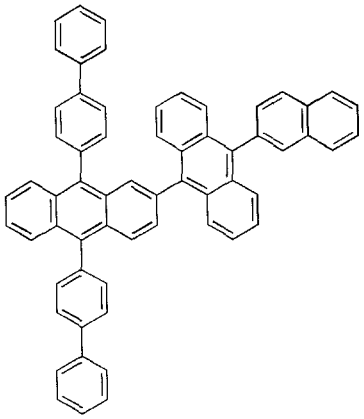
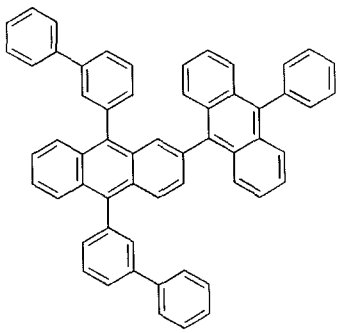
An organic electroluminescent material according to claim 1, wherein R1 through R3 of Chemical Formula (1) are independently selected from the group consisting of phenyl, naphtyl, anthryl, fluorenyl, phenanthryl, fluorancenyl, pyrenyl, perylenyl or naphthacenyl; and phenyl, naphthyl, anthryl, fluorenyl, phenanthryl, flurorancenyl, pyrenyl, perylenyl and naphthacenyl are optionally substituted by C1~C20 alkyl groups, C1~C20 alkoxy groups, halogen atoms, C5~C7 cycloalkyl groups, phenyl group, or a fused multicyclic

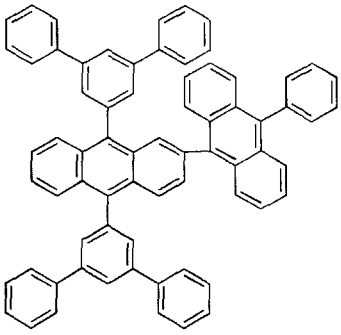
aromatic group.

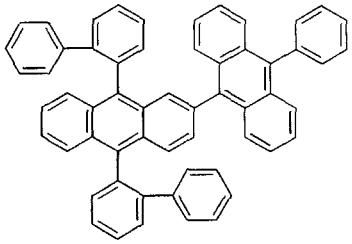
【Claim 3】

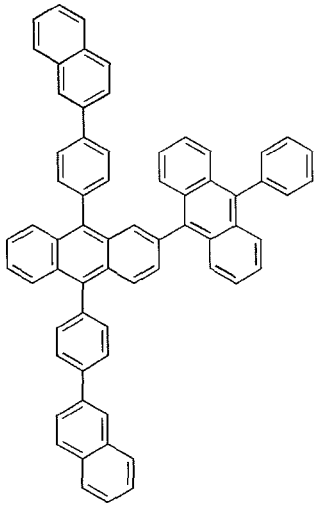
An organic electroluminescent material according to claim 2, which is selected from the compounds represented by following chemical formulas:

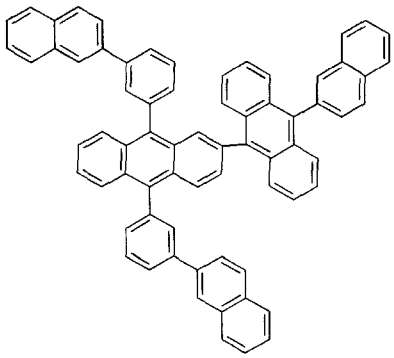


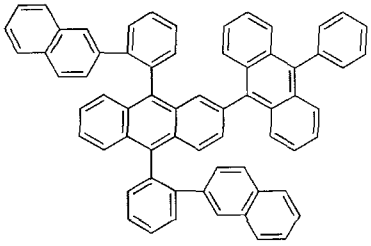













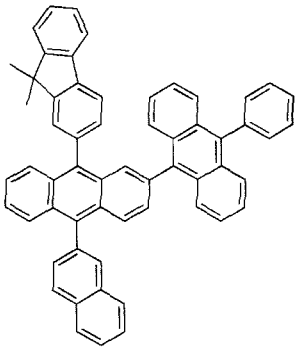


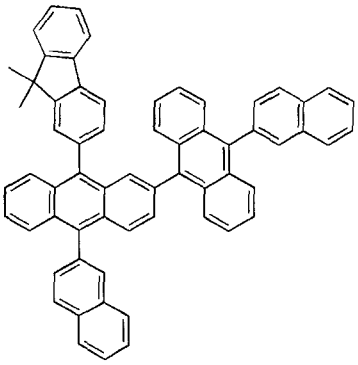


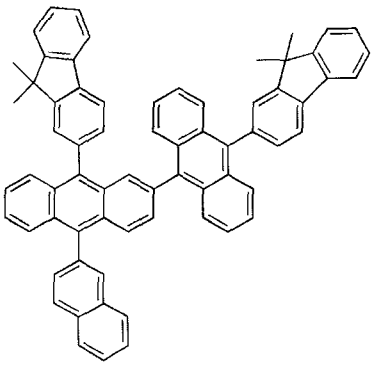


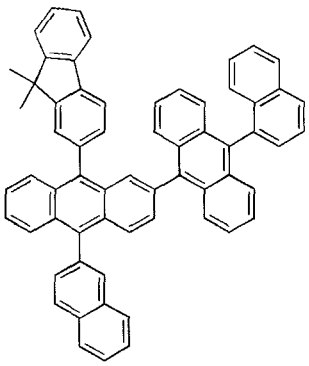


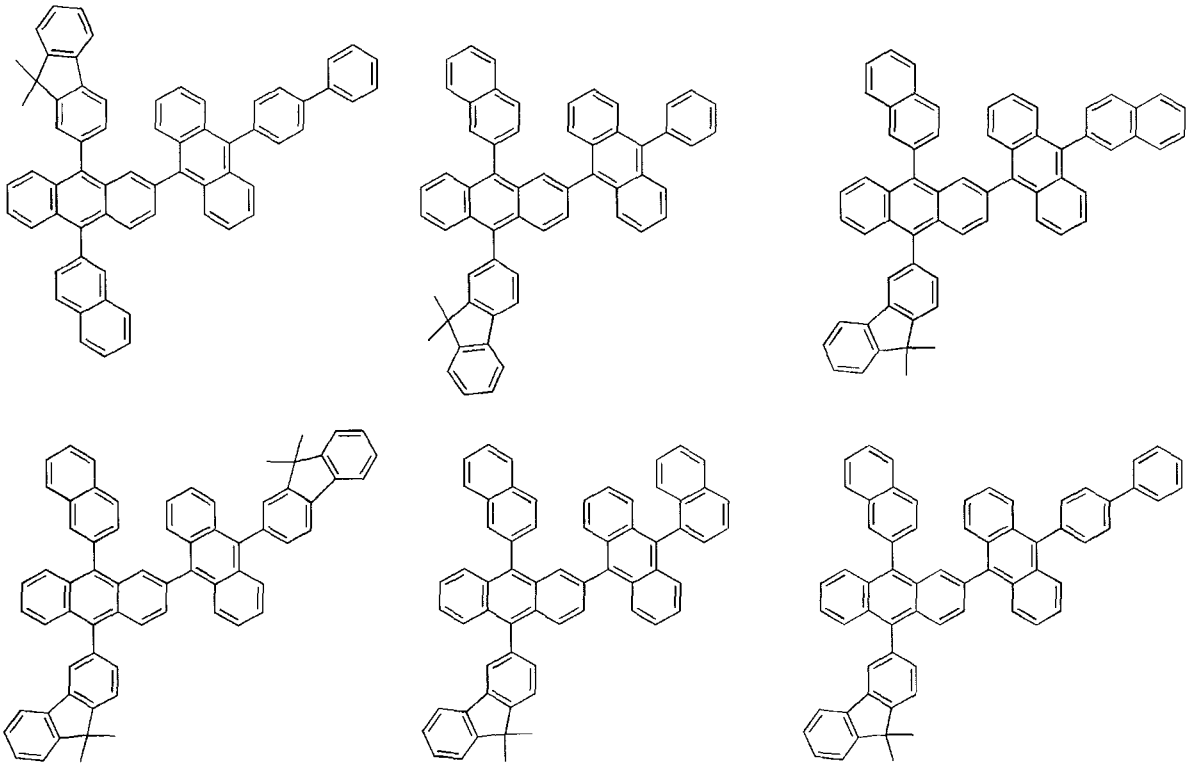








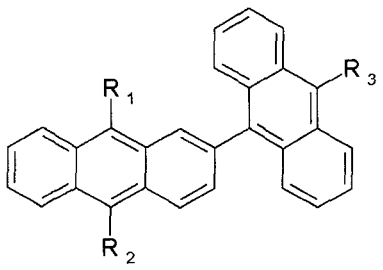




【Claim 4】

An organic electroluminescent device comprised of a first electrode; a second electrode; and one or more organic layer(s) interposed between the first electrode and the second electrode, wherein the organic layer comprises one or more compound(s) represented by Chemical Formula (1):

[Chemical Formula 1]



wherein R1 to R3 independently represent phenyl group or C10~C20 fused multi-cyclic aromatic ring, and the phenyl group

or C10~C20 fused multi-cyclic aromatic ring of R1 to R3 may be further substituted by C1~C20 alkyl group, C1~C20 alkoxy group, halogen, C5~C7 cycloalkyl group.

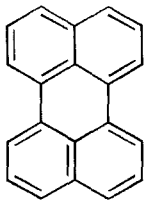
【Claim 5】

An organic electroluminescent device according to claim 4, wherein the organic layer comprises electroluminescent region which comprises one or more compound(s) represented by Chemical Formula (1) and one or more electroluminescent dopant(s).

