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(54) **COMPOUND, DISPLAY PANEL, AND DISPLAY APPARATUS**

(71) Applicant: **Wuhan Tianma Micro-Electronics Co., Ltd.**, Wuhan (CN)

(72) Inventors: **Lei ZHANG**, Wuhan (CN); **Wei Gao**, Wuhan (CN); **Jinghua Niu**, Wuhan (CN); **Yang Li**, Wuhan (CN); **Yan Lu**, Wuhan (CN); **Gaojun Huang**, Wuhan (CN)

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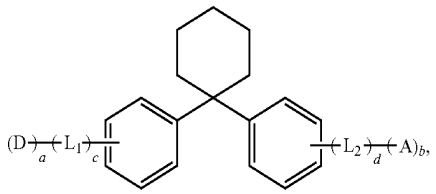
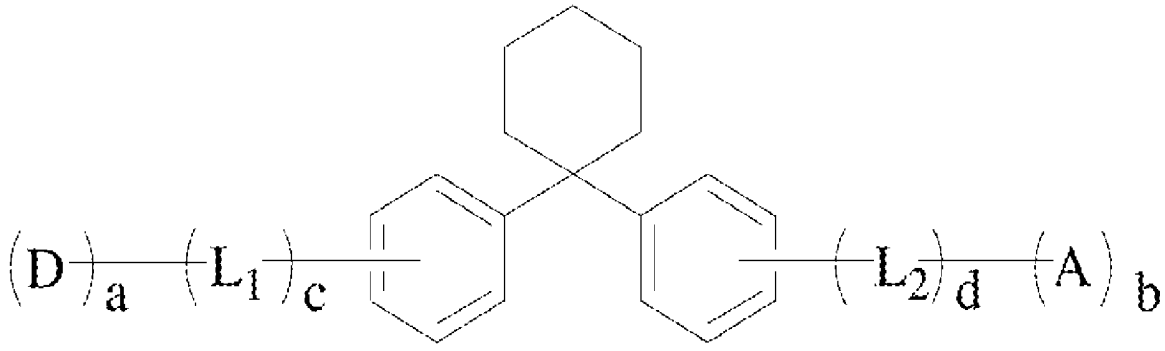
(57) **ABSTRACT**

An organic compound can be applied as a host material for an OLED display device. The compound has a structure represented by Formula (I):

Formula (I)



a and b, being independently 1, 2 or 3, respectively represent the numbers of electron donor D and electron acceptor A; c and d, independently being 0, 1, or 2, respectively representing the numbers of group L_1 and group L_2. D, L_1 and L_2 are each alkyl, cycloalkylene, heterocyclic group, aryl, heteroaryl, fused aryl, or fused heteroaryl; and A is selected from nitrogen-containing heterocyclic substituents, cyano-containing substituents, triaryl-boron-derived substituents, and phosphoxy-containing substituents. The compound has a D-(π)-σ-(π)-A structure with bipolarity, and the σ bond can interrupt an intramolecular charge transfer between D and A, so that the excited state is limited to a local excited state in moiety of D or A, and the compound has a small excited-state dipole moment.



