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Seo et al.

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(54) **ORGANIC LIGHT EMITTING DISPLAY
PANEL AND METHOD OF
MANUFACTURING THE SAME**

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patent is extended or adjusted under 35
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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**

H01L 51/00 (2006.01)

H01L 51/52 (2006.01)

H01L 27/32 (2006.01)

(52) **U.S. Cl.**

CPC **H01L 51/5253** (2013.01); **H01L 51/006**
(2013.01); **H01L 27/3244** (2013.01); **H01L**
51/0058 (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

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Primary Examiner — J. L. Yang

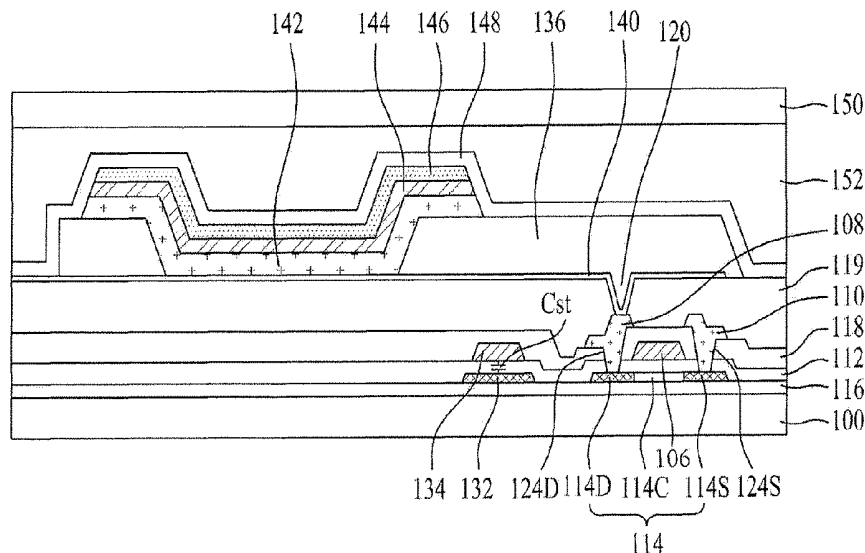
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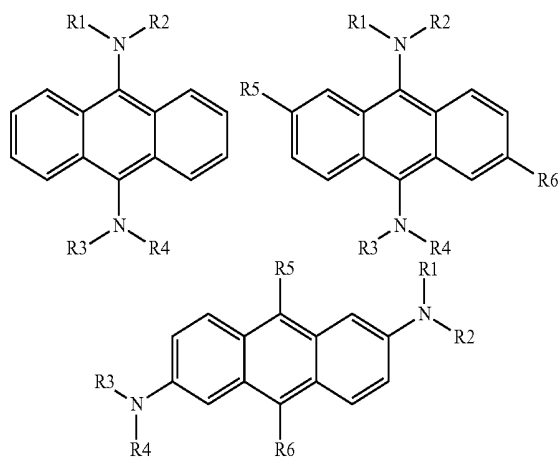
ABSTRACT

An organic light emitting display panel includes a light emitting diode array substrate and an encapsulation substrate adhered to the light emitting array diode substrate by an adhesive film. The light emitting array diode substrate includes a driving thin film transistor formed on a substrate, an organic light emitting diode including a first electrode connected to the driving thin film transistor, an organic emission layer formed on the first electrode, and a second electrode formed on the organic emission layer, and first and second passivation layers formed on the second electrode. In this regard, the first passivation layer is formed of an organic compound having at least one of the structural formulae described in Formula 1 below:

(Continued)



<Formula 1>



wherein R1, R2, R3, R4, R5, and R6 are each independently selected from substituted or unsubstituted C₆-C₄₀ aromatic groups.

13 Claims, 9 Drawing Sheets

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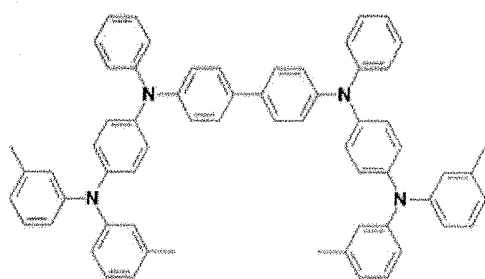
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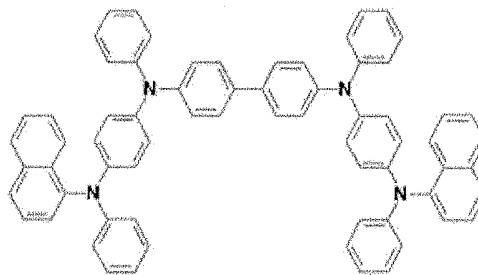
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FIG. 1



DNTPD



IDE406

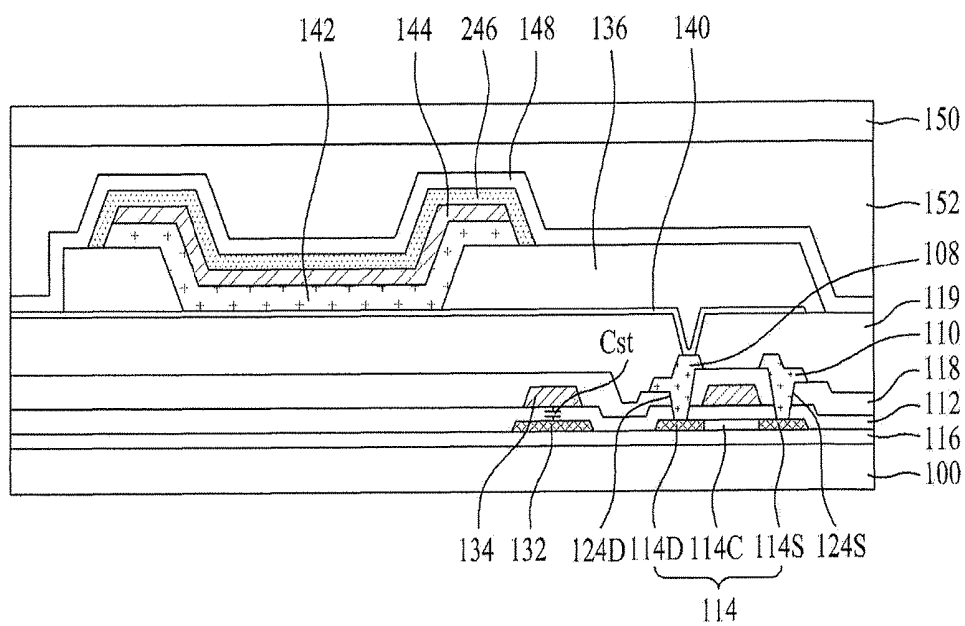


FIG. 4A

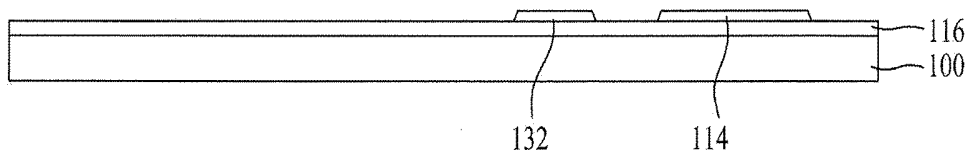


FIG. 4B

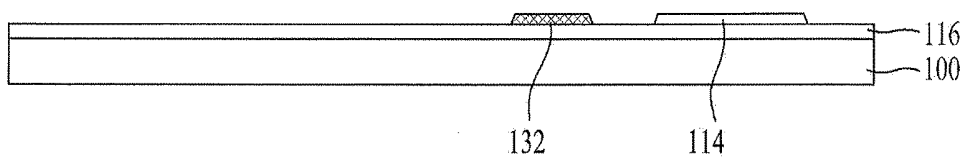


FIG. 4C

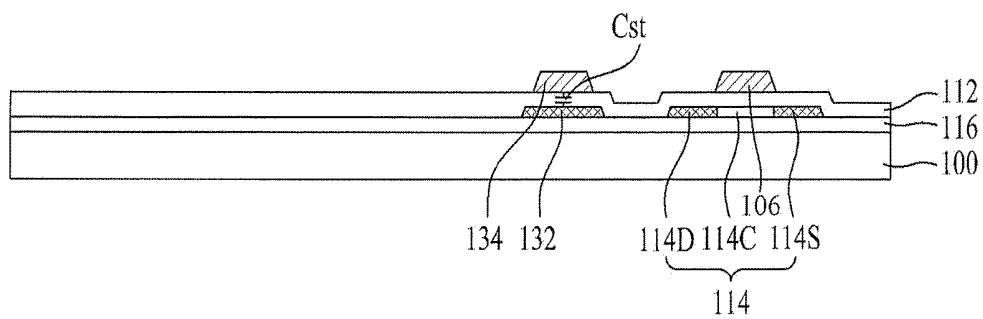


FIG. 4D

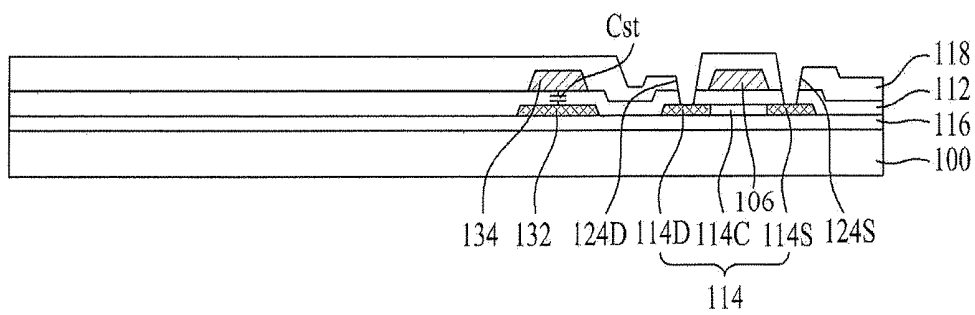


FIG. 4E

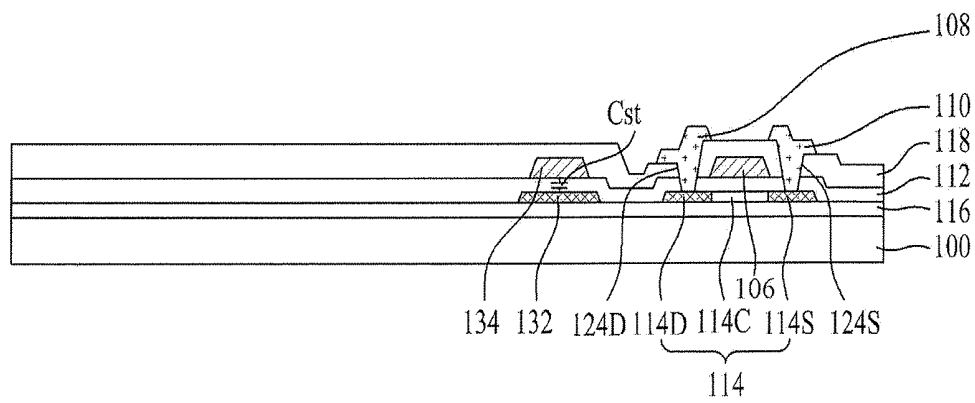


FIG. 4F

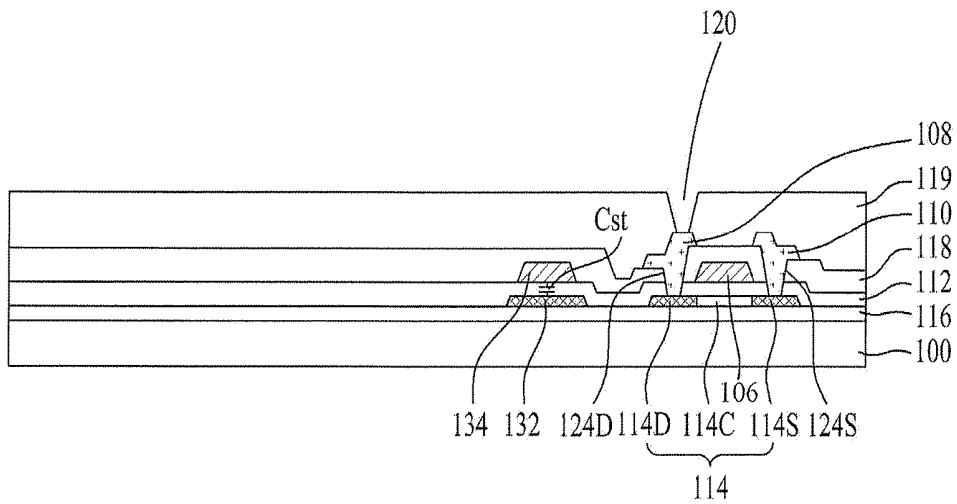


FIG. 4G

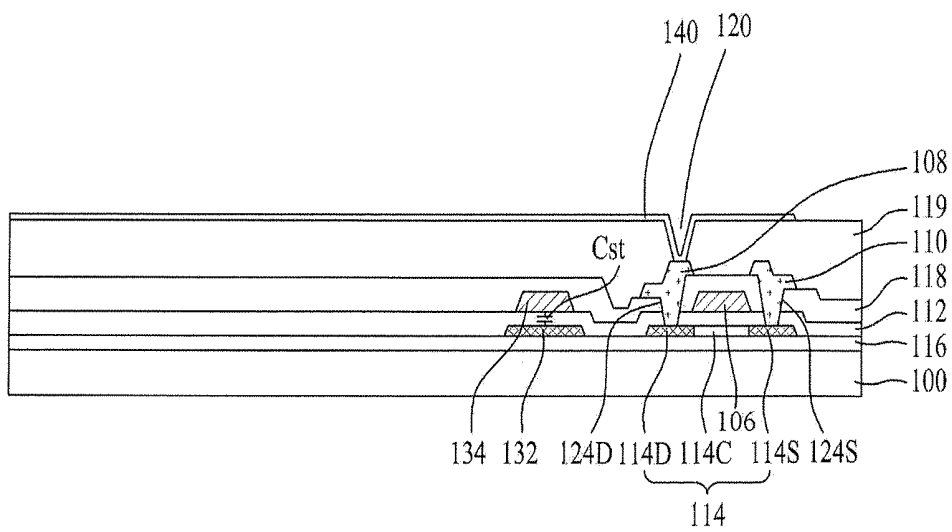


FIG. 4H

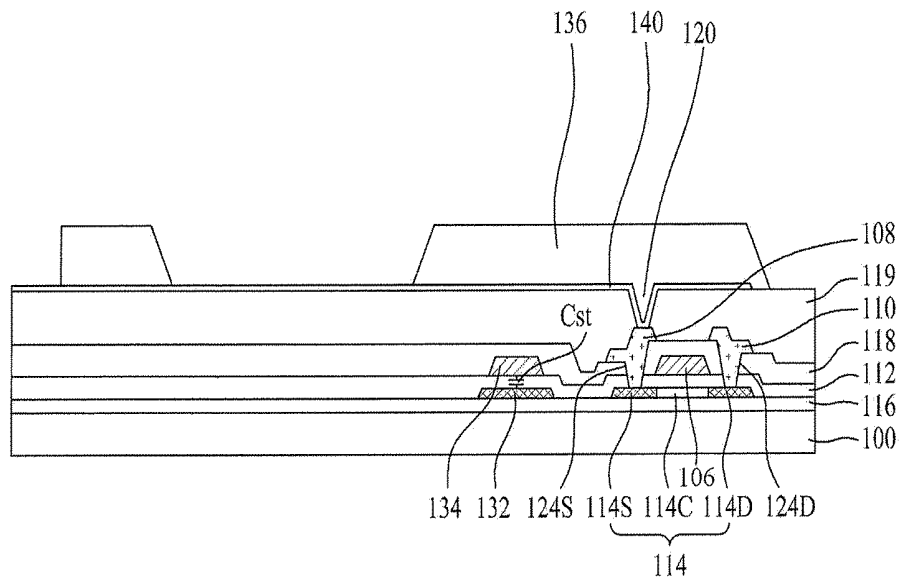


FIG. 4I

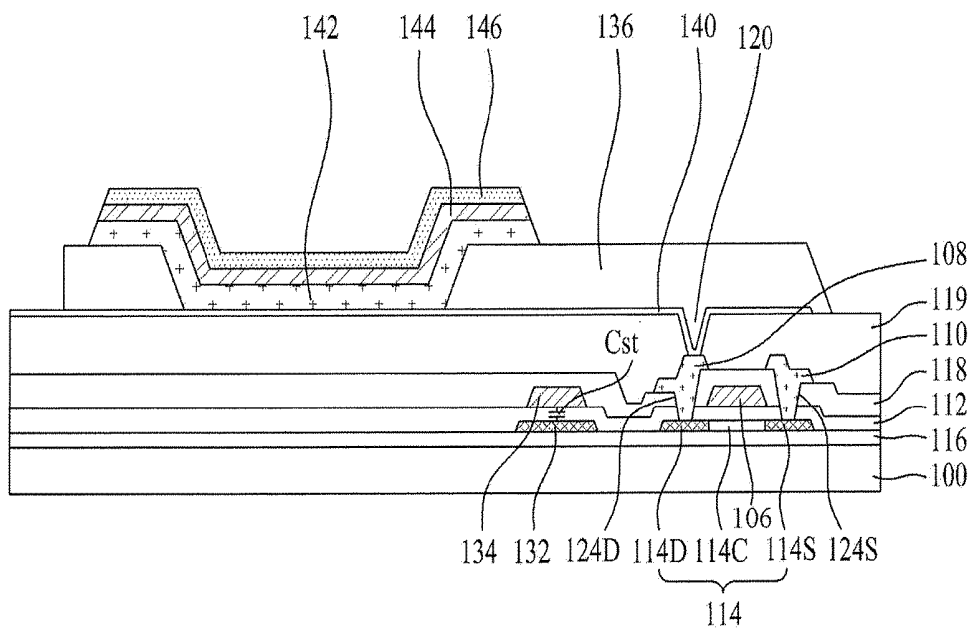


FIG. 4J

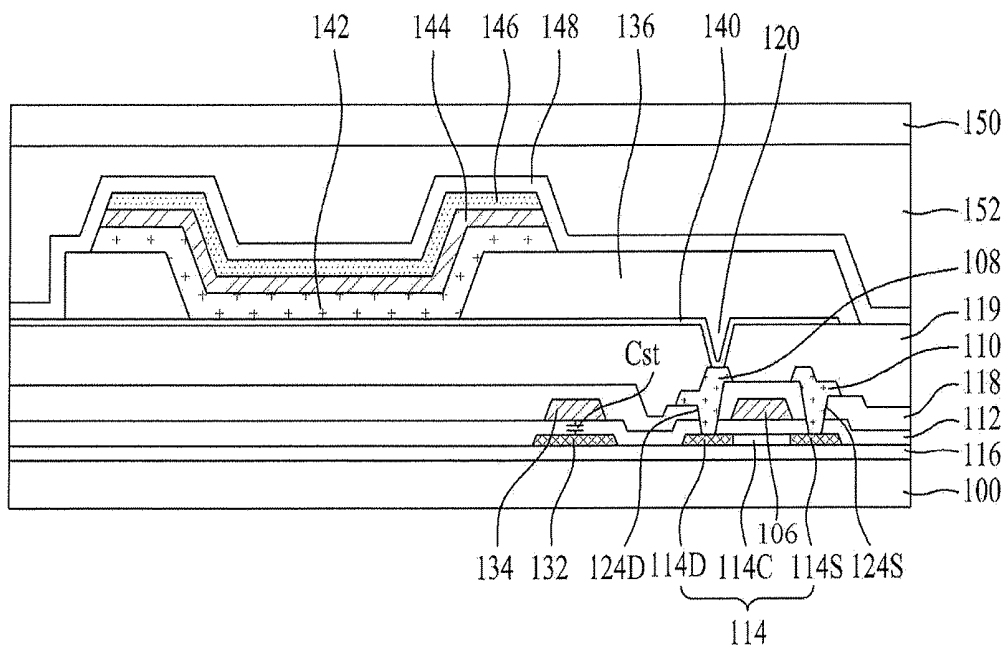
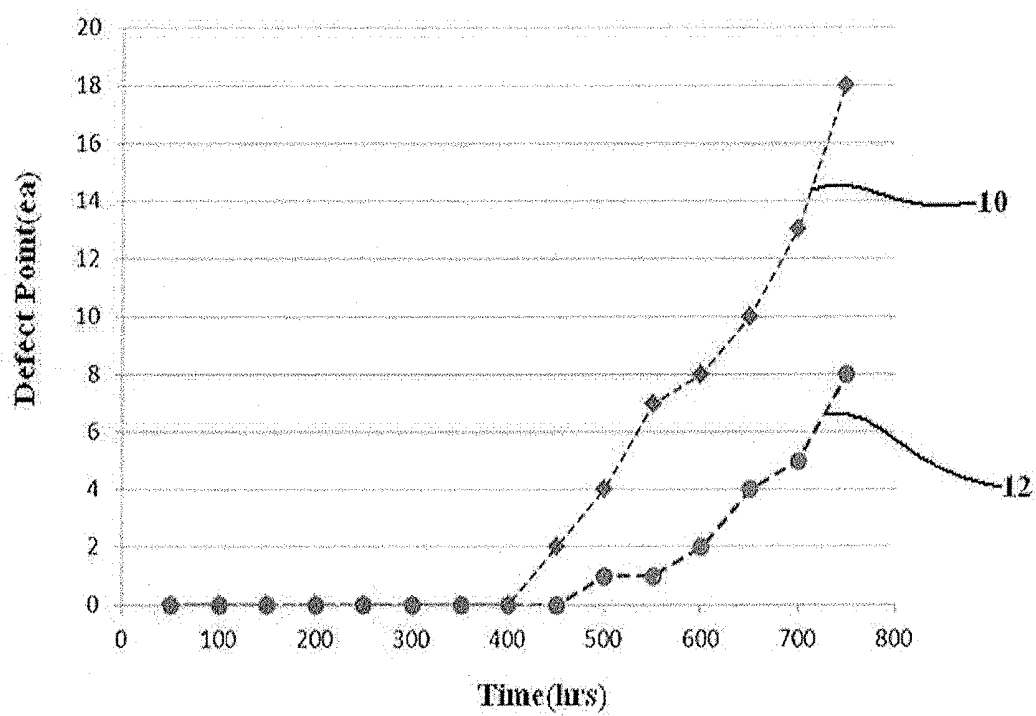


FIG. 5



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ORGANIC LIGHT EMITTING DISPLAY PANEL AND METHOD OF MANUFACTURING THE SAME

This application claims the benefit of priority of Korean Patent Application No. 10-2012-0122752, filed on Oct. 31, 2012, which is hereby incorporated by reference as if fully set forth herein.

BACKGROUND

Field of the Disclosure

The present disclosure relates to an organic light emitting display panel and a method of manufacturing the same, and more particularly, to an organic light emitting display panel that has increased life by preventing moisture or oxygen from permeating an organic light emitting diode and is manufactured at reduced cost and a method of manufacturing the same.

Discussion of the Related Art

Conventional organic light emitting display devices, which are self-emissive devices, do not require backlight unit and thus may be lightweight and thin and be manufactured using a simplified manufacturing process. In addition, these organic light emitting display devices have wide viewing angles, a rapid response time, a high contrast ratio, and the like and thus are suitable for use as a next generation flat panel display.

In particular, an organic light emitting display panel includes a light emitting diode array substrate including driving thin film transistors (TFTs), organic light emitting diodes respectively connected to the driving TFTs, and a passivation layer formed to protect the organic light emitting diodes, and an encapsulation substrate adhered to the light emitting diode array substrate by an adhesive film.

In this regard, the passivation layer generally has high thermal stability and is formed of Alq_3 , which is inexpensive. When Alq_3 is deposited, however, ash is generated and thus the passivation layer is not uniformly deposited on the organic light emitting diode.

In other words, due to generation of ash, the ash is deposited together with the passivation layer, and thus the passivation layer is not uniformly formed. Due to non-uniform deposition of the passivation layer, a gap is formed between an anode and the passivation layer and thus moisture or oxygen permeates the gap therebetween.

As described above, since moisture or oxygen is permeated between the anode and the passivation layer, life of an organic light emitting diode is reduced.

In addition, to complement a material constituting Alq_3 , an organic material such as DNTPD or IDE406 is used as a material forming a passivation layer. However, costs of the organic materials are high, which results in increase in manufacturing costs of an organic light emitting display panel.

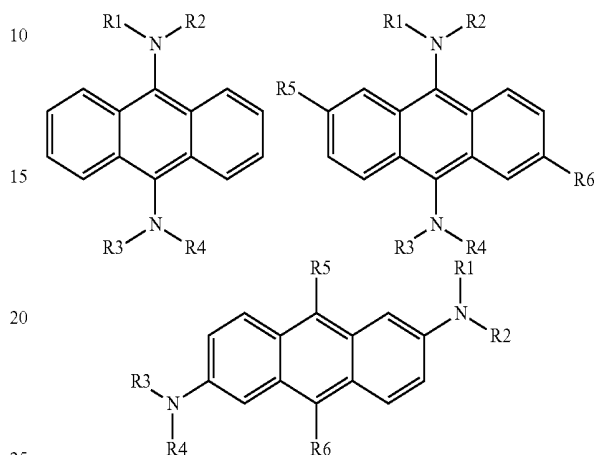
SUMMARY

An organic light emitting display panel includes a driving thin film transistor formed on a substrate, an organic light emitting diode including a first electrode connected to the driving thin film transistor, an organic emission layer formed on the first electrode, and a second electrode formed on the organic emission layer, and first and second passivation layers formed on the second electrode, a light emitting diode array substrate including the driving thin film transistor, the organic light emitting diode, the first passivation layer and

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the second passivation layer and an encapsulation substrate adhered to the light emitting diode array substrate by an adhesive film, wherein the first passivation layer is formed of an organic compound having at least one of the structural formulae described in Formula 1 below:

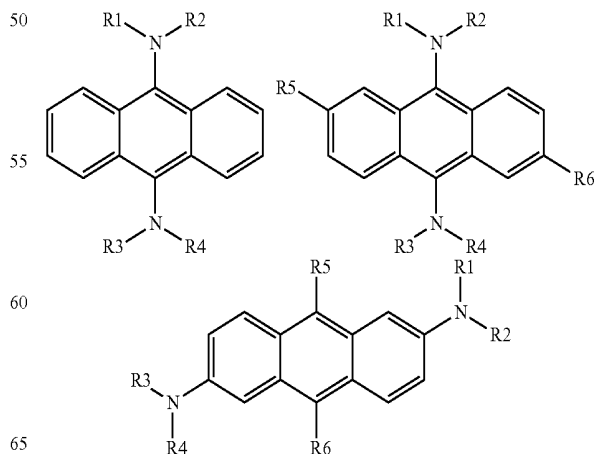
<Formula 1>



wherein R1, R2, R3, R4, R5, and R6 are each independently selected from substituted or unsubstituted C_6-C_{40} aromatic groups.

In another aspect of the present invention, a method of manufacturing an organic light emitting display panel includes forming a driving thin film transistor on a substrate, forming a first electrode to be connected to the driving thin film transistor, forming an organic emission layer and a second electrode on the first electrode, forming a first passivation layer on the second electrode, forming a second passivation layer over the substrate with the first passivation layer formed thereon, and adhering a light emitting diode array substrate including the driving thin film transistor, the first electrode, the organic emission layer, the second electrode, the first passivation layer, and the second passivation layer to an encapsulation substrate by an adhesive film, wherein the first passivation layer is formed of an organic compound having at least one of the structural formulae described in Formula 1 below:

<Formula 1>



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wherein R1, R2, R3, R4, R5, and R6 are each independently selected from substituted or unsubstituted C₆-C₄₀ aromatic groups.

