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(54) **ORGANIC LIGHT EMITTING DEVICE AND DISPLAY PANEL USING THE SAME**

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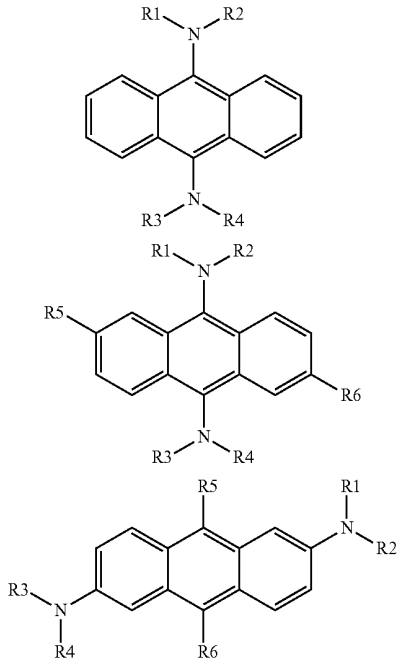
USPC **257/40**; 257/E51.026

(57) **ABSTRACT**

An organic light emitting device includes an anode, a hole injection layer, a hole transport layer, a light emitting layer, an electron transport layer, an electron injection layer and a cathode laminated in this order, wherein the hole injection layer comprises a mixture of an inorganic material comprising at the least of one of an alkali metal oxide, an alkaline earth metal oxide, a halogen compound of an alkali metal, a halogen compound of an alkaline earth metal, and an organic material comprising at least one of compounds represented by Formula 1:

(1)



wherein R1, R2, R3, R4, R5 and R6 are each independently selected from a substituted or unsubstituted C_6 to C_{30} aromatic group and a C_5 to C_{29} heterocyclic group containing N, S, or O, wherein the substituent is selected from a C_1 to C_6 aliphatic group and a C_6 to C_{12} aromatic group.

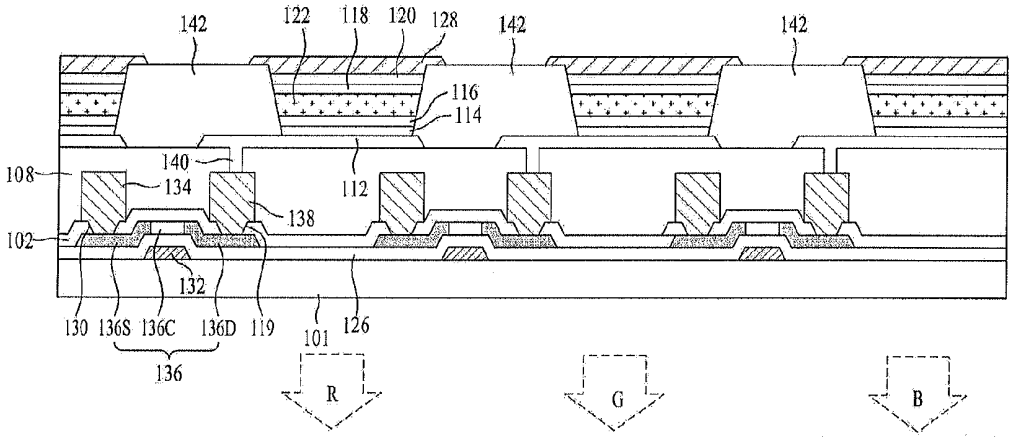
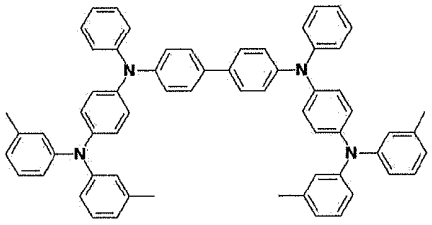
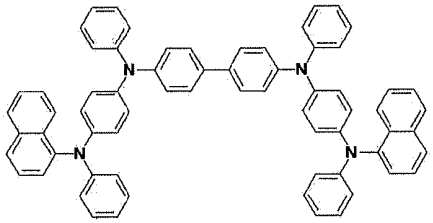


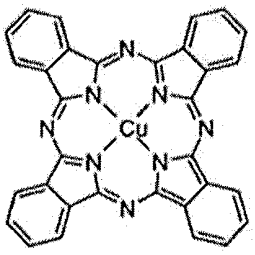
FIG. 1



DNTPD



IDE406



CuPc

FIG. 2

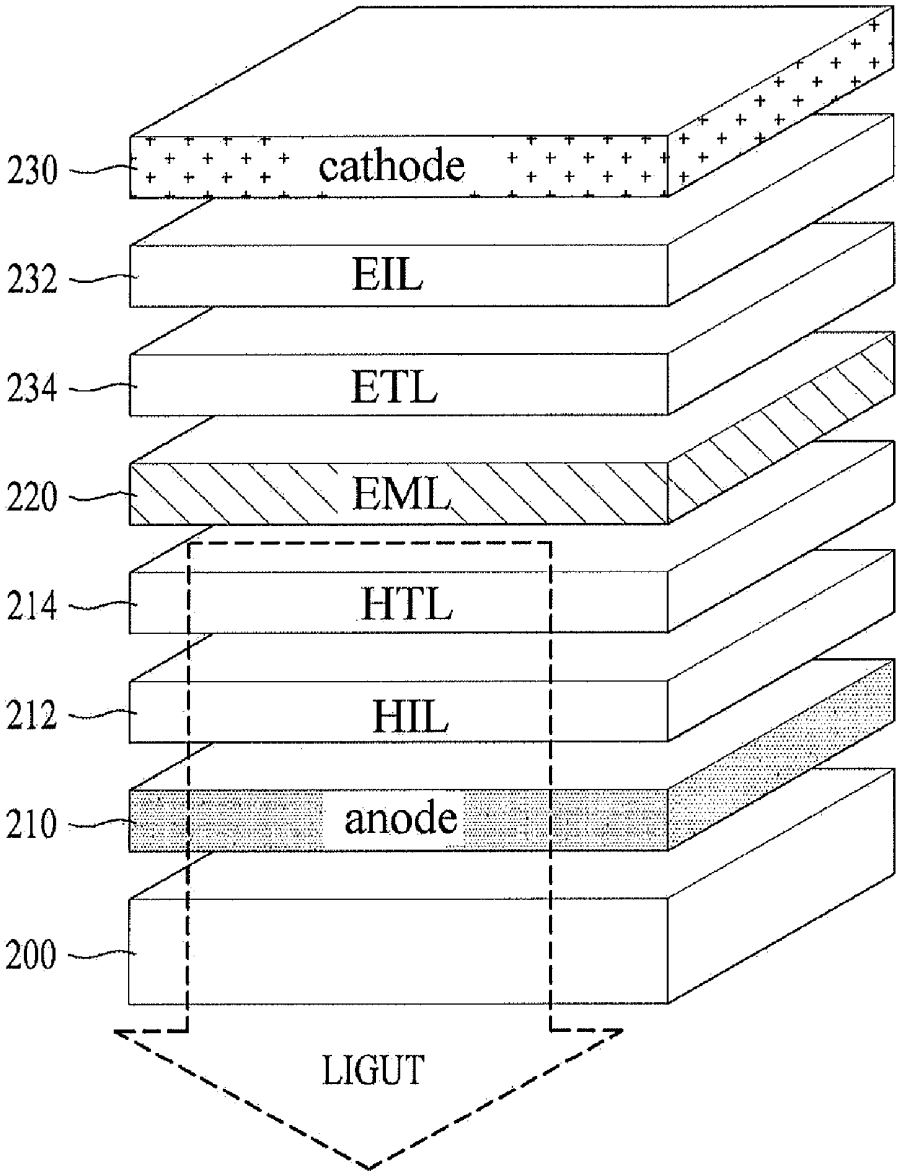

230
cathode
232
EIL
234
ETL
220
EML
214
HTL
212
HIL
210
anode
200
LIGUT

FIG. 3

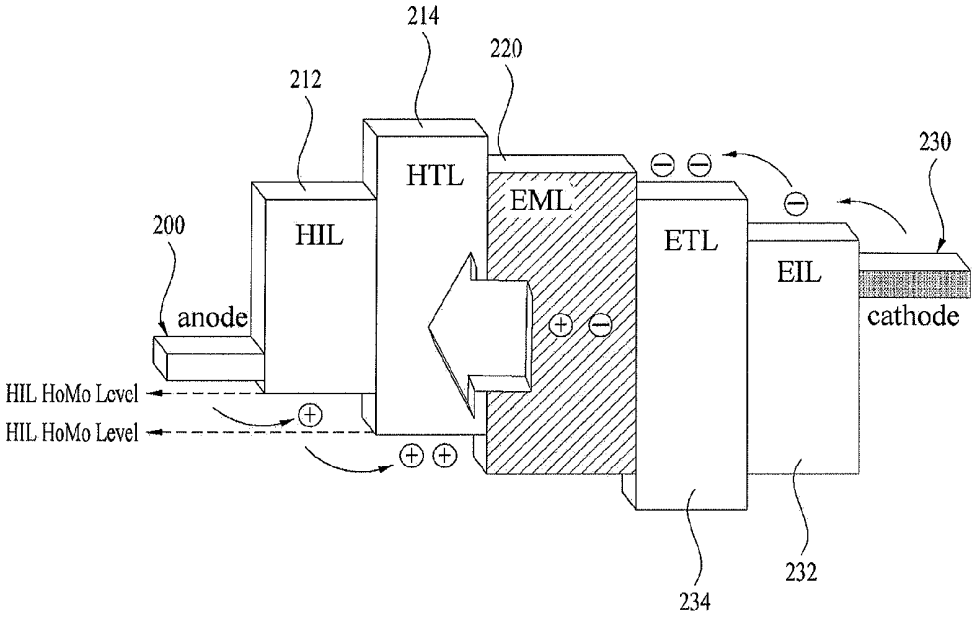

214
220
212
230
HTL
EML
200
HIL
ETL
EIL
anode
cathode
HIL HoMo Level
HIL HoMo Level
234
232