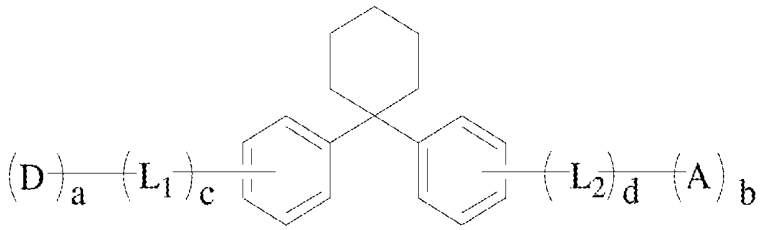


FIG. 1

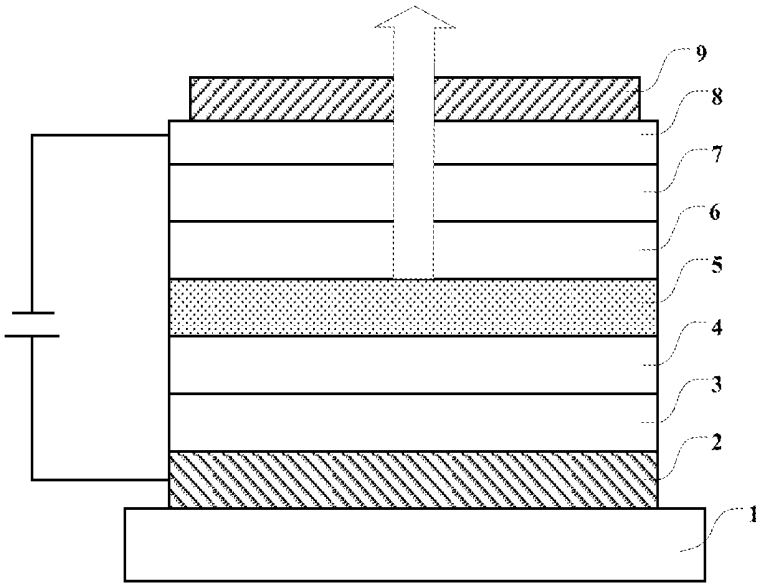


FIG. 2

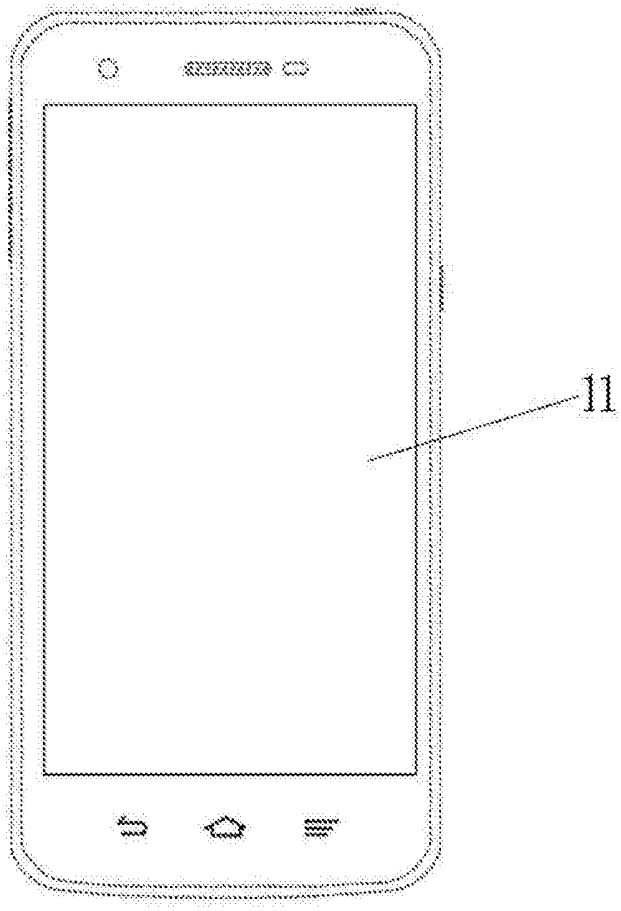


FIG. 3

COMPOUND, DISPLAY PANEL, AND DISPLAY APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to Chinese Patent Application No. CN201811622667.X filed on Dec. 28, 2018 the content of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to the technical field of organic electroluminescent materials, and particularly, to an electroluminescent compound, a display panel and a display apparatus containing the compound.

BACKGROUND

[0003] As a new generation of display technology, the organic electroluminescent materials such as OLEDs have been widely used in flat-panel displays, flexible displays, solid-state lighting and vehicle displays, due to their advantages of being ultrathin, being self-luminous, and having a wide viewing angle, fast response, high luminous efficiency, good temperature adaptability, simple manufacturing process, low driving voltage, low energy consumption and the like.