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

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:

FIG. 1 illustrates structural formulae of DNTPD and IDE406 as a compound used in a conventional hole injection layer;

FIG. 2 is a sectional view of an organic light emitting display panel according to an embodiment of the present invention;

FIG. 3 is a sectional view illustrating another example of a first protective layer;

FIGS. 4A through 4J are sectional views sequentially illustrating a method of manufacturing the organic light emitting display panel, according to an embodiment of the present invention; and

FIG. 5 is a graph showing comparison results between lifespan of an organic light emitting diode when a protective layer formed of Alq₃ is used and lifespan of an organic light emitting diode when the first protective layer according to the present invention is used.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts. When it is determined that a detailed description of the related art may unnecessarily obscure the subject matter of the present invention, a description thereof will be omitted.

Hereinafter, embodiments of the present invention will be described in detail with reference to FIGS. 2 through 5.

FIG. 2 is a sectional view of an organic light emitting display panel according to an embodiment of the present invention. FIG. 3 is a sectional view illustrating another example of a first passivation layer.

As illustrated in FIG. 2, the organic light emitting display panel includes a light emitting diode array substrate and an encapsulation substrate 150 adhered to the light emitting diode array substrate by an adhesive film 152.

The light emitting diode array substrate includes a driving thin film transistor (TFT) formed on a substrate 100, an organic light emitting diode connected to the driving TFT, and first and second passivation layers 146 and 148 to protect the organic light emitting diode.

In the driving TFT, as illustrated in FIG. 2, a buffer layer 116 and an active layer 114 are formed on the substrate 100, and a gate electrode 106 is formed to correspond to a channel region 114c of the active layer 114, with a gate insulating layer 112 intervening therebetween. Source and drain electrodes 110 and 108 are provided therebetween with

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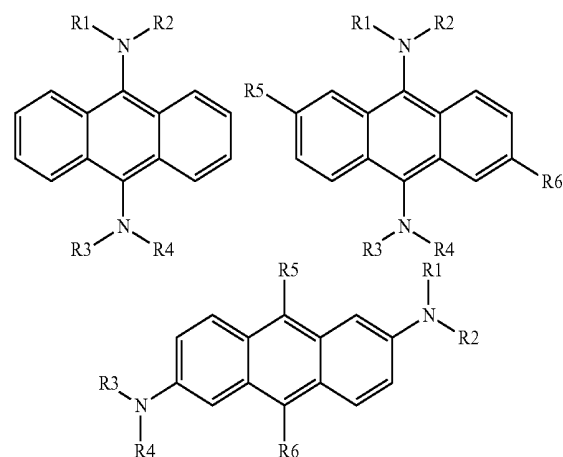
the gate electrode 106 and an interlayer insulating layer 118 to be insulated from each other. The source and drain electrodes 110 and 108 are respectively connected to source and drain regions 114S and 114D of the active layer 114 which are formed by injection of n+ impurities via a source contact hole 124S and a drain contact hole 124D, respectively, each of which penetrates the interlayer insulating layer 118 and the gate insulating layer 112. In addition, the active layer 114 may further include the channel region 114C and a lightly doped drain (LDD) region (not shown) formed between the source and drain regions 114S and 114D by injection of n- impurities, to reduce off-current. In addition, a pixel protective layer 119 formed of an organic insulating material is formed on the driving TFT formed on the substrate 100. Alternatively, the pixel protective layer 119 on the driving TFT may have a double-layered structure including an inorganic protective layer and an organic protective layer.

The organic light emitting diode includes a first electrode 140 connected to the drain electrode 108 via a pixel contact hole 120, a bank insulating layer 136 having a bank hole to expose the first electrode 140, an organic emission layer (EML) 142 formed on the first electrode 140 and including a light emitting layer, and a second electrode 144 formed on the organic EML 142. In the organic light emitting diode, when a voltage is applied between the first electrode 140 and the second electrode 144, holes are injected from the first electrode 140, electrons are injected from the second electrode 144, and injected holes and electrons are recombined in the organic EML 142 to generate excitons. When the generated excitons drop to a ground state, light is emitted from the organic EML 142.

The organic EML 142 may include, in this order, a hole-related layer, the EML, an electron-related layer or include these layers in reverse order. For example, the organic EML 142 may include a hole injection layer (HIL), a hole transport layer (HTL), the EML, an electron transport layer (ETL), and an electron injection layer (EIL).

The first passivation layer 146 is formed on the second electrode 144 to prevent the organic EML 142 and the second electrode 144 from being damaged by moisture, oxygen, or the like and prevent deterioration of luminous properties. For this operation, the first passivation layer 146 may be formed of an organic compound having at least one of the structural formulae described in Formula 1 below.

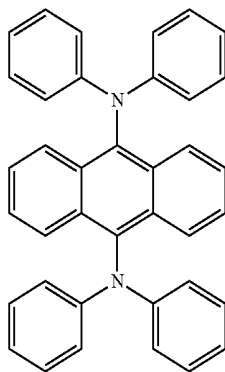
<Formula 1>



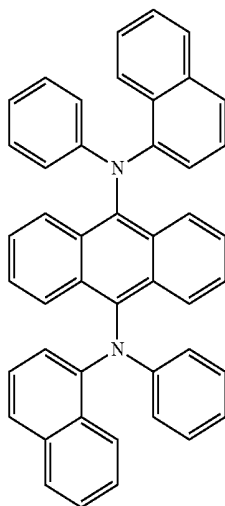
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In Formula 1, R1, R2, R3, R4, R5, and R6 may be each independently a substituted or unsubstituted C₆-C₄₀ aromatic group.

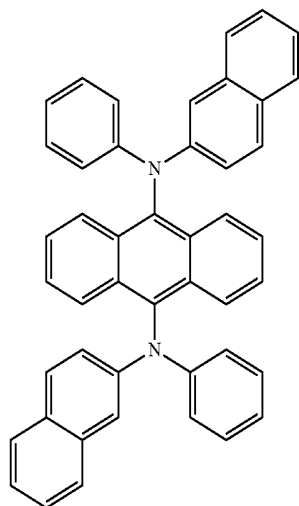
The organic compound having at least one of the structural formulae of Formula 1 is selected from HM-01 through HM-65.



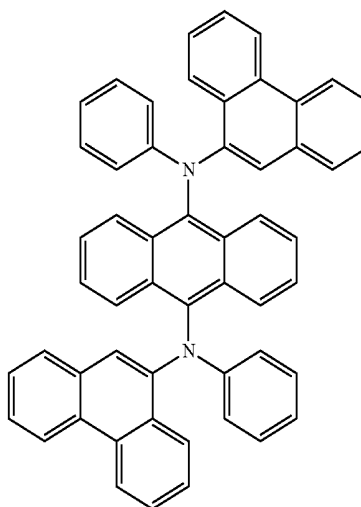
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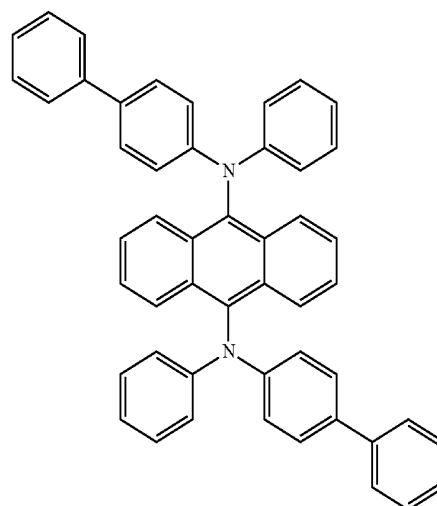
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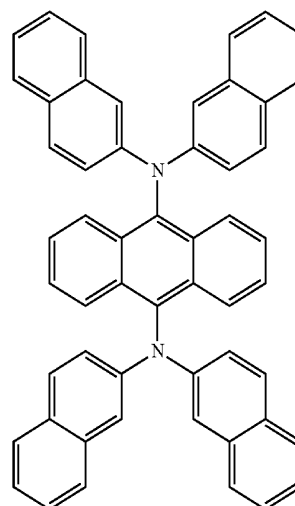
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HM-04



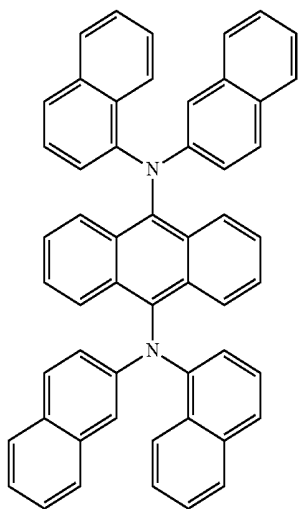
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HM-06

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HM-07

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HM-11

HM-09

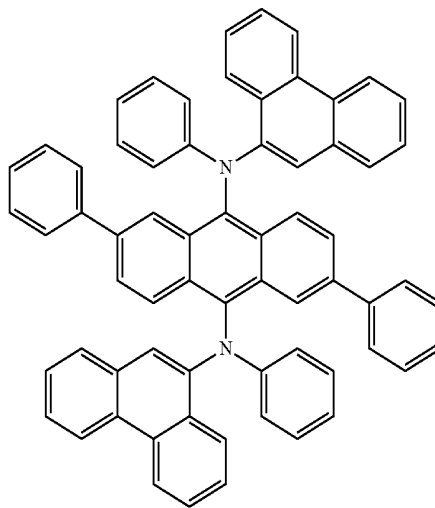
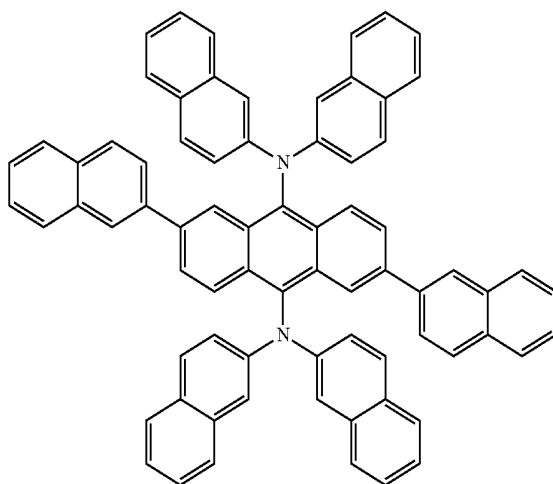
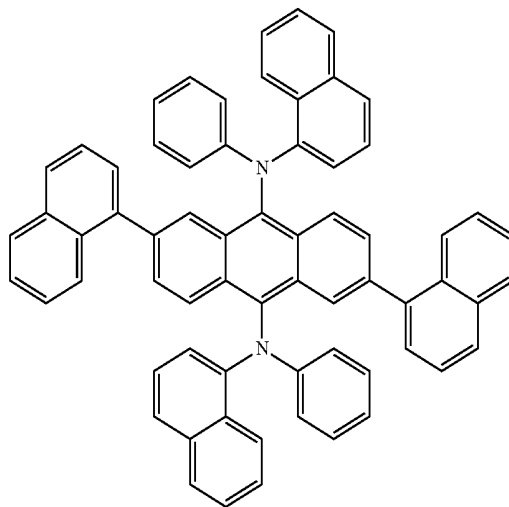
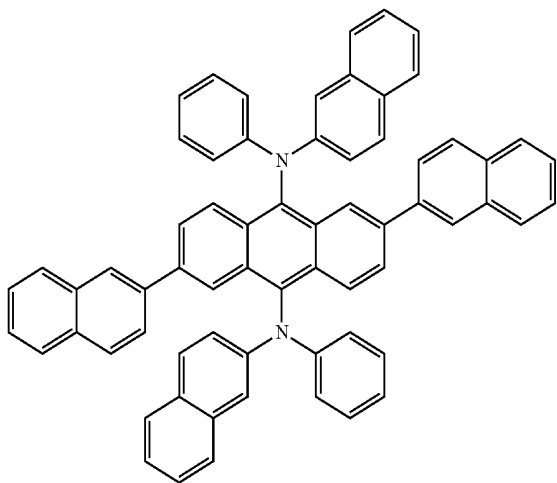
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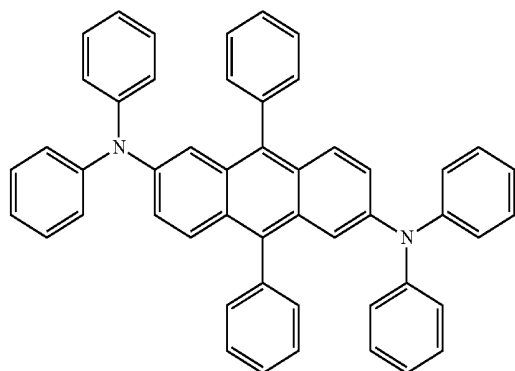
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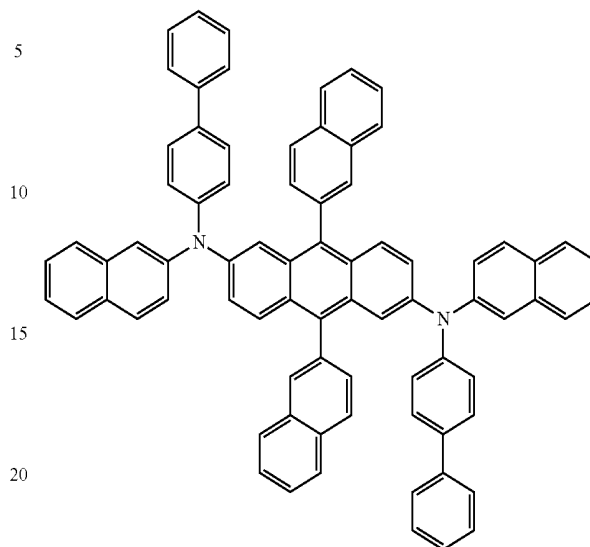
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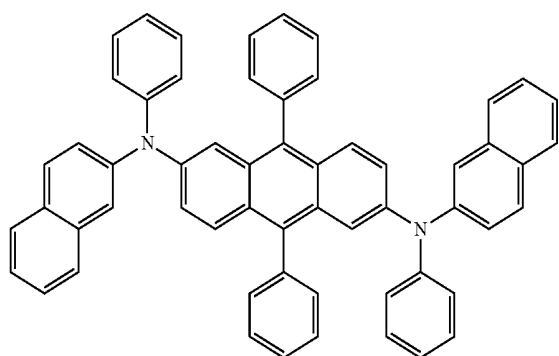


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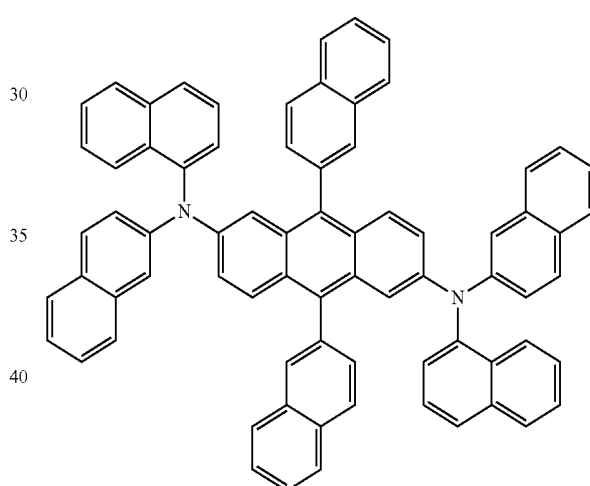
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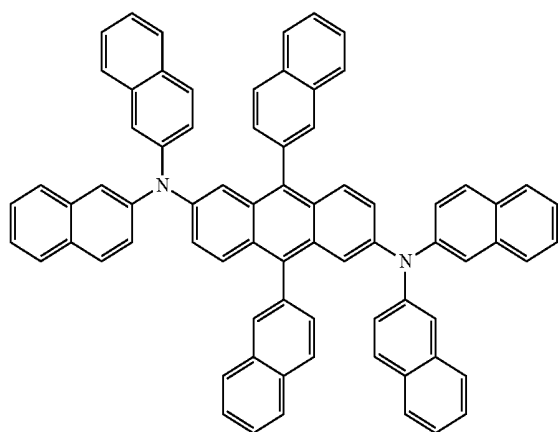
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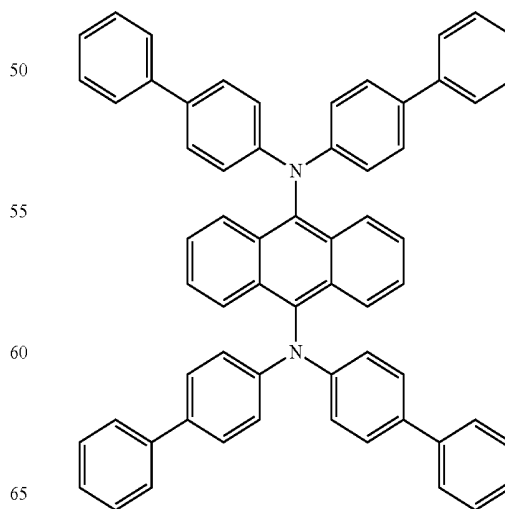
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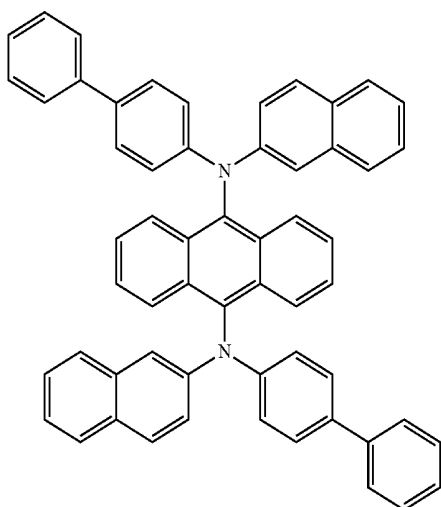
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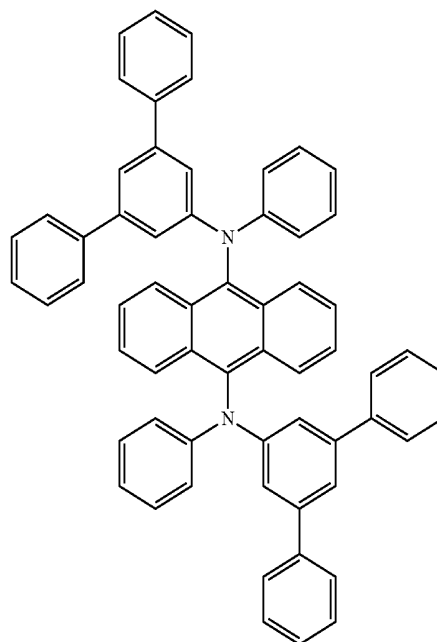
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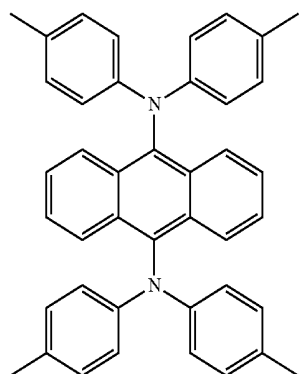
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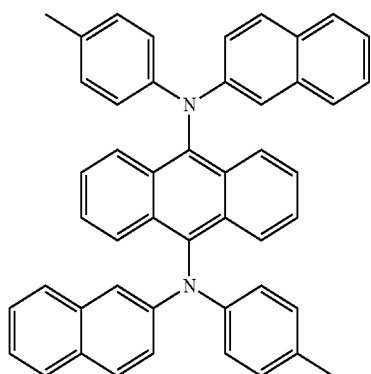


HM-22



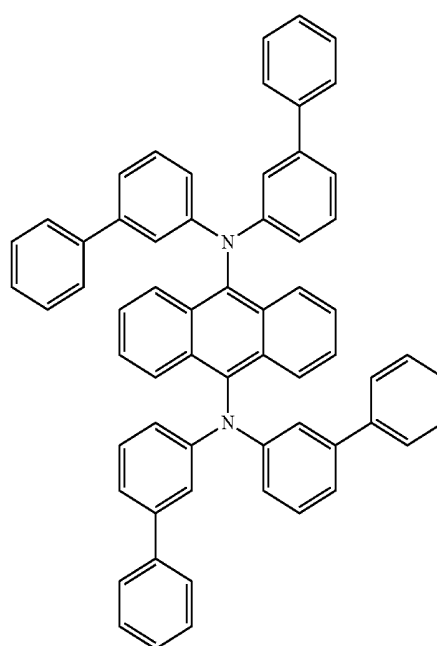
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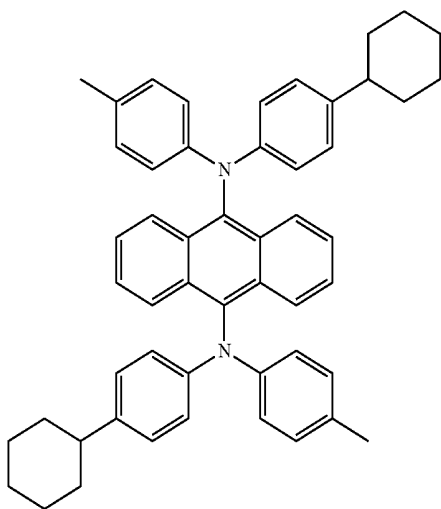
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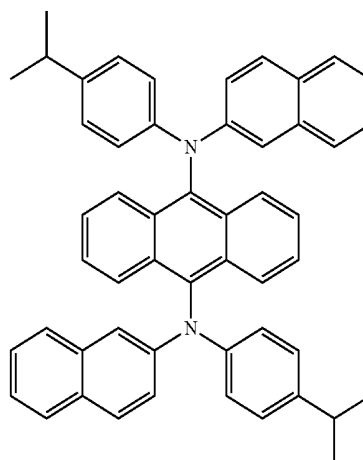
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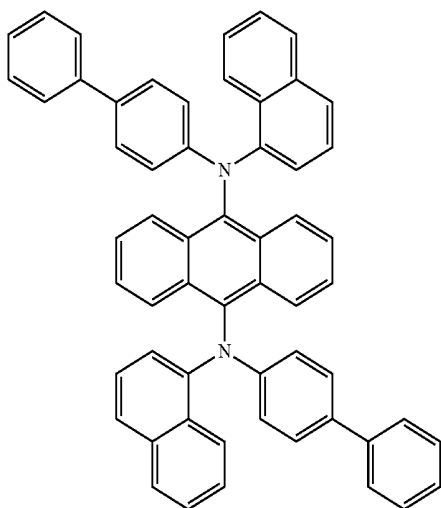
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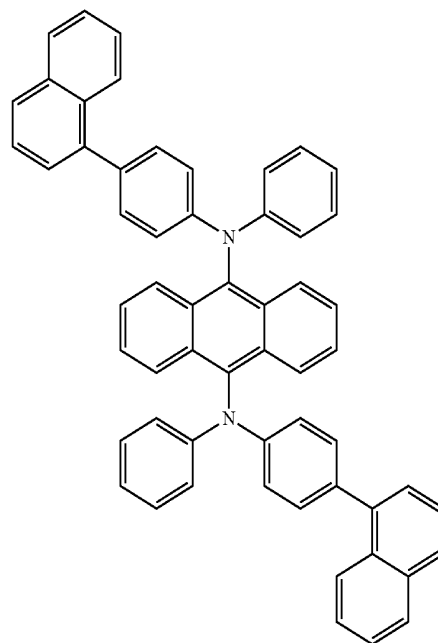
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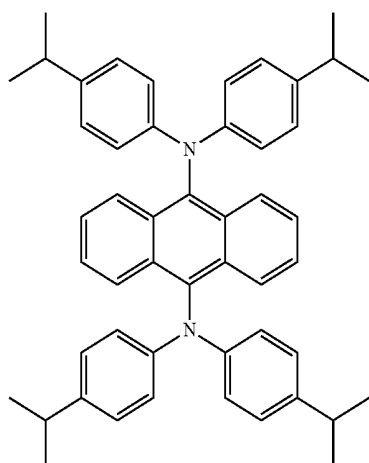
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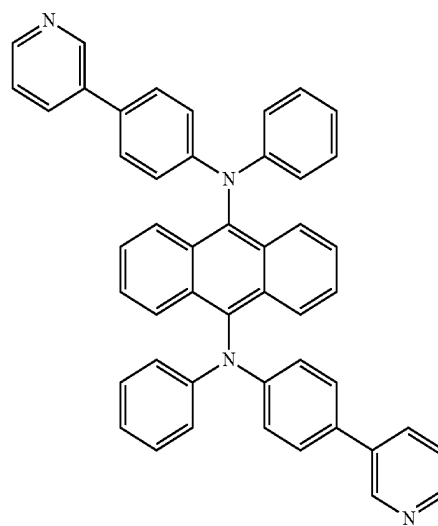
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HM-28



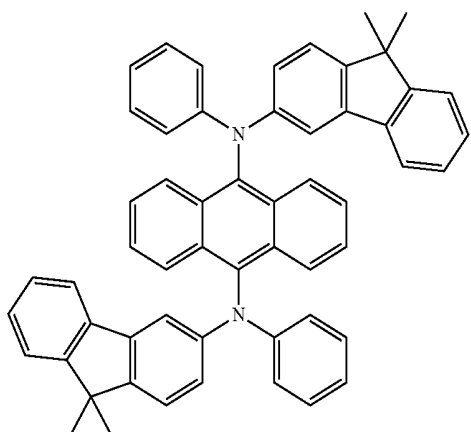
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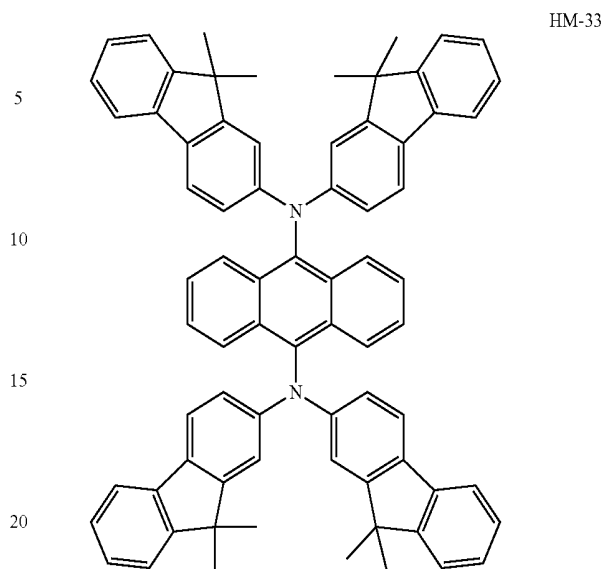
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HM-30

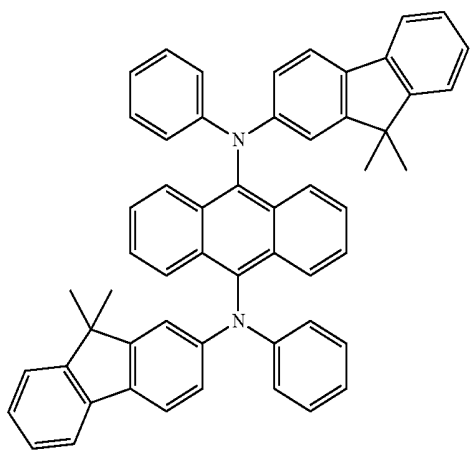
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HM-33