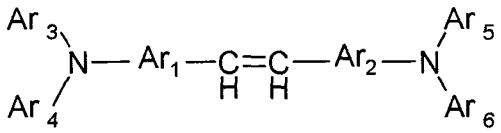
【Claim 6】

An organic electroluminescent device according to claim 5, wherein the electroluminescent dopant is selected from the compounds represented by one of Chemical Formulas (2) to (4):

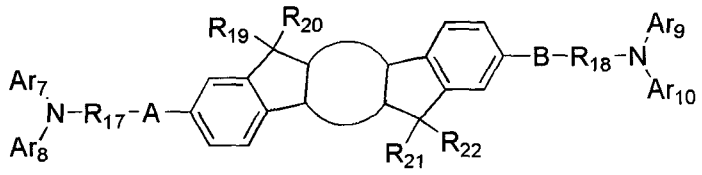
[Chemical Formula 2]



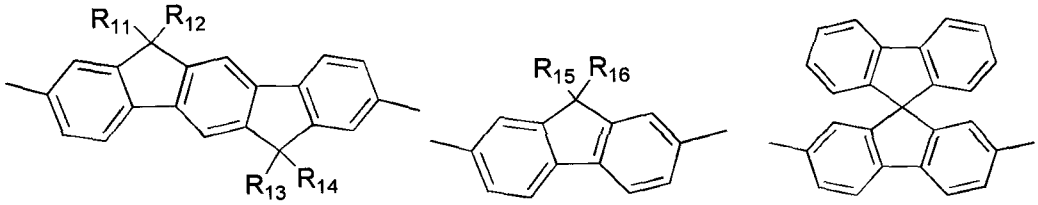
[Chemical Formula 3]



[Chemical Formula 4]

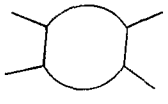
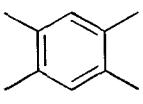
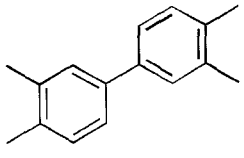


wherein, Ar1 and Ar2 are selected from indenofluorene, fluorene and spiro-fluorene, represented by following chemical formulas:

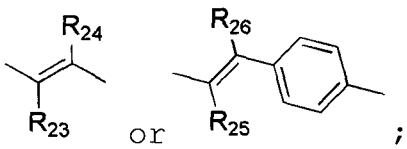


wherein R11 to R16 are independently selected from the group consisting of C1~C20 alkyl, and phenyl or naphthyl with or without C1~C5 alkyl substituent(s);

Ar3 to Ar6 are independently selected from C5~C20 aromatic or multi-cyclic aromatic ring; provided that Ar1 and Ar2 are identical, Ar3 and Ar5 are identical, and Ar4 and Ar6 are identical;

group  represents  or  ;

A and B independently represent a chemical bond, or group



;

R17 and R18 independently represent an aromatic ring or a multi-cyclic aromatic ring wherein two or more aromatic rings have been fused;

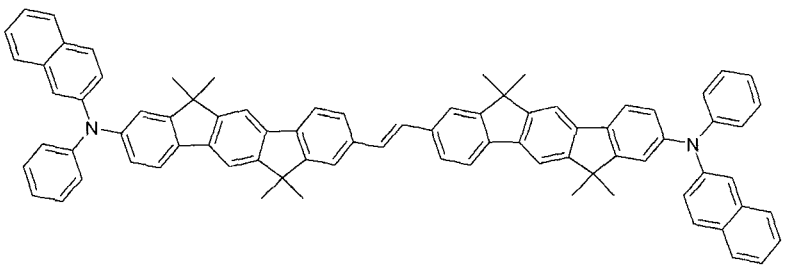
R19 to R22 independently represent a linear or branched C1~C20 alkyl group with or without halogen substituent(s);

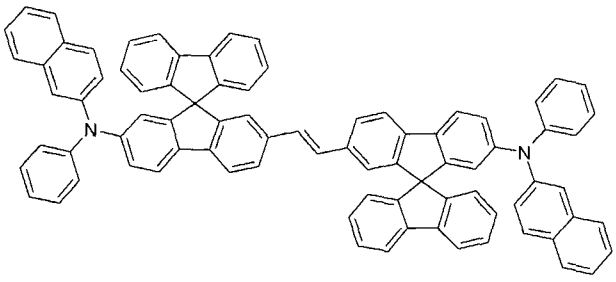
R23 to R26 independently represent hydrogen or an aromatic group; and

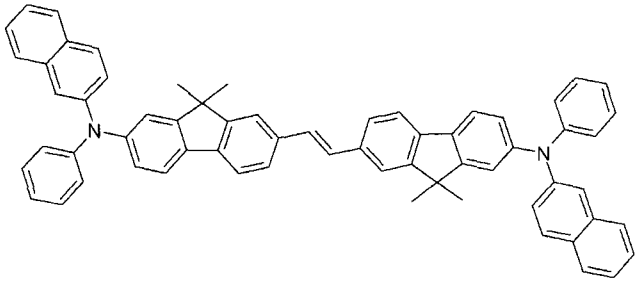
Ar7 to Ar10 independently represent an aromatic ring or a multi-cyclic aromatic ring wherein two or more aromatic rings have been fused.

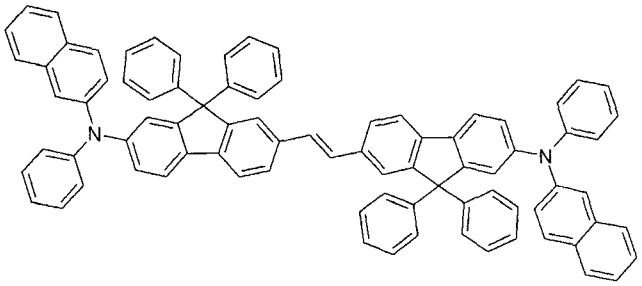
【Claim 7】

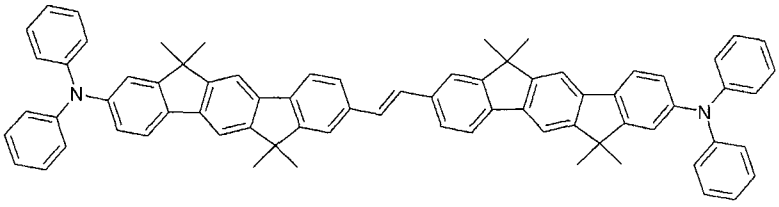
An organic electroluminescent device according to claim 6, wherein the electroluminescent dopant is selected from the compounds represented by one of the following formulas:

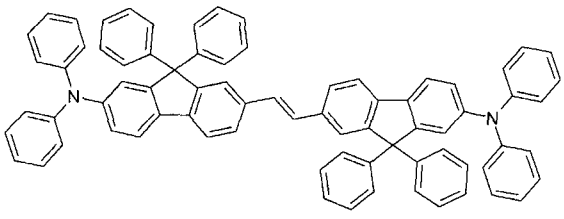


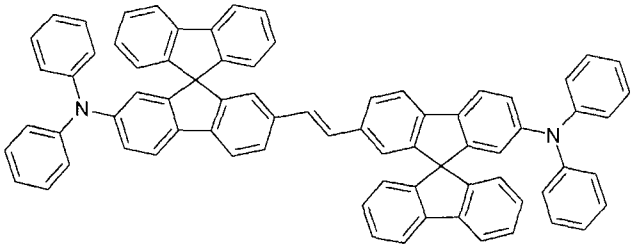


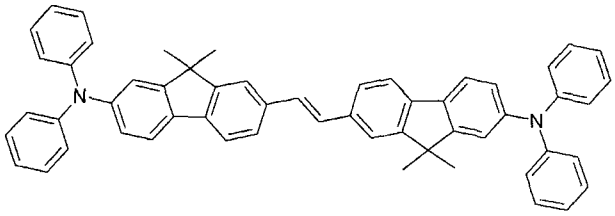


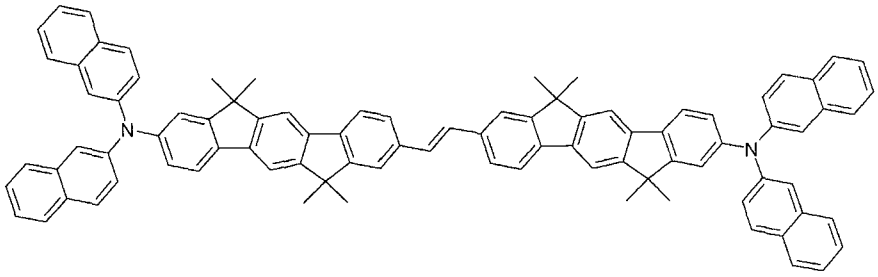


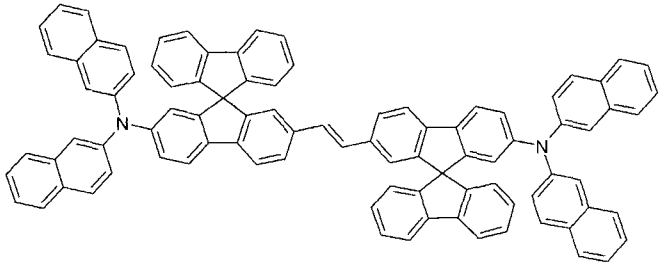


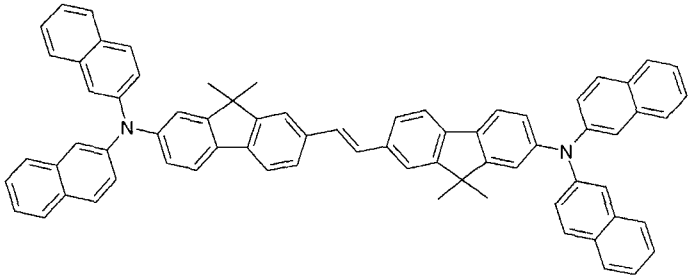


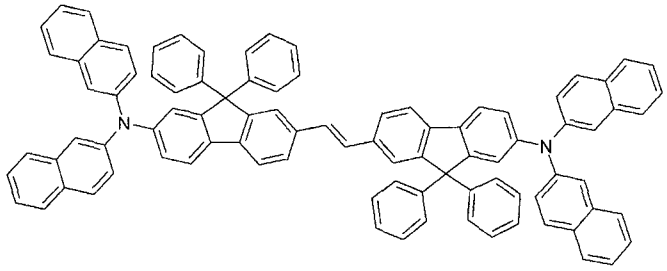


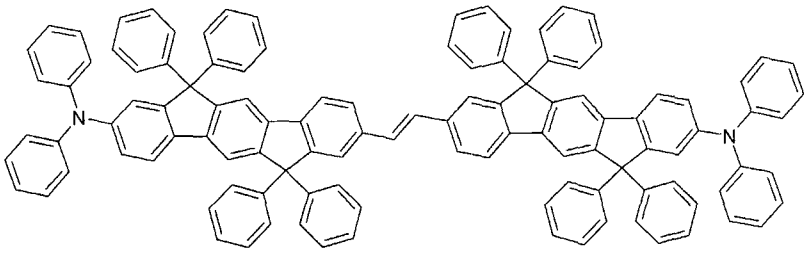


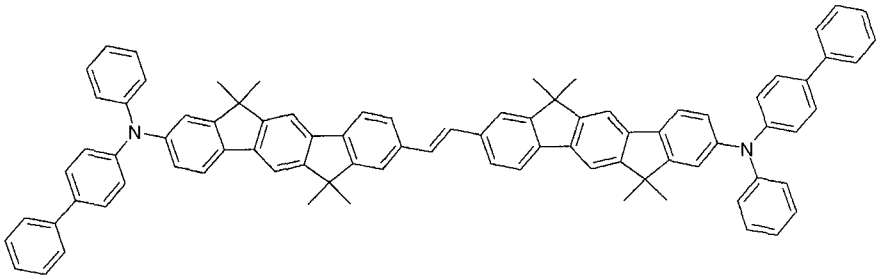


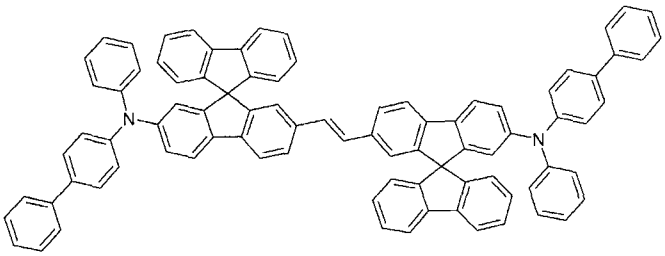


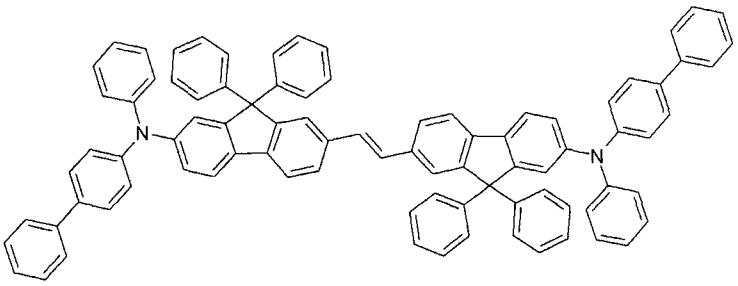


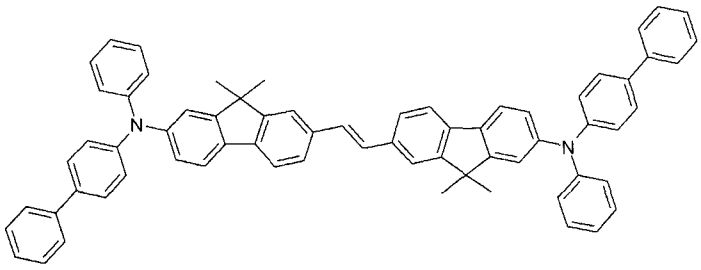


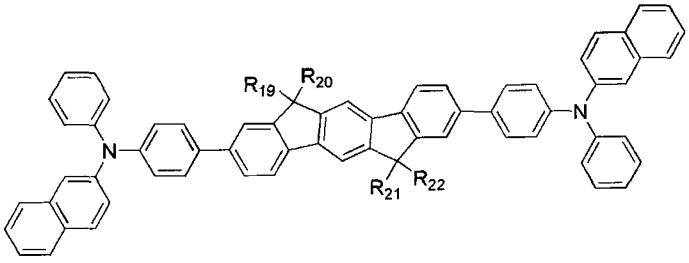








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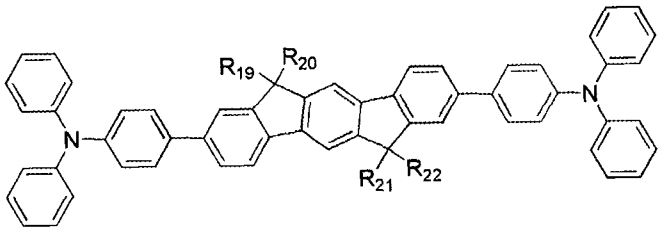