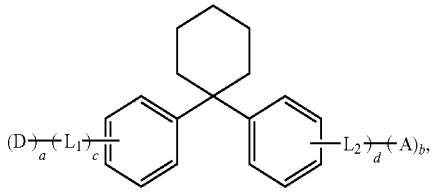
[0004] Light emitted by the OLEDs can be classified into electro-fluorescence and electro-phosphorescence depending upon the luminescence mechanism. Fluorescence is emission light resulted from a radiation attenuation transition of singlet excitons, and phosphorescence is emission light resulted from a radiation attenuation of triplet excitons to the ground state. According to the spin quantum statistics theory, a forming probability ratio of singlet excitons to triplet excitons is 1:3. The internal quantum efficiency of the electro-fluorescent materials is no more than 25%, and the external quantum efficiency thereof is generally even less than 5%. Theoretically, the internal quantum efficiency of the electro-phosphorescent materials can reach 100%, and the external quantum efficiency thereof can be up to 20%. In 1998, Professor Yuguang Ma from Jilin University in China and Professor Forrest from Princeton University in the United States respectively reported ruthenium (Ru) complexes and platinum complexes that were used as dyes doped into the light-emitting layer, successfully obtained and explained a phenomenon of phosphorescence electroluminescence for the first time, and pioneered the application of the phosphorescent materials to an electroluminescent device.

[0005] The long lifetime (in μs) of phosphorescent heavy metal materials may lead to triplet state-triplet state quenching and concentration quenching at high current densities and further result in a degradation of device performance. Therefore, phosphorescent heavy metal materials are usually doped into suitable host materials to form a host-guest doping system. In this way, energy transfer is optimized, and luminous efficiency and lifetime are maximized. At present, the commercialization of heavy metal doping materials is mature, and it is difficult to develop alternative doping materials. Thus, developing a novel phosphorescent host material is becoming a new research topic.

SUMMARY

[0006] In a first aspect, the present disclosure provides a compound having a D-(π)-σ-(π)-A structure. The compound has a chemical structure represented by a Formula (I):

Formula (I)



[0007] wherein D represents an electron donor, A represents an electron acceptor, a is a number of an electron donor D, b is a number of an electron acceptor A, and a and b are each 1, 2, or 3 independently,

[0008] c is a number of a group L_1, d is a number of a group L_2, and c and d are each 0, 1, or 2 independently,

[0009] L_1 and L_2 are each independently selected from the group consisting of a single bond, a substituted or unsubstituted C1-C20 alkylene, a substituted or unsubstituted C3-C20 cycloalkylene, a substituted or unsubstituted C3-C20 heterocycloalkylene, a substituted or unsubstituted C6-C40 arylene, a substituted or unsubstituted C4-C40 heteroarylene, a substituted or unsubstituted C10-C60 fused arylene, and a substituted or unsubstituted C10-C60 fused heteroarylene,

[0010] when c or d is 2, the two L_1 or the two L_2 are identical or different;

[0011] the electron donor D is selected from the group consisting of a substituted or unsubstituted C1-C20 alkyl, a substituted or unsubstituted C3-C20 cycloalkyl, a substituted or unsubstituted C1-C20 alkoxy, a substituted or unsubstituted C3-C20 heterocyclic group, a substituted or unsubstituted C6-C40 aryl, a substituted or unsubstituted C4-C40 heteroaryl, a substituted or unsubstituted C10-C60 fused arylene, a substituted or unsubstituted C10-C60 fused heteroarylene, a substituted or unsubstituted C12-C40 carbazolyl and a derivative group thereof, a substituted or unsubstituted C12-C40 diphenylamino and a derivative group thereof, and a substituted or unsubstituted C12-C40 acridinyl and a derivative group thereof,

[0012] when a is 2 or 3, the two or three electron donors D are identical or different,

[0013] the electron acceptor A is selected from the group consisting of nitrogen-containing heterocyclic substituents, cyano-containing substituents, triaryl-boron-derived substituents, and phosphoxy-containing substituents, and

[0014] when b is 2 or 3, the two or three electron acceptors A are identical or different.

[0015] In a second aspect, the present disclosure provides a display panel, comprising an organic light-emitting device, wherein the organic light-emitting device comprises an anode, a cathode disposed oppositely to the anode, and a light-emitting layer disposed between the anode and the cathode, wherein the light-emitting layer comprises a host material and a guest material, and the host material is one or more compounds in the first aspect.

[0016] In a third aspect, the present disclosure provides a display panel, comprising an organic light-emitting device, wherein the organic light-emitting device comprises an

anode, a cathode disposed oppositely to the anode, a capping layer disposed on a side of the cathode facing away from the anode, and an organic layer disposed between the anode and the cathode, the organic layer comprises an electron transmission layer, a hole transmission layer, and a light-emitting layer, and at least one of the capping layer, the electron transmission layer, the hole transmission layer, and the light-emitting layer is made of the compound in the first aspect.