HM-31



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HM-31

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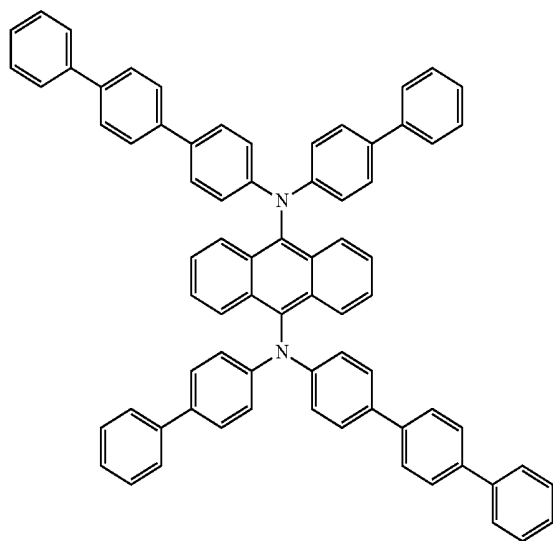
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HM-36



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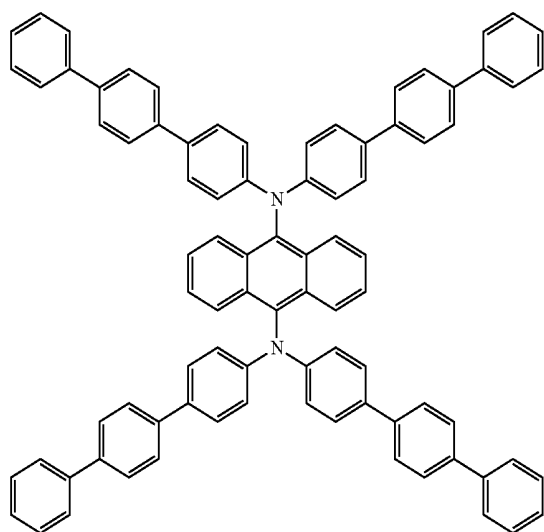
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HM-37

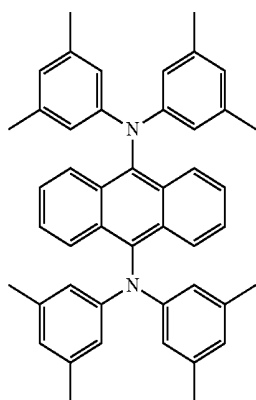


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HM-38

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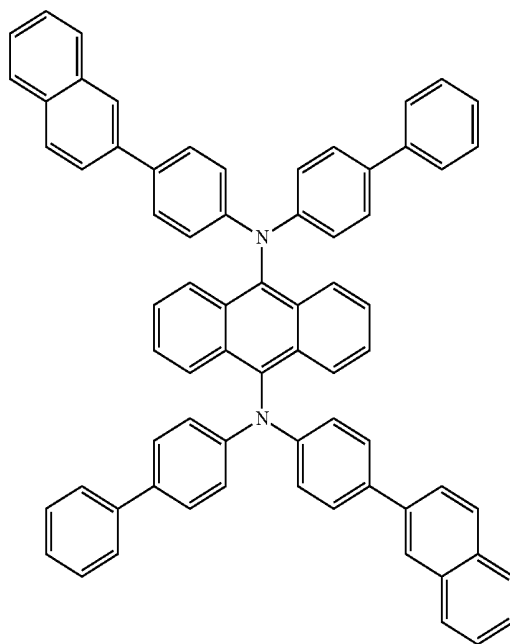
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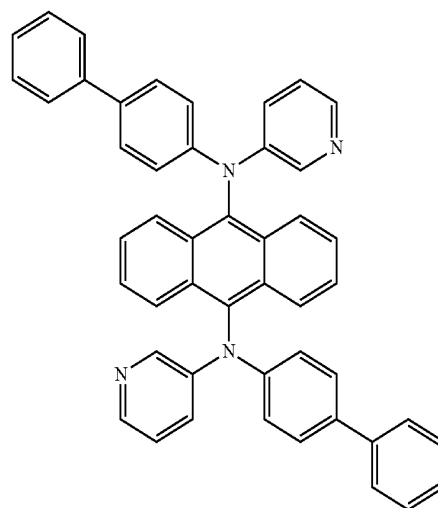
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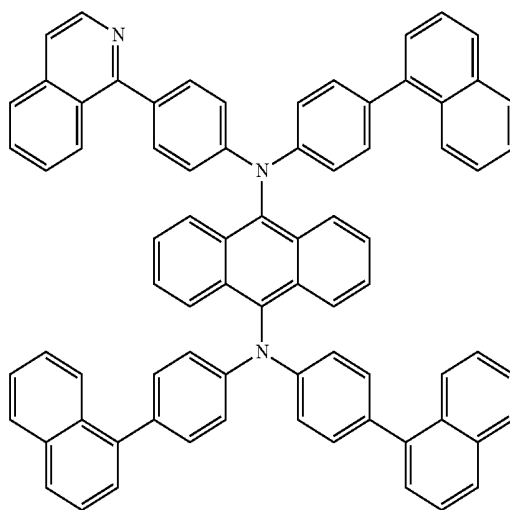
HM-39



HM-40

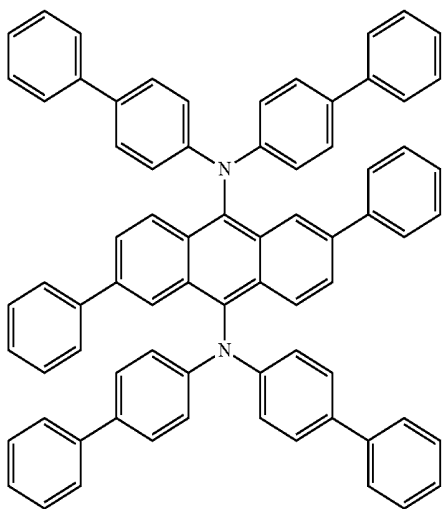


HM-41



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HM-42

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HM-43

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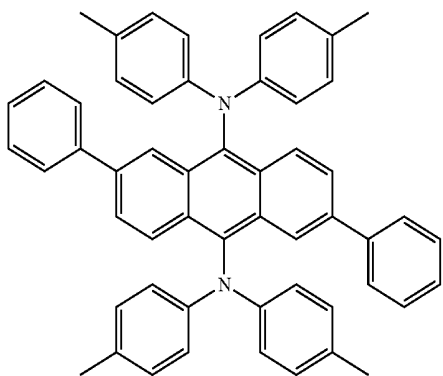
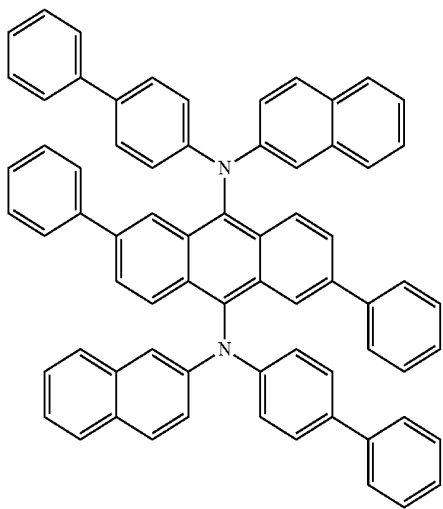
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HM-44

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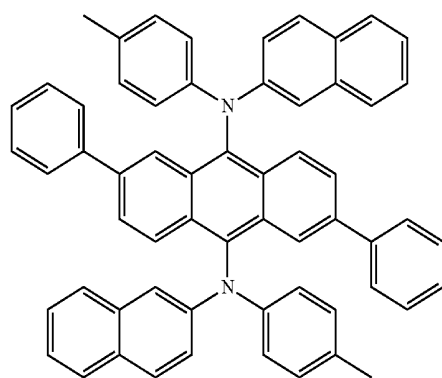
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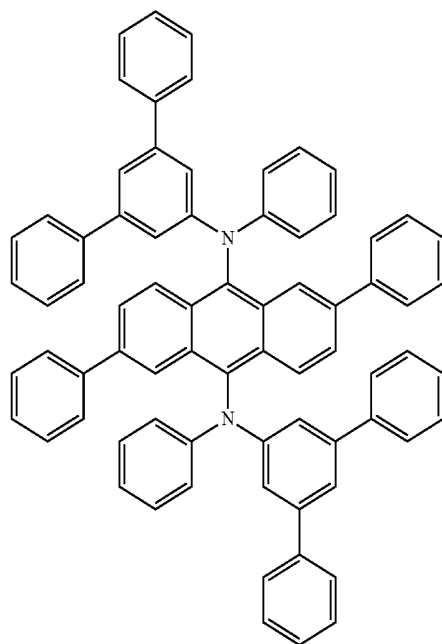


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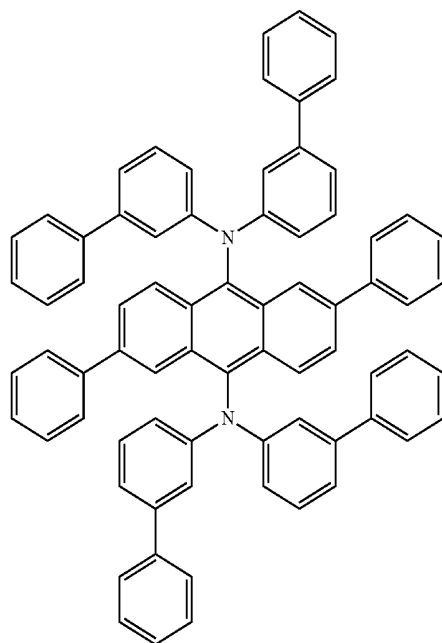
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HM-45



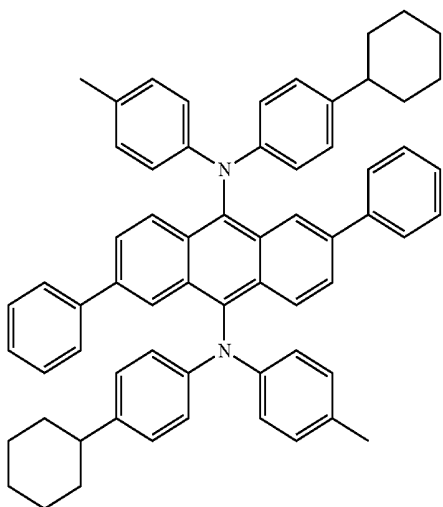
HM-46



HM-47

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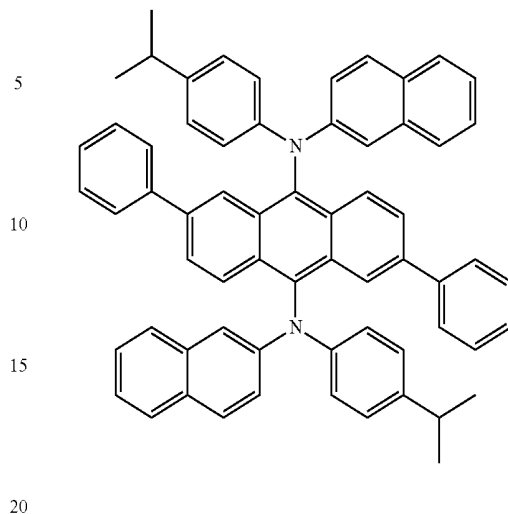
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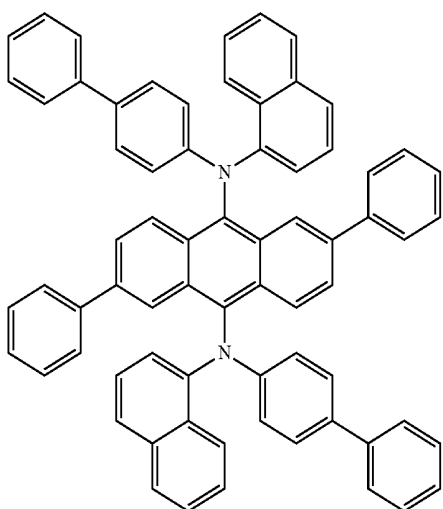
HM-48

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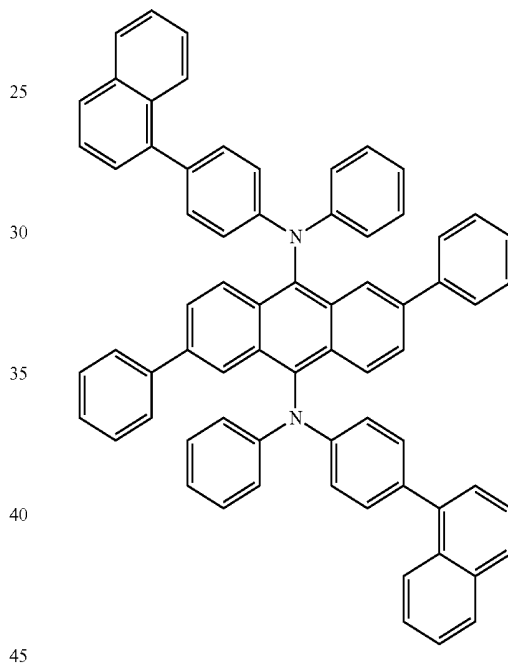
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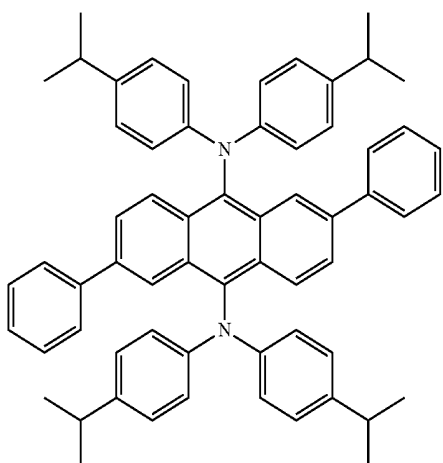
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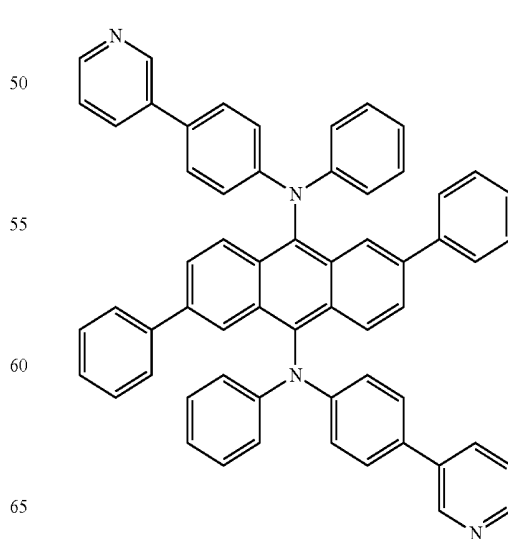
HM-49



HM-52



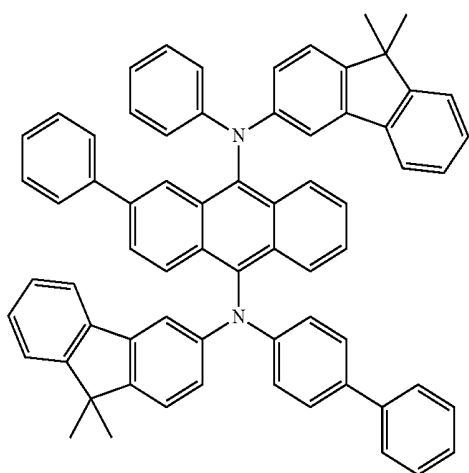
HM-50



HM-53

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HM-54

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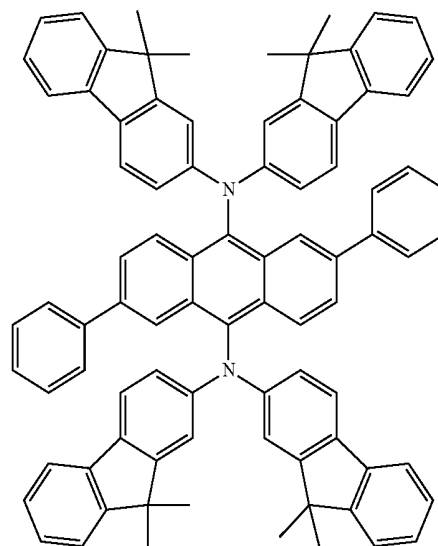
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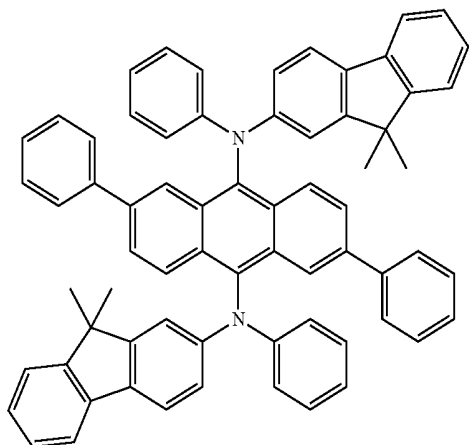
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HM-57

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HM-55



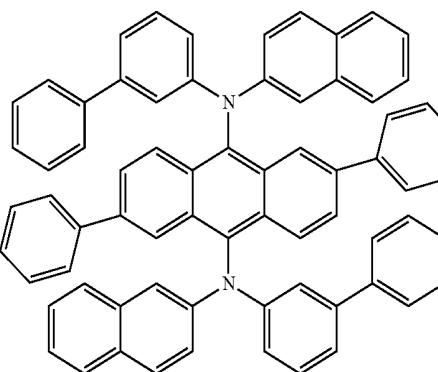
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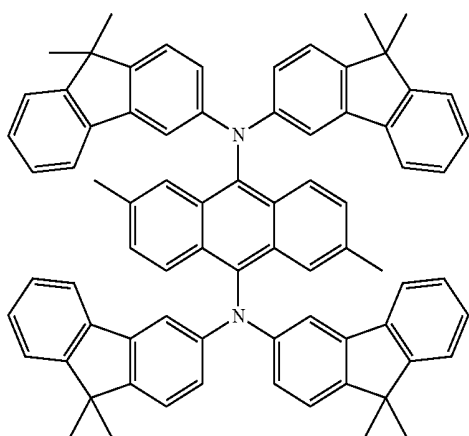
HM-58



HM-59

HM-56

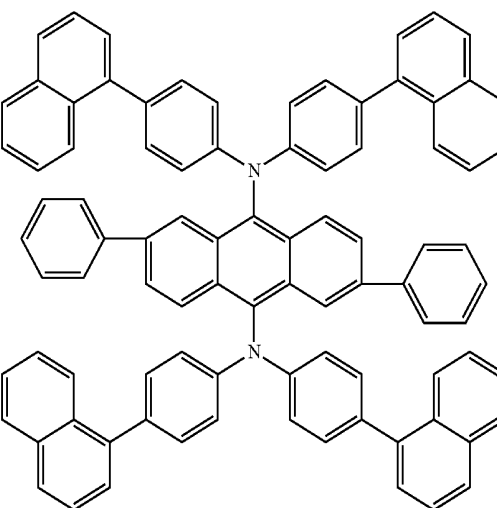
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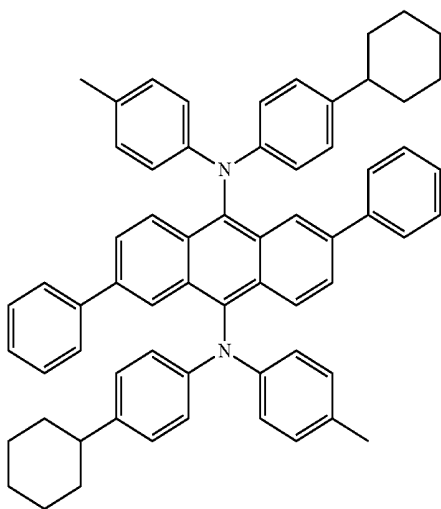
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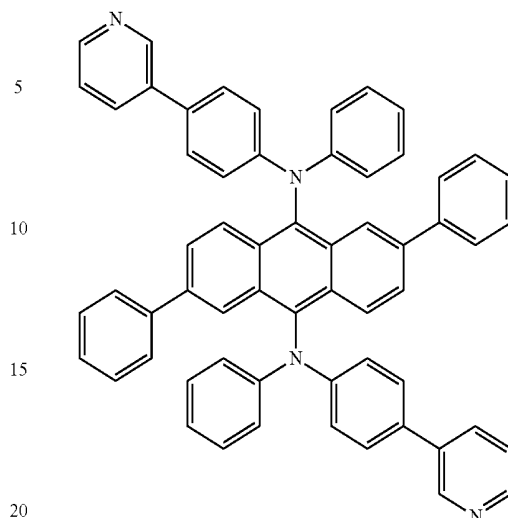
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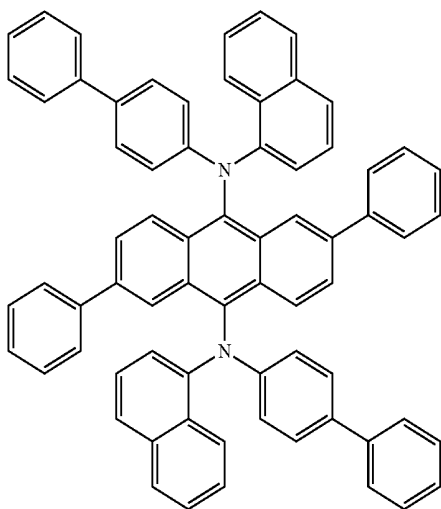
HM-60

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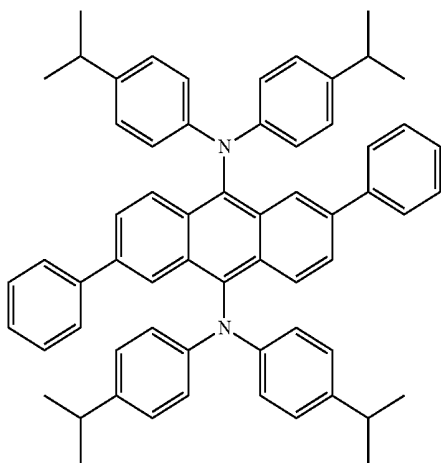
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HM-65



HM-61



HM-62

When the organic compound having at least one of the structural formulae of Formula 1 is used to form the first passivation layer **146**, ash is not generated when the first passivation layer **146** is formed by deposition. Accordingly, the first passivation layer **146** is uniformly and smoothly formed on the second electrode **144**, and a second passivation layer **148** is also uniformly formed on the first passivation layer **146**. As described above, since the first and second passivation layers **146** and **148** are smoothly and uniformly formed, permeation of moisture or oxygen into the organic light emitting diode may be prevented, and thus lifespan of the organic light emitting diode may be improved.

In this regard, as illustrated in FIG. 2, the first passivation layer **146** may be formed over the second electrode **144**. In another embodiment, as illustrated in FIG. 3, a first passivation layer **246** may be entirely formed on the organic EML **142** and the second electrode **144** to cover side surfaces of the organic EML **142** and the second electrode **144**. When the first passivation layer **246** is formed as illustrated in FIG. 3, permeation of moisture, hydrogen, and oxygen into the side and upper surfaces of the second electrode **144** and the organic EML **142** may be prevented.

The second passivation layer **148** is formed between the organic light emitting diode and the adhesive film **152** and thus may prevent damage to the organic light emitting diode by moisture or oxygen or deterioration of luminous properties of the organic light emitting diode. In particular, the second passivation layer **148** contacts the adhesive film **152** and thus may prevent permeation of moisture, hydrogen, and oxygen into side and front surfaces of the organic light emitting diode. For example, the second passivation layer **148** may be an inorganic insulating layer formed of SiN_x or SiO_x .

A storage capacitor Cst includes a lower storage electrode **132** and an upper storage electrode **134** that are doped with p+ or n+ impurities and formed to correspond to each other with the gate insulating layer **112** intervening therebetween. The storage capacitor Cst stably maintains a data signal with which the first electrode **140** is charged until a next data signal is charged.

FIGS. 4A through 4J are sectional views sequentially illustrating a method of manufacturing the organic light emitting display panel, according to an embodiment of the present invention.

Referring to FIG. 4A, the buffer layer **116** is formed on the substrate **100**, and the active layer **114** and the lower storage electrode **132** are formed on the buffer layer **116**.

In particular, the buffer layer **116** is formed over the substrate **100** using an inorganic insulating material such as silicon oxide (SiO_2) or the like by deposition such as chemical vapor deposition (CVD), plasma enhanced CVD, or the like. The active layer **114** is formed by depositing amorphous silicon on the buffer layer **116**, crystallizing the amorphous silicon using a laser to form polycrystalline-silicon, and patterning the polycrystalline-silicon by photolithography and etching using a mask. In addition, a dehydrogenation process for the removal of hydrogen atoms existing in a thin film of amorphous silicon may be further performed before the crystallization process.

Referring to FIG. 4B, the lower storage electrode **132** is doped with an impurity to have conductivity.

In particular, a mask is formed on the substrate **100** on which the active layer **114** of the driving TFT and the lower storage electrode **132** are formed to expose the lower storage electrode **132**. The exposed lower storage electrode **132** is doped with a p+ impurity or an n+ impurity to have conductivity.

Referring to FIG. 4C, the gate insulating layer **112** is formed on the buffer layer **116** with the active layer **114** formed thereon, the gate electrode **106** and the upper storage electrode **134** are formed thereon, and the source and drain regions **114S** and **114D** and the channel region **114C** of the active layer **114** are formed such that the channel region **114C** is formed between the source and drain regions **114S** and **114D**.

In particular, the gate insulating layer **112** is formed by depositing an inorganic insulating material such as silicon oxide (SiO_2) over the buffer layer **116** on which the active layer **114** is formed, by PECVD or CVD. Subsequently, a gate metal layer is formed on the gate insulating layer **112** using a deposition method such as sputtering. The gate metal layer may have a single- or multi-layered structure formed of molybdenum (Mo), aluminum (Al), chromium (Cr), or an alloy thereof. Thereafter, the gate metal layer is patterned by photolithography and etching using a mask to form the gate electrode **106** and the upper storage electrode **134**. As a result, the gate electrode **106** overlaps with the active layer **114**, provided therebetween with the gate insulating layer **112**, and the upper storage electrode **134** overlaps with the lower storage electrode **132**, provided therebetween with the gate insulating layer **112**.

Non-overlapped regions of the active layer **114** with respect to the gate electrode **106** are doped with an n+ impurity using the gate electrode **106** as a mask to form the source and drain regions **114S** and **114D** of the active layer **114** that are doped with the n+ impurity.

Referring to FIG. 4D, the interlayer insulating layer **118** is formed on the gate insulating layer **112** on which the gate electrode **106** is formed, and the source and drain contact holes **124S** and **124D** are formed to penetrate the gate insulating layer **112** and the interlayer insulating layer **118**.

In particular, the interlayer insulating layer **118** is formed by depositing an inorganic insulating material such as silicon oxide, silicon nitride, or the like over the gate insulating layer **112** with the gate electrode **106** formed thereon using a deposition method such as PECVD or CVD. Subsequently, the source and drain contact holes **124S** and **124D** are formed by photolithography and etching using a mask to penetrate the gate insulating layer **112** and the interlayer

insulating layer **118**. The source and drain contact holes **124S** and **124D** respectively expose the source and drain regions **114S** and **114D**.

Referring to FIG. 4E, the source and drain electrodes **110** and **108** are formed on the substrate **100** on which the interlayer insulating layer **118** is formed.

In particular, a source and drain metal layer is formed on the interlayer insulating layer **118** using a deposition method such as sputtering and the source and drain metal layer is patterned by photolithography and etching using a mask to form the source and drain electrodes **108** and **110**. The source electrode **108** and the drain electrode **110** respectively contact the source region **114S** and the drain region **114D** of the active layer **114** via the source contact hole **124S** and the drain contact hole **124D**, respectively.