FIG. 4

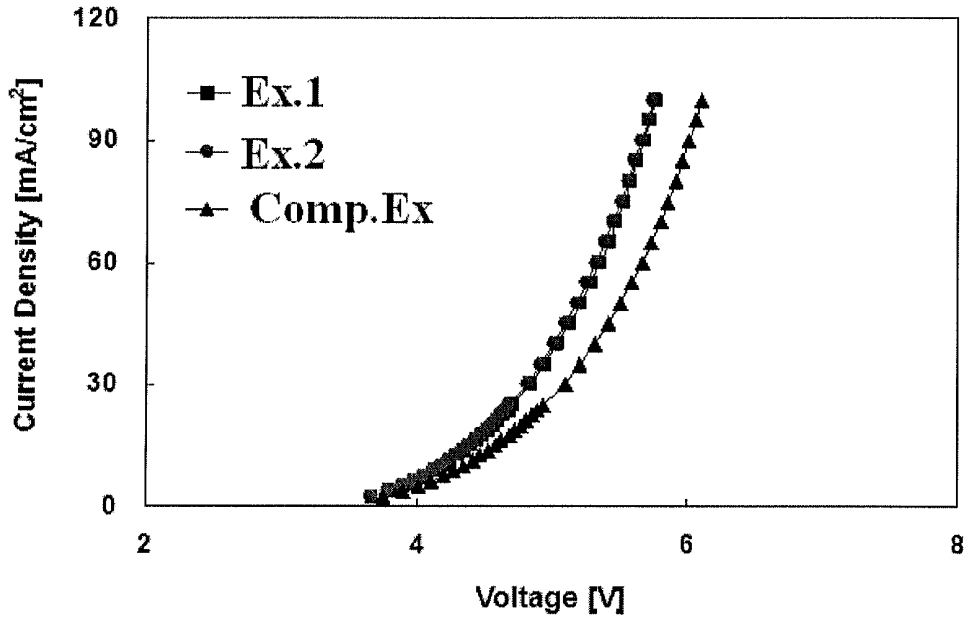

120
90
60
30
0
Current Density [mA/cm²]
Ex.1
Ex.2
Comp.Ex
2
4
6
8
Voltage [V]

FIG. 5

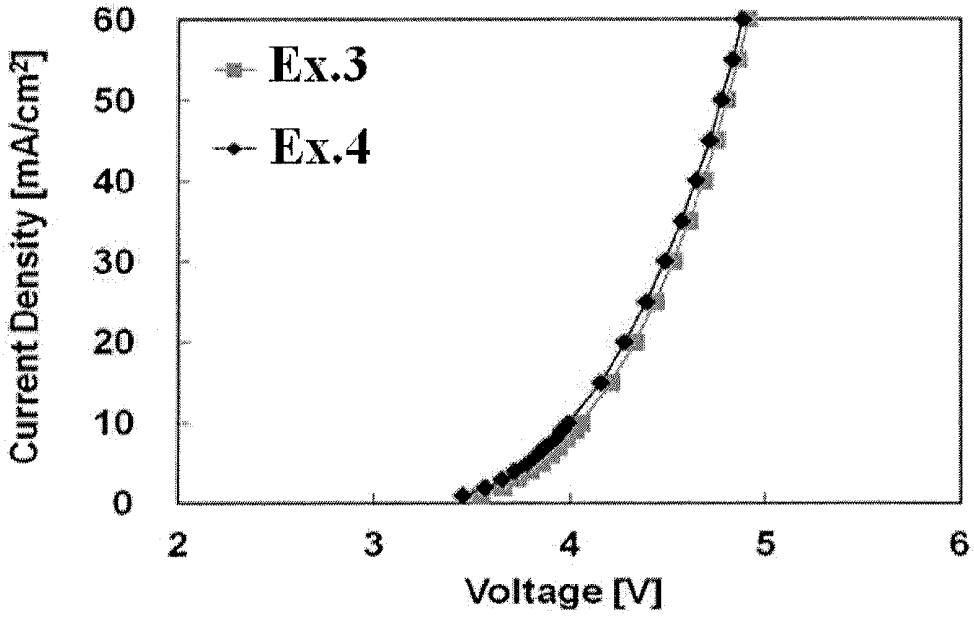

Ex.3
Ex.4
Current Density [mA/cm²]
Voltage [V]
0
10
20
30
40
50
60
2
3
4
5
6

FIG. 6

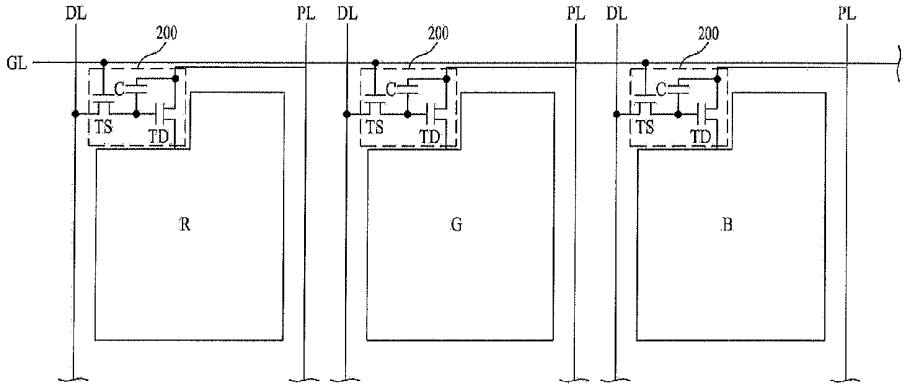
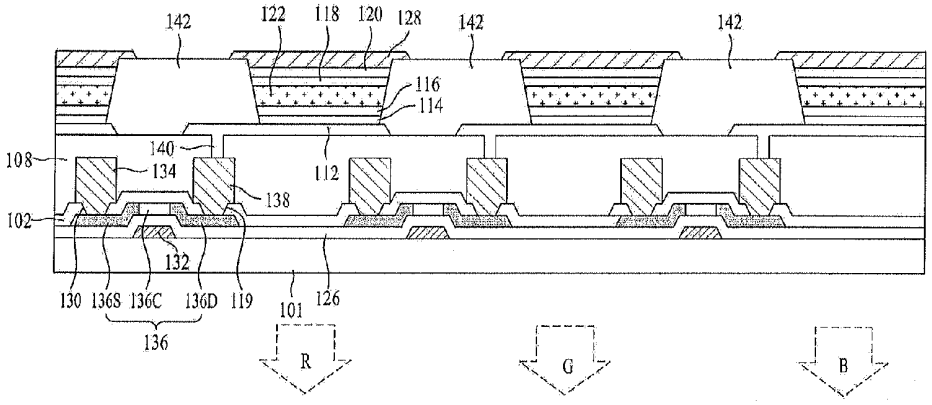

DL
PL
GL
200
C
TS
TD
R
G
B

FIG. 7


142
122
118
120
128
116
114
140
134
138
112
108
102
132
130
136S
136C
136D
119
101
126
136
R
G
B

ORGANIC LIGHT EMITTING DEVICE AND DISPLAY PANEL USING THE SAME

[0001] This application claims the benefit of Korean Patent Application No. 10-2011-0105093 filed on Oct. 14, 2011, and No. 10-2012-0112178 filed on Oct. 10, 2012, which is hereby incorporated by reference as if fully set forth herein.

BACKGROUND

[0002] 1. Field of the Disclosure

[0003] The present disclosure relates to an organic light emitting device and a display panel using the same. More specifically, the present disclosure relates to an organic light emitting device and a display panel using the same, to reduce a driving voltage.

[0004] 2. Discussion of the Related Art

[0005] With recent trends toward large-area displays, there has been increased demand for flat display devices that take up little space. In particular, technology of organic electroluminescent (EL) devices (also called 'organic light emitting diodes (OLEDs)') as flat display devices has been rapidly developed. A variety of prototypes of organic electroluminescent (EL) devices have been reported to date.

[0006] When charge carriers are injected into an organic film formed between an electron injection electrode (cathode) and a hole injection electrode (anode) of an organic electroluminescent device, electrons combine with holes to create electron-hole pairs, which then decay to emit light. Organic electroluminescent devices have advantages in that they can be fabricated on flexible transparent substrates (e.g., plastic substrates) and can be operated at a voltage (e.g., 10V or below) lower than voltages required to operate plasma display panels (PDPs) and inorganic electroluminescent devices. Other advantages of organic electroluminescent devices are relatively low power consumption and excellent color representation. Further, since organic electroluminescent (EL) devices can emit light of three colors (i.e., green, blue and red), they have been the focus of intense interest lately as next-generation display devices capable of producing images of various colors. A general method for fabricating organic EL devices will be briefly explained below.

[0007] (1) First, a transparent substrate is covered with an anode material. Indium tin oxide (ITO) is generally used as the anode material.

[0008] (2) A hole injection layer (HIL) is formed to a thickness of 10 to 30 nm on the anode. Copper (II) phthalocyanine (CuPc) is mainly used as a material of the hole injection layer.

[0009] (3) A hole transport layer (HTL) is introduced into the resulting structure. The hole transport layer is formed by depositing 4,4'-bis[N-(1-naphthyl)-N-phenylamino]-biphenyl (NPB) to a thickness of about 30 to about 60 nm on the hole injection layer.

[0010] (4) An organic light-emitting layer is formed on the hole transport layer. If necessary, a dopant may be added to a material for the organic light-emitting layer. For green light emission, tris(8-hydroxyquinoline)aluminum (Alq_3) as a material for the organic light-emitting layer is deposited to a thickness of about 30 to about 60 nm on the hole transport layer, and N-methylquinacridone (MQD) is mainly used as the dopant.

[0011] (5) An electron transport layer (ETL) and an electron injection layer (EIL) are sequentially formed on the organic light-emitting layer. Alternatively, an electron injection/transport layer is formed on the organic light-emitting layer. In the case of green light emission, since Alq_3 has excellent electron-transport ability, the formation of the electron injection/transport layer may be unnecessary.

[0012] (6) A cathode material is coated on the electron injection layer, and finally a passivation film is covered thereon.

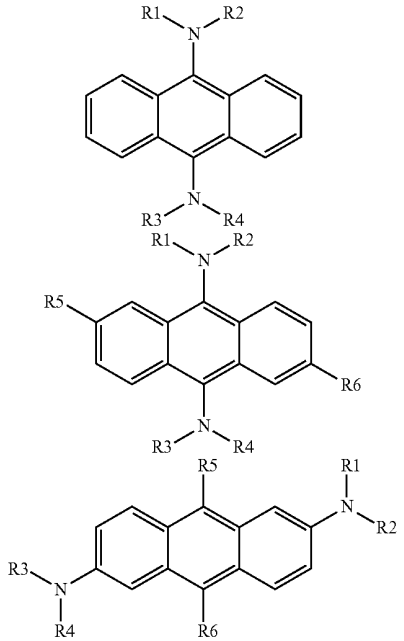
[0013] The type of the organic electroluminescent devices (i.e. blue, green and red light-emitting devices) will be determined depending on the kind of materials for the light-emitting layer.

[0014] Meanwhile, DNTPD, IDE406 and CuPc shown in FIG. **1** are used as materials for the hole injection layer. The materials for the hole injection layer disadvantageously cause an increase in driving voltage due to difficulty of injection of holes caused by difference in highest occupied molecular orbital (HOMO) energy level between the hole injection layer and the hole transport layer.