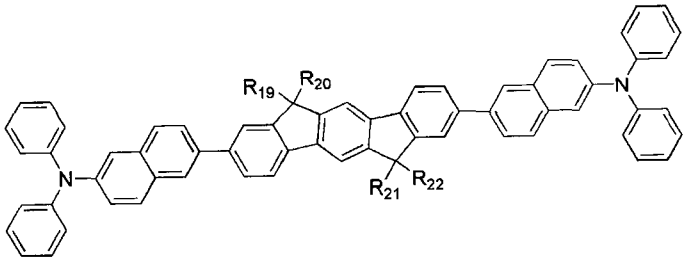

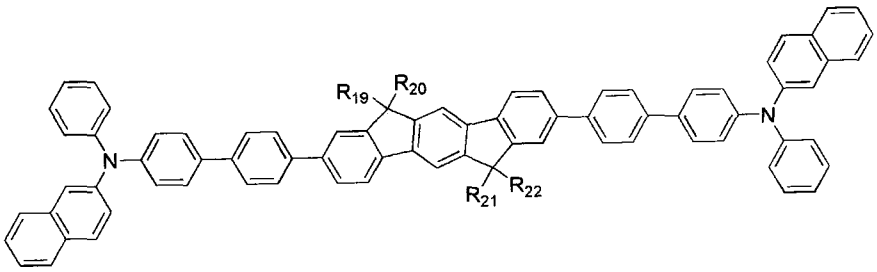

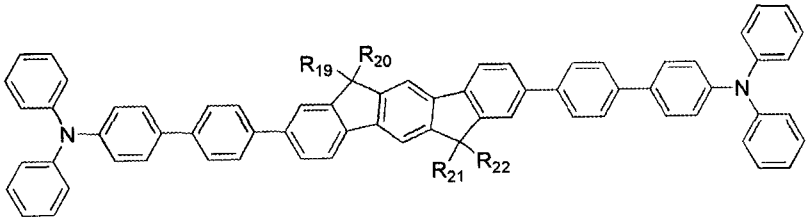

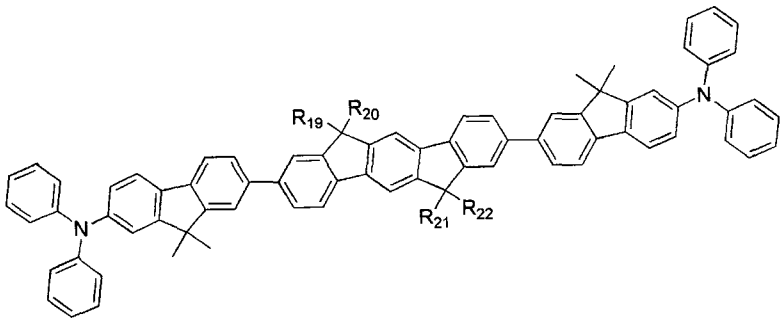

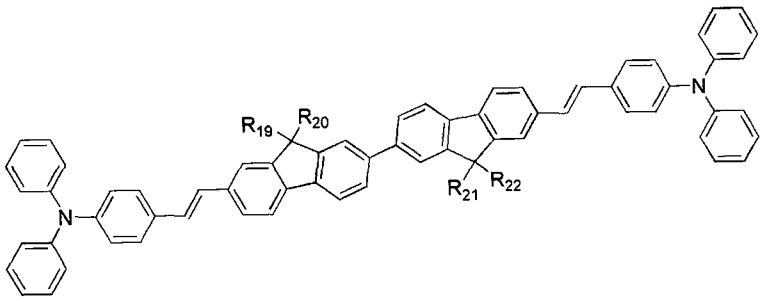

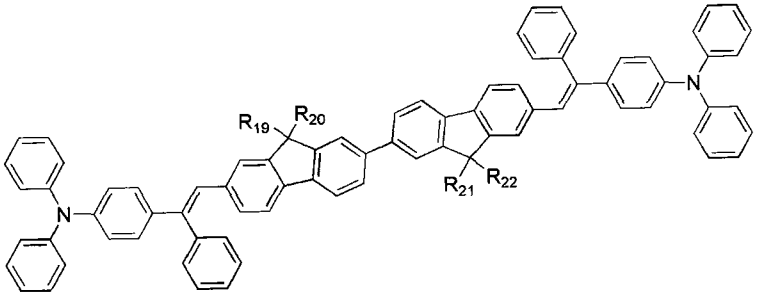
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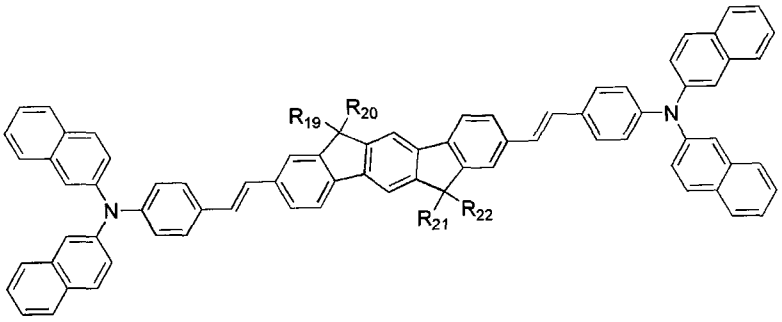
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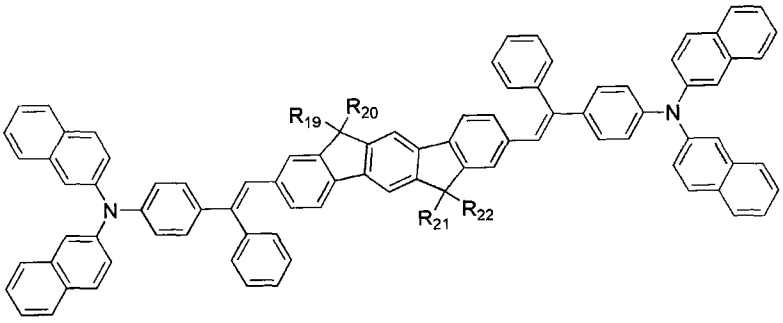
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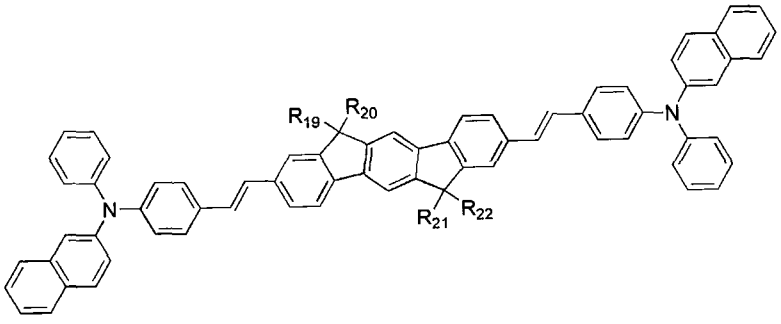
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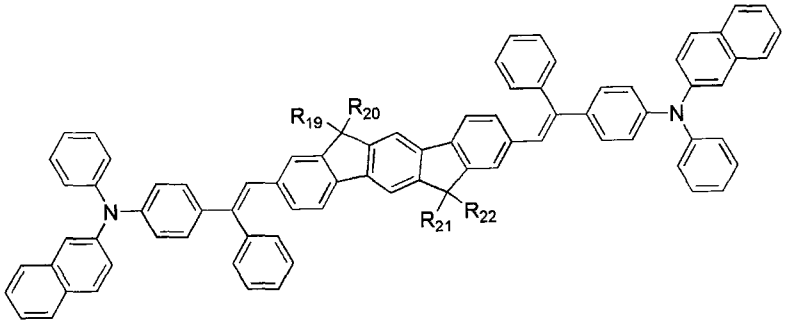
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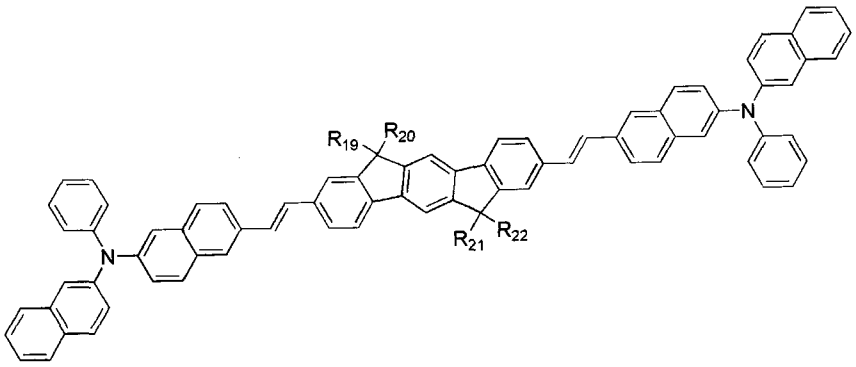
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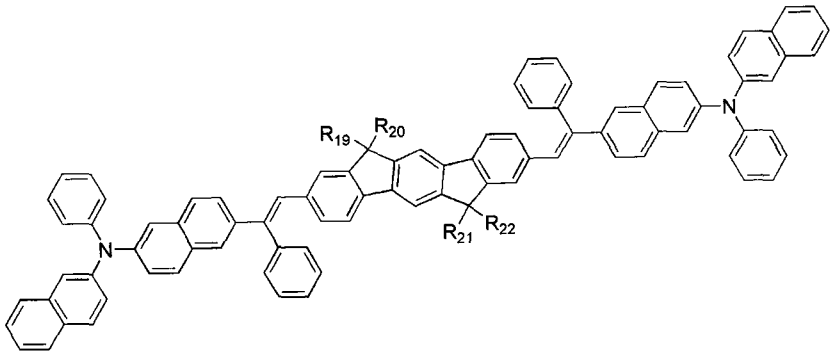
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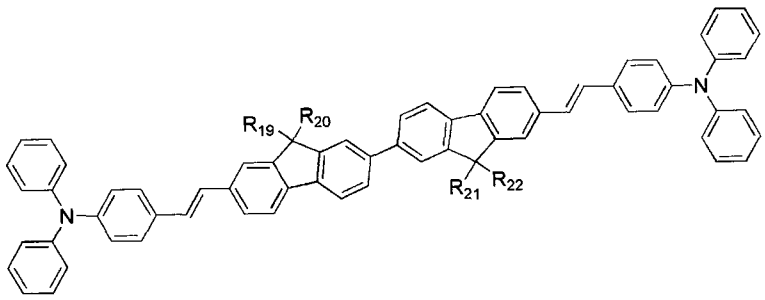
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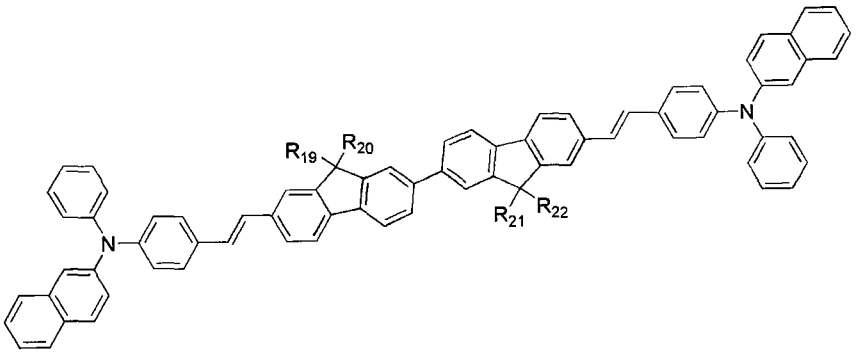
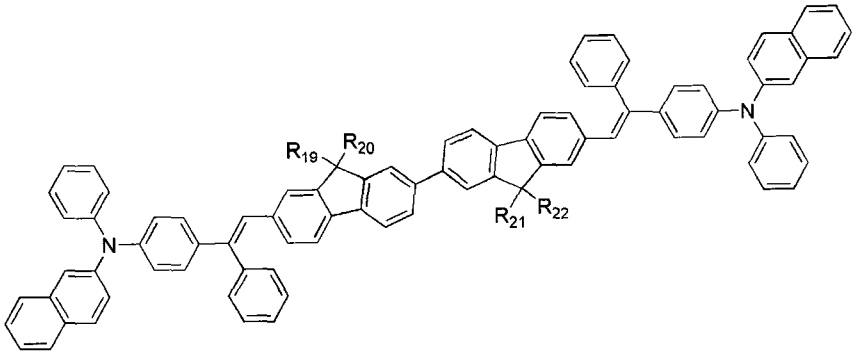
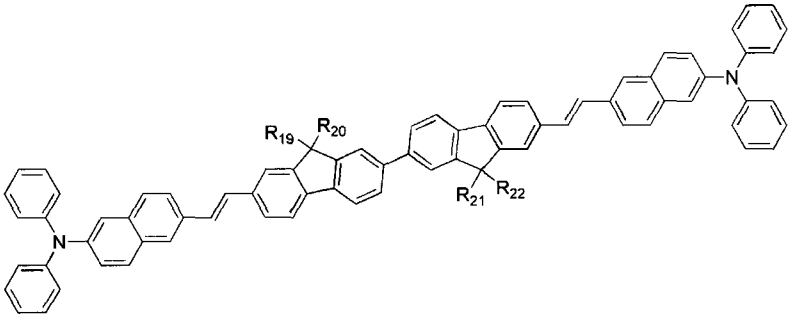
R22
N