Referring to FIG. 4F, the pixel protective layer **119** having the pixel contact hole **120** is formed on the substrate **100** on which the source and drain electrodes **110** and **108** are formed.

In particular, the pixel protective layer **119** is formed on the substrate **100** with the source and drain electrodes **110** and **108** formed thereon by PECVD or CVD. The pixel protective layer **119** may be formed of an inorganic insulating material or an organic insulating material. Alternatively, two pixel protective layers formed of an inorganic insulating material and an organic insulating material may be formed. The pixel protective layer **119** is patterned by photolithography and etching using a mask to form the pixel contact hole **120** penetrating the pixel protective layer **119**. The pixel contact hole **120** exposes the drain electrode **108**.

Referring to FIG. 4G, the first electrode **140** of the organic light emitting diode is formed to be connected to the drain electrode **108** of the driving TFT via the pixel contact hole **120**.

In particular, a transparent conductive electrode layer formed of a transparent conductive oxide (TCO), indium tin oxide (ITO), indium zinc oxide (IZO), or the like is formed on the pixel protective layer **119** using a deposition method such as sputtering and the transparent conductive electrode layer is patterned by photolithography and etching using a mask to form the first electrode **140**.

Referring to FIG. 4H, the bank insulating layer **136** having a bank hole is formed on the substrate **100** on which the first electrode **140** is formed.

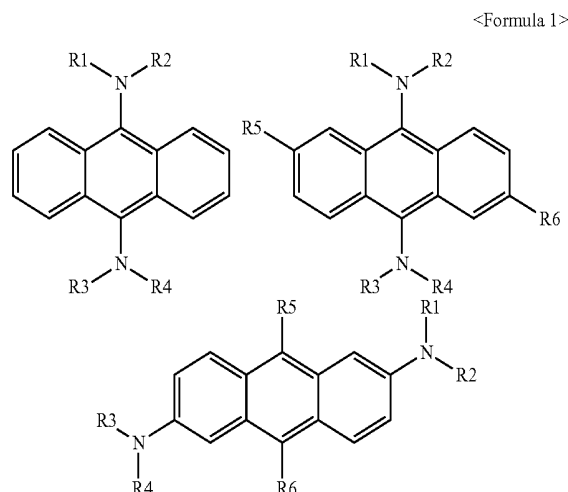
In particular, an organic insulating material such as an acrylic-based resin is entirely coated on the substrate **100** with the first electrode **140** formed thereon, by spinless or spin coating. Thereafter, a coating layer of the organic insulating material is patterned by photolithography and etching using a mask to form the bank insulating layer **136** having a bank hole through which the first electrode **140** is exposed.

Referring to FIG. 4I, the organic EML **142**, the second electrode **144**, and the first passivation layer **146** are formed on the first electrode **140**.

In particular, the organic EML **142** is formed by sequentially forming an HIL, an HTL, an EML, an ETL, and an EIL using a shadow mask. Sequentially, the second electrode **144** formed of a material having high reflexivity, such as Al and the first passivation layer **146** are formed on the substrate **100** on which the organic EML **142** is formed, using the same shadow mask as that used to form the organic EML **142**. The shadow mask has an opening through which a deposition material passes when deposition is performed and a shielding region that shields the deposition material when the deposition is performed. Through the opening of the shadow mask, the organic EML **142**, the second electrode

144, and the first passivation layer 146 are sequentially stacked on the first electrode 140.

The first passivation layer 146 is formed of an organic compound having at least one of the structural formulae described in Formula 1 below.



In Formula 1, R1, R2, R3, R4, R5, and R6 are each independently selected from substituted or unsubstituted C₆-C₄₀ aromatic groups. The organic compound having at least one of the structural formulae described in Formula 1 is selected from HM-01 through HM-65, and formulae of HM-01 through HM-65 are the same as described above.

When the organic compound having at least one of the structural formulae of Formula 1 is used to form the first passivation layer 146, ash is not generated when the first passivation layer 146 is formed by deposition. Accordingly, permeation of moisture and oxygen from the outside may be prevented. That is, when a passivation layer covering a conventional organic light emitting diode is formed, ash is generated and is also deposited in the passivation layer and thus the passivation layer is not uniformly formed. Consequently, a gap is formed between a first electrode and the passivation layer due to non-uniform formation of the passivation layer and thus moisture or oxygen permeates the gap therebetween. In the embodiments, however, ash is not generated when the first passivation layer 146 is formed and thus the first passivation layer 146 may be uniformly and smoothly formed. Thus, the first passivation layer 146 is formed on the second electrode 144 to be uniform and smooth. In addition, since the first passivation layer 146 is uniformly and smoothly formed on the second electrode 144, the second passivation layer 148 is also uniformly formed on the first passivation layer 146.

In other words, no gap is formed between the second electrode 144 and the first passivation layer 146 and no gap is formed between the first passivation layer 146 and the second passivation layer 148. Thus, permeation of moisture or oxygen between the second electrode 144 and the first passivation layer 146 and between the first passivation layer 146 and the second passivation layer 148 may be prevented. In addition, the first and second passivation layers 146 and 148 are smoothly formed without a gap therebetween and thus no gap is formed between the second passivation layer 148 and the encapsulation substrate 150 that are adhered to each other by the adhesive film 152.

As described above, by smoothly and uniformly forming the first passivation layer 146, no gap is formed among the

second passivation layer 148, the adhesive film 152, and the encapsulation substrate 150 that are sequentially stacked on the first passivation layer 146. Consequently, damage to the organic light emitting diode by moisture or oxygen may be prevented, which results in increased lifespan of the organic light emitting diode.

Meanwhile, as illustrated in FIG. 2, when the first passivation layer 146 is formed in the same pattern as that used to form the organic EML 142 and the second electrode 144, the first passivation layer 146 and the second electrode 144 may be formed using the same shadow mask. In another embodiment, as illustrated in FIG. 3, when the first passivation layer 246 is entirely formed on the organic EML 142 and the second electrode 144 to cover side surfaces of the organic EML 142 and the second electrode 144, the first passivation layer 246 may be formed using a shadow mask having a wider opening than that of a shadow mask used to form the organic EML 142 and the second electrode 144.

Referring to FIG. 4J, silicon oxide or silicon nitride is deposited over the light emitting diode substrate 100 on which the first passivation layer 146 is formed, to form the second passivation layer 148. In this regard, the second passivation layer 148 is entirely formed by deposition without using a mask for deposition. Subsequently, the adhesive film 152 is attached to a front surface of the second passivation layer 148 or a rear surface of the encapsulation substrate 150, and then the light emitting diode array substrate including the organic light emitting diode is adhered to the encapsulation substrate 150 by the adhesive film 152.

FIG. 5 is a graph showing comparison results between lifespan of an organic light emitting diode when a passivation layer formed of Alq₃ is used and lifespan of an organic light emitting diode when the first passivation layer according to the present invention is used.

In FIG. 5, the x axis denotes lifespan (time (hrs)) of an organic light emitting diode and the y axis denotes the number of defect points. The experimental data shown in FIG. 5 were obtained under high temperature and high humidity conditions, i.e., 85° C. and 85%.

A first curve 10 shows the lifespan of an organic light emitting diode when the passivation layer of Alq₃ is used, and a second curve 12 shows the lifespan of an organic light emitting diode when the first passivation layer according to the present invention is used.

As illustrated in FIG. 5, the first curve 10 exhibits a more rapid rate of increase in the number of defect points than in the second curve 12 and exhibits a shorter lifespan under high temperature and high humidity conditions than in the second curve 12.

As described above, when the first passivation layer according to the present invention is used, permeation of moisture or oxygen may be prevented and thus an increase rate of the number of defect points is slow and lifespan is long under high temperature and high humidity conditions.

As is apparent from the above description, in an organic light emitting display panel and a method of manufacturing the same, according to the present invention, a first passivation layer formed of an organic compound having at least one of the structural formulae described in Formula 1 may be formed to cover an organic light emitting diode without generation of ash during deposition.

Accordingly, the first passivation layer is uniformly and smoothly formed on the organic light emitting diode without a gap between the organic light emitting diode and the first passivation layer, which may be formed by non-uniform formation of a conventional passivation layer due to generated ash, and thus an adhesive strength between the organic

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light emitting diode and a first electrode is increased. Accordingly, permeation of moisture or oxygen from the outside may be prevented.

Since permeation of moisture or oxygen is prevented, the organic light emitting diode may have increased lifespan.

In addition, the first passivation layer according to the present invention may be formed of an organic material which is less expensive than a material of a passivation layer of a conventional organic light emitting diode, such as DNTPD and IDE406, and thus manufacturing costs of the organic light emitting display panel may be reduced.

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 display comprising:

a driving thin film transistor on a substrate, the driving thin film transistor including an active layer having a channel region and source and drain regions on the substrate, a gate insulating layer on the substrate with the active layer, a gate electrode on the gate insulating layer and over the channel region, an interlayer insulating layer on the gate insulating layer with the gate electrode, and source and drain electrodes on the interlayer insulating layer to contact with the source and drain regions;

a storage capacitor on the substrate, the storage capacitor including a lower storage electrode, an upper storage electrode and the gate insulating layer between the lower storage electrode and the upper storage electrode;

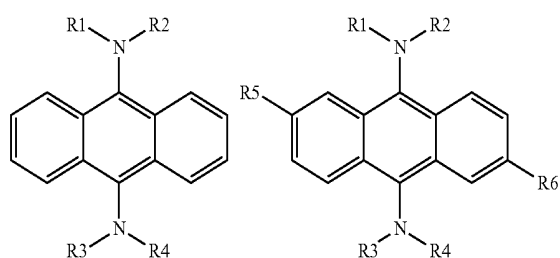
an organic light emitting diode comprising a first electrode connected to the driving thin film transistor, an organic emission layer on the first electrode, and a second electrode on the organic emission layer;

a first passivation layer formed on the second electrode of the organic light emitting diode; and

a second passivation layer formed on the first passivation layer;

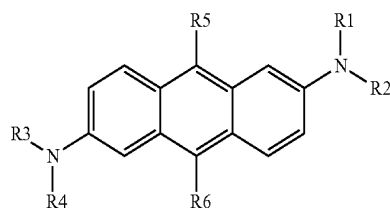
a light emitting diode array substrate including the driving thin film transistor, the organic light emitting diode, the first passivation and second passivation layers; and an encapsulation substrate adhered to the second passivation layer of the light emitting diode array substrate by an adhesive film,

wherein the first passivation layer is formed of an organic compound, having at least one of the structural formulae described in Formula 1 below:



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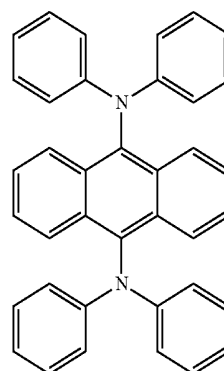
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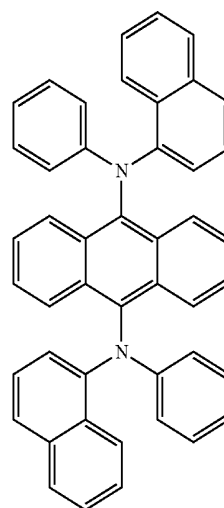
wherein R1, R2, R3, R4, R5, and R6 are each independently selected from substituted or unsubstituted C₆-C₄₀ aromatic groups.

2. The organic light emitting display according to claim 1, wherein the first passivation layer is entirely on the organic emission layer and the second electrode to cover side surfaces of the organic emission layer and the second electrode.

3. The organic light emitting display according to claim 1, wherein the organic compound having at least one of the structural formulae of Formula 1 is selected from HM-01 through HM-65:



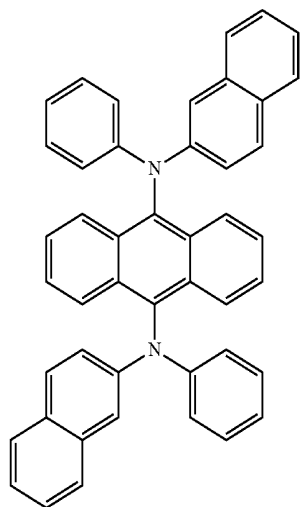
HM-01



HM-02

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HM-03

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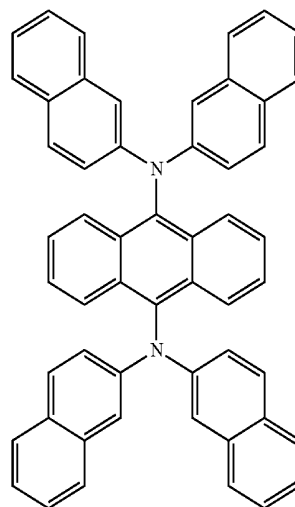
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HM-06

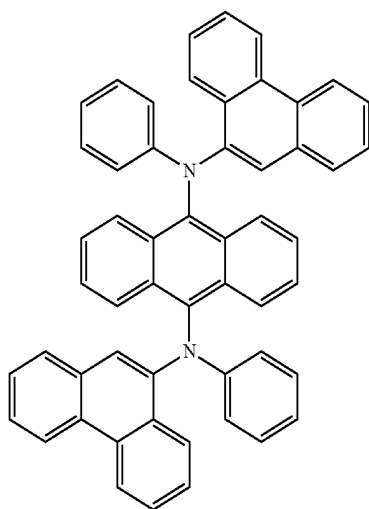
HM-04 25

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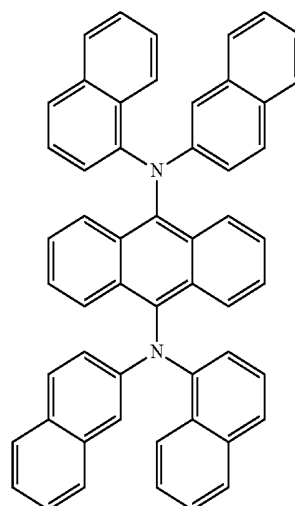
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HM-07



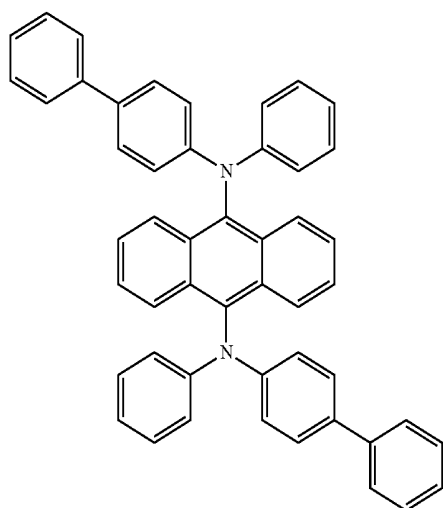
HM-05

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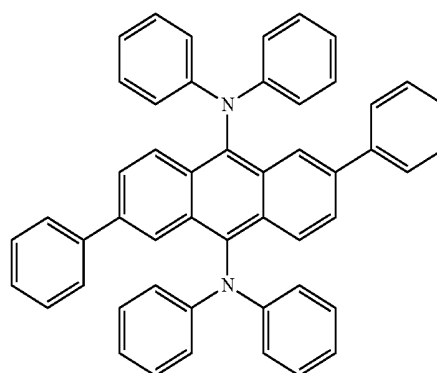
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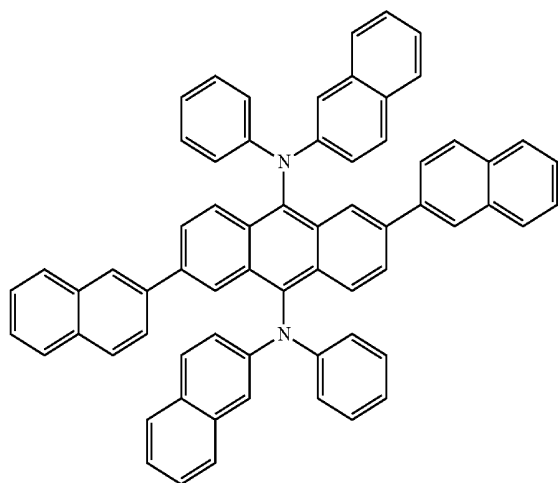
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HM-09



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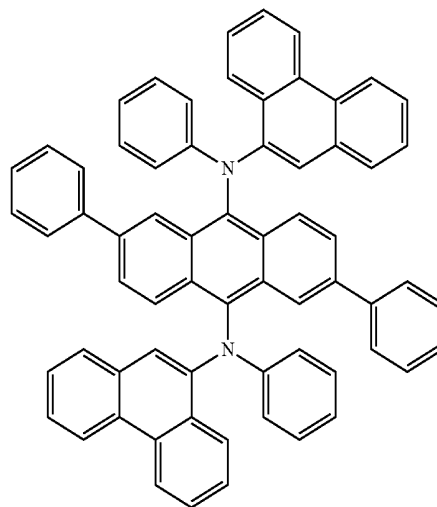
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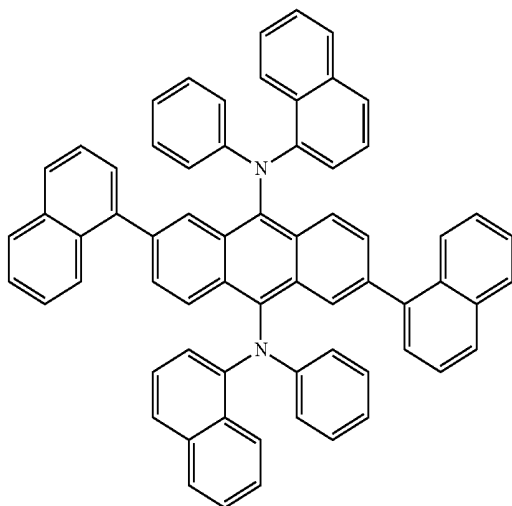


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HM-13

HM-10

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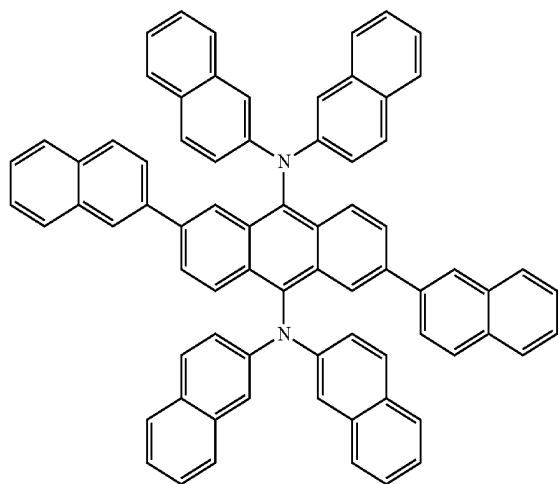
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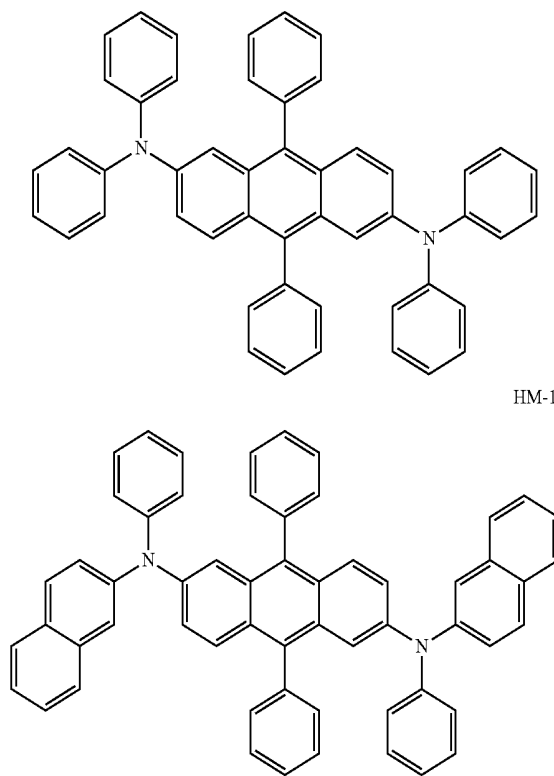
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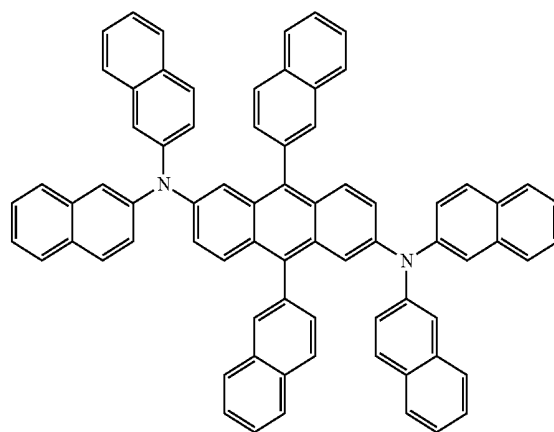
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HM-14

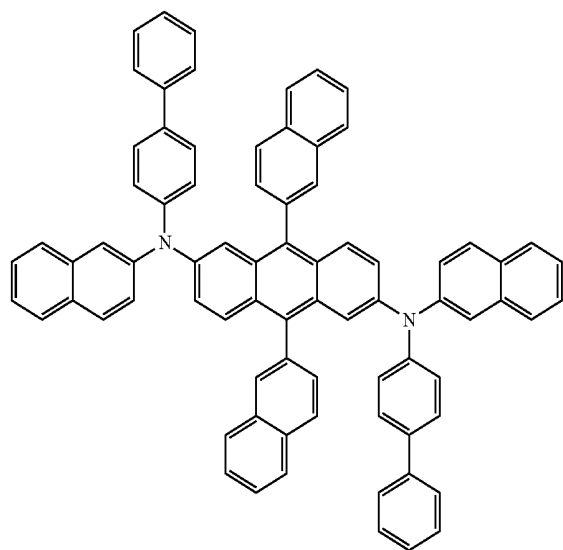
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HM-16



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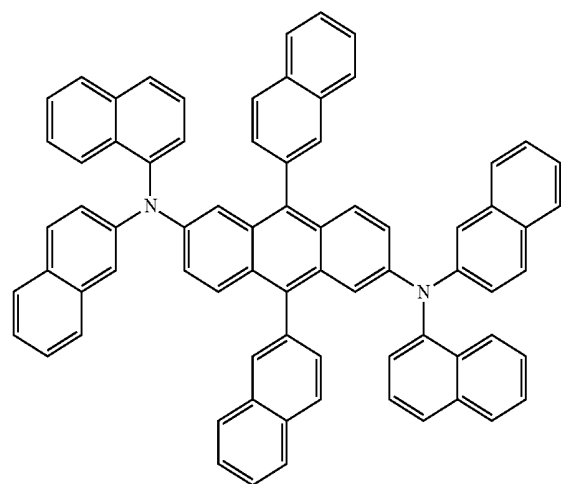
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HM-17



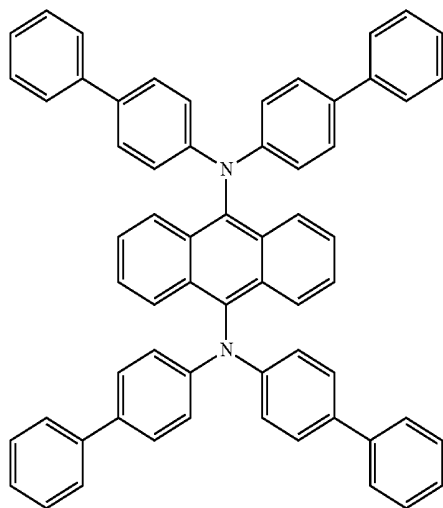
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HM-18



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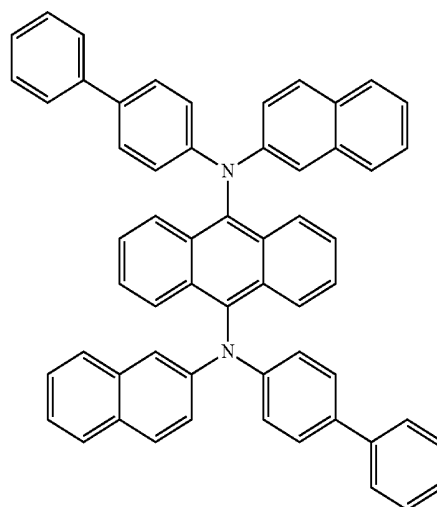
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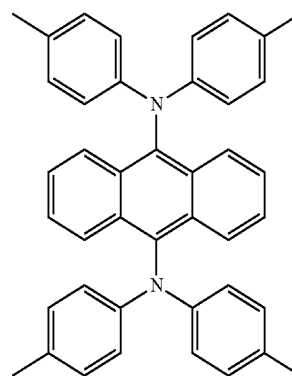
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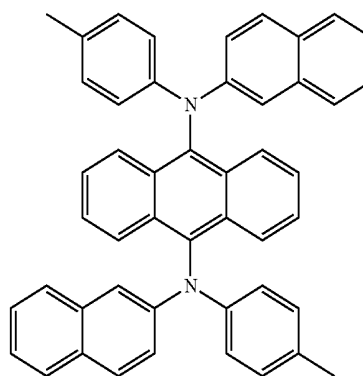
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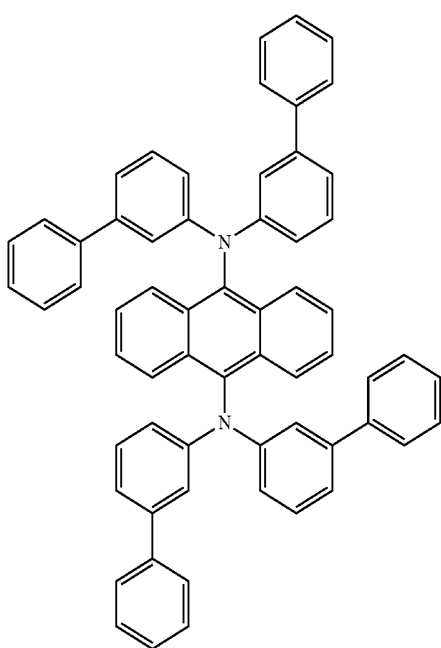
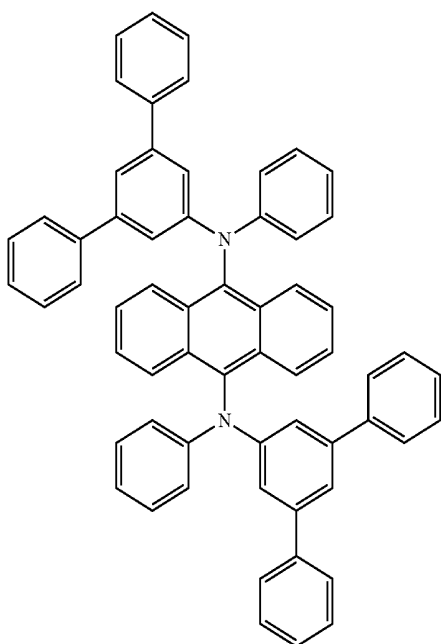