SUMMARY

[0015] An organic light emitting device includes an anode, a hole injection layer, a hole transport layer, a light emitting layer, an electron transport layer, an electron injection layer and a cathode laminated in this order, wherein the hole injection layer comprises a mixture of an inorganic material comprising at least one of an alkali metal oxide, an alkaline earth metal oxide, a halogen compound of an alkali metal, and a halogen compound of an alkaline earth metal, and an organic substance comprising at least one of compounds represented by Formula 1:

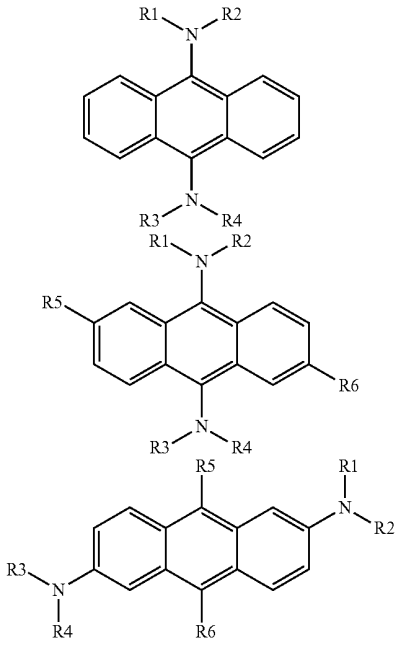
(1)



[0016] wherein R1, R2, R3, R4, R5 and R6 are each independently selected from a substituted or unsubstituted C_6 to C_{30} aromatic group and a C_5 to C_{29} heterocyclic group containing N, S, or O, wherein the substituent is selected from a C_1 to C_6 aliphatic group and a C_6 to C_{12} aromatic group.

[0017] In accordance with another aspect of the present invention, provided is a display panel including: a driving thin film transistor formed on a substrate; a first electrode connected to the driving thin film transistor; a bank insulating film provided with a bank hole to expose the first electrode; an organic common layer formed in the bank hole, the organic common layer including a hole injection layer, a hole transport layer, a light emitting layer, an electron transport layer and an electron injection layer laminated in this order; and a second electrode facing the first electrode such that the organic common layer is interposed between the second electrode and the first electrode, wherein the hole injection layer comprises a mixture of an inorganic material comprising at the least of one of an alkali metal oxide, an alkaline earth metal oxide, a halogen compound of an alkali metal, a halogen compound of an alkaline earth metal, and an organic material comprising at least one of compounds represented by Formula 1:

(1)



[0018] wherein R1, R2, R3, R4, R5 and R6 are each independently selected from a substituted or unsubstituted C_6 to C_{30} aromatic group and a C_5 to C_{29} heterocyclic group containing N, S, or O, wherein the substituent is selected from a C_1 to C_6 aliphatic group and a C_6 to C_{12} aromatic group.

[0019] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

[0021] FIG. **1** shows structures of DNTPD, IDE406 and CuPc, compounds used for a conventional hole injection layer;

[0022] FIG. **2** is a perspective view illustrating an organic light emitting device according to an embodiment of the present invention;

[0023] FIG. **3** is a perspective view illustrating a driving principle of the organic light emitting device and a hole injection layer of the present invention shown in FIG. **2**;

[0024] FIGS. **4** and **5** are a graph showing a driving voltage of the organic light emitting device according to the present invention and a driving voltage of the organic light emitting device in Comparative Example;

[0025] FIG. **6** is a view illustrating equivalent circuits of R, G and B sub-pixel regions according to the present invention; and

[0026] FIG. **7** is a vertical cross-sectional view illustrating R, G, and B sub-pixel regions shown in FIG. **6**.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0027] Hereinafter, preferred embodiments of the present invention will be described with reference to the annexed drawings. Configurations of the present invention, and actions and effects obtained thereby will be clearly understood from the following detailed description. Prior to the detailed description of the present invention, it should be noted that same elements are designated by same reference numerals although they are shown in other drawings, and a detailed description of well-known configuration may be omitted when it is considered to obscure subject matters of the present invention.

[0028] Hereinafter, preferred embodiments of the present invention will be described with reference to FIGS. **2** to **6** in detail.

[0029] FIG. **2** is a perspective view illustrating an organic light emitting device according to an embodiment of the present invention, and FIG. **3** a perspective view illustrating a driving principle of the organic light emitting device and a hole injection layer shown in FIG. **2**.

[0030] Referring to FIGS. **2** and **3**, the organic light emitting device according to an embodiment of the present invention has a structure including an anode **210**, an organic common layer including a hole injection layer (HIL, **212**), a hole transport layer (HTL, **214**), a light emitting layer **220**, an electron transport layer (ETL, **234**), an electron injection layer (EIL, **232**), and a cathode **230** laminated in this order on a substrate **200**.

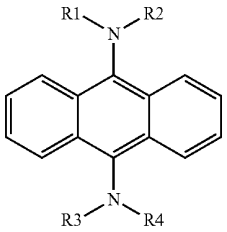
[0031] In such an organic light emitting device, a voltage is applied between the anode **210** and the cathode **230**, holes injected from the anode **210** are recombined with electrons injected from the cathode **230** in the light emitting layer **220** to produce exicitons. Then, the excitons fall to a ground state to emit light toward the rear surface of the device.

[0032] The hole injection layer **212** receive holes from the anode **210** and transport the same to the hole transport layer **214**, and the hole transport layer **214** receive holes from the hole injection layer **212** and inject and transport the same to the light emitting layer **220**. As shown in FIG. **3**, in order to facilitate transportation and injection of holes between the hole injection layer **210** and the hole transport layer **214**, a difference between a highest occupied molecular orbital (hereinafter, referred to as "HOMO") energy level of the hole injection layer **210** and a HOMO energy level of the hole injection layer **214** should be not large, and interfacial properties between the hole injection layer **212** with the anode **210** should be excellent.

[0033] Accordingly, the hole injection layer **212** is formed using a mixture of an inorganic material and an organic material inorganic material and can thus easily inject and transport from the anode **210** to the hole transport layer **214**, thus satisfying the conditions. At this time, a mix ratio of the inorganic material and the organic material is about 10:1 to about 1:10. For example, when a mix ratio of the inorganic material and the organic material is 10:1, the inorganic material may be 1 and the organic material may be 0.1. Also, the hole injection layer **212** is formed to have a thickness of about 10 Å to about 200 Å. The inorganic material may be at least one selected from an alkali metal oxide, an alkaline earth metal oxide, a halogen compound of an alkali metal, a halogen compound of an alkaline earth metal. In the alkali metal oxide or the alkali earth metal oxide, the metal may be at least one selected from Li, Na, K, Rb, Cs, Be, Mg, Ca, Sr and Ba.

[0034] In the halogen compound of alkali metal or the halogen compound of alkaline earth metal, a central metal is at least one selected from Li, Na, K, Rb, Cs, Be, Mg, Ca, Sr and Ba, and the halogen is at least one selected from F, CI, Br, and I.

[0035] The organic material comprises at least one of compounds represented by Formula 1.



(1)

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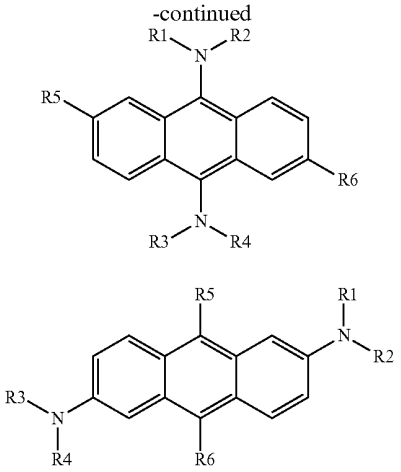
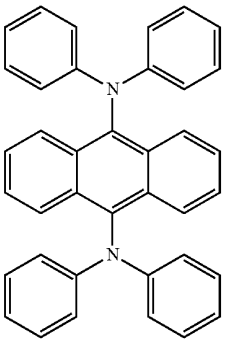


[0036] wherein R1, R2, R3, R4, R5 and R6 are each independently selected from a substituted or unsubstituted C_6 to C_{30} aromatic group and a C_5 to C_{29} heterocyclic group containing N, S, or O, wherein the substituent is selected from a C_1 to C_6 aliphatic group and a C_6 to C_{12} aromatic group. The substituent of the substituted C_6 to C_{30} aromatic group is at least one C_1 to C_6 aliphatic group selected from methyl, ethyl, propyl, butyl and hexyl, and the substituted C_6 to C_{12} aromatic group is at least one selected from phenyl, biphenyl, naphthyl and terphenyl. The unsubstituted C_6 to C_{30} aromatic group is at least one selected from phenyl, biphenyl, naphthyl, terphenyl, anthracene, phenanthrene, pyrene, and fluoranthene.

[0037] Specific examples of the compound of Formula 1 are as follows.

HM-01



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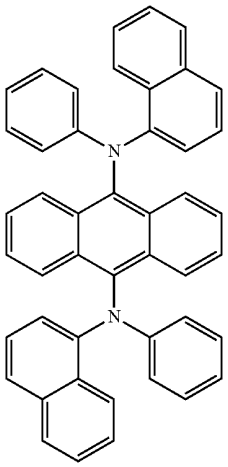

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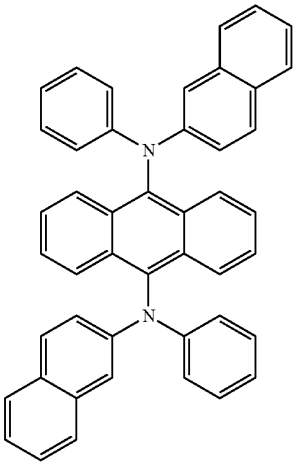
HM-03



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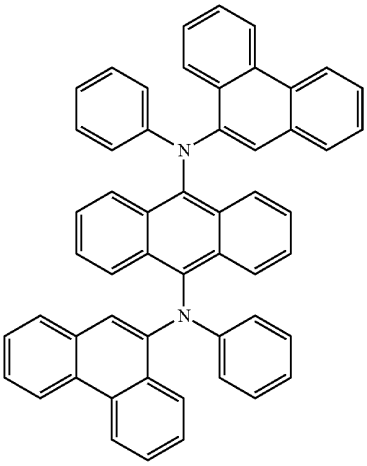

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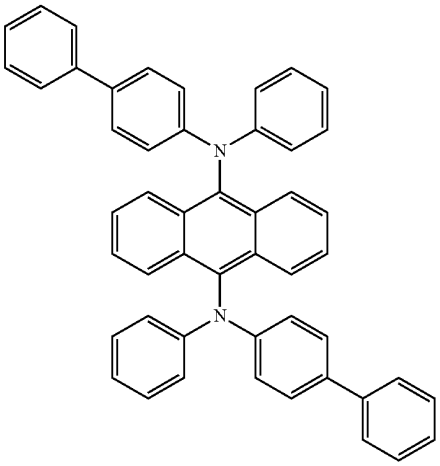