[0017] In a fourth aspect, the present disclosure provides a display apparatus including the above display panel.

[0018] The compound having the D-(π)-σ-(π)-A structure according to the present disclosure is a bipolar material, which can replace the conventional D-π-A skeleton known in the prior art. The conventional D-π-A bipolar material with a large dipole moment μ_s may present a strong intramolecular charge transfer. The D-(π)-σ-(π)-A structure of the compound according to the present disclosure has bipolarity, and the intermediate σ bond can effectively interrupt the intramolecular charge transfer between the electron donor D and the electron acceptor A, so that the excited state is limited as a local excited state in moiety of the electron donor D or the electron acceptor A, and thus the compound has a small excited-state dipole moment. In this way, the compound, when used as host material of a light-emitting layer of an OLED device, can effectively reduce an efficiency roll-off of a blue light material and enhance the brightness and luminous efficiency.

[0019] The compound according to the present disclosure, which is used as the host material in an electroluminescent device, has a high triplet energy level E_T, a large molecular density, a high glass transition temperature and a high molecular thermal stability, and thus can effectively improve an equilibrium migration of carriers and widen a recombination area of excitons. In this regard, the external quantum efficiency (EQE) and service life of the device are effectively enhanced. Therefore, the compound according to the present disclosure can be well applied in the electroluminescent device field.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] FIG. **1** is a chemical formula of a compound according to the present disclosure;

[0021] FIG. **2** is a structural schematic diagram of an OLED device according to an embodiment of the present disclosure; and

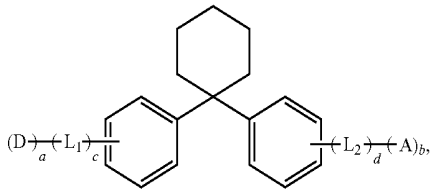
[0022] FIG. **3** is a schematic diagram of a display apparatus according to an embodiment of the present disclosure.

DESCRIPTION OF EMBODIMENTS

[0023] The present disclosure is described in detail with aid of embodiments and comparative examples. The following embodiments are merely used to illustrate the present disclosure, but not intended to limit the scope of the present disclosure. Any modification or equivalent replacement with respect to the technical solutions of the present disclosure without departing from the scope of the present disclosure shall fall into the protection scope of the present disclosure.

[0024] In a first aspect, the present disclosure provides a compound having a chemical structure represented by a Formula (I):

Formula (I)



[0025] in which D represents an electron donor, A represents an electron acceptor, a is a number of the electron donor D, b is a number of the electron acceptor A, and a and b are each 1, 2, or 3 independently,

[0026] c is a number of the group L_1, d is a number of the group L_2, c and d are each 0, 1, or 2 independently,

[0027] L_1 and L_2 are each independently selected from the group consisting of a single bond, a substituted or unsubstituted C1-C20 alkylene, a substituted or unsubstituted C3-C20 cycloalkylene, a substituted or unsubstituted C3-C20 heterocycloalkylene, a substituted or unsubstituted C6-C40 arylene, a substituted or unsubstituted C4-C40 heteroarylene, a substituted or unsubstituted C10-C60 fused arylene, and a substituted or unsubstituted C10-C60 fused heteroarylene,

[0028] the electron donor D is selected from the group consisting of a substituted or unsubstituted C1-C20 alkyl, a substituted or unsubstituted C3-C20 cycloalkyl, a substituted or unsubstituted C1-C20 alkoxy, a substituted or unsubstituted C3-C20 heterocyclic group, a substituted or unsubstituted C6-C40 aryl, a substituted or unsubstituted C4-C40 heteroaryl, a substituted or unsubstituted C10-C60 fused arylene, a substituted or unsubstituted C10-C60 fused heteroarylene, a substituted or unsubstituted C12-C40 carbazolyl and a derivative group thereof, a substituted or unsubstituted C12-C40 diphenylamino and a derivative group thereof, and a substituted or unsubstituted C12-C40 acridityl and a derivative group thereof, and

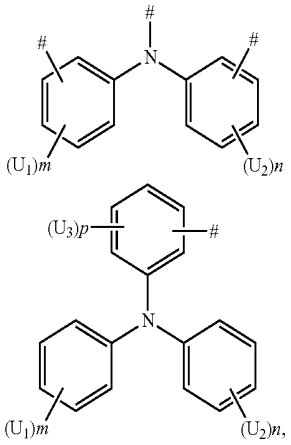
[0029] the electron acceptor A is selected from the group consisting of a nitrogen-containing heterocyclic substituents, cyano-containing substituents, triaryl-boron-derived substituents, and phosphoxy-containing substituents.