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HM-22

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HM-23

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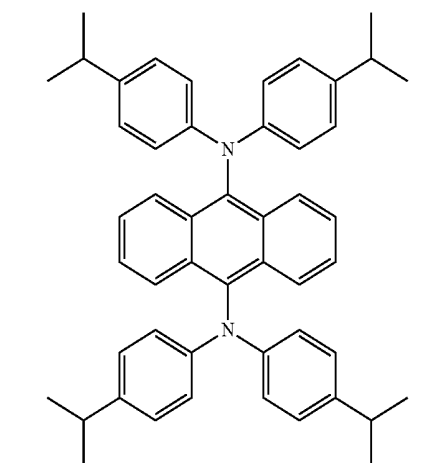
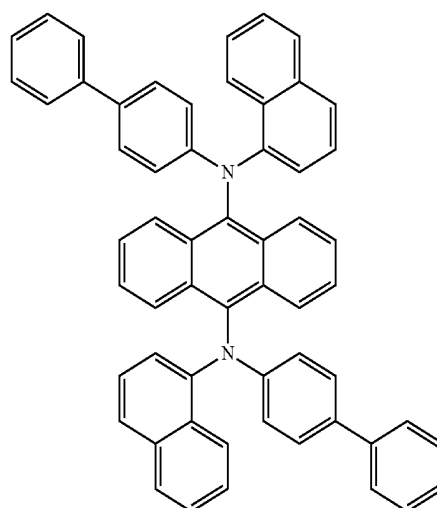
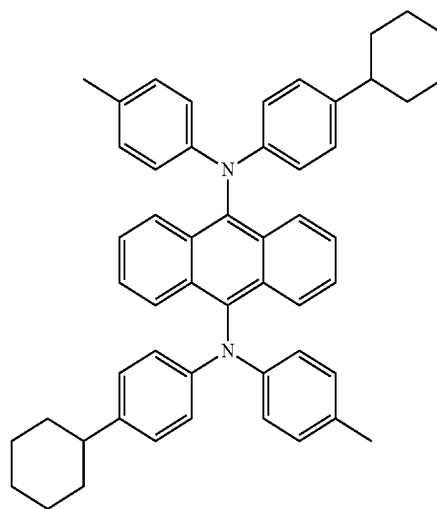
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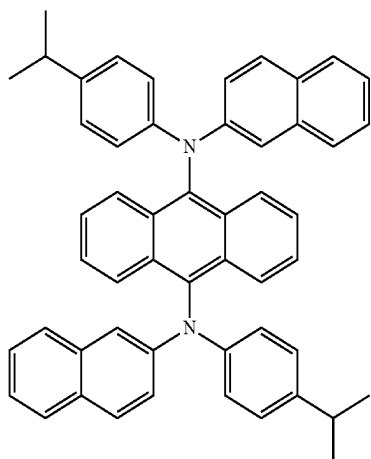
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HM-25

HM-26

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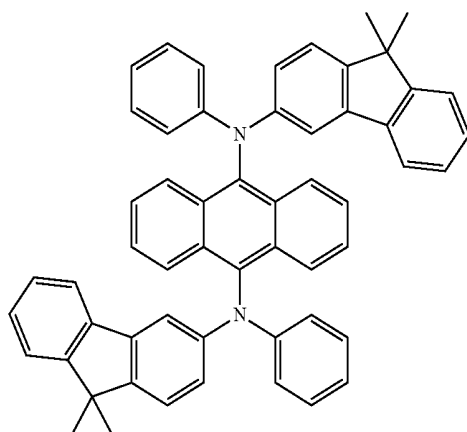
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HM-30

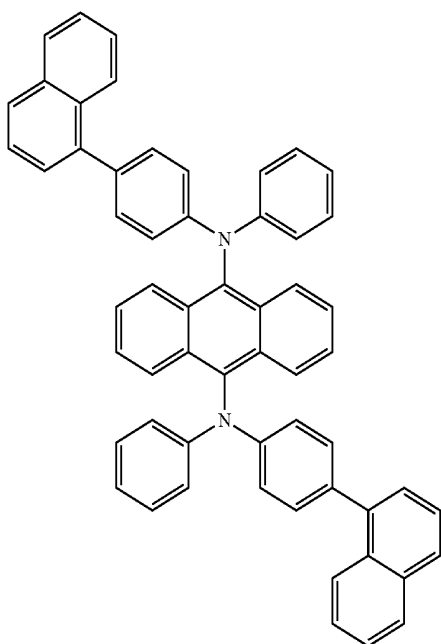
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HM-28



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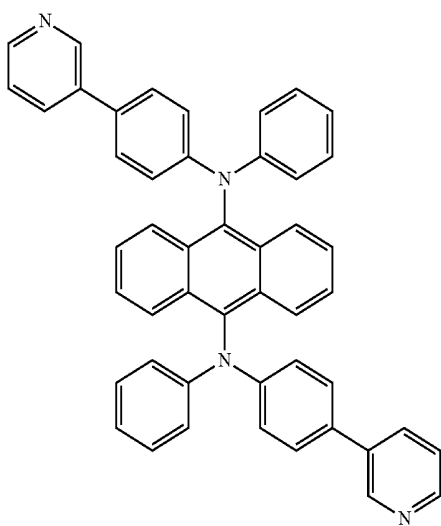
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HM-29

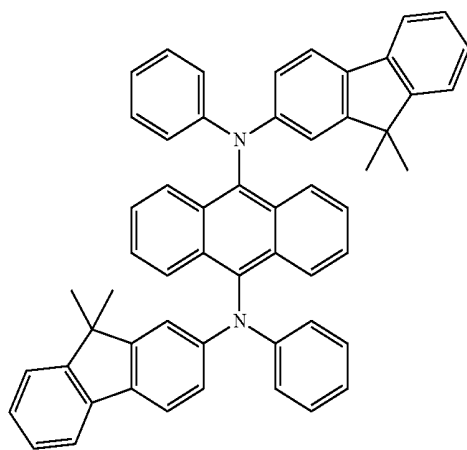


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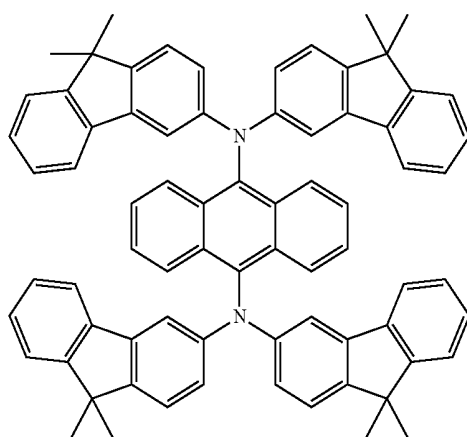
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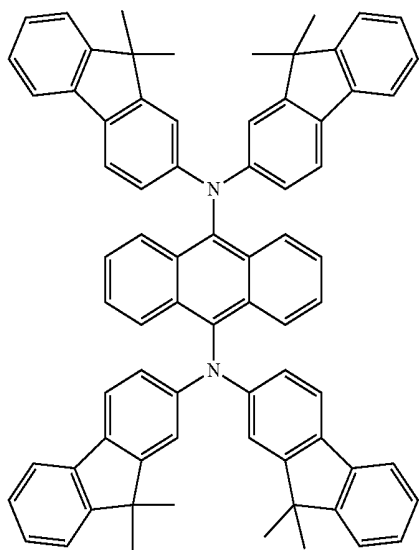
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HM-32

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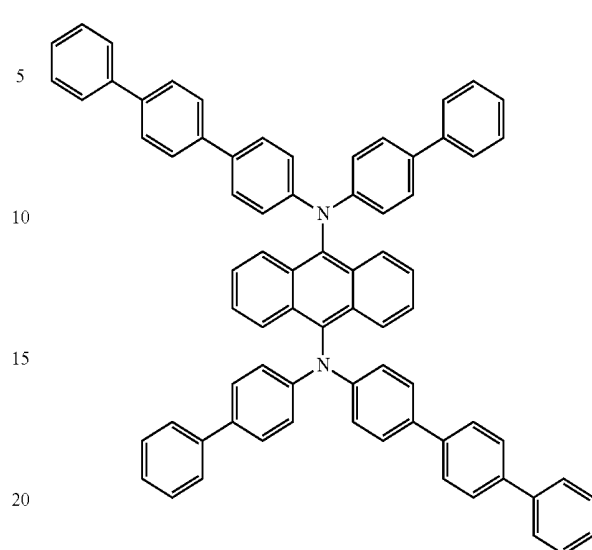
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HM-33

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HM-36

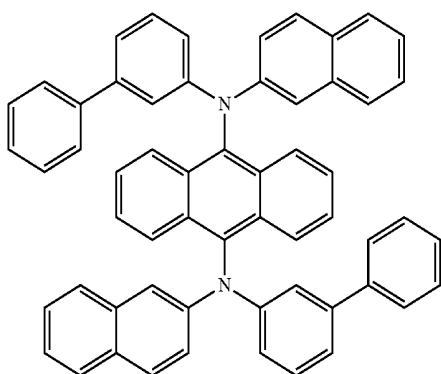
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HM-34

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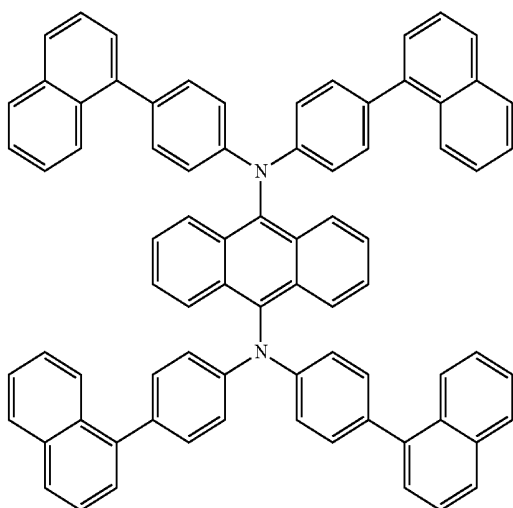
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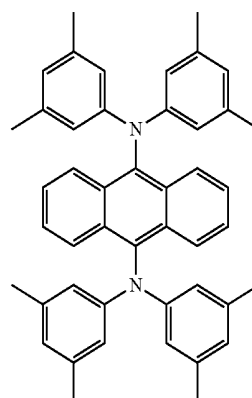
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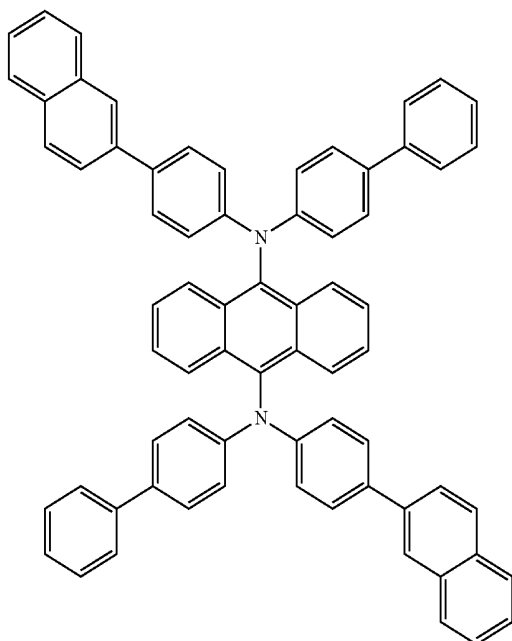


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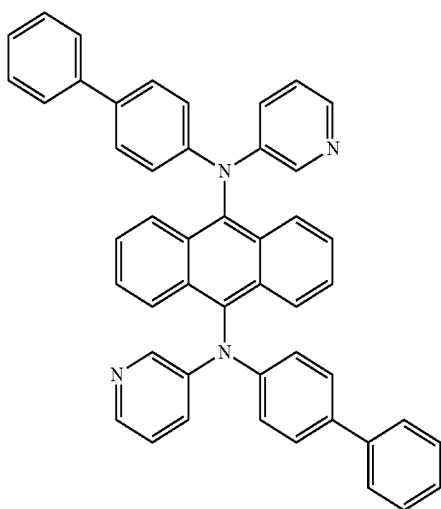
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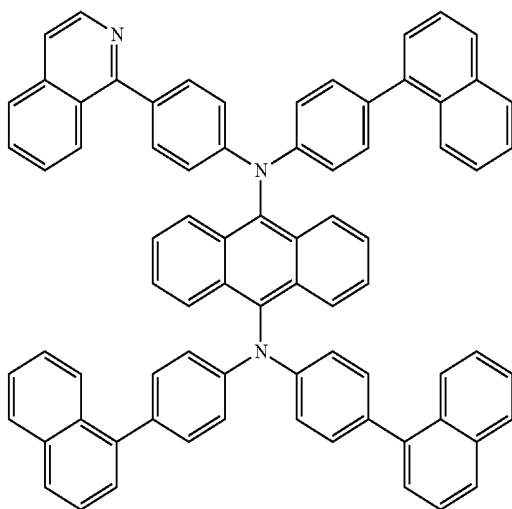
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HM-40

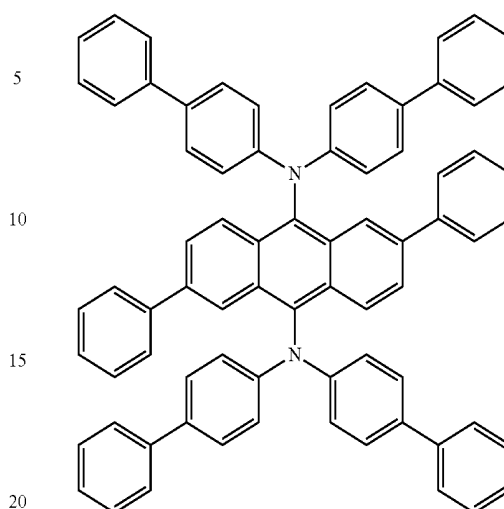


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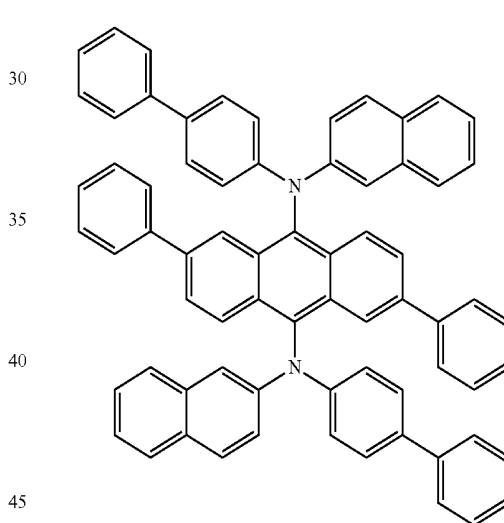
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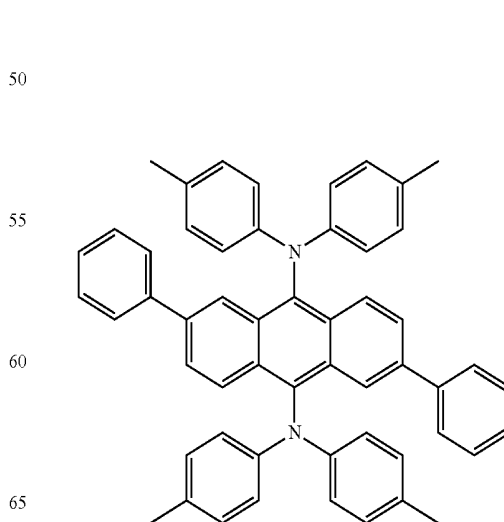
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HM-43

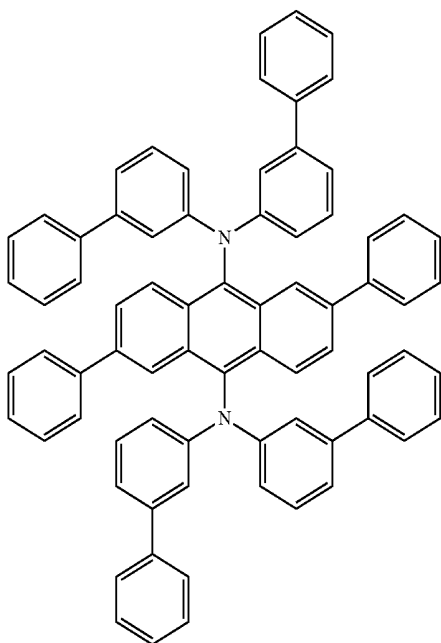
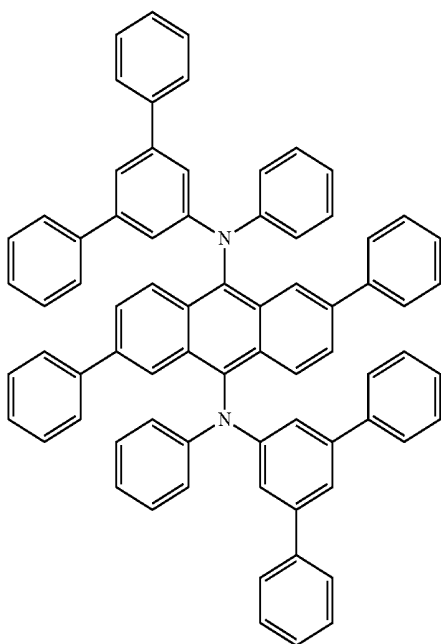
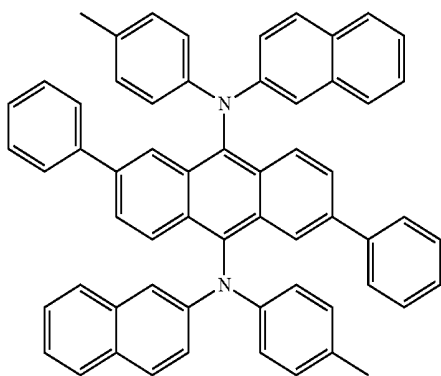


HM-44



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HM-45

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HM-46

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HM-47

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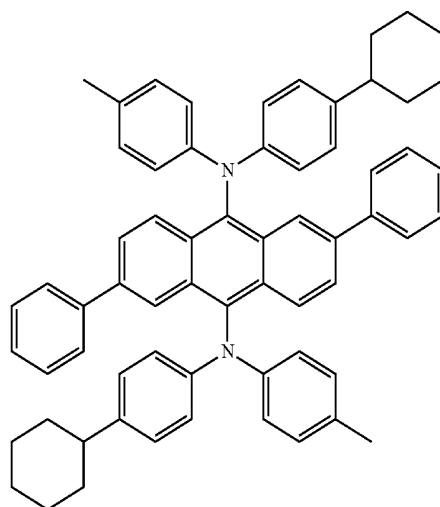
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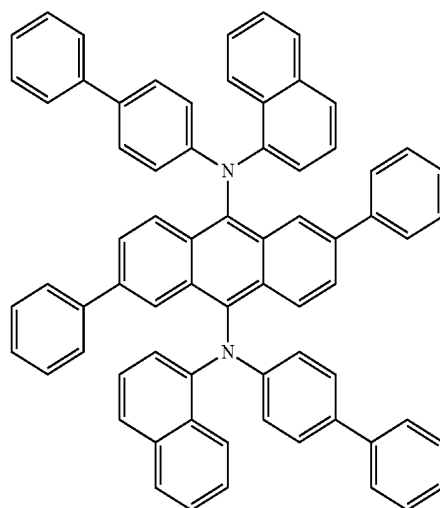
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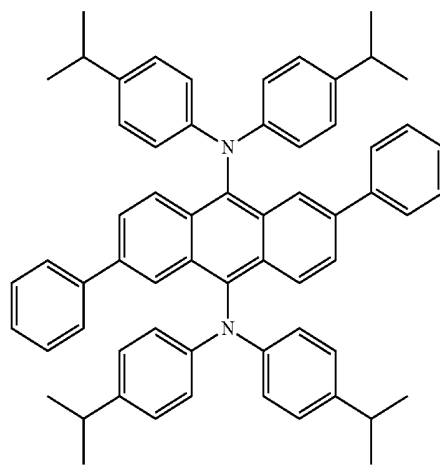
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HM-48



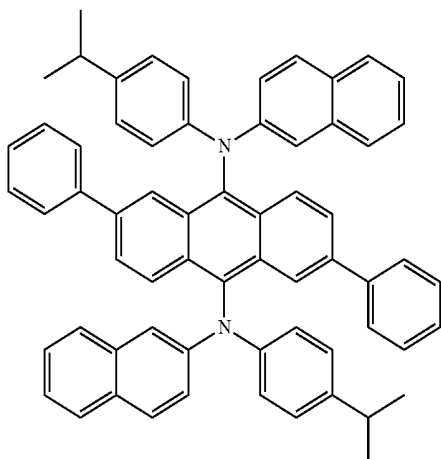
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HM-50

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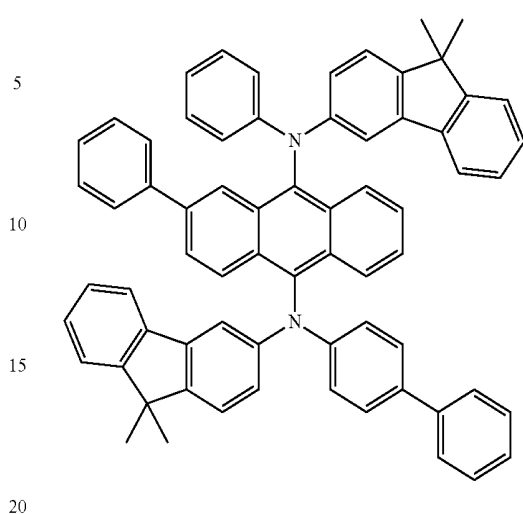
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HM-51

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HM-54

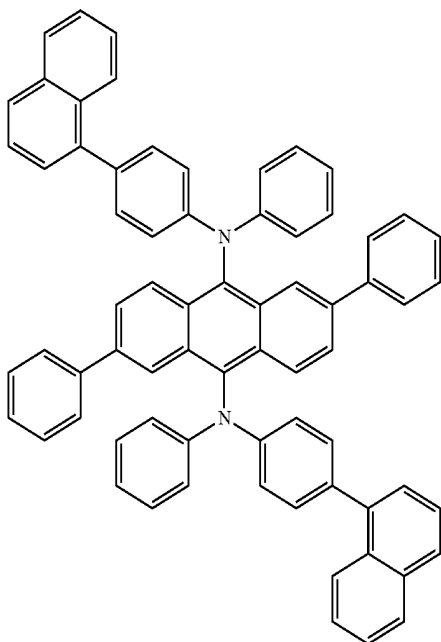
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HM-52



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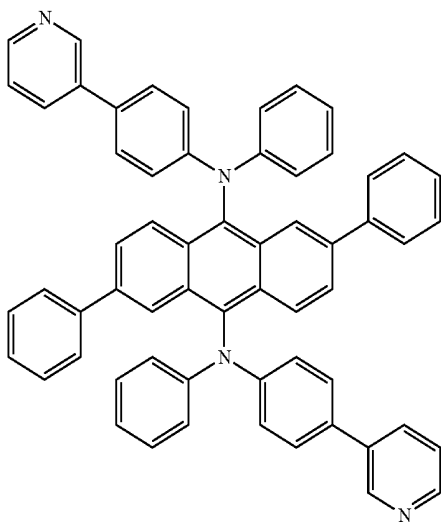
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HM-53



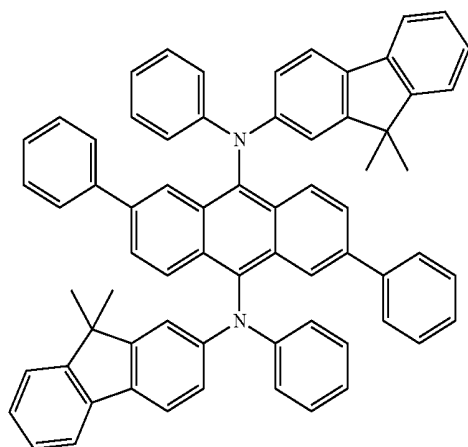
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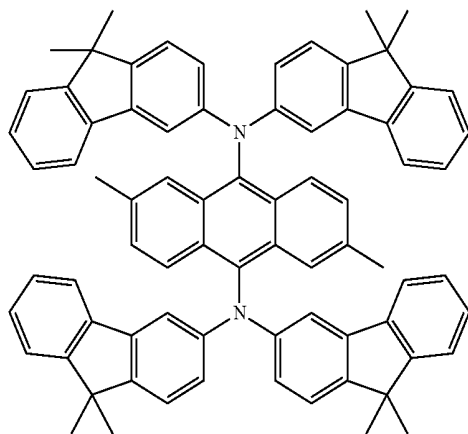
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HM-55

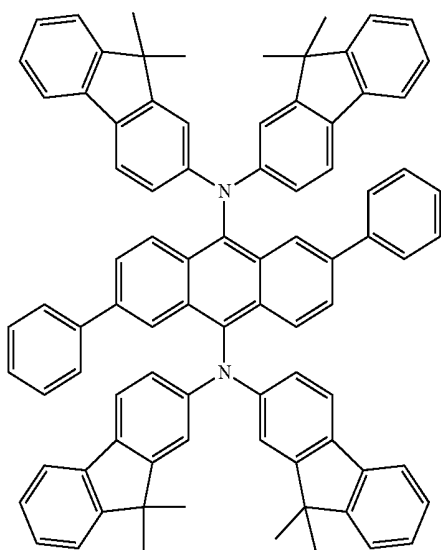


HM-56



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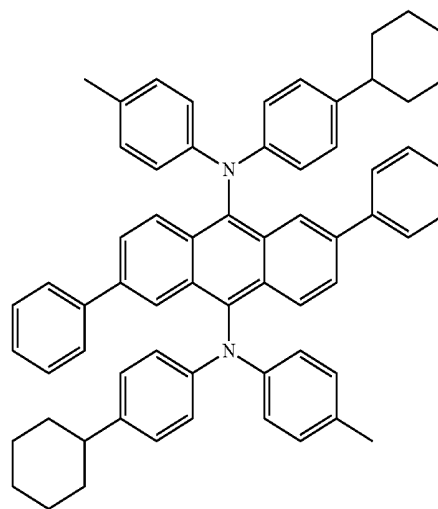
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HM-57

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HM-60

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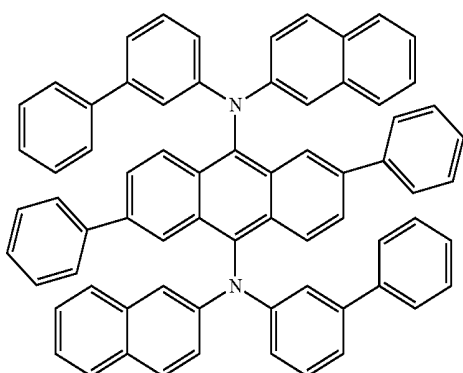
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HM-58



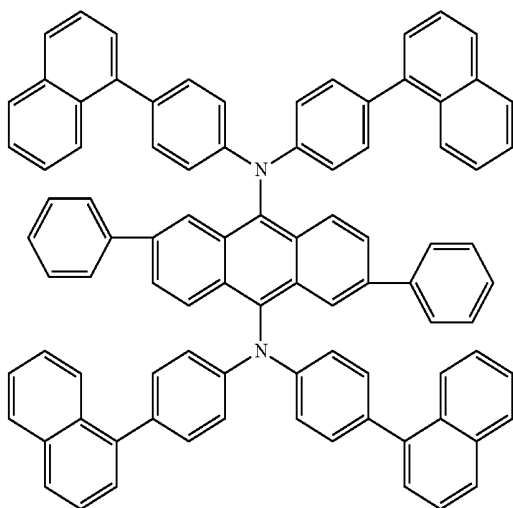
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HM-59