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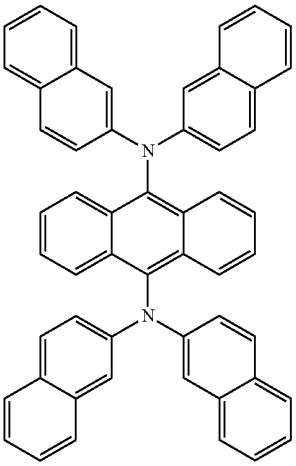

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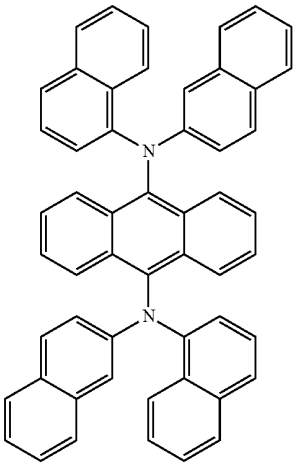

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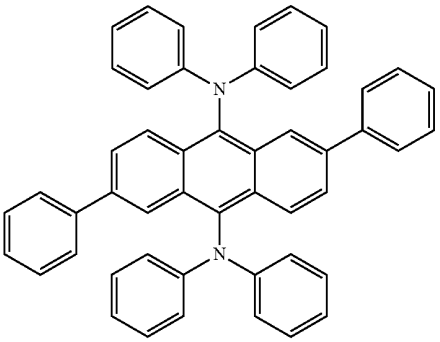

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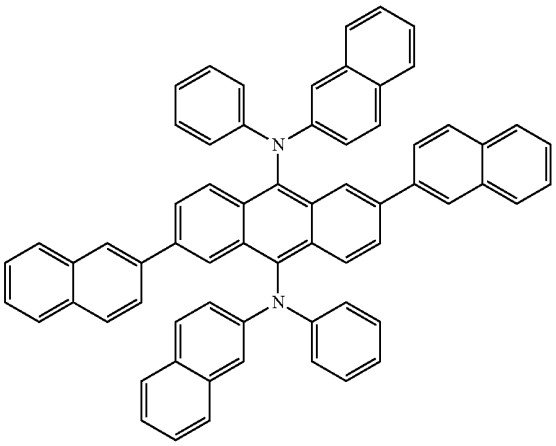

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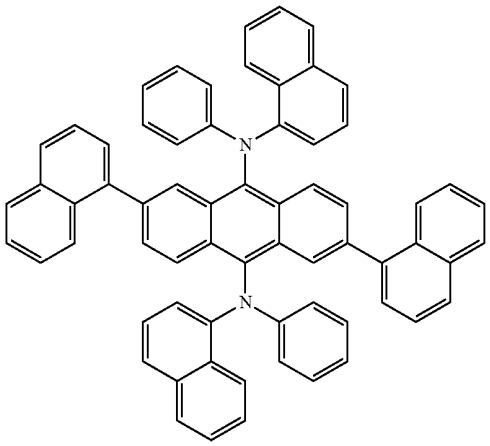

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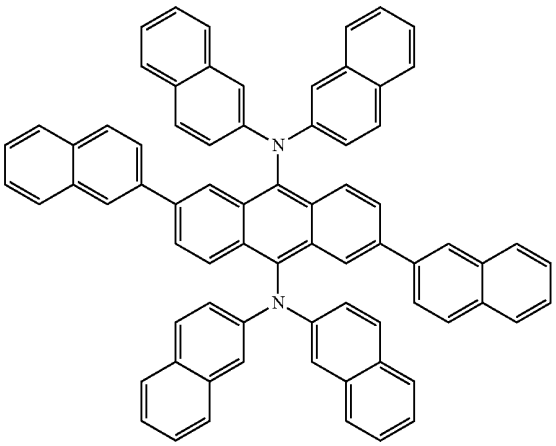

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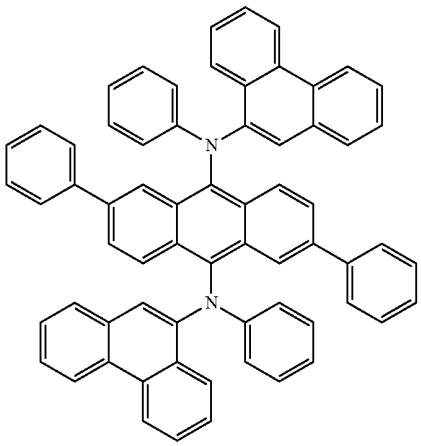
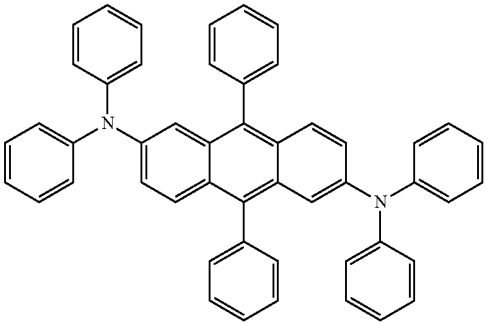


HM-13



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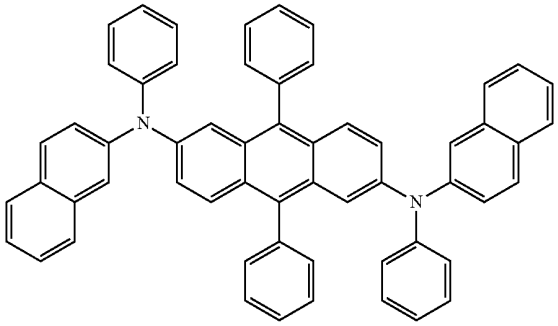

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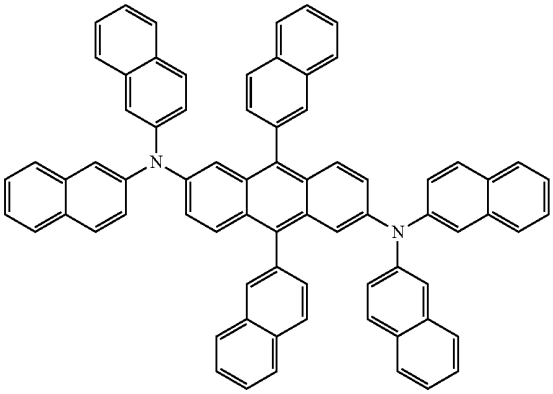

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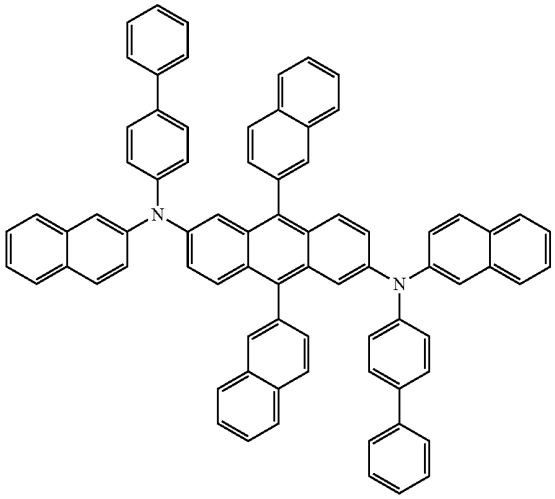

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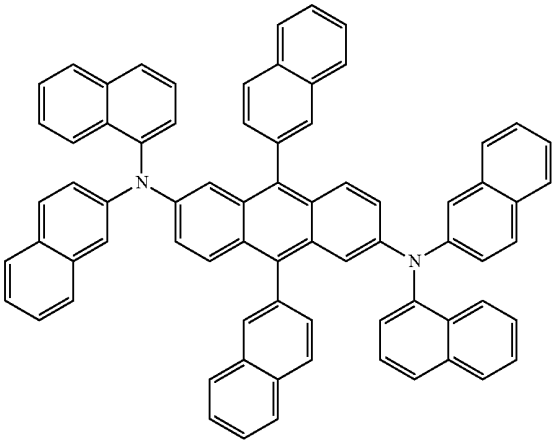
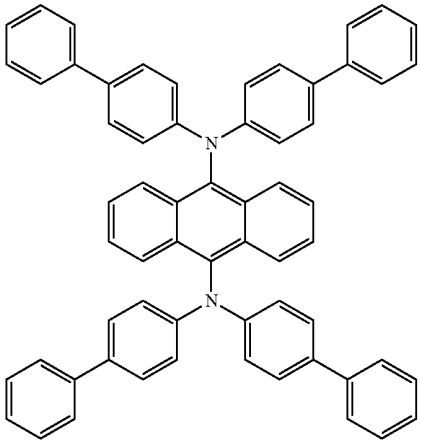


HM-18



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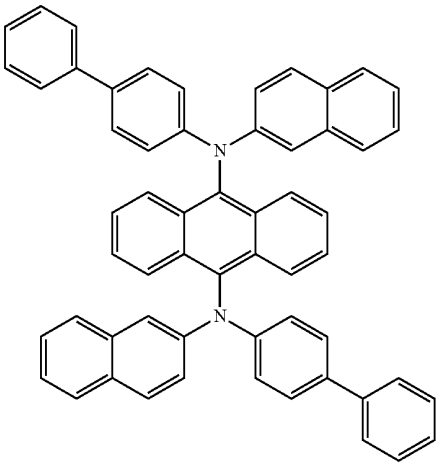

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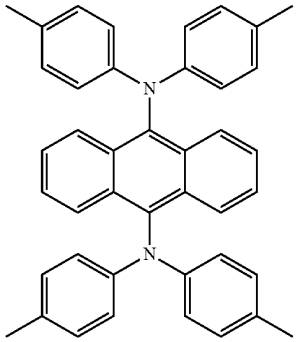

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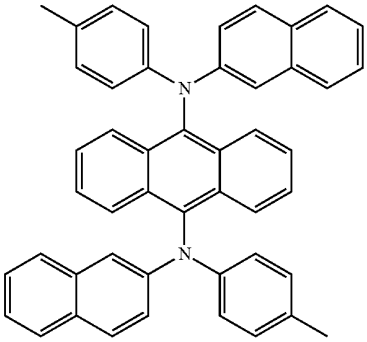

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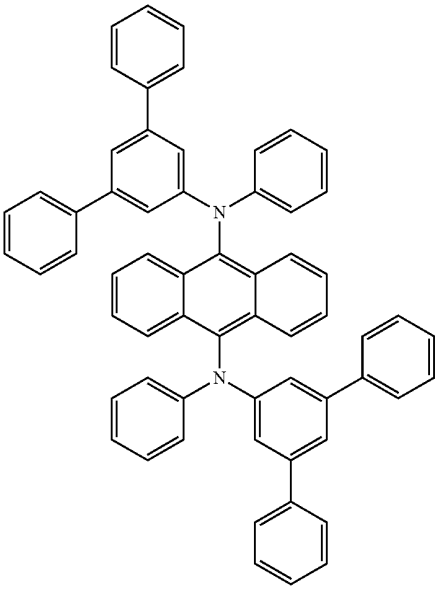