[0030] The D-(π)-σ-(π)-A structure of the compound according to the present disclosure also has bipolarity, and the intermediate σ bond can effectively interrupt the intramolecular charge transfer between the electron donor D and the electron acceptor A, so that the excited state is limited to a local excited state in moiety of the electron donor D or the electron acceptor A, and thus the compound has a mall excited-state dipole moment. In this way, the compound, when used as host material of a light-emitting layer of an OLED device, can effectively reduce an efficiency roll-off of a blue light material and enhance the luminous brightness and luminous efficiency.

[0031] The compound according to the present disclosure, which is used as the host material in the electroluminescent device, has a high triplet energy level E_T, a large molecular density, a high glass transition temperature and a high molecular thermal stability, and thus can effectively improve an equilibrium migration of carriers, widen a recombination area of excitons, and effectively improve light extraction efficiency. In this regard, the external quantum efficiency (EQE) and service life of the device are effectively

enhanced. Therefore, the compound according to the present disclosure can be well applied in the electroluminescent device field.

[0032] According to an embodiment of the compound of the present disclosure, the electron donor D is further selected from the following groups:

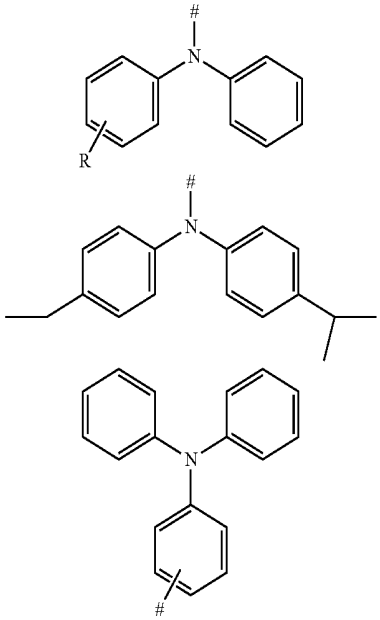


[0033] in which m, n and p are each independently 0, 1, 2, or 3,

[0034] U_1, U_2 and U_3 are each independently selected from the group consisting of hydrogen, a substituted or unsubstituted C1-C30 alkyl, a substituted or unsubstituted silicylene, a substituted or unsubstituted C3-C20 cycloalkyl, a substituted or unsubstituted C1-C30 alkoxy, a substituted or unsubstituted C6-C30 aryl, and a substituted or unsubstituted C10-C30 fused aryl, and

[0035] # represents a bonding position.

[0036] According to an embodiment of the compound of the present disclosure, the electron donor D is further selected from the following groups:



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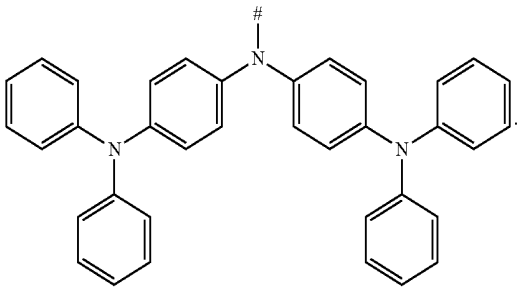
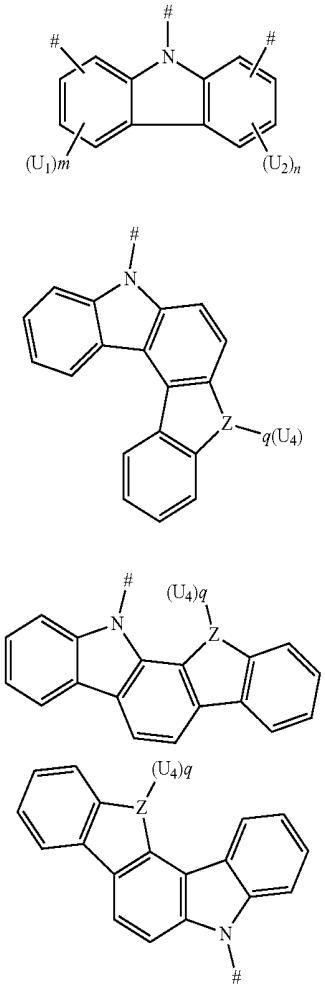