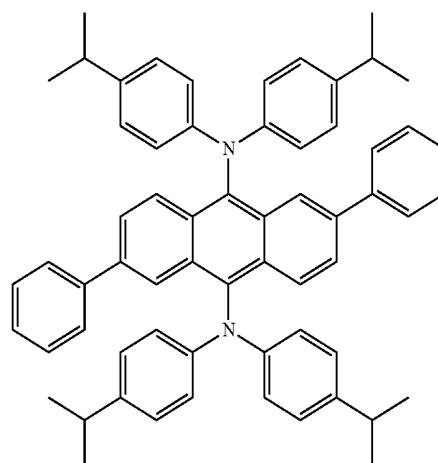
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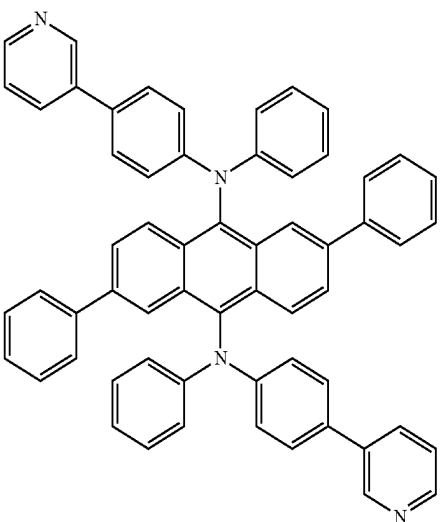
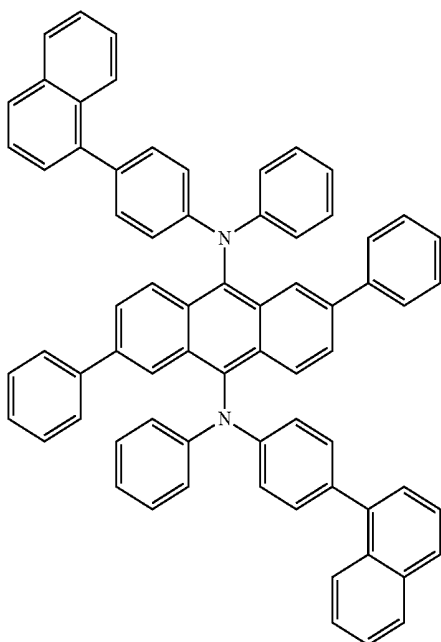
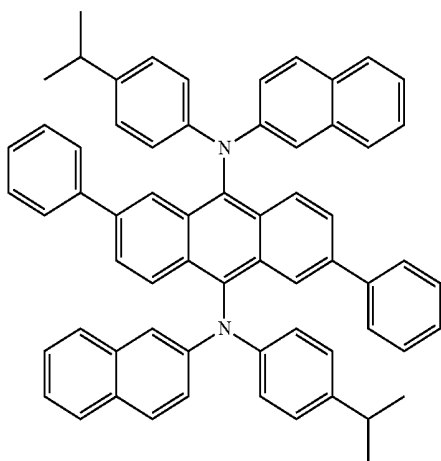
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HM-62



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4. A method of manufacturing an organic light emitting display, the method comprising:

forming a driving thin film transistor on a substrate, the driving thin film transistor including an active layer

HM-63

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HM-64

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HM-65

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having a channel region and source and drain regions on the substrate, a gate insulating layer on the substrate with the active layer, a gate electrode on the gate insulating layer and over the channel region, an interlayer insulating layer on the gate insulating layer with the gate electrode, and source and drain electrodes on the interlayer insulating layer to contact with the source and drain regions;

forming a storage capacitor on the substrate, the storage capacitor including a lower storage electrode, an upper storage electrode and the gate insulating layer between the lower storage electrode and the upper storage electrode;

forming a first electrode to be connected to the driving thin film transistor;

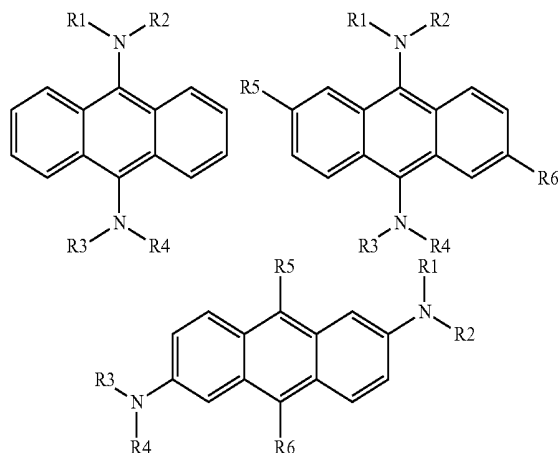
forming an organic emission layer and a second electrode on the first electrode;

forming a first passivation layer on the second electrode;

forming a second passivation layer over the substrate with the first passivation layer formed thereon; and

adhering a light emitting diode array substrate including thereon the driving thin film transistor, the first electrode, the organic emission layer, the second electrode, the first passivation layer, and the second passivation layer to an encapsulation substrate by an adhesive film, wherein the first passivation layer is formed of an organic compound having at least one of the structural formulae described in Formula 1 below:

<Formula 1>



wherein R1, R2, R3, R4, R5, and R6 are each independently selected from substituted or unsubstituted C₆-C₄₀ aromatic groups.

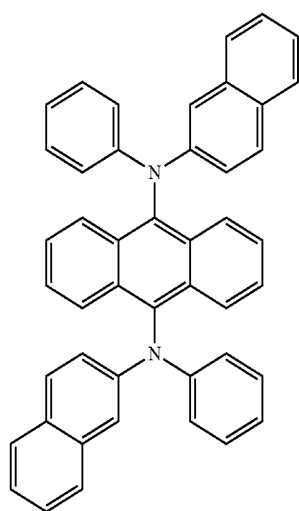
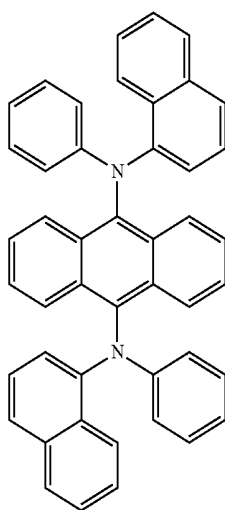
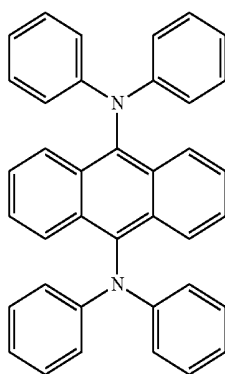
5. The method according to claim 4, wherein the first passivation layer is formed over the second electrode.

6. The method according to claim 5, wherein the first passivation layer is formed by deposition using the same mask as that used to form the organic emission layer and the second electrode.

7. The method according to claim 4, wherein the first passivation layer is entirely formed on the organic emission layer and the second electrode to cover side surfaces of the organic emission layer and the second electrode.

8. The method according to claim 4, wherein the organic compound having at least one of the structural formulae of Formula 1 is selected from HM-01 through HM-65:

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HM-01

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HM-02

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HM-03 45

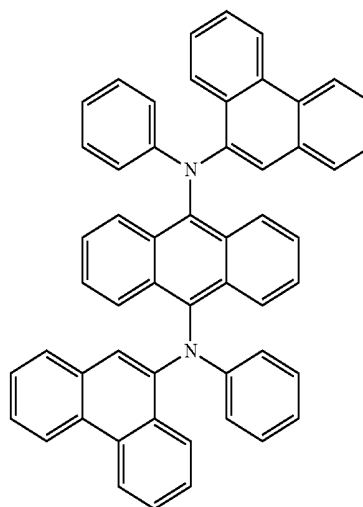
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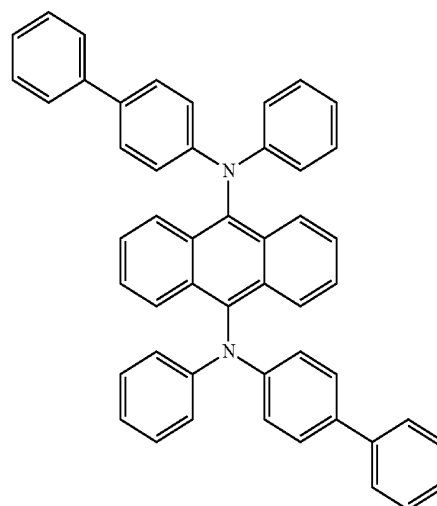
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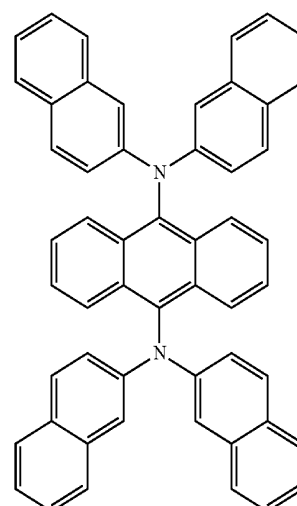
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HM-05

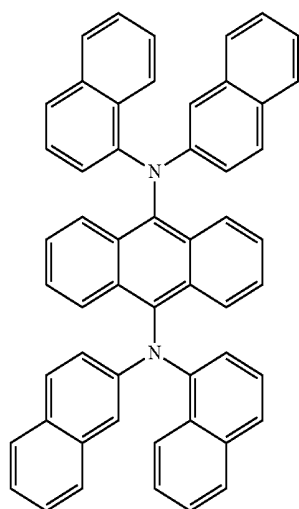


HM-06



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HM-07

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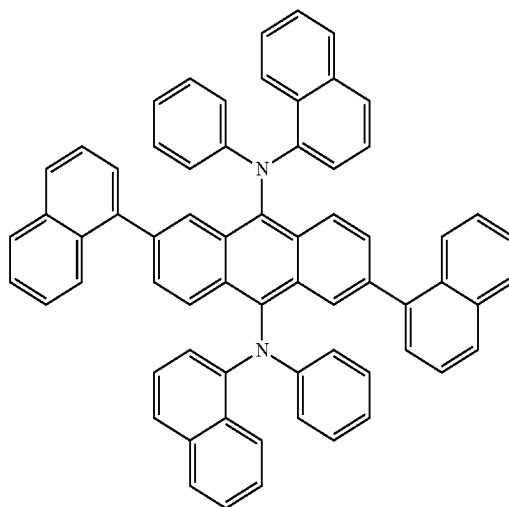
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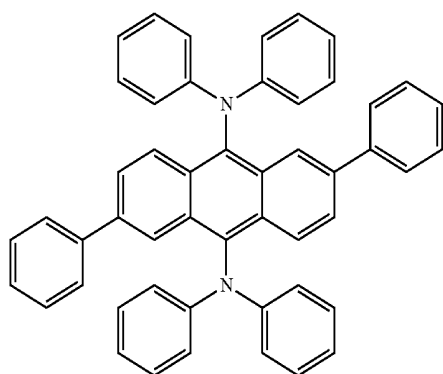
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HM-10



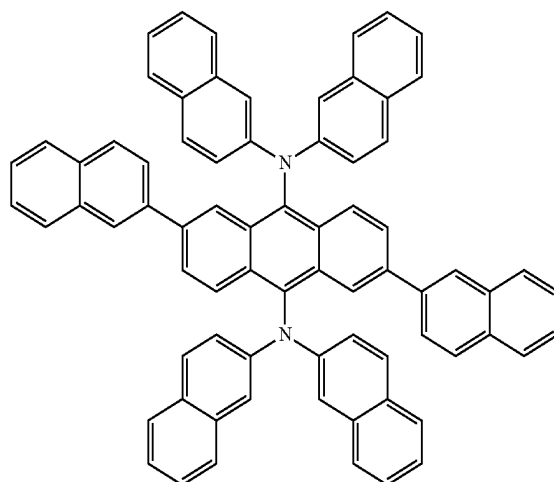
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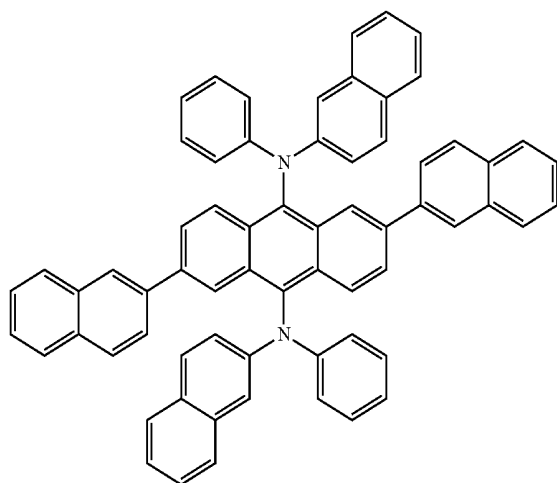
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HM-11



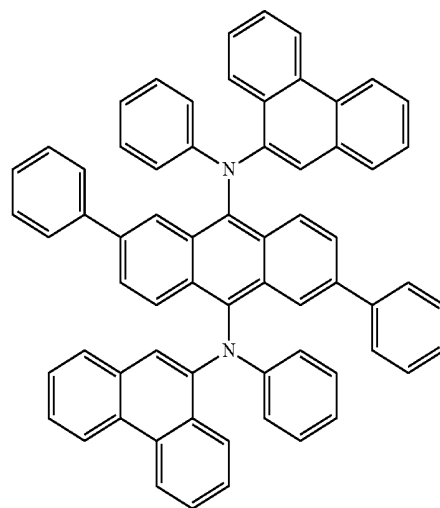
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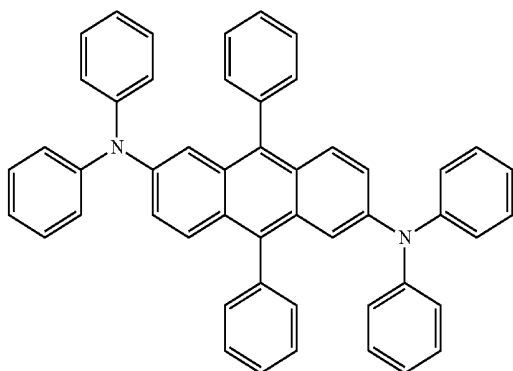


HM-12

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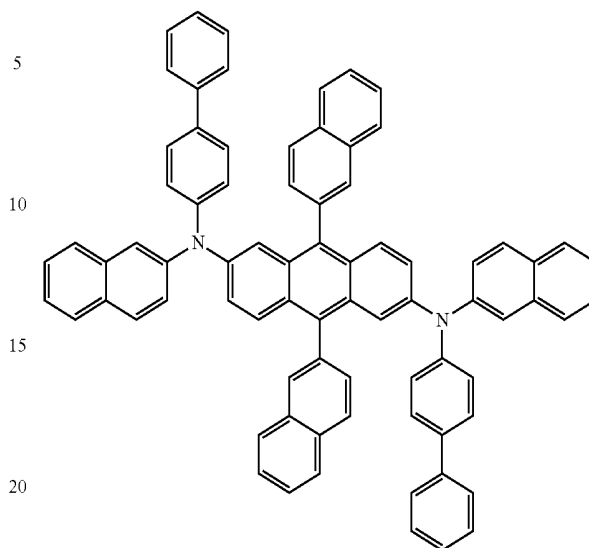
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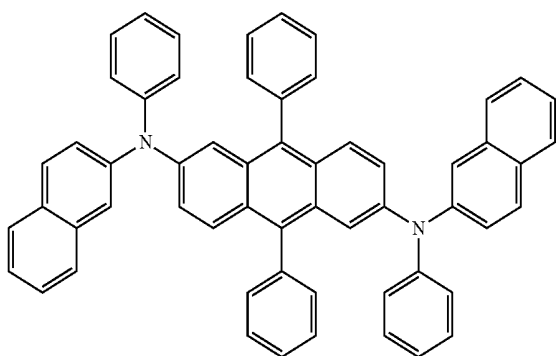
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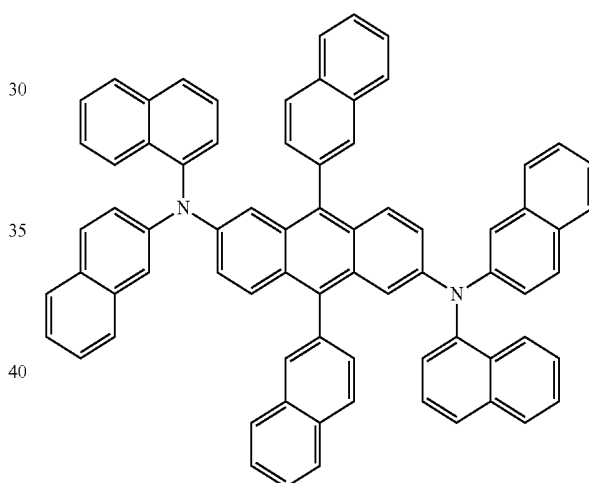
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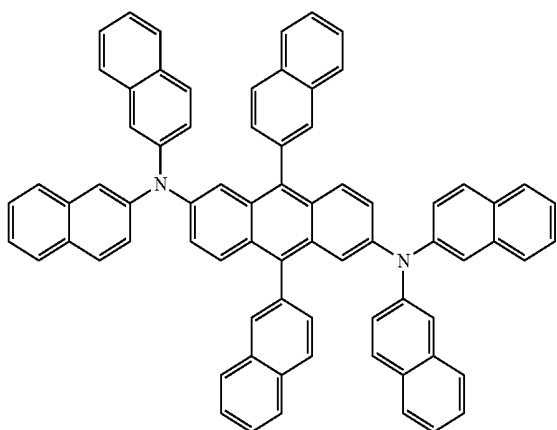
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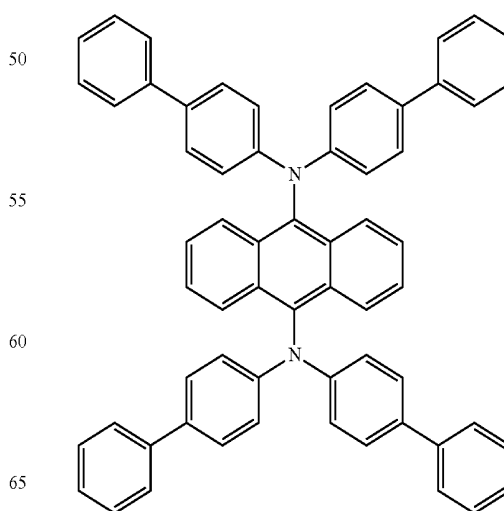
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HM-15

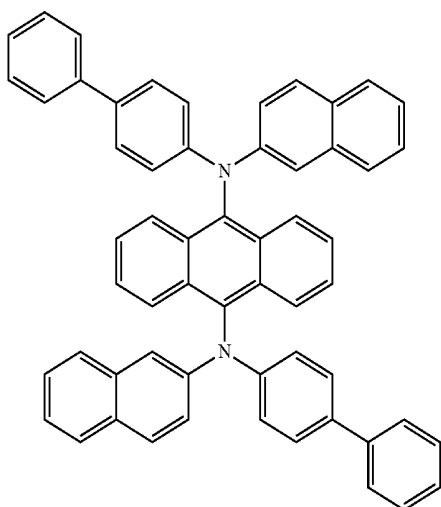


HM-18



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HM-19

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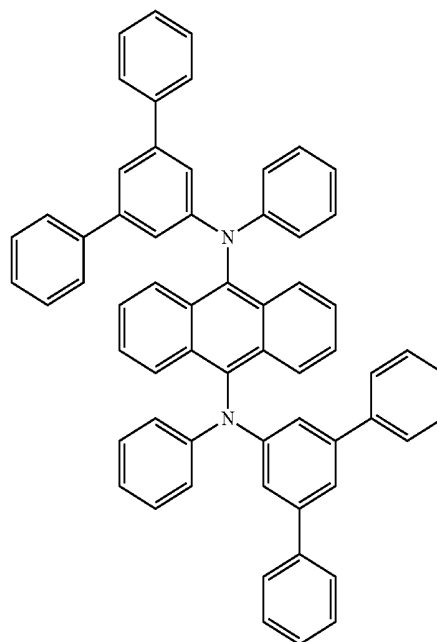
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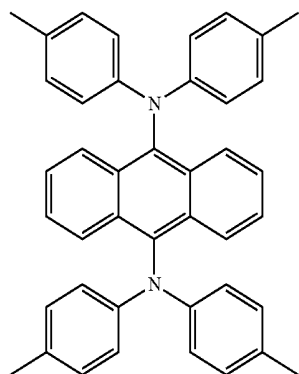
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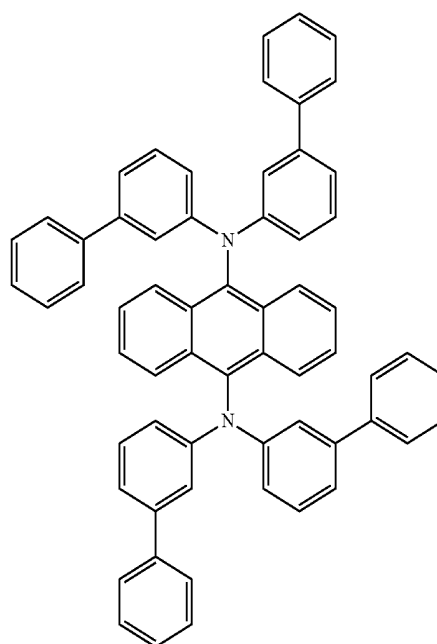
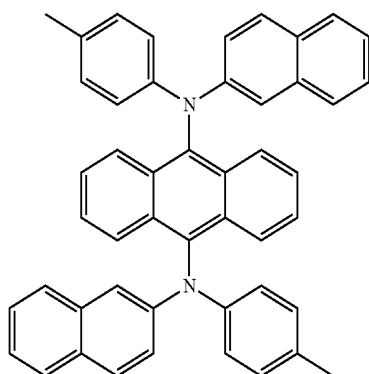
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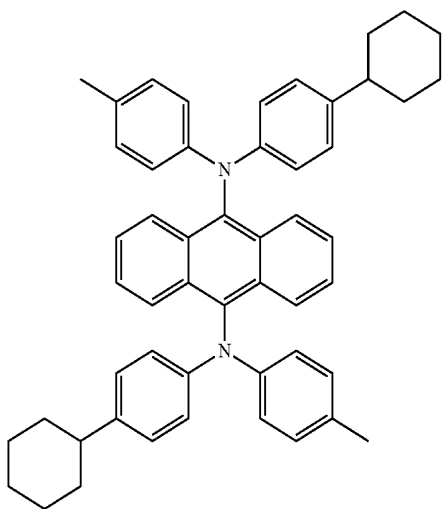
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HM-23

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HM-24

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HM-25

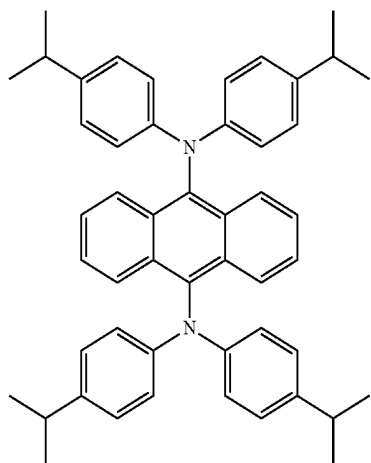
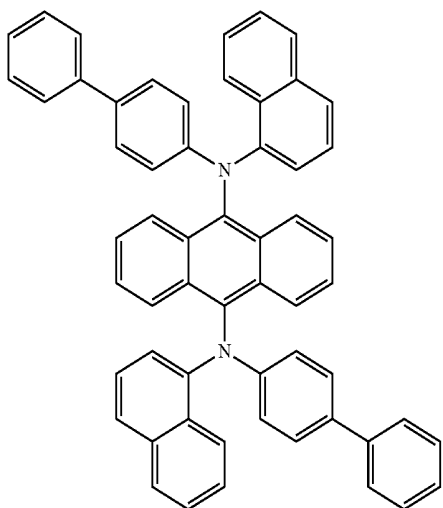
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HM-26

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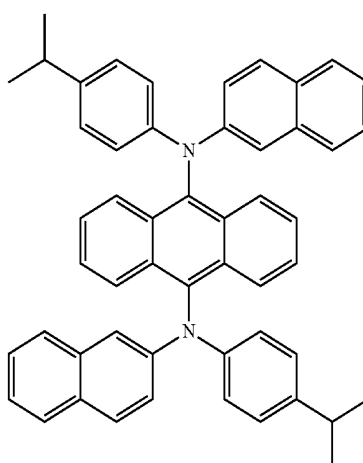
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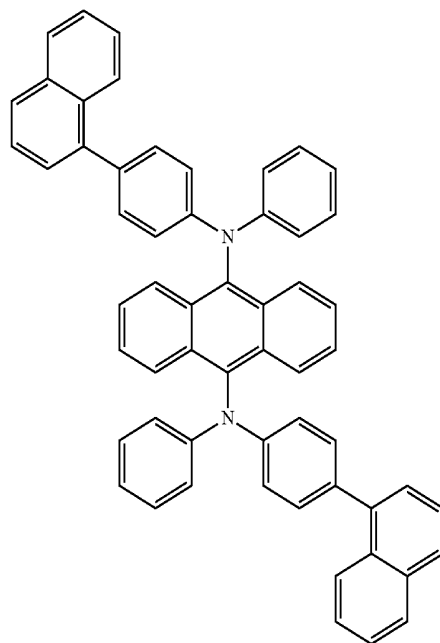
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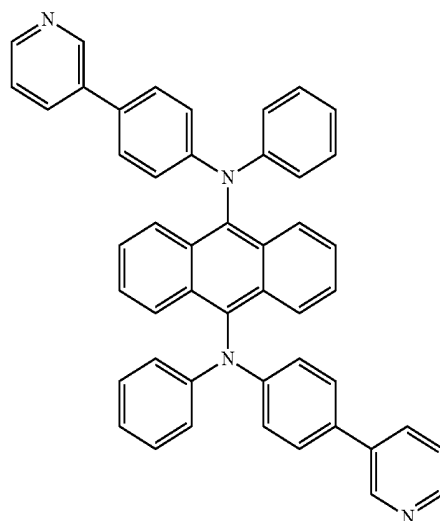
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HM-27



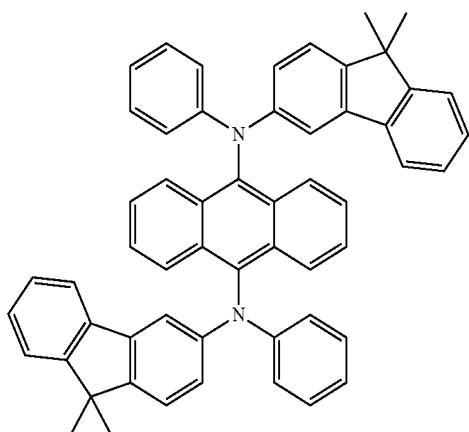
HM-28



HM-29

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HM-30

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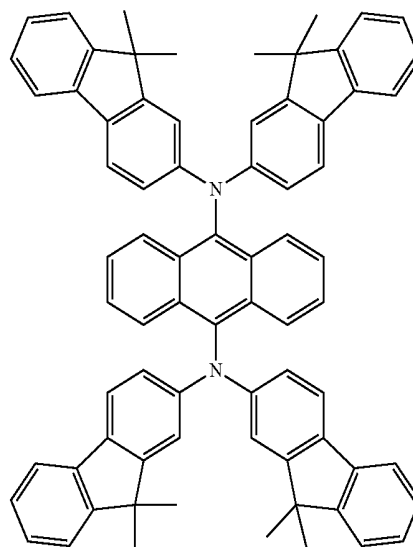
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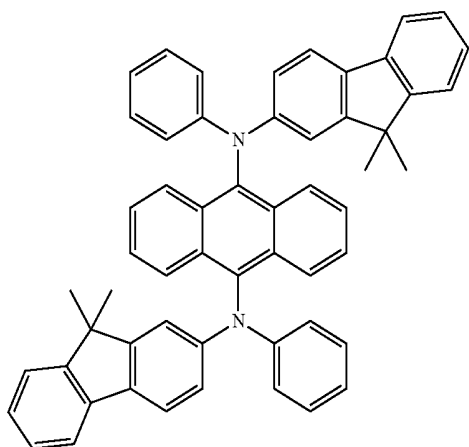
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HM-33