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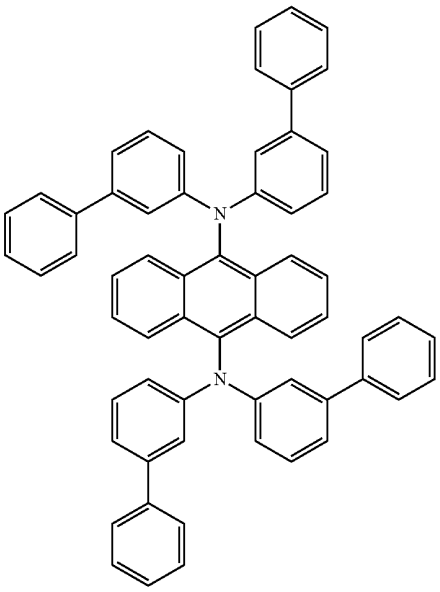

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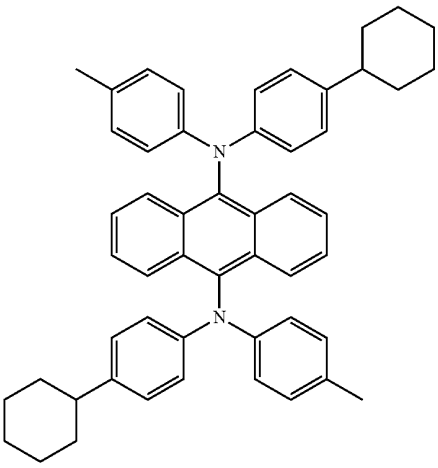

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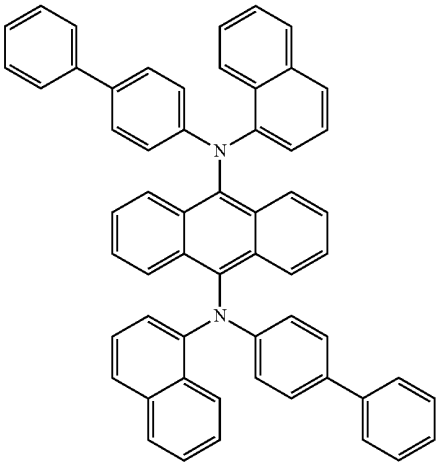

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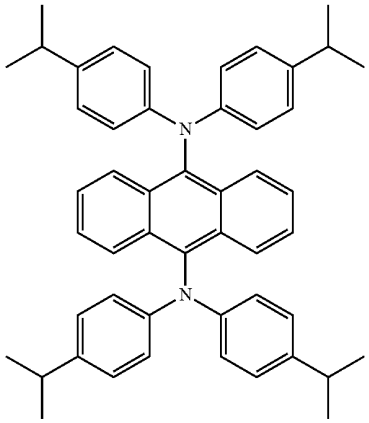

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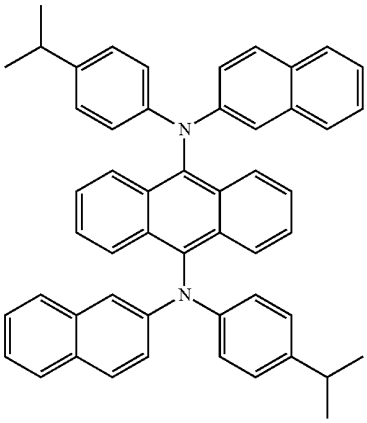

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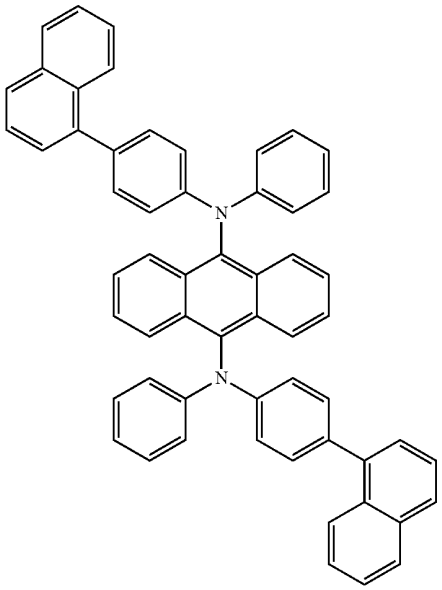

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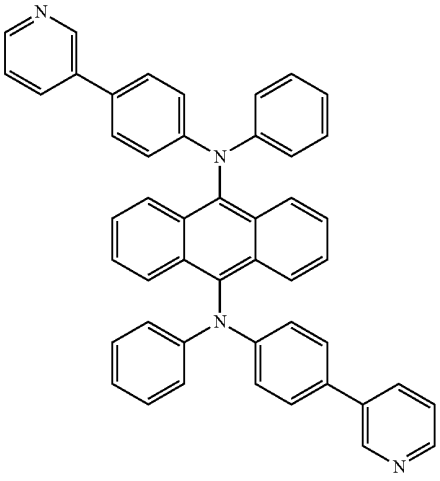

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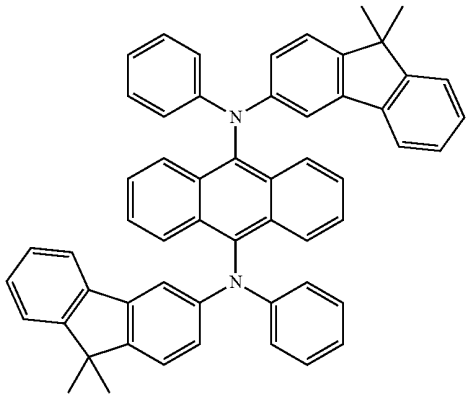

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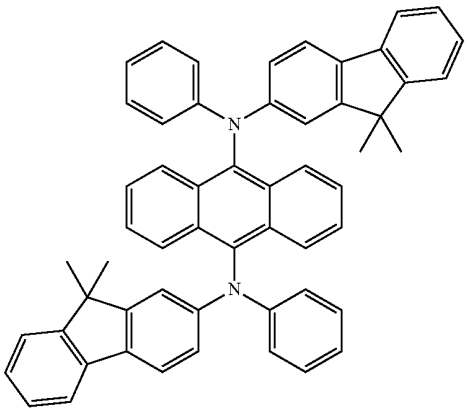

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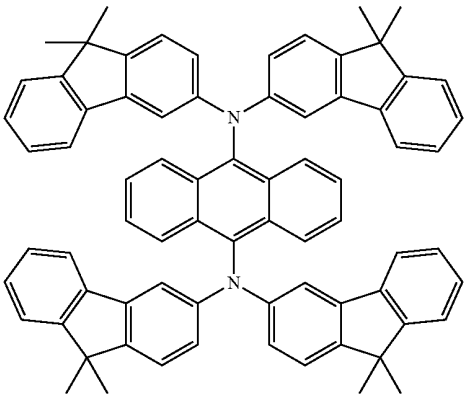

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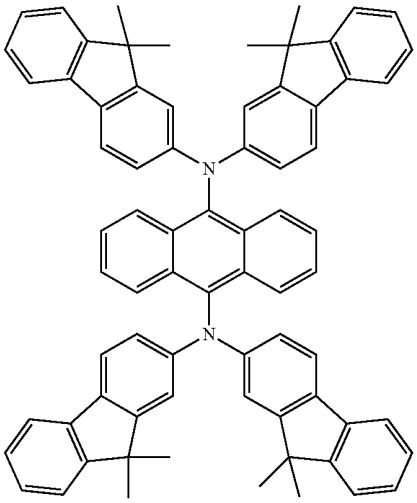

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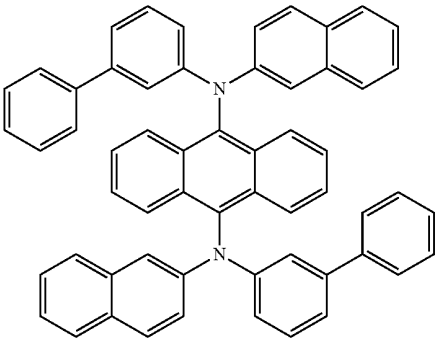

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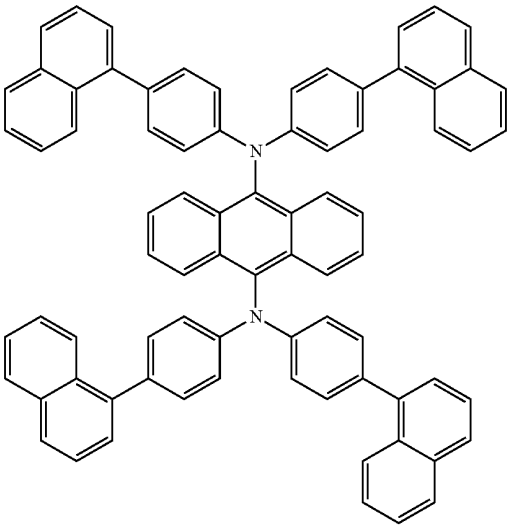

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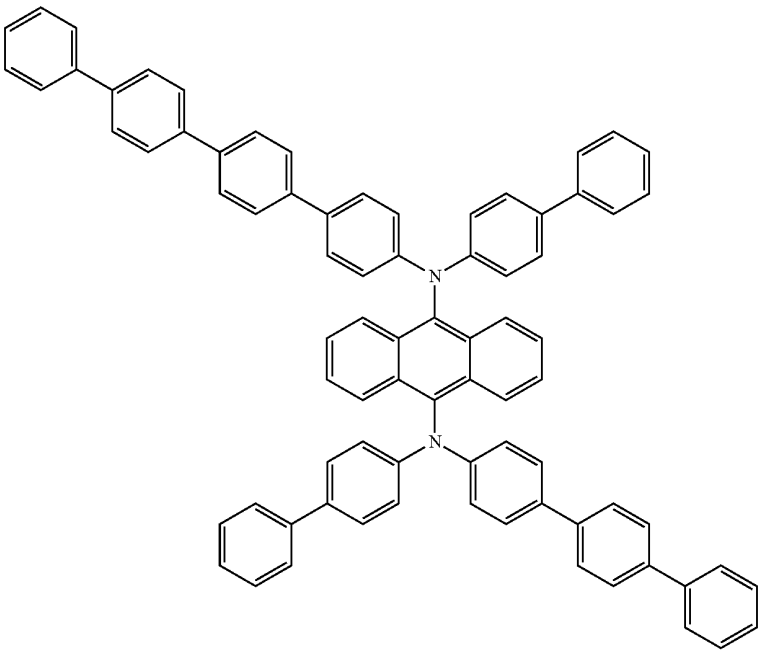