[0037] in which R is selected from the group consisting of hydrogen, a substituted or unsubstituted C1-C20 alkyl, a substituted or unsubstituted silicylene, a substituted or unsubstituted C3-C20 cycloalkyl, a substituted or unsubstituted C1-C20 alkoxy, a substituted or unsubstituted C3-C20 heterocyclic group, a substituted or unsubstituted C6-C40 aryl, a substituted or unsubstituted C10-C30 fused aryl, and a substituted or unsubstituted C4-C40 hetero aryl.

[0038] According to an embodiment of the compound of the present disclosure, the electron donor D is further selected from the following groups:



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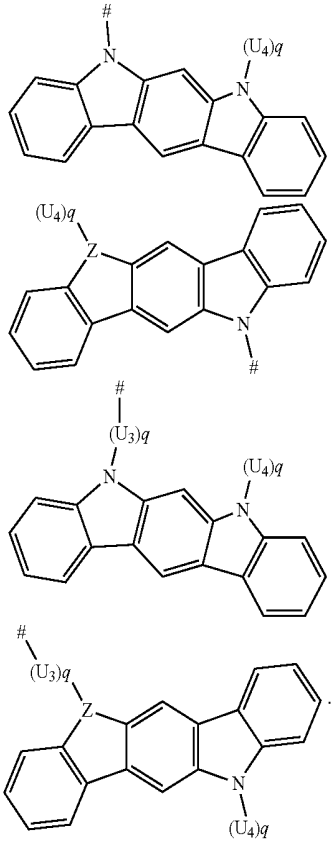


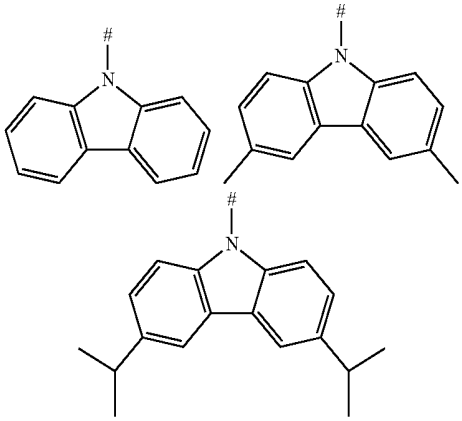
[0039] in which Z is carbon, nitrogen, oxygen, sulfur, or silicon,

[0040] m, n and p are each independently 0, 1, 2, or 3,

[0041] U_2, U_3 and U_4 are each independently selected from the group consisting of hydrogen, a substituted or unsubstituted C1-C30 alkyl, a substituted or unsubstituted silicylene, a substituted or unsubstituted C3-C20 cycloalkyl, a substituted or unsubstituted C1-C30 alkoxy, a substituted or unsubstituted C6-C30 aryl, and a substituted or unsubstituted C10-C30 fused aryl,

[0042] when Z is oxygen or sulfur, q is 0, and # represents a bonding position.

[0043] According to an embodiment of the compound of the present disclosure, the electron donor D is further selected from the following groups:



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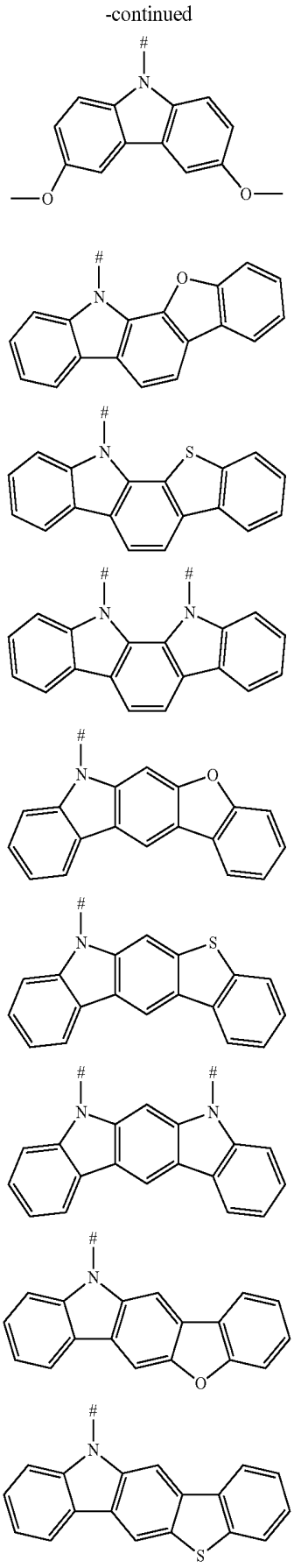

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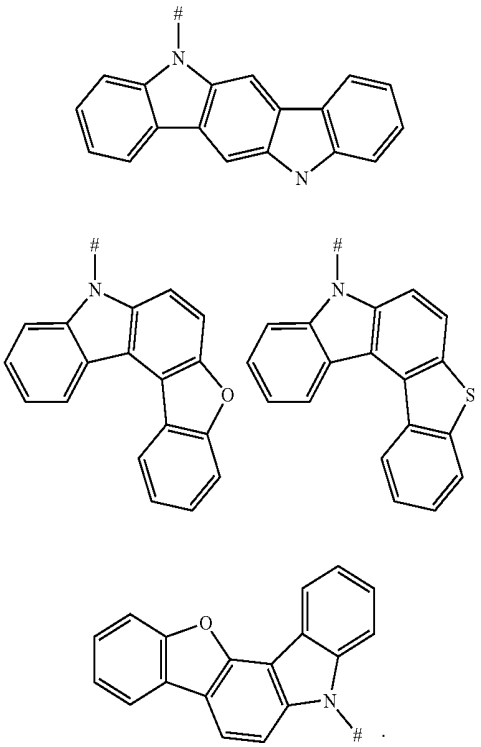
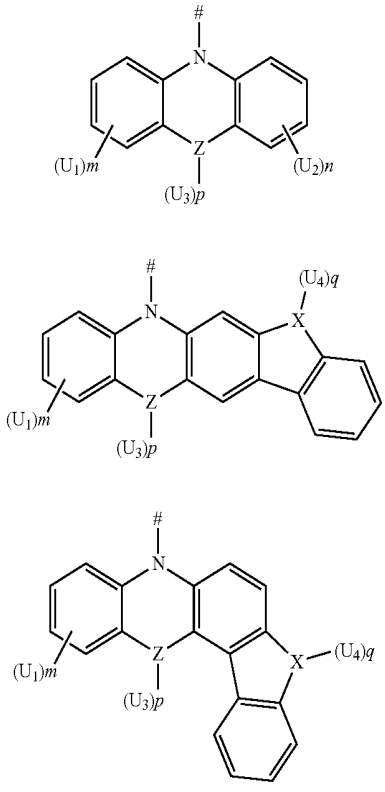


[0044] According to an embodiment of the compound of the present disclosure, the electron donor D is further selected from the following groups:



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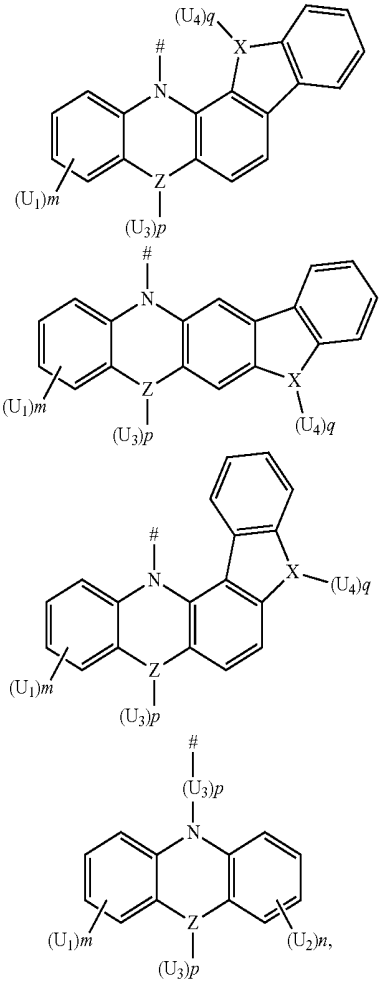