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HM-31



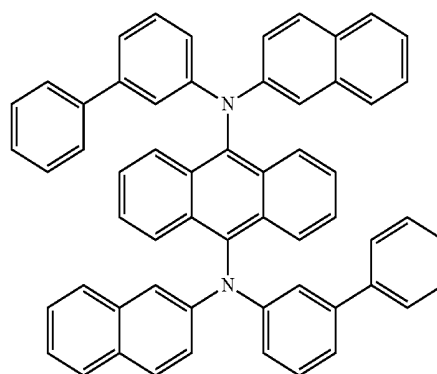
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HM-34



HM-35

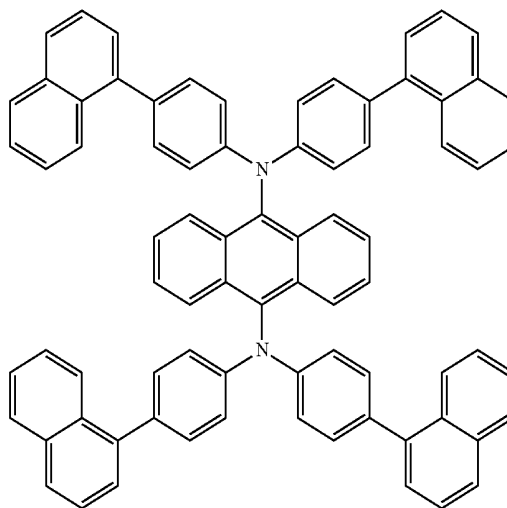
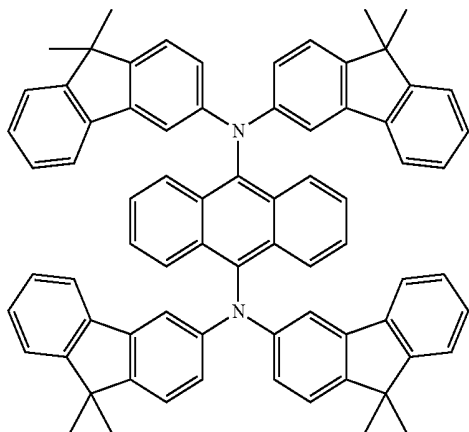
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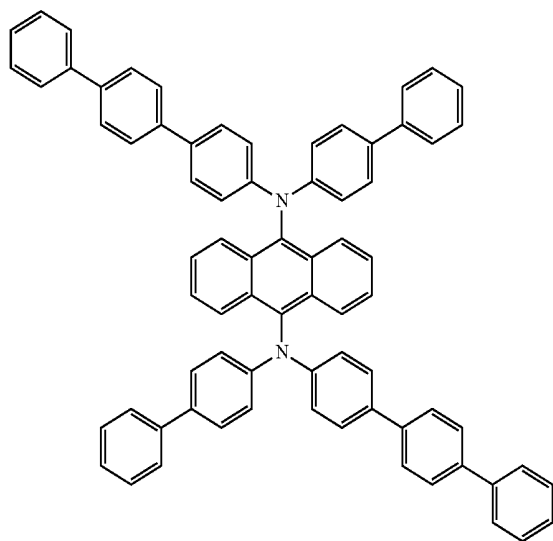
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HM-36



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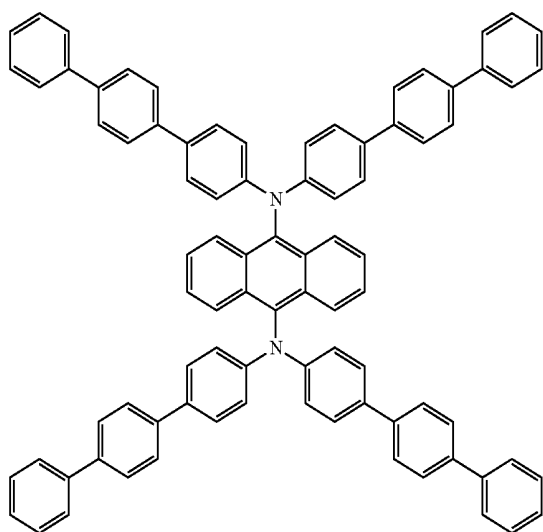
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HM-37



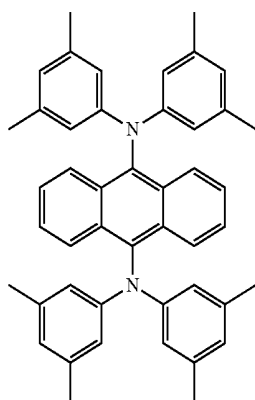
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HM-38



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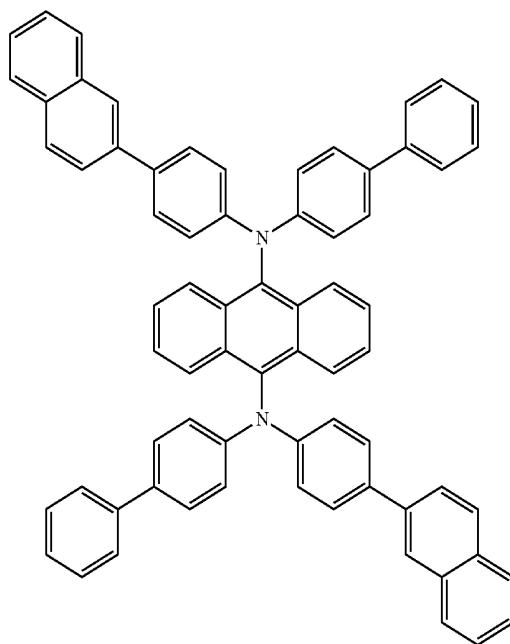
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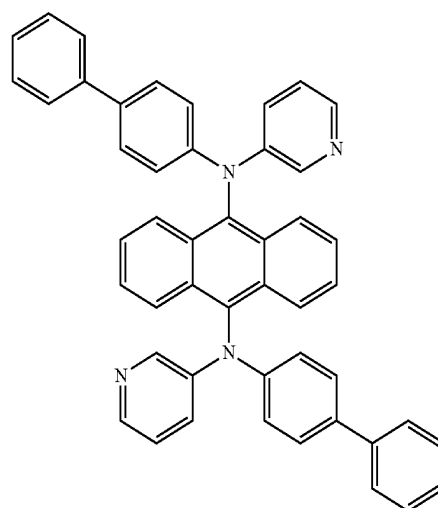
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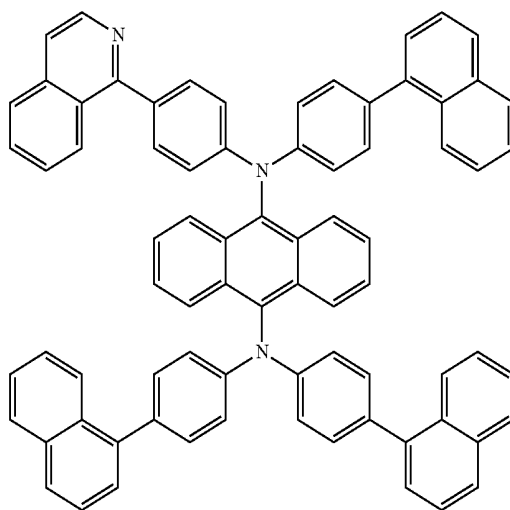
HM-39



HM-40

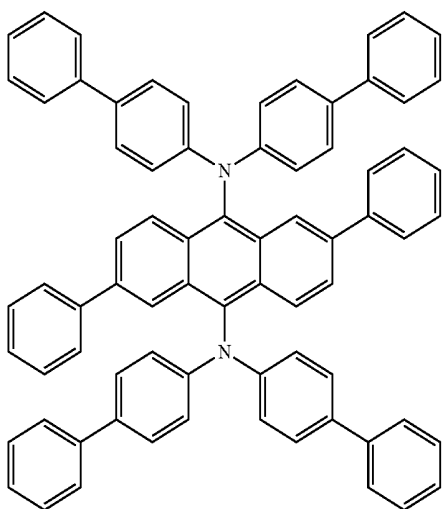


HM-41



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HM-42

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HM-43

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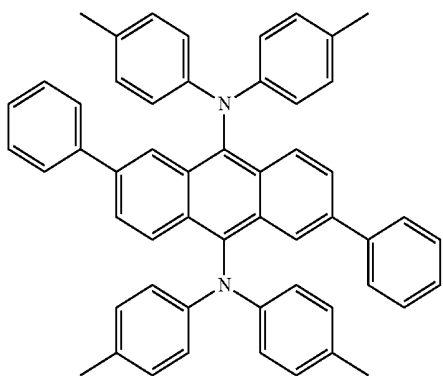
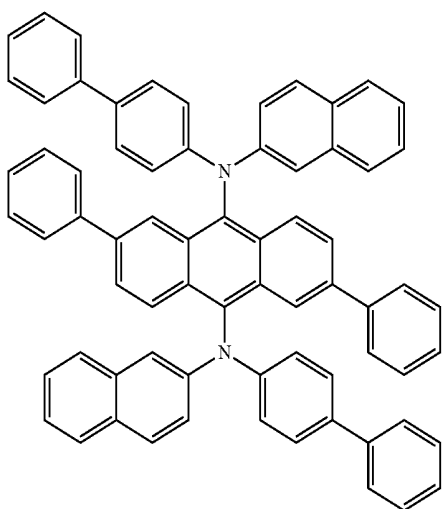
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HM-44

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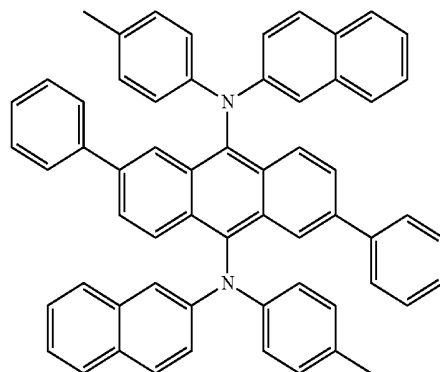
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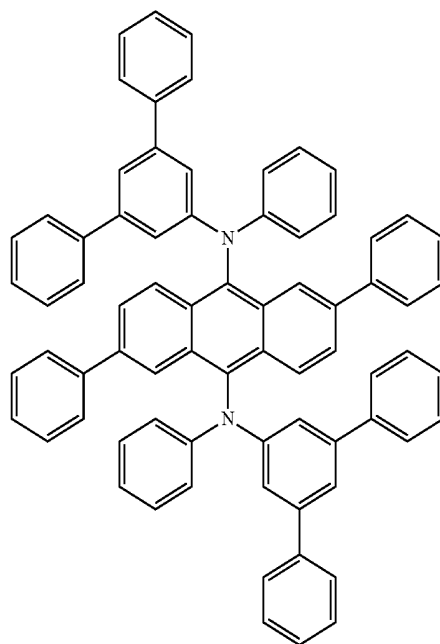


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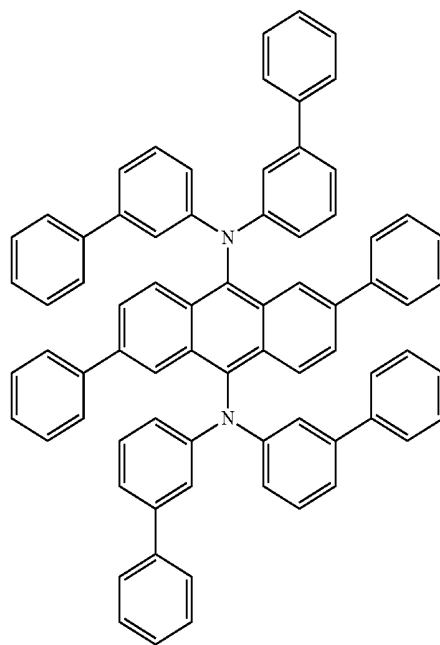
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HM-45



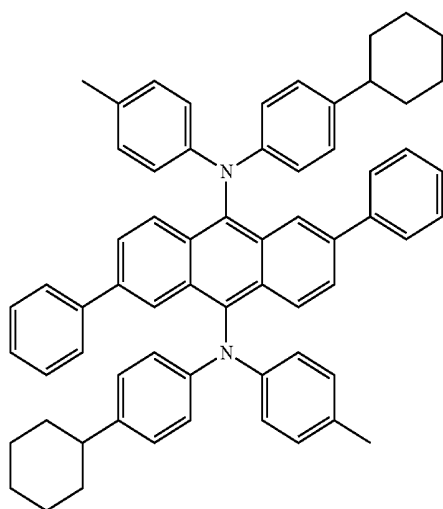
HM-46



HM-47

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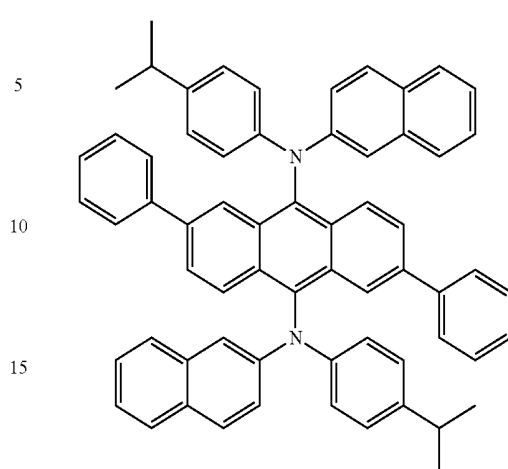
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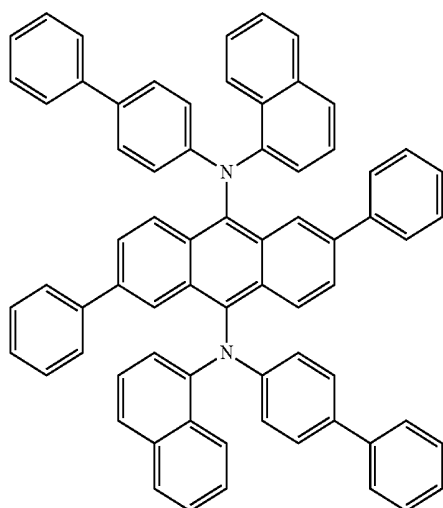
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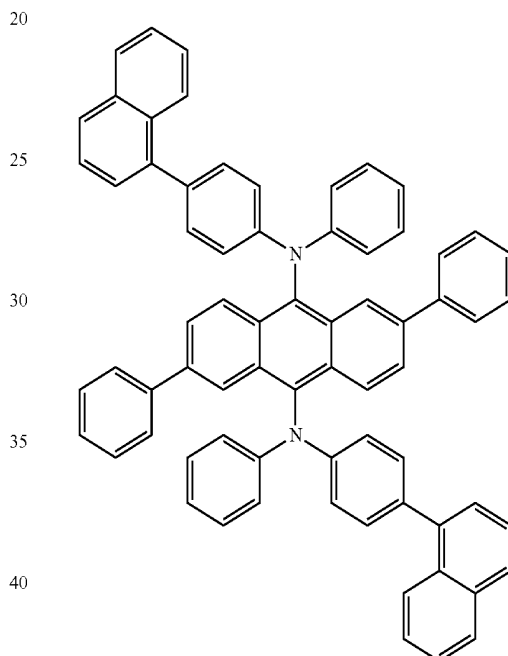
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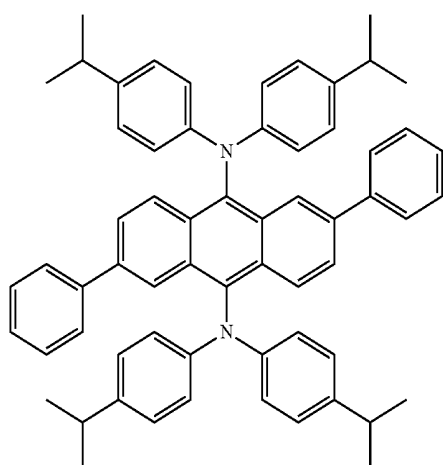
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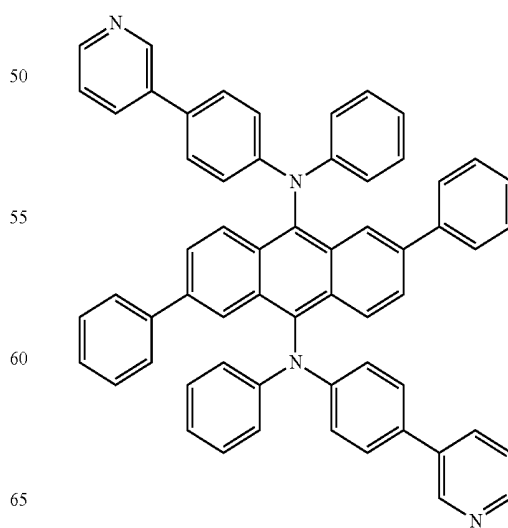
HM-49



HM-52



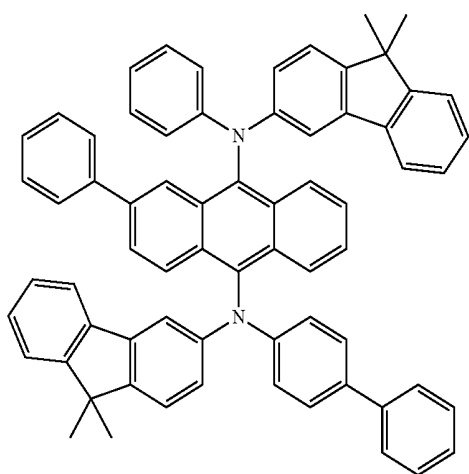
HM-50



HM-53

73

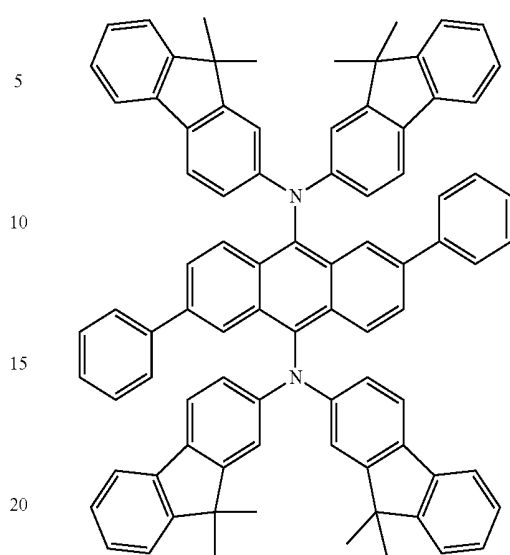
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HM-54

74

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HM-57

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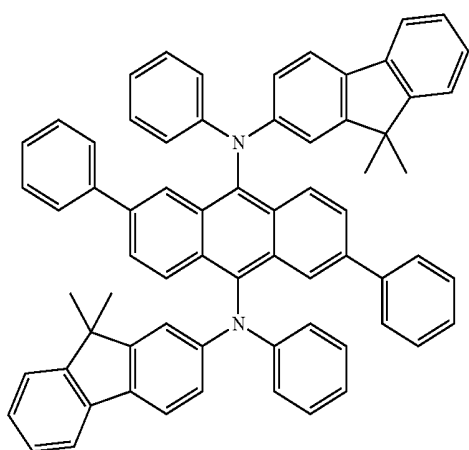
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HM-55



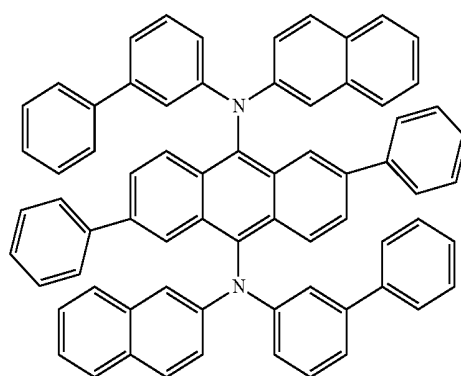
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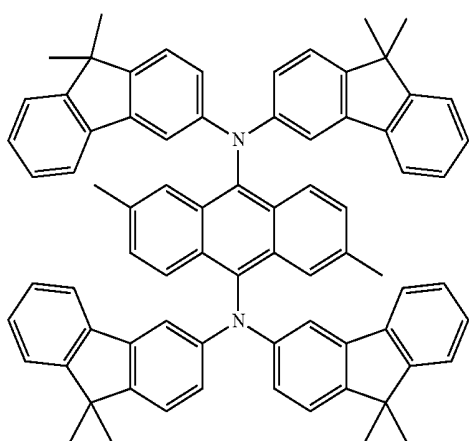
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HM-58



HM-59

HM-56

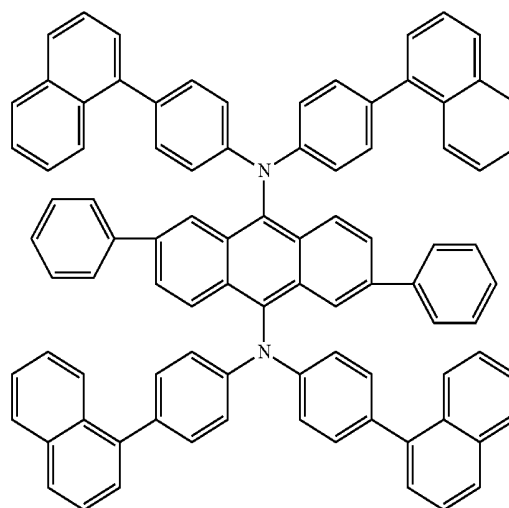


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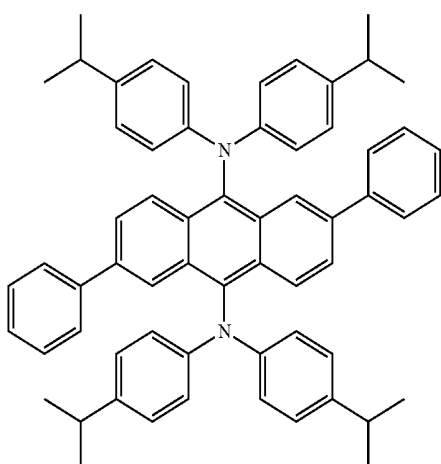
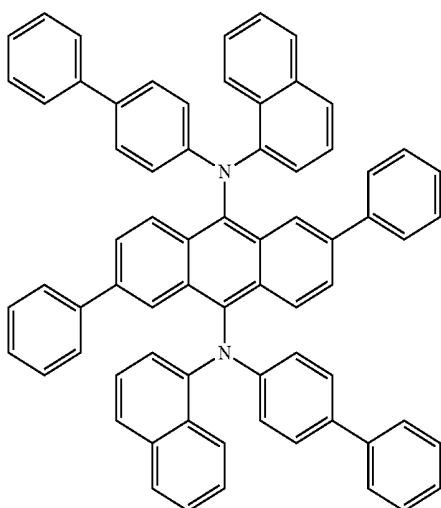
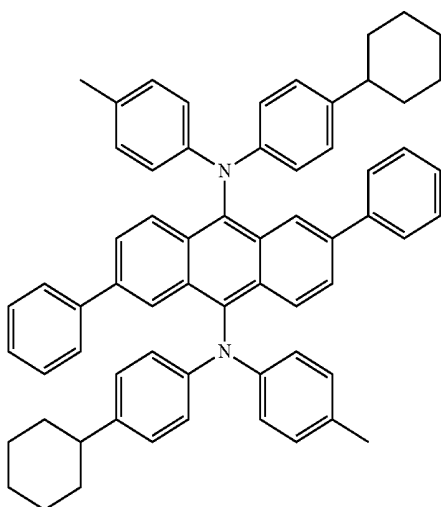
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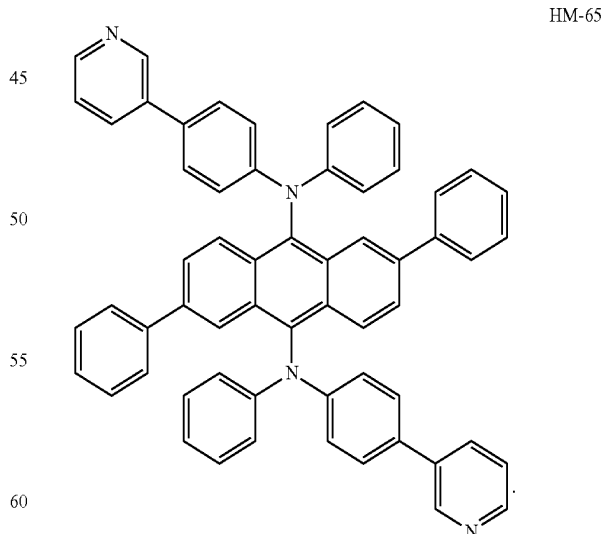
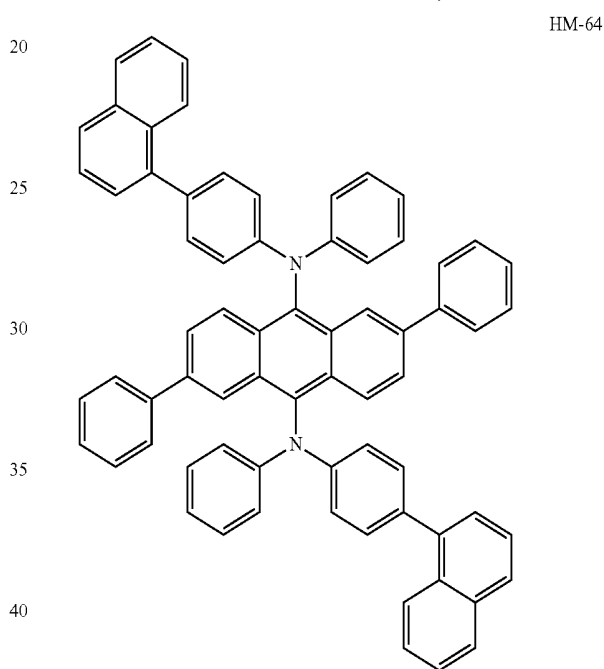
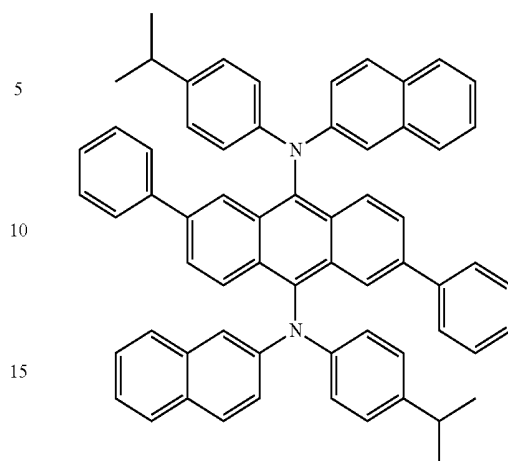
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**76**

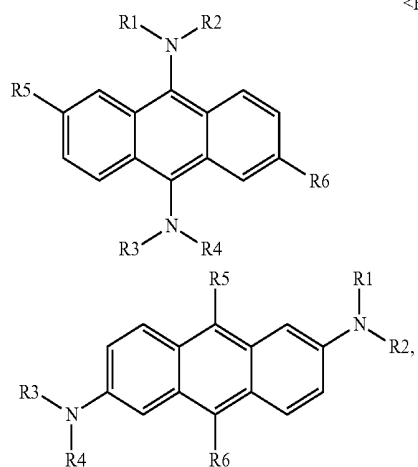
-continued

HM-63



9. The organic light emitting display panel according to claim 1, wherein the first passivation layer is formed of an organic compound having at least one of the structural formulae described in Formula 2 below:

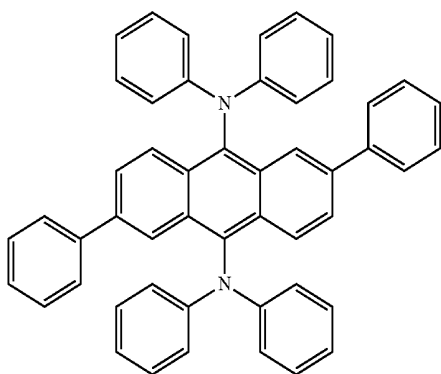
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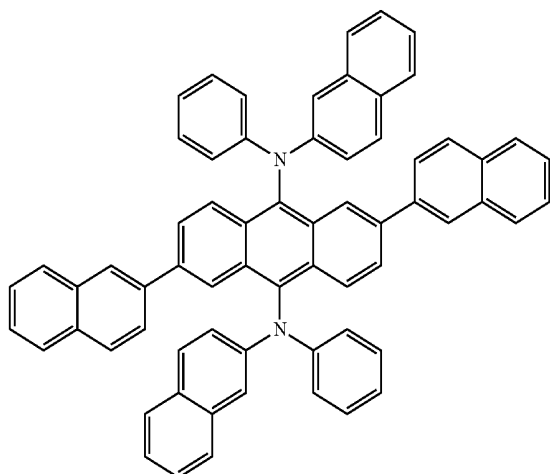
<Formula 2>

wherein R1, R2, R3, R4, R5, and R6 are each independently selected from substituted or unsubstituted C₆-C₄₀ aromatic groups.