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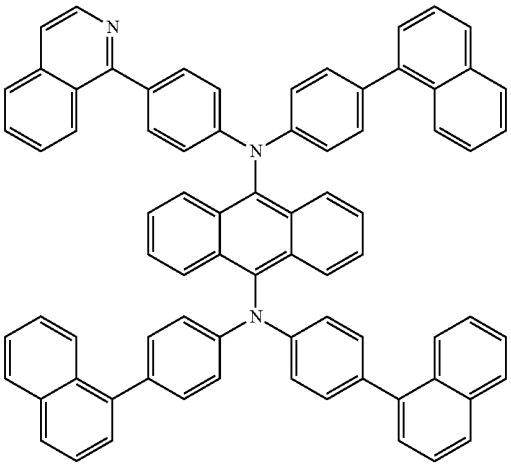

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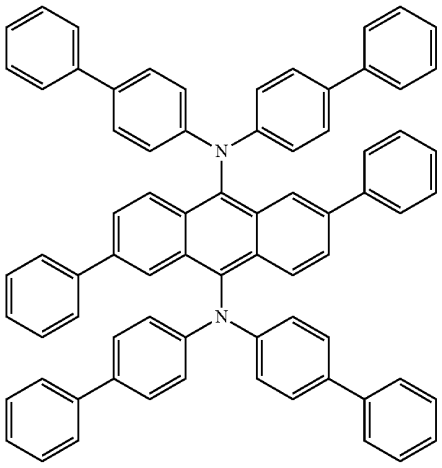

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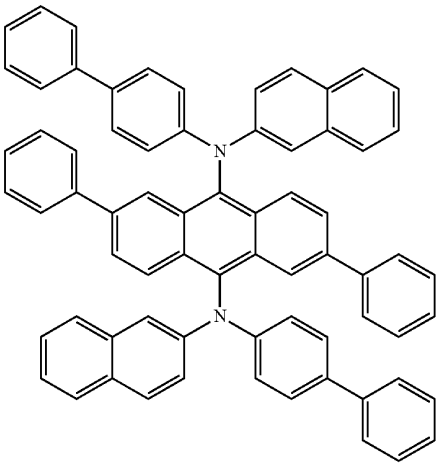

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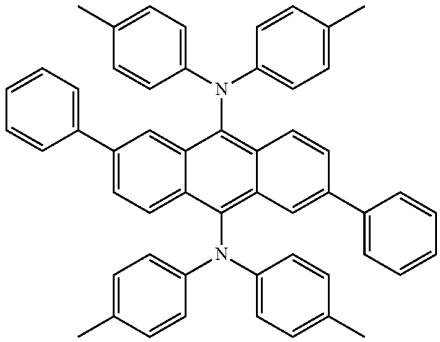

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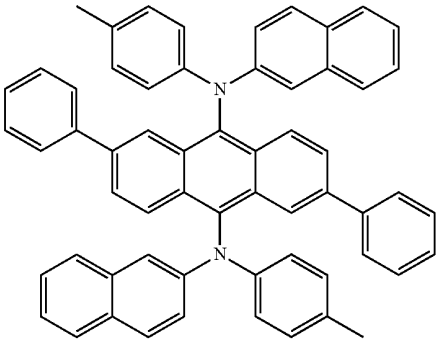

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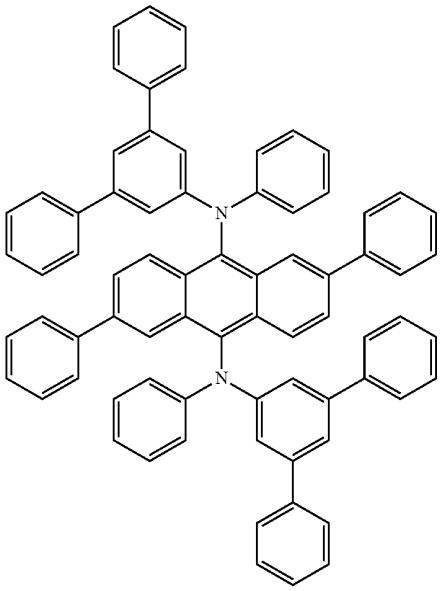

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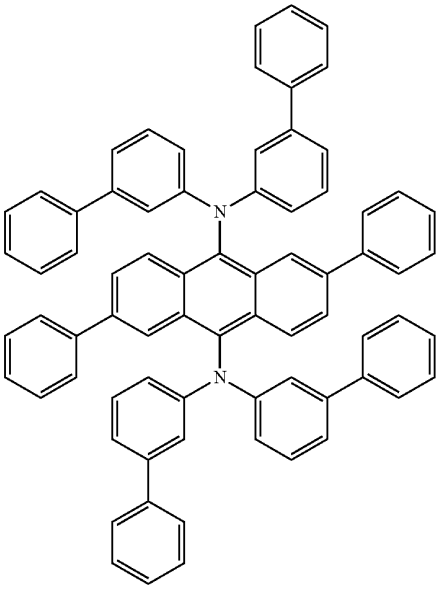

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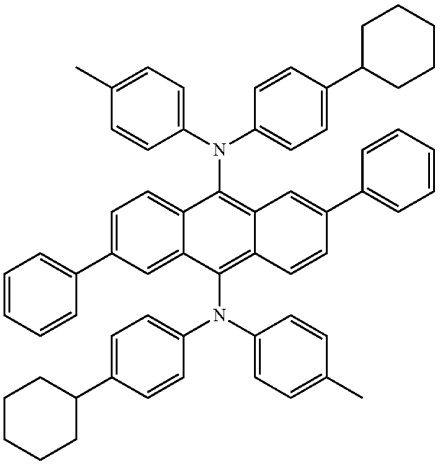

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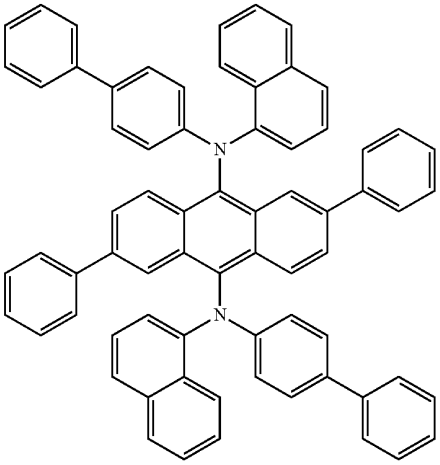

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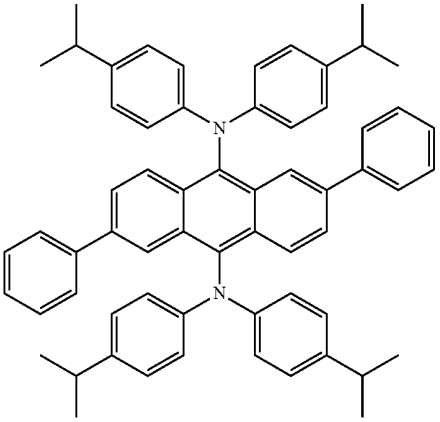

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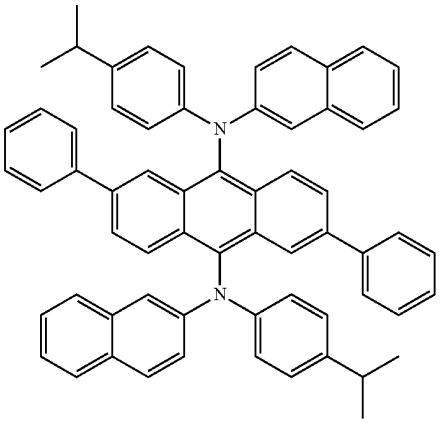

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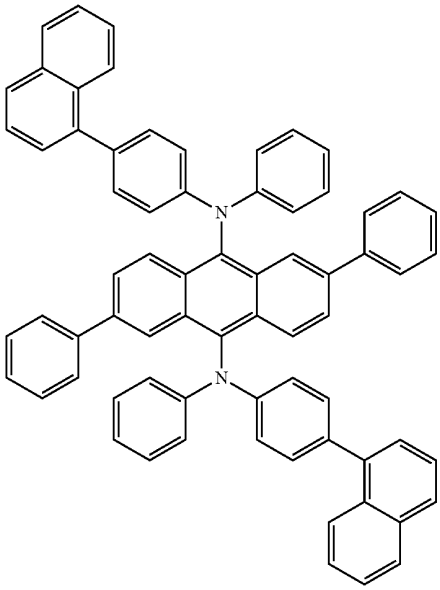

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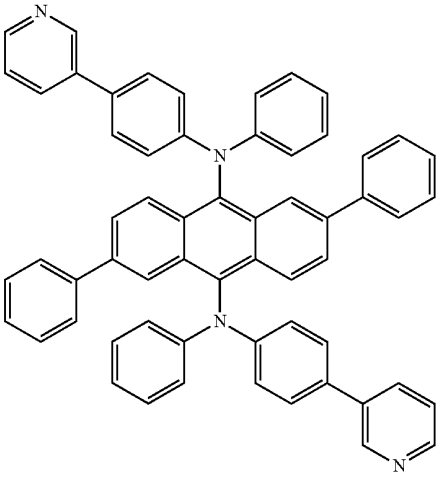

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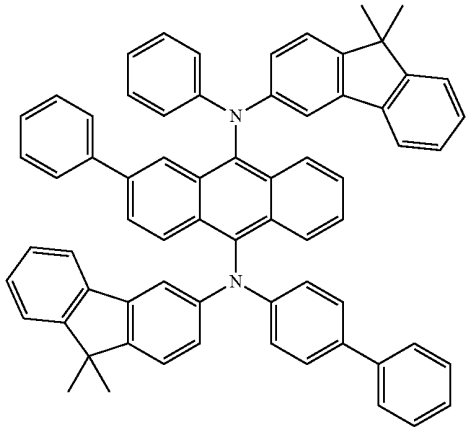

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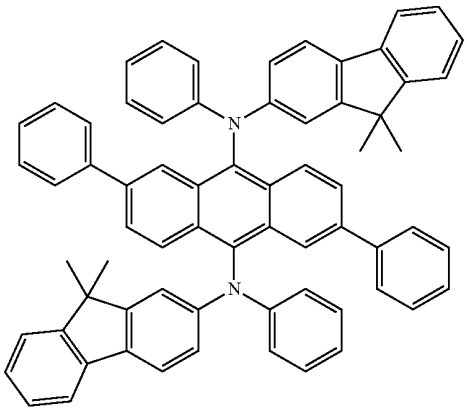