R19
R20
R21
R22
N


R19
R20
R21
R22
N

5


R19
R20
R21
R22
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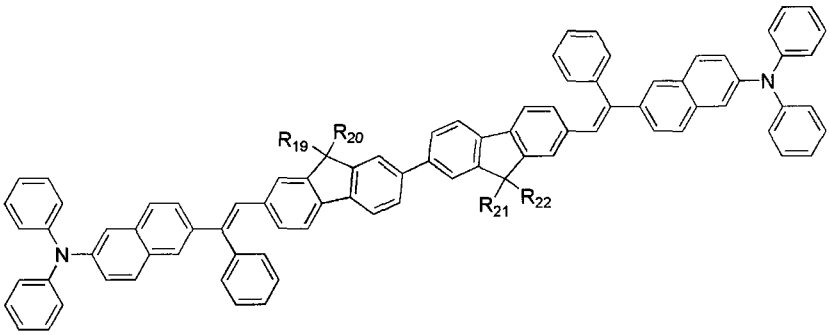
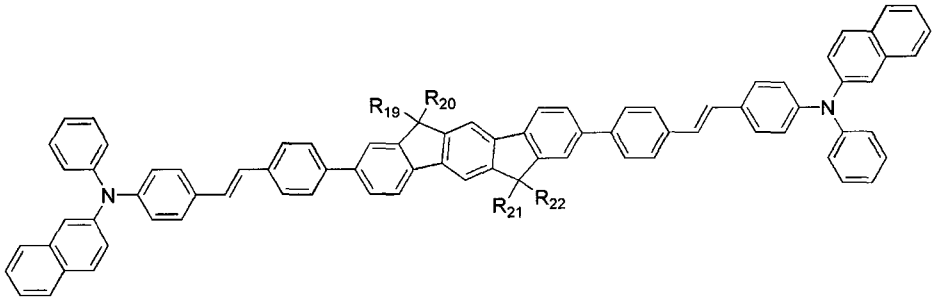
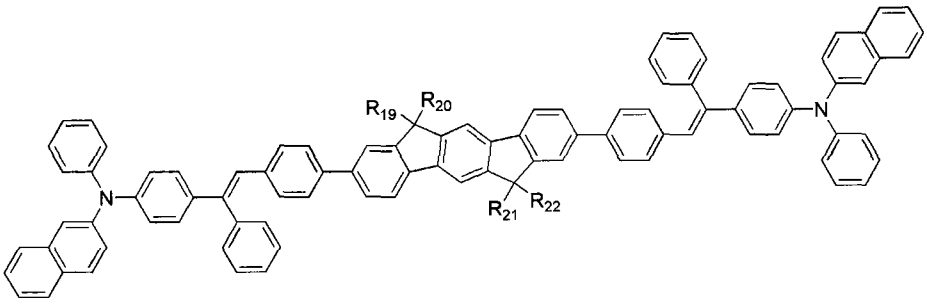
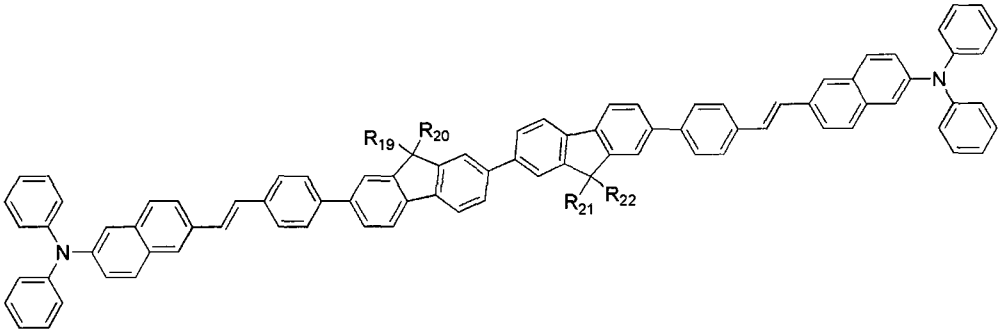
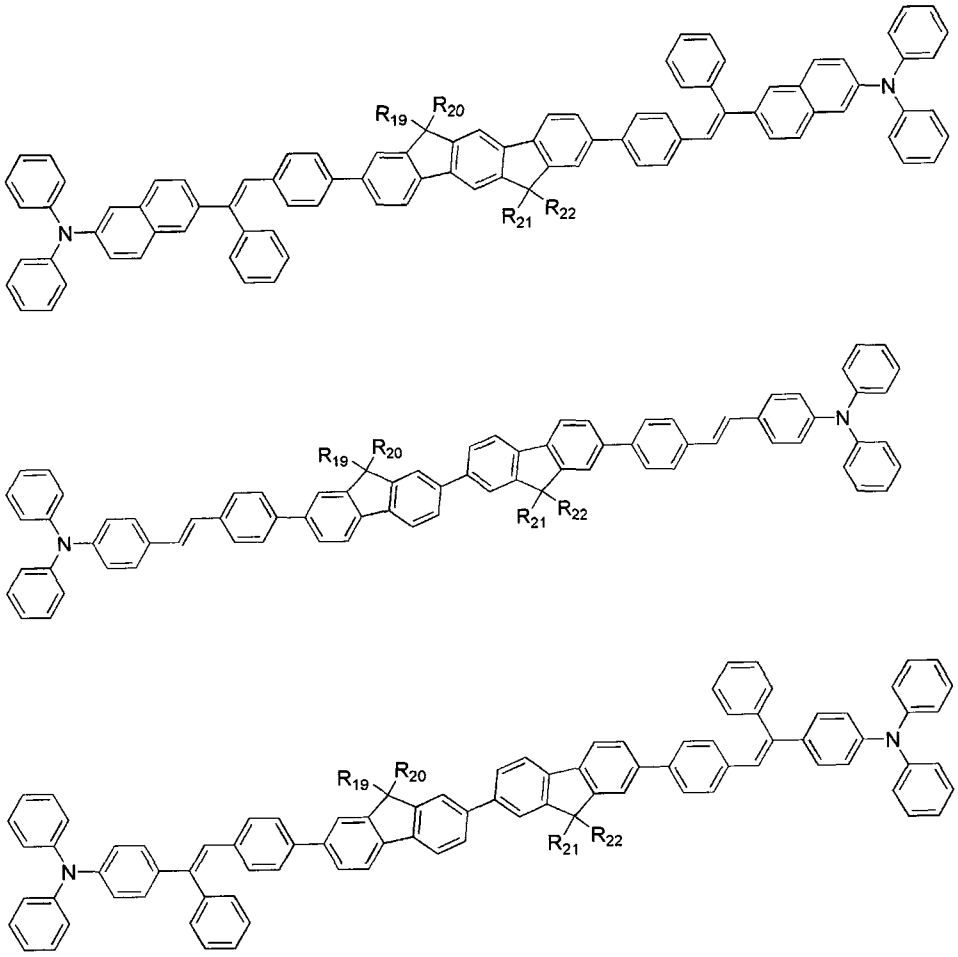

R19
R20
R21
R22
N


R19
R20
R21
R22
N


R19
R20
R21
R22
N


R19
R20
R21
R22
N

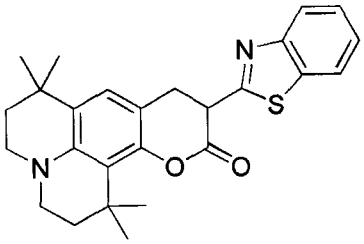


where in, R19 to R22 represent methyl group or ethyl group.

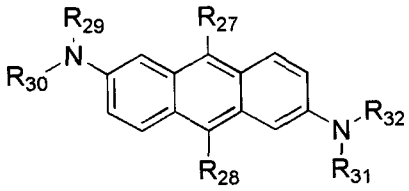
【Claim 8】

An organic electroluminescent device according to claim 5, wherein the electroluminescent dopant is selected from the compounds represented by one of Chemical Formulas (5) to (7):

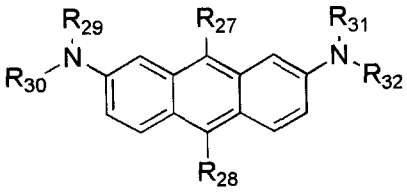
[Chemical Formula 5]



[Chemical Formula 6]



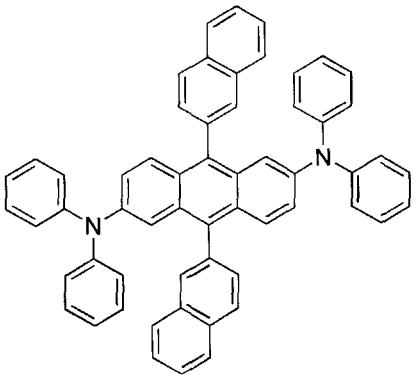
[Chemical Formula 7]

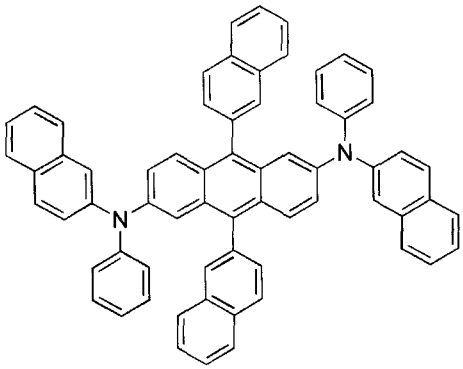


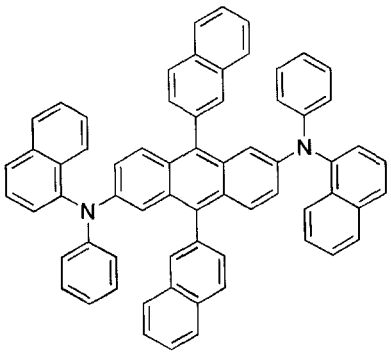
wherein, R27 and R28 independently represent a multicyclic aromatic ring wherein two more aromatic rings have been fused; R29 to R32 independently represent an aromatic ring; and each aromatic ring of R27 to R32 may be further substituted by C1~C20 alkyl group(s).