10. The organic light emitting display panel according to claim 9, wherein the organic compound having at least one of the structural formulae of Formula 2 is selected from the following compounds:



HM-08



HM-09

78

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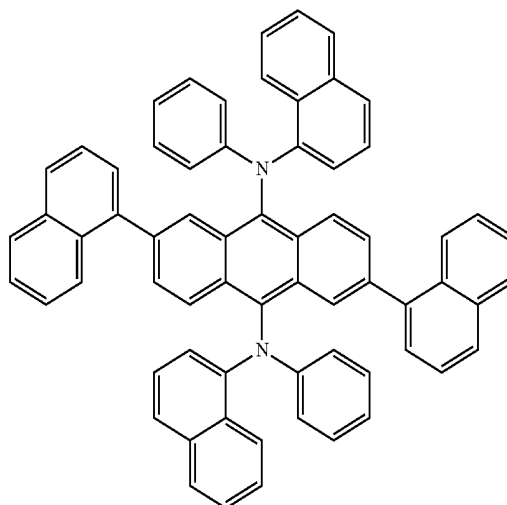
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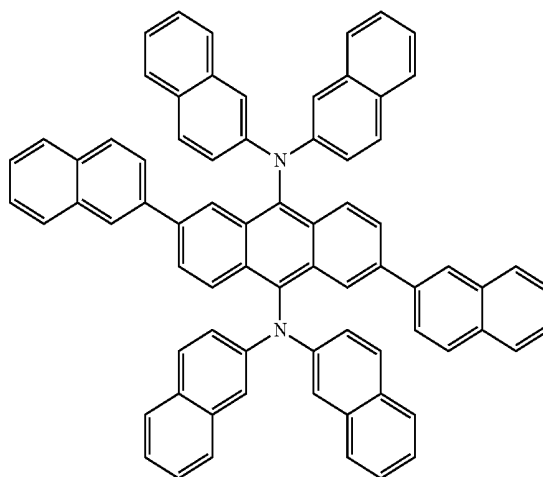
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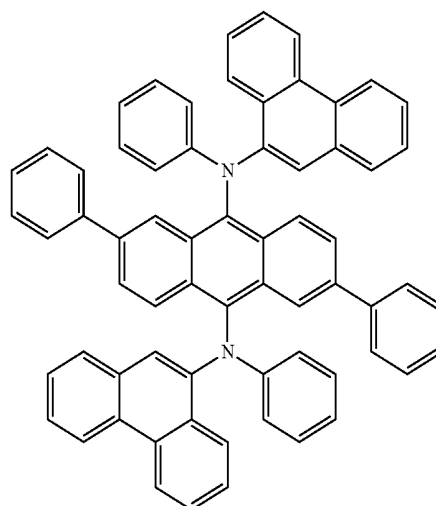
HM-12

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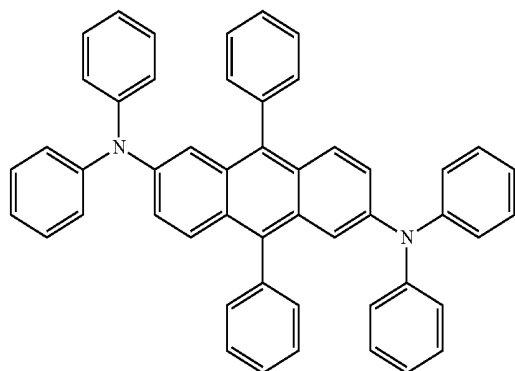
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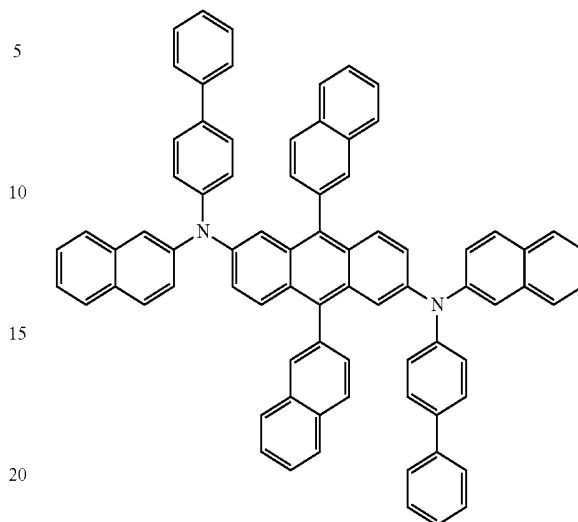
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HM-13

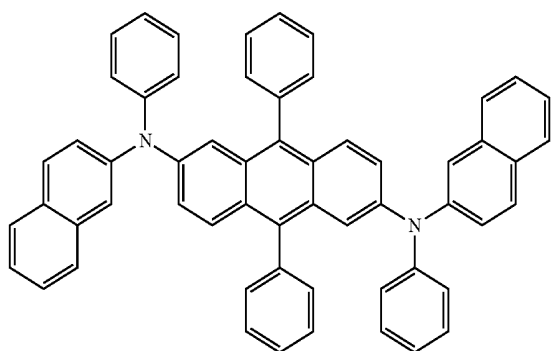


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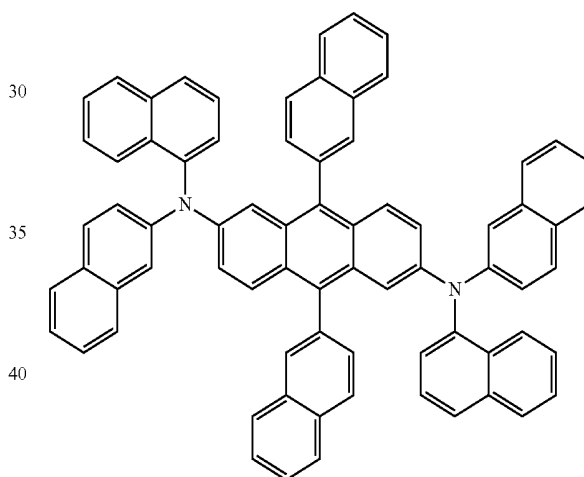
HM-16



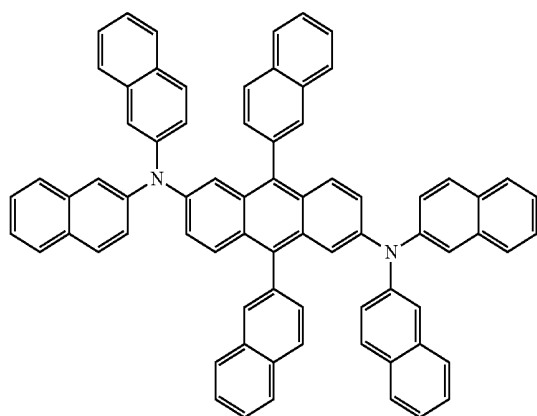
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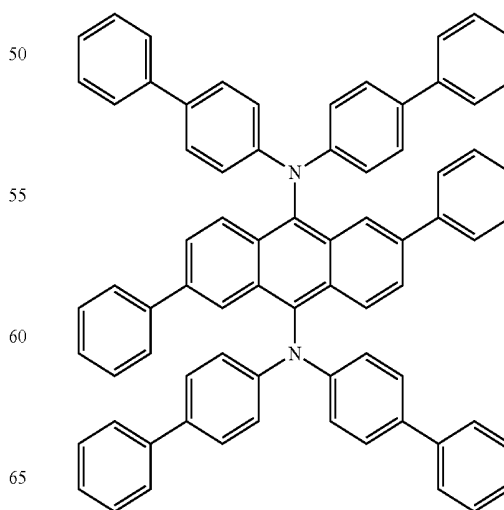
HM-17



HM-15

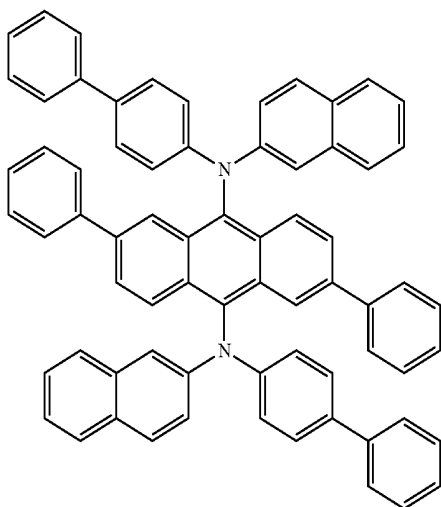


HM-42



81

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HM-43

82

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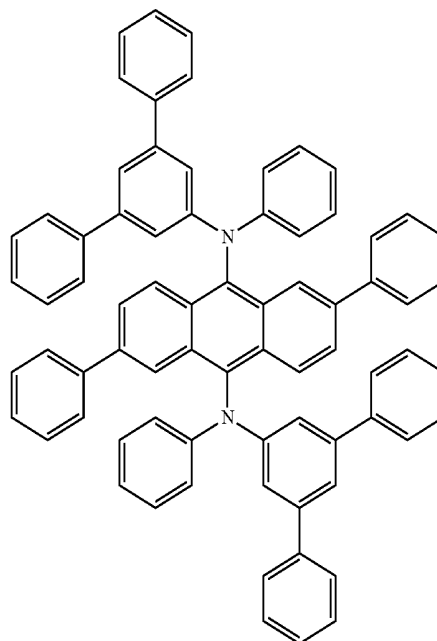
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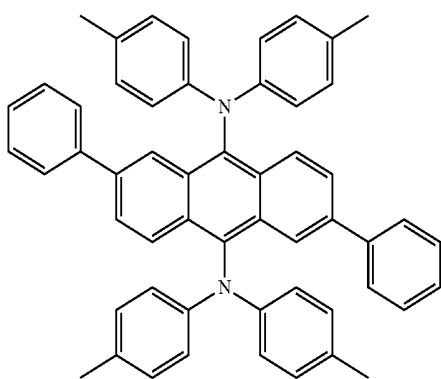
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HM-46

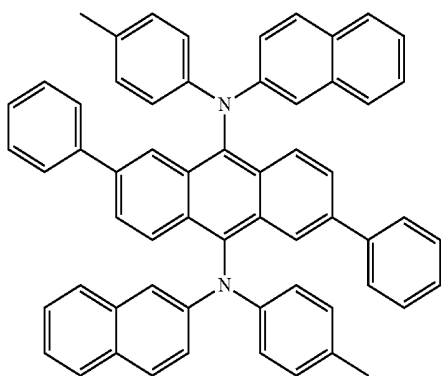


HM-44

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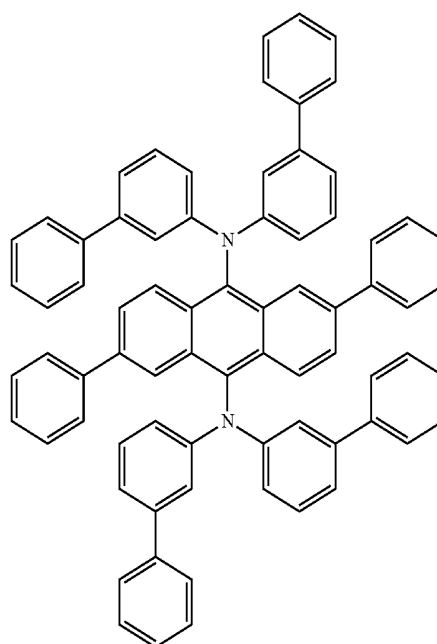
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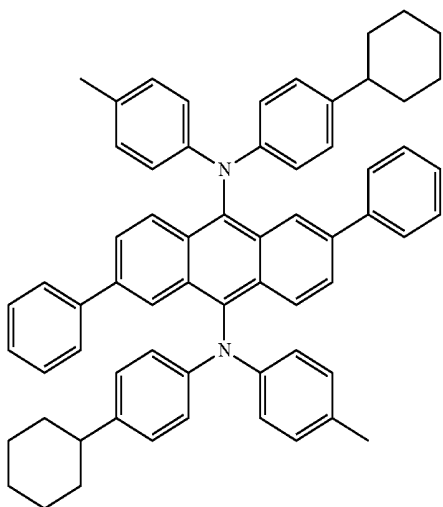
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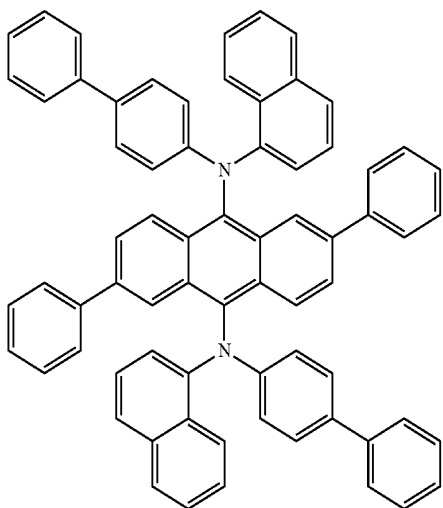
HM-47

83

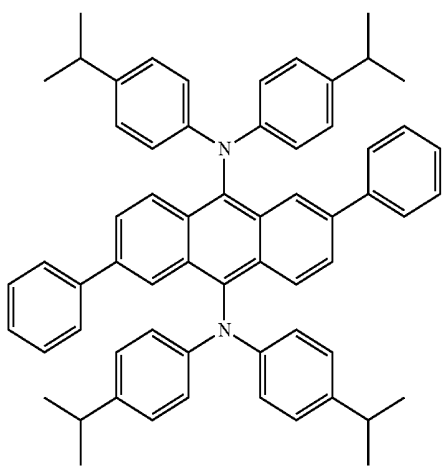
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HM-48



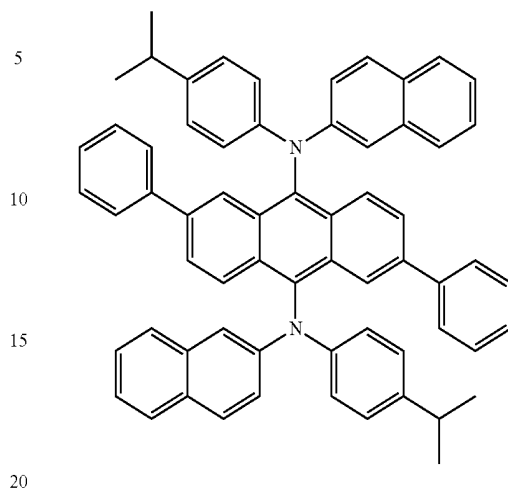
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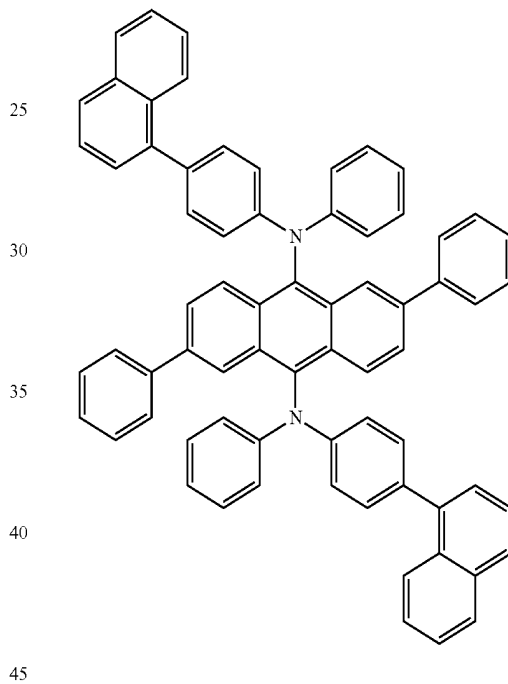
HM-50

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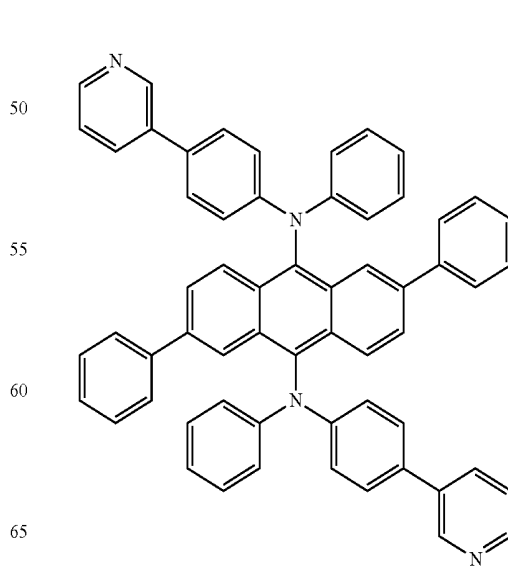
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HM-51



HM-52

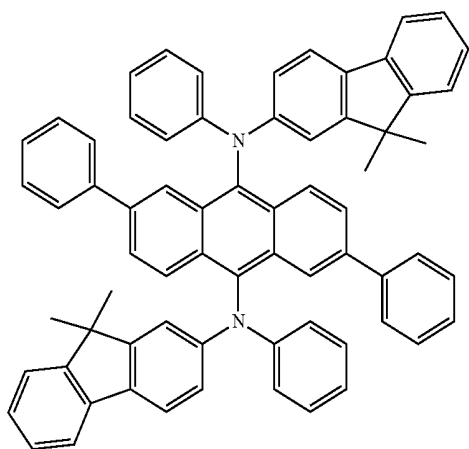


HM-53

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HM-55



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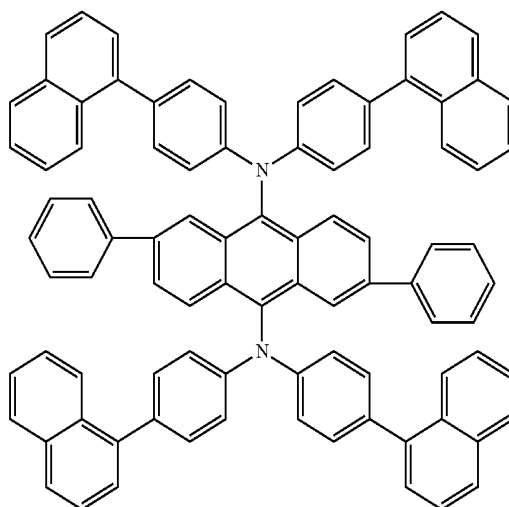
HM-59

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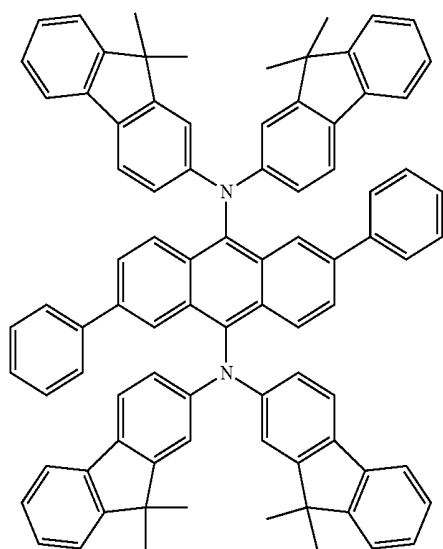
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HM-57

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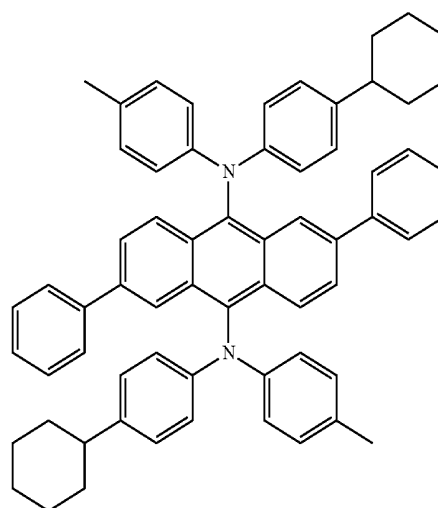
HM-60

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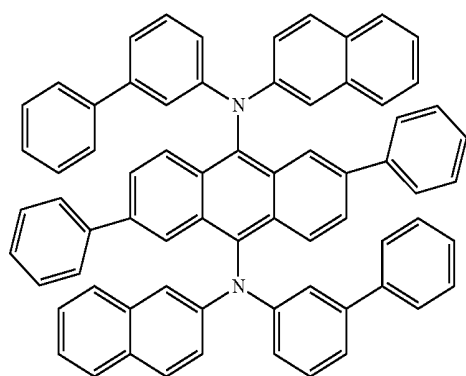
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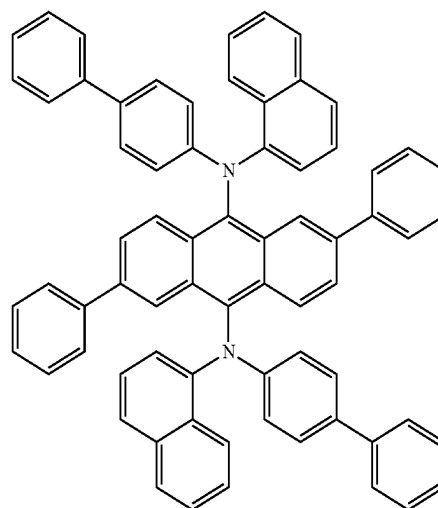
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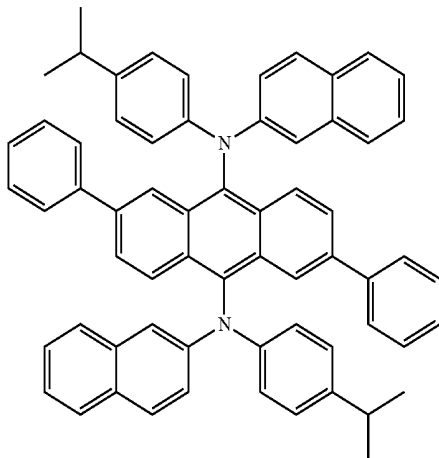
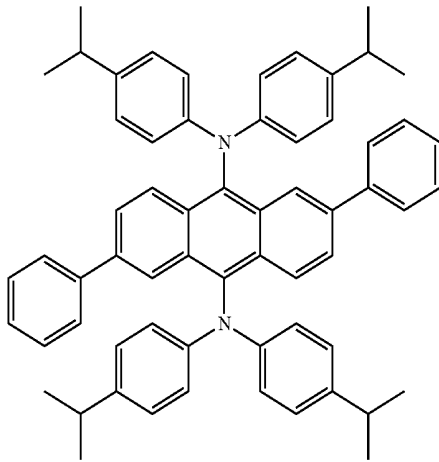


HM-61



87

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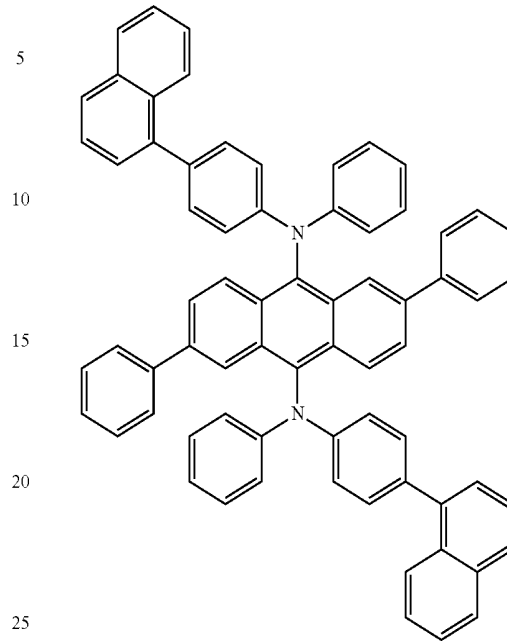


HM-62

88

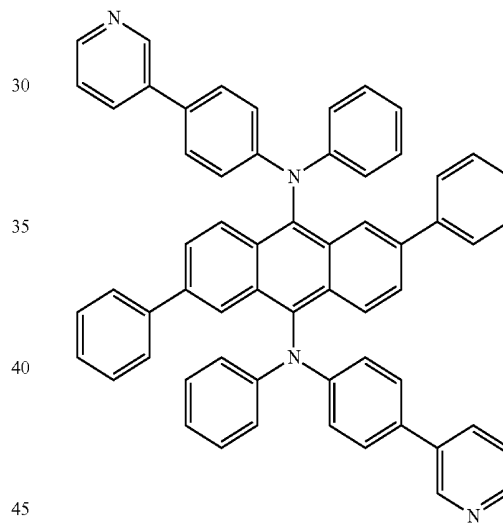
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HM-64



HM-65

HM-63



11. The organic light emitting display according to claim 1, wherein the lower storage electrode, and the source and drain regions are doped with the p+ or n+ impurity.

12. The organic light emitting display according to claim 1, wherein the lower storage electrode is formed from the same layer as the active layer.

13. The organic light emitting display according to claim 1, wherein the upper storage electrode is formed from the same layer as the gate electrode.

* * * * *

专利名称(译)	有机发光显示面板及其制造方法		
公开(公告)号	US9972805	公开(公告)日	2018-05-15
申请号	US13/872689	申请日	2013-04-29
[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 HAN CHANG WOOK TAK YOON HEUNG KIM HYO SEOK		
发明人	SEO, JEONG-DAE HAN, CHANG-WOOK TAK, YOON-HEUNG KIM, HYO-SEOK		
IPC分类号	H01L51/00 H01L51/52 H01L27/32		
CPC分类号	H01L51/5253 H01L51/006 H01L51/0058 H01L27/3244		
优先权	1020120122752 2012-10-31 KR		
其他公开文献	US20140117322A1		
外部链接	Espacenet USPTO		

摘要(译)

有机发光显示面板包括发光二极管阵列基板和通过粘合膜粘附到发光阵列二极管基板的封装基板。发光阵列二极管基板包括形成在基板上的驱动薄膜晶体管，包括连接到驱动薄膜晶体管的第一电极的有机发光二极管，形成在第一电极上的有机发光层，以及形成在第一电极上的第二电极。有机发光层，以及形成在第二电极上的第一和第二钝化层。在这方面，第一钝化层由具有下面的式1中描述的结构式中的至少一个的有机化合物形成：其中R1，R2，R3 R4，R5和R6各自独立地选自取代或未取代的C6-C40芳族基团。