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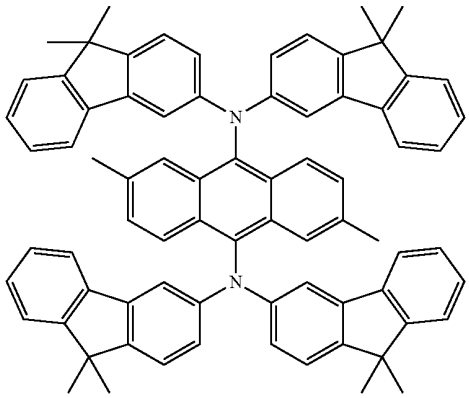

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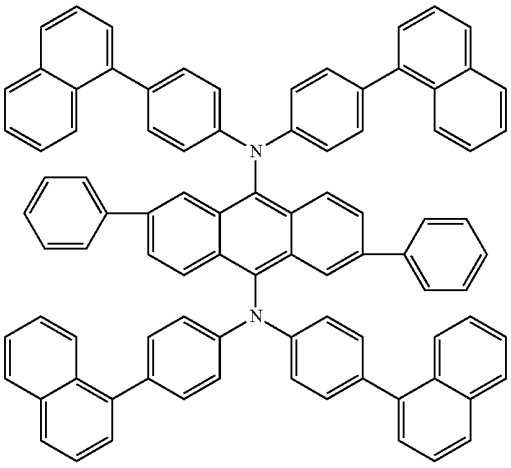

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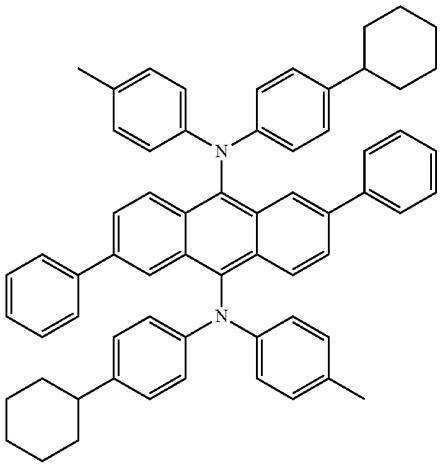

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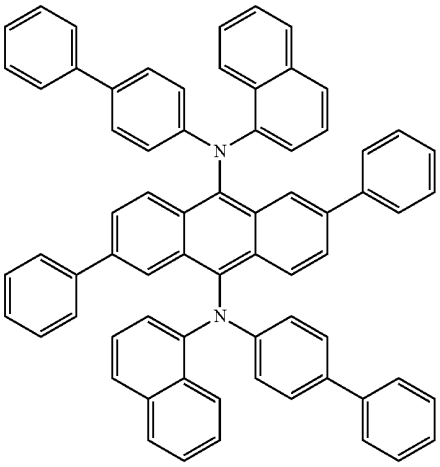

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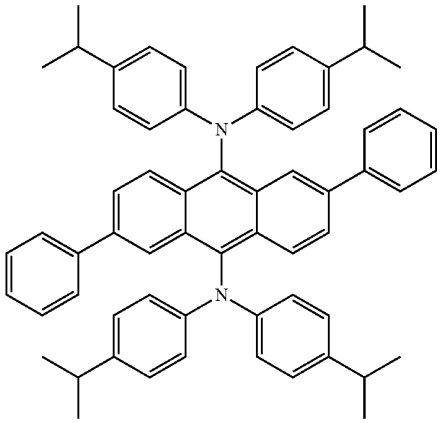

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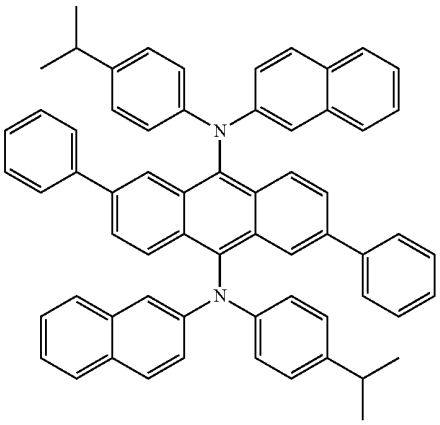

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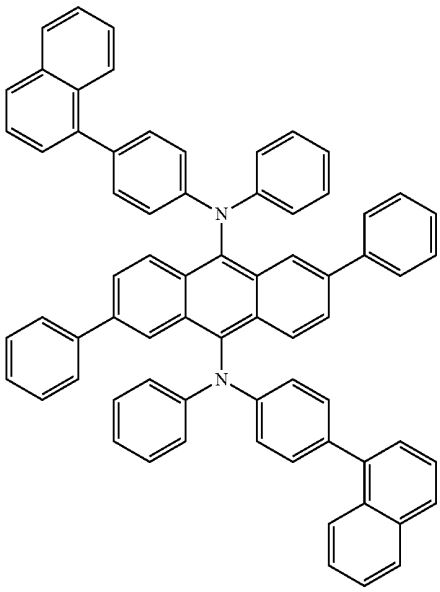

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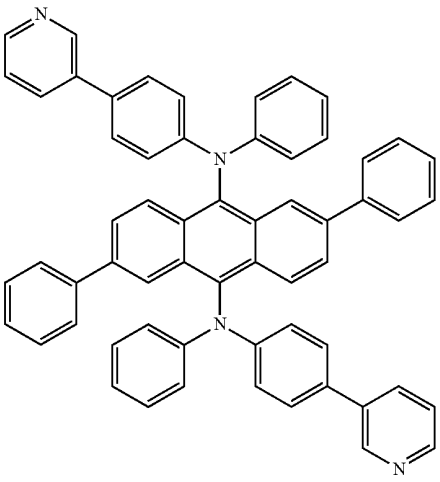
HM-65



[0038] FIGS. **4** and **5** are a graph showing a driving voltage of the organic light emitting device according to the present invention and a driving voltage of the organic light emitting device in Comparative Example. The driving voltage of the organic light emitting device according to the present invention will be described in conjunction with FIGS. **4**, **5** and Table 1.

[0039] The organic light emitting device according to Comparative Example as set forth in Table 1 uses, as a material for the hole injection layer, a mixture of an organic material and an inorganic material at a ratio of 1:3. The organic material comprises NPD and the inorganic material comprises MgF_2. Also, the organic light emitting device according to Example 1 of the present invention uses, as a material for the hole injection layer, a mixture of an organic material and an inorganic material at a ratio of 1:3. The organic material comprises the HM-03 compound and the inorganic material comprises MgF_2. Also, the organic light emitting device according to Example 2 of the present invention uses, as a material for the hole injection layer, a mixture of an organic material and an inorganic material at a ratio of 1:5. The organic material comprises a compound of HM-03 and the inorganic material comprises MgF_2. And, the organic light emitting device according to Example 3 of the present invention uses, as a material for the hole injection layer, a mixture of an organic material and an inorganic material at a ratio of 1:3. The organic material comprises a compound of HM-18 and the inorganic material comprises MgF_2. the organic light emitting device according to Example 4 of the present invention uses, as a material for the hole injection layer, a mixture of an organic material and an inorganic material at a ratio of 1:5. The organic material comprises a compound of HM-18 and the inorganic material comprises MgF_2.

TABLE 1

	Hole injection layer						
	Organic material	In-organic material	Volume ratio	Current density (mA/cm^2)	Driving voltage (V)	EQE (%)	CIE (xy)
Ex. 1	HM-03	MgF_2	1:3	10	4.2	9.1	0.137 0.087

TABLE 1-continued

	Hole injection layer						
	Organic material	In-organic material	Volume ratio	Current density (mA/cm^2)	Driving voltage (V)	EQE (%)	CIE (xy)
Ex. 2	HM-03	MgF_2	1:5	10	4.2	9.0	0.137 0.087
Ex. 3	HM-18	MgF_2	1:3	10	3.9	10.2	0.138 0.084
Ex. 4	HM-18	MgF_2	1:5	10	4.0	10.1	0.137 0.087
Comp. Ex.	NPD	MgF_2	1:3	10	4.34	9.0	0.137 0.086

[0040] As can be seen from Table 1, FIGS. **4** and **5**, the organic light emitting device according to the present invention exhibited a decrease in driving voltage at a current of 10 mA/cm^2. This means that interface properties between the hole injection layer and the anode are improved, a difference between the HOMO energy level of the hole injection layer and the HOMO energy level of the hole transport layer is reduced and driving voltage is thus reduced, by forming the hole injection layer with a mixture of an inorganic material and an organic material.

[0041] FIG. **6** is a view illustrating equivalent circuits of R, G and B sub-pixel regions according to the present invention and FIG. **7** is a vertical cross-sectional view illustrating R, G, and B sub-pixel regions shown in FIG. **6**.

[0042] Referring to FIG. **6**, a display panel using the organic light emitting device according to an embodiment of the present invention includes R, G, and B sub-pixel regions defined by intersection of a plurality of gate lines (GL), a plurality of data lines (DL) and a plurality of power lines (PL). The R, G and B sub-pixel regions are arrayed in the form of a matrix to display an image.

[0043] Each of R, G, and B sub-pixel regions includes a cell driver **200** and an organic light emitting device connected to the cell driver **200**.

[0044] The cell driver **200** includes a switch thin film transistor (TS) connected to the gate lines (GL) and the data lines (DL), a driving thin film transistor (TD) connected to the

switch thin film transistor (TS) and power lines (PL) and a first electrode **122** of the organic light emitting device, and a storage capacitor (C) connected to the power line (PL) and a drain electrode **110** of the switch thin film transistor (TS).

[0045] The gate electrode of the switch thin film transistor (TS) is connected to the gate line (GL), the source electrode is connected to the data line (DL), and the drain electrode is connected to the gate electrode of the driving thin film transistor (TD) and the storage capacitor (C). The source electrode of the driving thin film transistor (TD) is connected to the power line (PL) and the drain electrode **110** is connected to the first electrode **122**. The storage capacitor (C) is connected to the power line (PL) and the gate electrode of the driving thin film transistor (TD).

[0046] The switch thin film transistor (TS) turns on and supplies a data signal supplied to the data line (DL) to the storage capacitor (C) and the gate electrode of the driving thin film transistor (TD), when a scan pulse is applied to the gate line (GL). In response to the data signal supplied to the gate electrode, the driving thin film transistor (TD) controls a current (I) supplied from the power line (PL) to the organic light emitting device, thereby controlling light emission of the organic light emitting device. Also, although the switch thin film transistor (TS) turns off, the driving thin film transistor (TD) supplies a predetermined current (I) due to voltage charged in the storage capacitor (C), until a data signal of the next frame is supplied, to maintain light emission of the organic light emitting device.