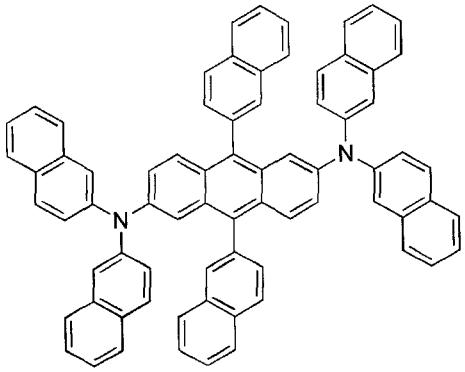
【Claim 9】

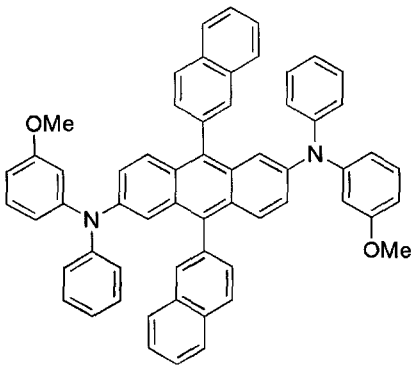
An organic electroluminescent device according to claim 8, wherein the electroluminescent dopant is selected from the compounds represented by one of the following formulas:

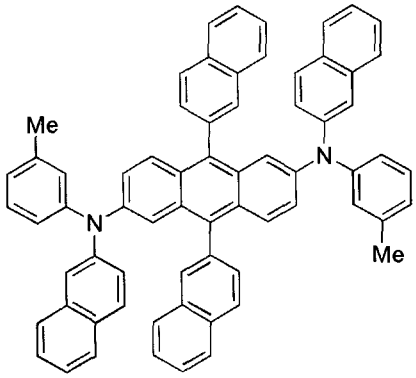


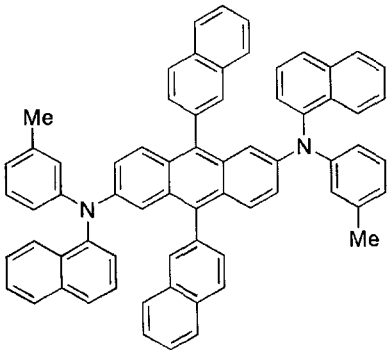


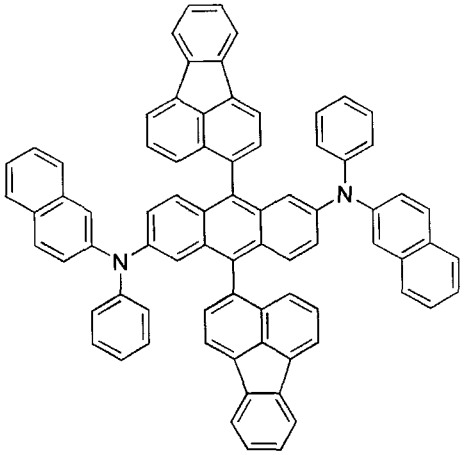


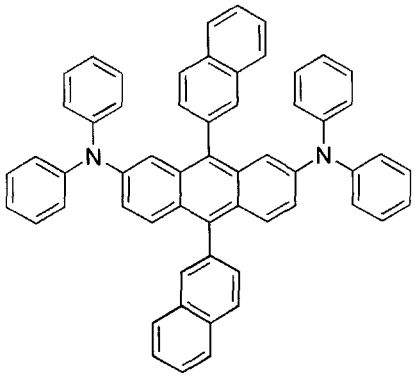


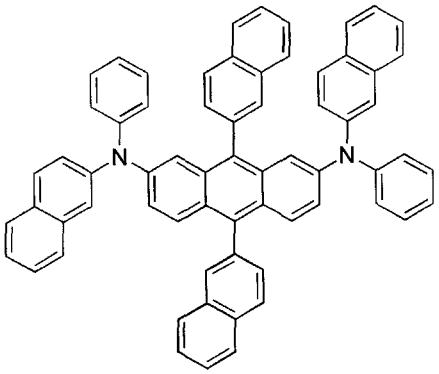

OMe
N
N
OMe

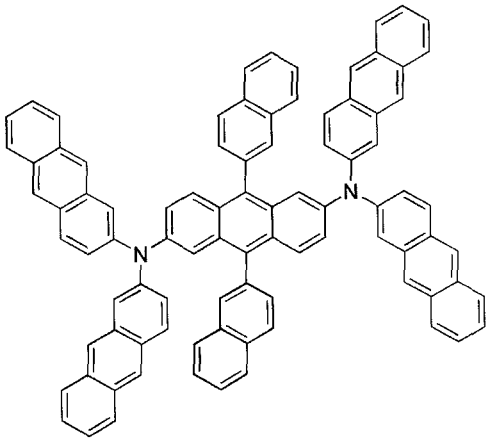

Me
N
N
Me

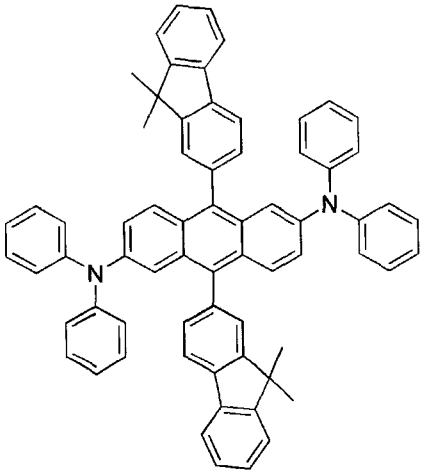

Me
N
N
Me

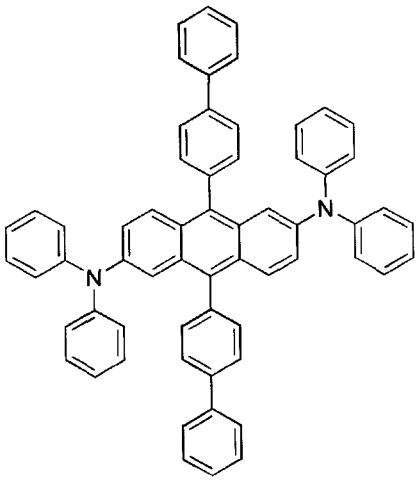

N
N

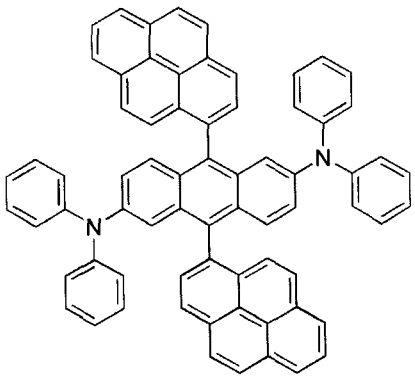








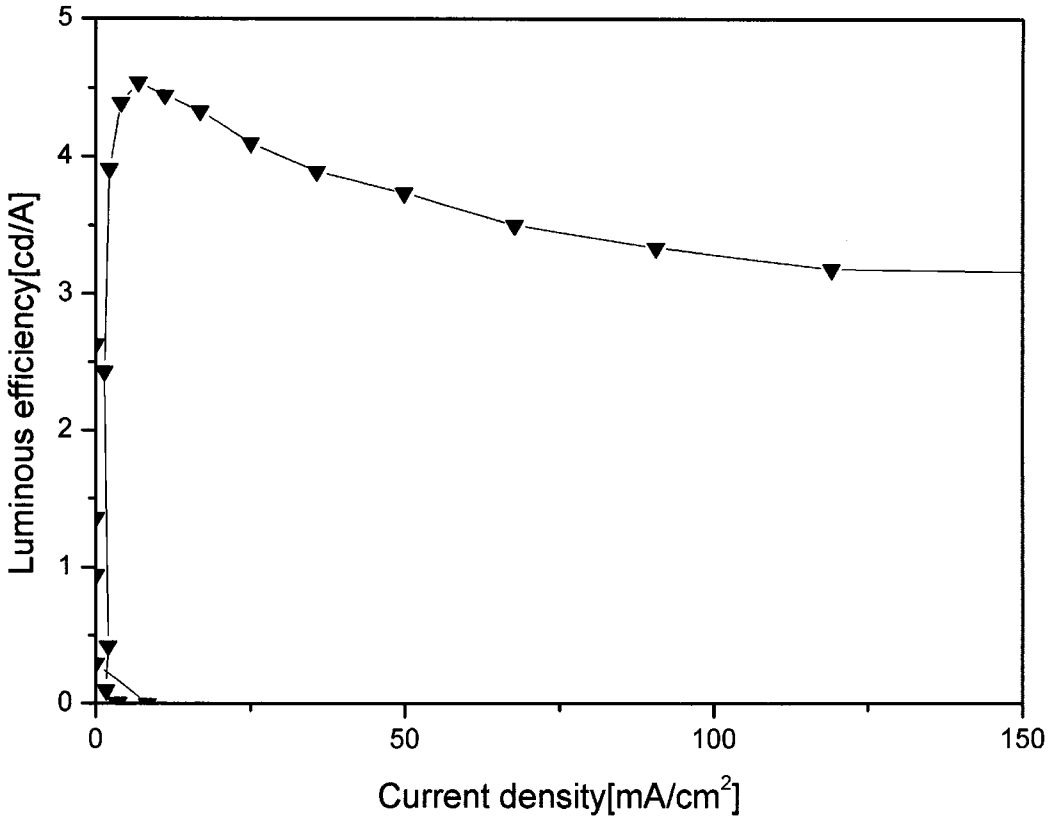




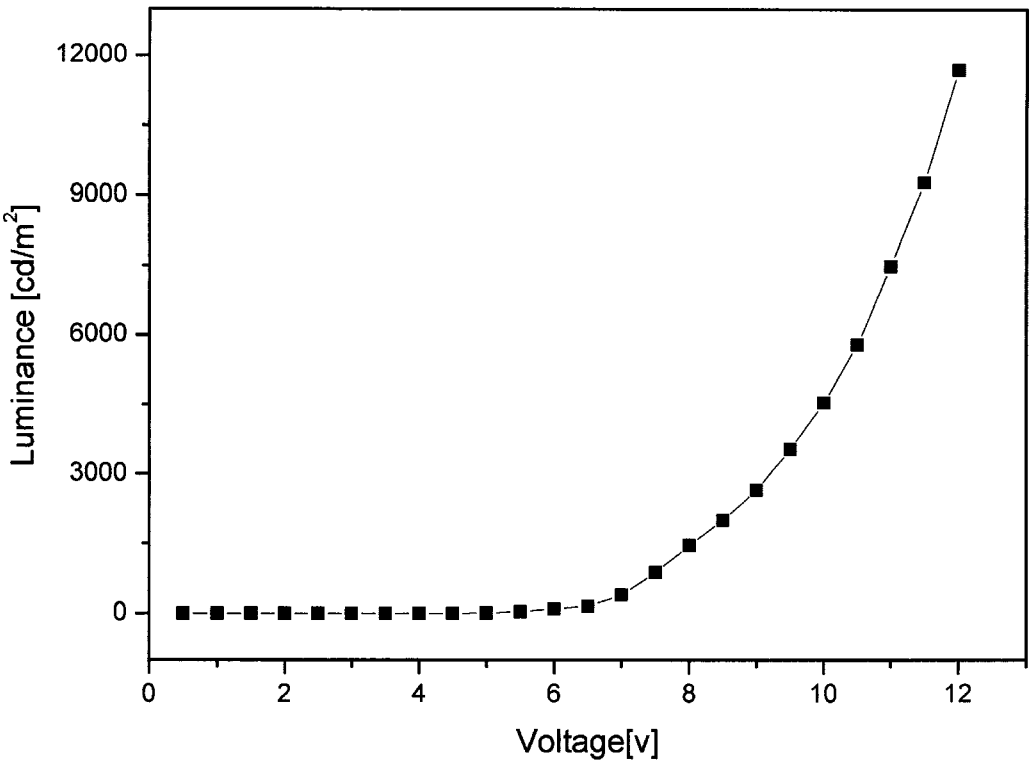
5

【DRAWINGS】

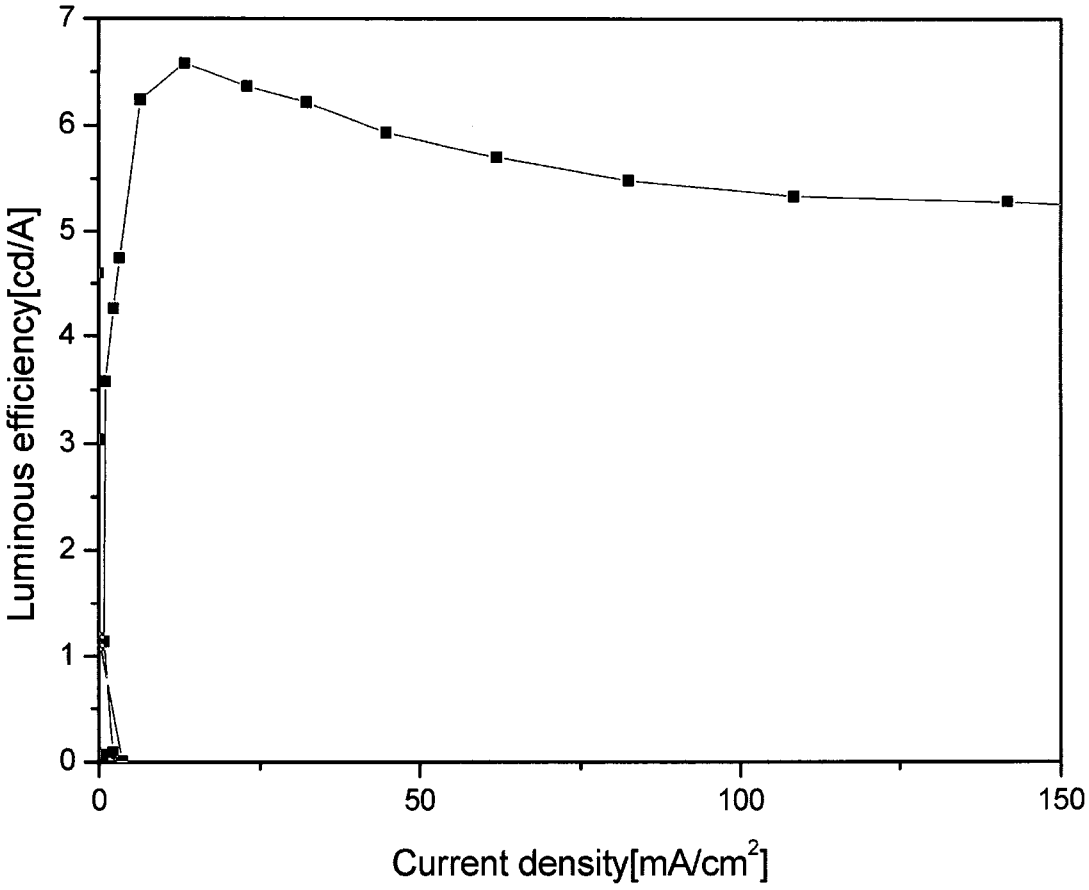
【Figure 1】



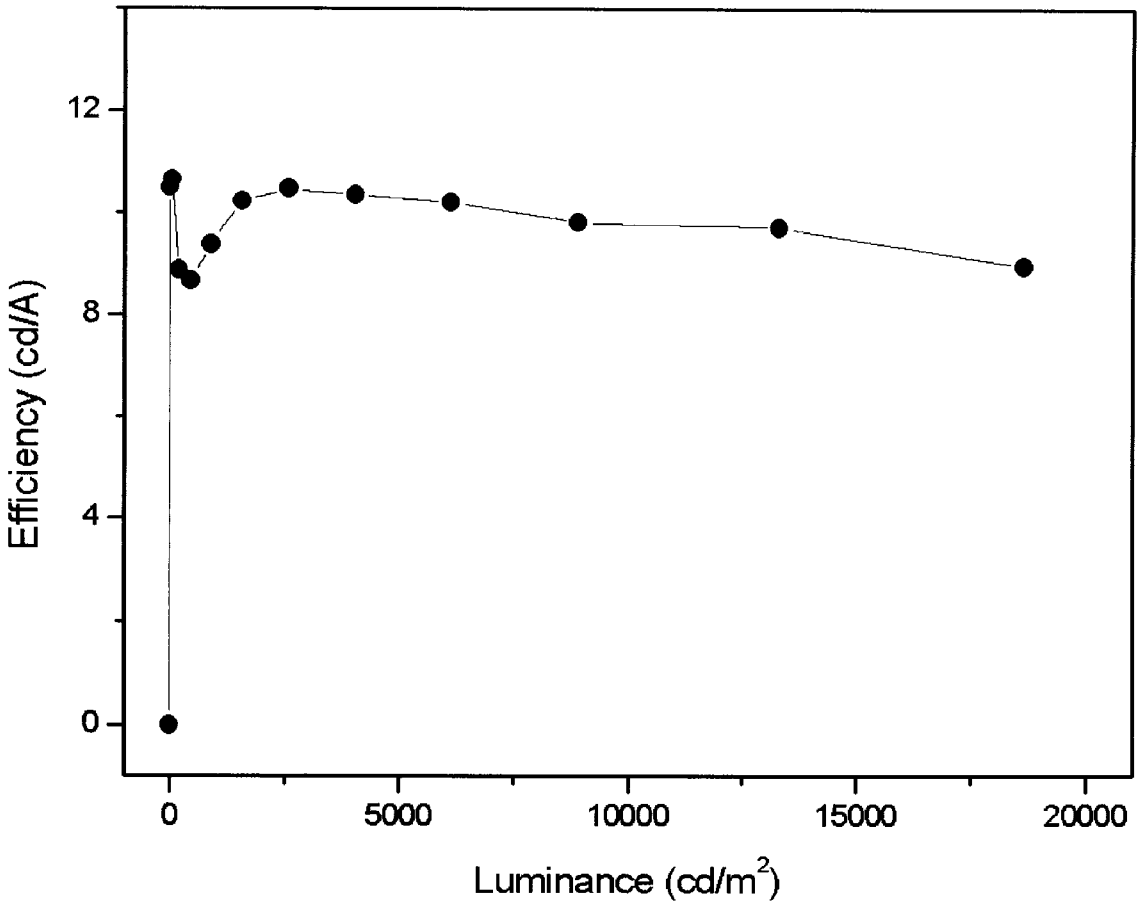
【Figure 2】



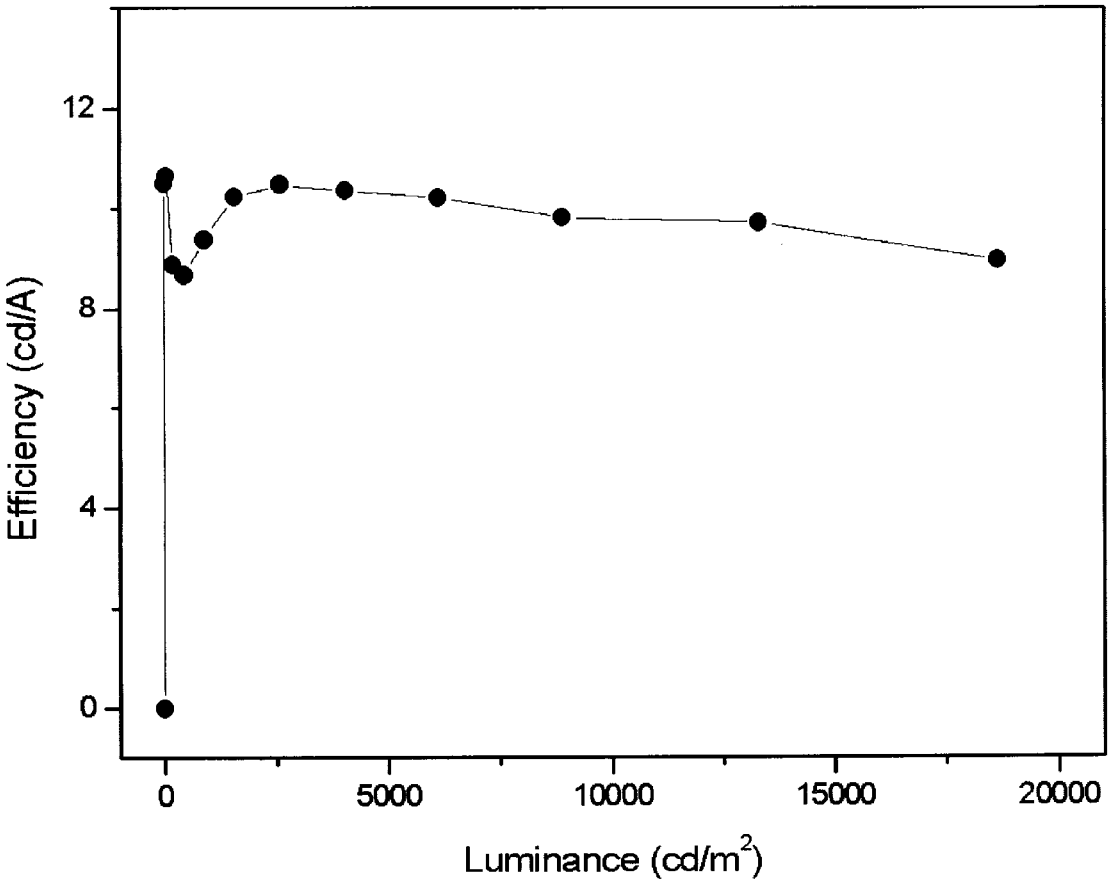
【Figure 3】


Luminous efficiency[cd/A]
Current density[mA/cm^2]
0
1
2
3
4
5
6
7
0
50
100
150

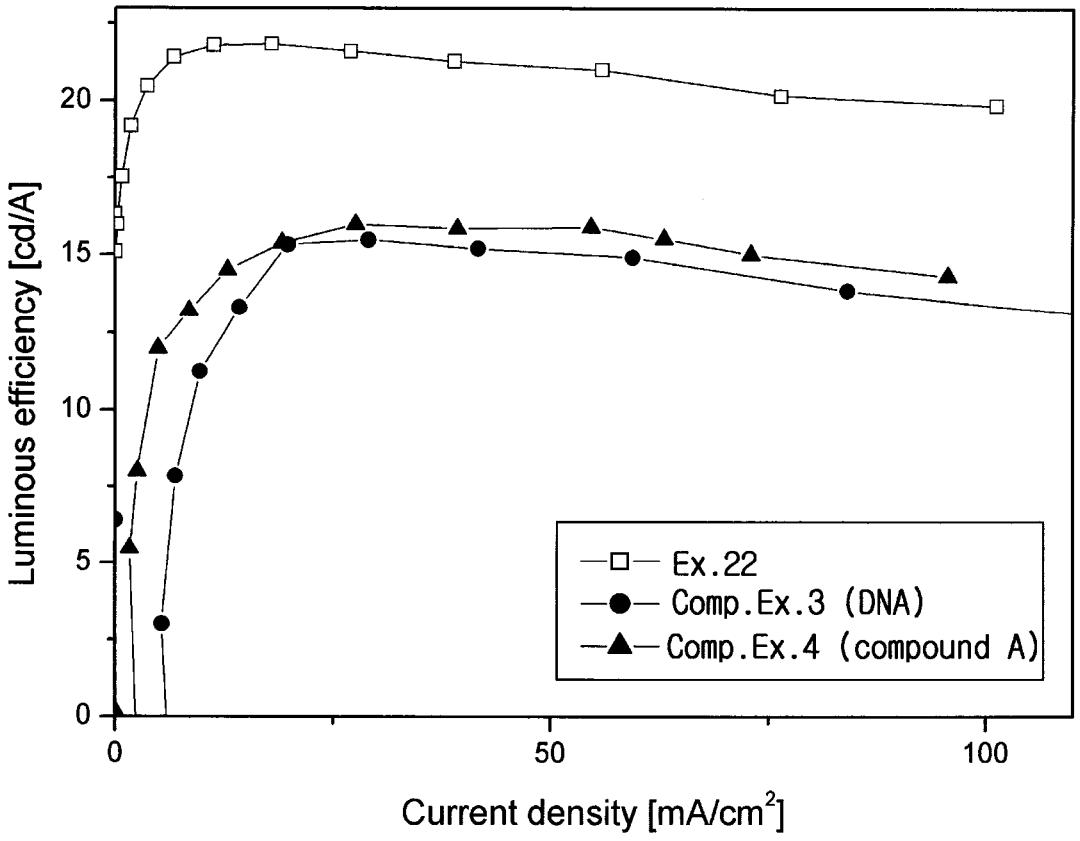
【Figure 4】


12
8
4
0
Efficiency (cd/A)
0
5000
10000
15000
20000
Luminance (cd/m2)

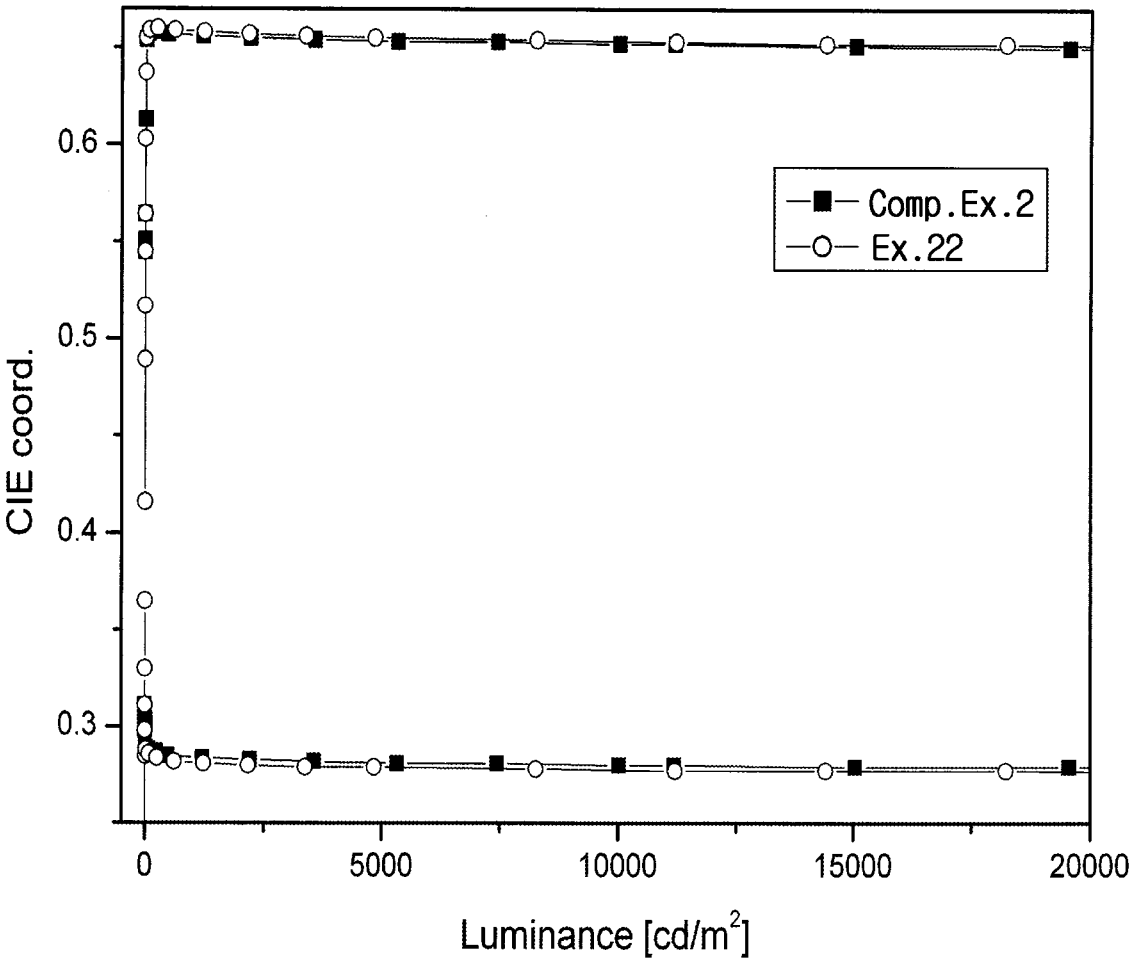
【Figure 5】


12
8
4
0
Efficiency (cd/A)
0
5000
10000
15000
20000
Luminance (cd/m2)

【Figure 6】


Luminous efficiency [cd/A]
Current density [mA/cm^2]
0
5
10
15
20
0
50
100
Ex.22
Comp.Ex.3 (DNA)
Comp.Ex.4 (compound A)

【Figure 7】


CIE coord.
0.6
0.5
0.4
0.3
0
5000
10000
15000
20000
Luminance [cd/m^2]
Comp.Ex.2
Ex.22

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2007/005942

A. CLASSIFICATION OF SUBJECT MATTER

C09K 11/06(2006.01)i

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)

IPC 8 : C09K, H05B

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)