[0047] As shown in FIG. **6**, the driving thin film transistor (TD) includes a gate electrode **132** formed on an insulating substrate **101**, a gate insulating film **126** to cover the gate electrode **132**, a semiconductor layer **136** formed on the gate insulating film **126**, an interlayer insulating film **122** to cover the semiconductor layer **136**, and a source electrode **134** and a drain electrode **138** connected to a source region **136**S and a drain region **136**D of the semiconductor layer **136**, respectively, through first and second contact holes **130** and **119** that pass through the interlayer insulating film **102**. The semiconductor layer **136** is formed of a LTPS thin film and includes a channel region **136**C that overlaps the gate electrode **132**, and a source region **136**S and a drain region **136**D that do not overlap the gate electrode **132** such that the channel region **136**C is interposed therebetween, and have injected impurities. Although an embodiment in which the semiconductor layer is formed of an LTPS thin film has been described, the present invention is not limited thereto.

[0048] The organic light emitting device (OLED) includes an anode **112** made of a transparent conductive material, formed on a protective film **108** to cover the driving thin film transistor (TD), a bank insulating film **142** provided with a bank hole that exposes the anode **112**, organic common layers **114**, **116**, **118**, **120**, and **122** formed on the anode **112** exposed through the bank hole, and a cathode **128** formed on the organic common layers **114**, **116**, **118**, **120**, and **122**.

[0049] The organic common layer includes a hole injection layer (HIL, **114**), a hole transport layer (HTL, **116**), a light emitting layer (**122**), an electron transport layer (ETL, **118**), and an electron injection layer (EIL, **120**).

[0050] The hole injection layer **120** comprises a mixture of an inorganic material and an organic material, thus satisfying the conditions and thereby easily injection holes from the anode **112** to the hole transport layer **116**. A mix ratio of the inorganic material and the organic material is 10:1 to 1:10 and the hole injection layer **120** has a thickness of 10 Å to 200 Å. The inorganic material may be at least one selected from an alkali metal oxide, an alkaline earth metal oxide, a halogen compound of an alkali metal, and a halogen compound of an alkaline earth metal. In the alkali metal oxide or the alkaline earth metal oxide, the metal may be at least one selected from Li, Na, K, Rb, Cs, Be, Mg, Ca, Sr and Ba. In the halogen compound of alkali metal or the halogen compound of alkaline earth metal, a central metal is at least one selected from Li, Na, K, Rb, Cs, Be, Mg, Ca, Sr and Ba, and the halogen is at least one selected from F, CI, Br, and I.

[0051] Also, the organic material comprises at the least one of compounds represented by Formula 1 above, and R1, R2, R3, R4, R5, and R6 in Formula 1 are each independently selected from a substituted or unsubstituted C_6 to C_{30} aromatic group, and a C_5 to C_{29} heterocyclic group containing N, S, or O, wherein the substituent is selected from a C_1 to C_6 aliphatic group and a C_6 to C_{12} aromatic group.

[0052] the substituent of the substituted C_6 to C_{30} aromatic group is at least one C_1 to C_6 aliphatic group selected from methyl, ethyl, propyl, butyl and hexyl, and the substituted C_6 to C_{12} aromatic group is at least one selected from phenyl, biphenyl, naphthyl and terphenyl.

[0053] The unsubstituted C_6 to C_{30} aromatic group is at least one selected from phenyl, biphenyl, naphthyl, terphenyl, anthracene, phenanthrene, pyrene, and fluoranthene.

[0054] Also, specific examples of the compound of Formula 1 are described above and a description thereof is thus omitted.

[0055] As apparent from the afore-going, the present invention provides an organic light emitting device that reduces a driving voltage by forming the hole injection layer with a mixture of an inorganic material comprising an oxide of an alkali metal and an alkaline earth metal, or a halogen compound of an alkali metal or an alkaline earth metal, and an organic material comprising at least one of compounds represented by Formula 1.

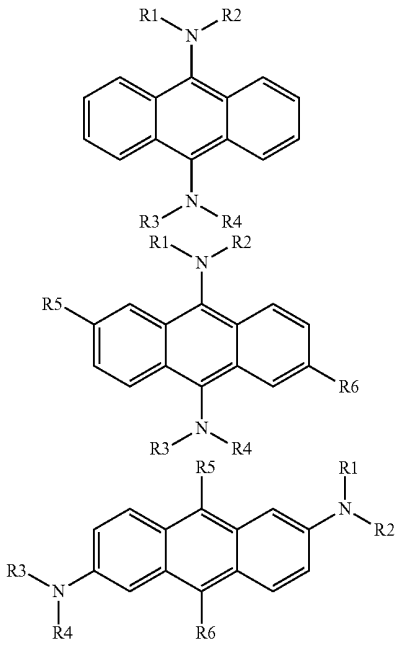
[0056] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the inventions. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. An organic light emitting device comprising an anode, a hole injection layer, a hole transport layer, a light emitting layer, an electron transport layer, an electron injection layer and a cathode laminated in this order,

wherein the hole injection layer comprises a mixture of an inorganic material comprising at the least of one of an alkali metal oxide, an alkali earth metal oxide, a halogen compound of an alkali metal, and a halogen compound of an alkali earth metal oxide, and an organic material comprising at least one of compounds represented by Formula 1:

(1)



wherein R1, R2, R3, R4, R5 and R6 are each independently selected from a substituted or unsubstituted C_6 to C_{30} aromatic group and a C_5 to C_{29} heterocyclic group containing N, S, or O, wherein the substituent is selected from a C_1 to C_6 aliphatic group and a C_6 to C_{12} aromatic group.

2. The organic light emitting device according to claim **1**, wherein a mix ratio of the inorganic material to the organic material is about 10:1 to about 1:10.

3. The organic light emitting device according to claim **1**, wherein the alkali metal oxide or the alkaline earth metal oxide is at least one selected from Li, Na, K, Rb, Cs, Be, Mg, Ca, Sr and Ba.

4. The organic light emitting device according to claim **1**, wherein, in the halogen compound of the alkaline metal or the halogen compound of alkali earth metal, a central metal is at least one selected from Li, Na, K, Rb, Cs, Be, Mg, Ca, Sr and Ba, and the halogen is at least one selected from F, CI, Br and I.

5. The organic light emitting device according to claim **1**, wherein the substituent of the substituted C_6 to C_{30} aromatic group is at least one C_1 to C_6 aliphatic group selected from methyl, ethyl, propyl, butyl and hexyl, and the substituted C_6 to C_{12} aromatic group is at least one selected from phenyl, biphenyl, naphthyl and terphenyl.

6. The organic light emitting device according to claim **1**, wherein the unsubstituted C_6 to C_{30} aromatic group is at least one selected from phenyl, biphenyl, naphthyl, terphenyl, anthracene, phenanthrene, pyrene, and fluoranthene.

7. A display panel comprising:

a driving thin film transistor formed on a substrate;

an anode connected to the driving thin film transistor;

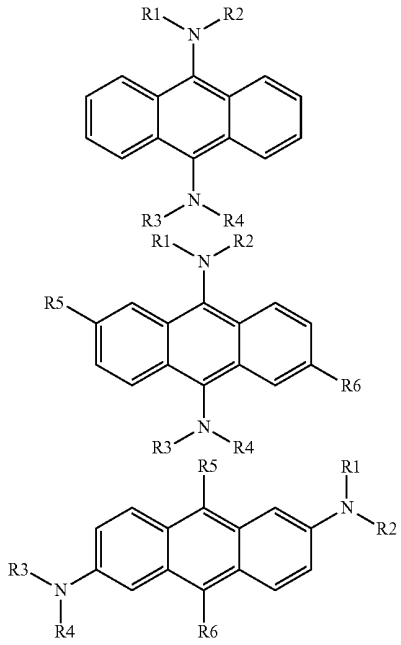
a bank insulating film provided with a bank hole to expose the anode;

an organic common layer formed in the bank hole, the organic common layer including a hole injection layer, a hole transport layer, a light emitting layer, an electron transport layer and an electron injection layer laminated in this order; and

a cathode facing the anode such that the organic common layer is interposed between the cathode and the anode,

wherein the hole injection layer comprises a mixture of an inorganic material comprising at the least of one of an alkali metal oxide, an alkali earth metal oxide, a halogen compound of an alkali metal, and a halogen compound of an alkali earth metal oxide, and an organic material comprising at least one of compounds represented by Formula 1:

(1)



wherein R1, R2, R3, R4, R5 and R6 are each independently selected from a substituted or unsubstituted C_6 to C_{30} aromatic group and a C_5 to C_{29} heterocyclic group containing N, S, or O.

8. The display panel according to claim **7**, wherein a mix ratio of the inorganic material to the organic material is about 10:1 to about 1:10.

9. The display panel according to claim **7**, wherein the oxide of alkali metal or the oxide of alkali earth metal is at least one selected from Li, Na, K, Rb, Cs, Be, Mg, Ca, Sr and Ba.

10. The display panel according to claim **7**, wherein, in the halogen compound of the alkali metal or the halogen compound of alkali earth metal is at least one selected from Li, Na, K, Rb, Cs, Be, Mg, Ca, Sr and Ba, and the halogen is at least one selected from F, CI, Br and I.

11. The display panel according to claim **7**, wherein the substituent of the substituted C_6 to C_{30} aromatic group is at least one C_1 to C_6 aliphatic group selected from methyl, ethyl, propyl, butyl and hexyl, and the substituted C_6 to C_{12} aromatic group is at least one selected from phenyl, biphenyl, naphthyl and terphenyl.

12. The display panel according to claim **7**, wherein the unsubstituted C_6 to C_{30} aromatic group is at least one selected from phenyl, biphenyl, naphthyl, terphenyl, anthracene, phenanthrene, pyrene, and fluoranthene.

* * * * *

专利名称(译)	有机发光器件和使用其的显示器面板		
公开(公告)号	US20130092910A1	公开(公告)日	2013-04-18
申请号	US13/650836	申请日	2012-10-12
[标]申请(专利权)人(译)	乐金显示有限公司		
申请(专利权)人(译)	LG DISPLAY CO. , LTD. ,		
当前申请(专利权)人(译)	LG DISPLAY CO. , LTD		
[标]发明人	SEO JEONG DAE SONG KI WOOG		
发明人	SEO, JEONG-DAE SONG, KI-WOOG		
IPC分类号	H01L51/54		
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其他公开文献	US9136478		
外部链接	Espacenet USPTO		

摘要(译)

有机发光器件包括依次层叠的阳极，空穴注入层，空穴传输层，发光层，电子传输层，电子注入层和阴极，其中空穴注入层包含混合物1.一种无机材料，其包含碱金属氧化物，碱土金属氧化物，碱金属的卤素化合物，碱土金属的卤素化合物中的至少一种，和包含至少一种下述化合物的有机材料。公式1： 其中R1，R2，R3，R4，R5和R6各自独立地选自取代或未取代的C6至C30芳族基团和含有N，S或O的C5至C29杂环基团，其中取代基选自C1至C6脂族基团和C6至C12芳族基团。