eKIPASS (KIPO internal), USPAT, PAJ, REGISTRY and CAPLUS (STN)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2007-102683 A1 (LG CHEM, LTD.) 13.09.2007 See Formula 1-112 to 1-121, [94] to [108]	1-9
A	WO 2007-110129 A1 (MERCK PATENT GMBH) 04.10.2007 See claims.	1-9
A	JP 2004-231563 A (IDEMITSU KOSAN CO., LTD.) 19.08.2004 See claims.	1-9

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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

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

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

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

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 JULY 2008 (25.07.2008)	**25 JULY 2008 (25.07.2008)**

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seo-gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

OH, Se Zu

Telephone No. 82-42-481-8156

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2007/005942

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007-102683 A1	13.09.2007	KR 10-2007-0091540 A	11.09.2007
		US 2007-205412 A1	06.09.2007
WO 2007-110129 A1	04.10.2007	None	
JP 2004-231563 A	19.08.2004	None	

专利名称(译)	有机电致发光化合物和含有它的显示装置		
公开(公告)号	EP2217677A1	公开(公告)日	2010-08-18
申请号	EP2007851144	申请日	2007-11-23
申请(专利权)人(译)	GRACEL显示增量.		
当前申请(专利权)人(译)	GRACEL显示增量.		
[标]发明人	SHIN HYO NIM CHOI IL WON KWON HYUCK JOO CHO YOUNG JUN KIM BONG OK KIM SUNG MIN YOON SEUNG SOO		
发明人	SHIN, HYO-NIM CHOI, IL WON KWON, HYUCK JOO CHO, YOUNG-JUN KIM, BONG OK KIM, SUNG MIN YOON, SEUNG SOO		
IPC分类号	C09K11/06		
CPC分类号	H05B33/14 C09K11/06 C09K2211/1011		
外部链接	Espacenet		

摘要(译)

有机电致发光化合物和使用该化合物的显示装置技术领域根据本发明的电致发光化合物具有良好的发光效率和优异的材料寿命，因此可以制备具有非常好的工作寿命的OLED器件。