[0045] in which Z is carbon, nitrogen, oxygen, sulfur, or silicon,

[0046] X is carbon, nitrogen, oxygen, or sulfur,

[0047] m, n, p and p are each independently 0, 1, 2, or 3,

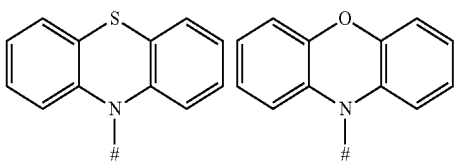
[0048] U_1, U_2, U_3 and U_4 are each independently selected from the group consisting of hydrogen, a substituted or unsubstituted C1-C30 alkyl, a substituted or unsubstituted silicylene, a substituted or unsubstituted C3-C20 cycloalkyl, a substituted or unsubstituted C1-C30 alkoxy, a substituted or unsubstituted C6-C30 aryl, and a substituted or unsubstituted C10-C30 fused aryl,

[0049] when Z is oxygen or sulfur, p is 0,

[0050] when X is oxygen or sulfur, q is 0, and

[0051] # represents a bonding position.

[0052] According to an embodiment of the compound of the present disclosure, the electron donor D is further selected from the following groups:



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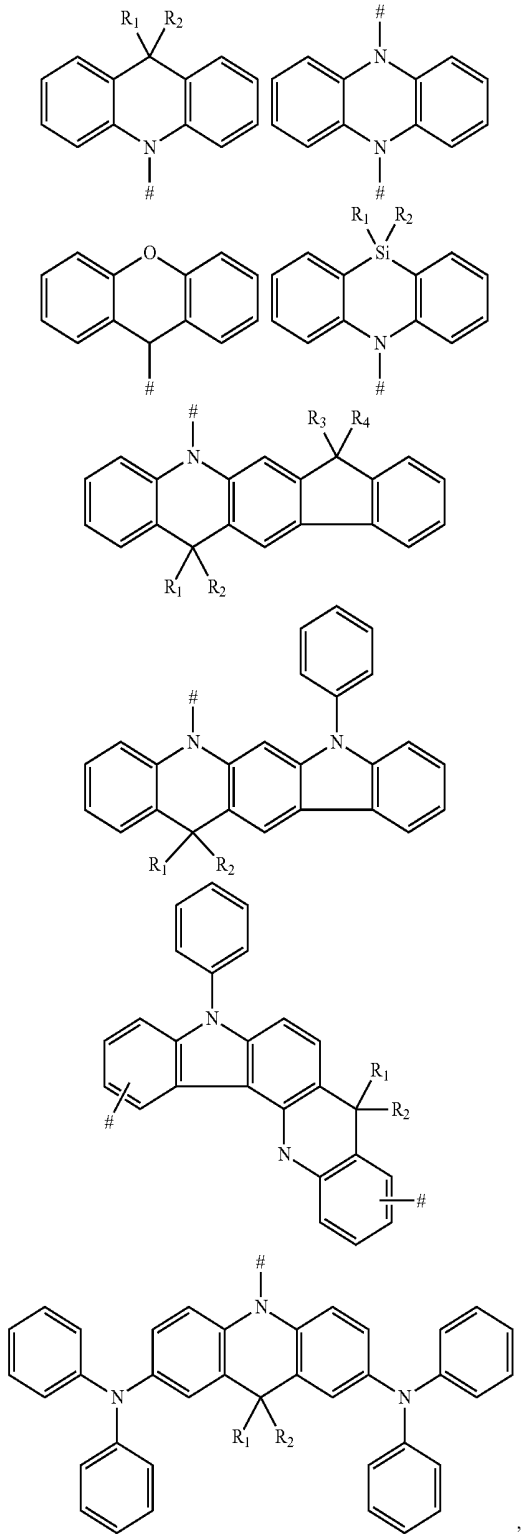
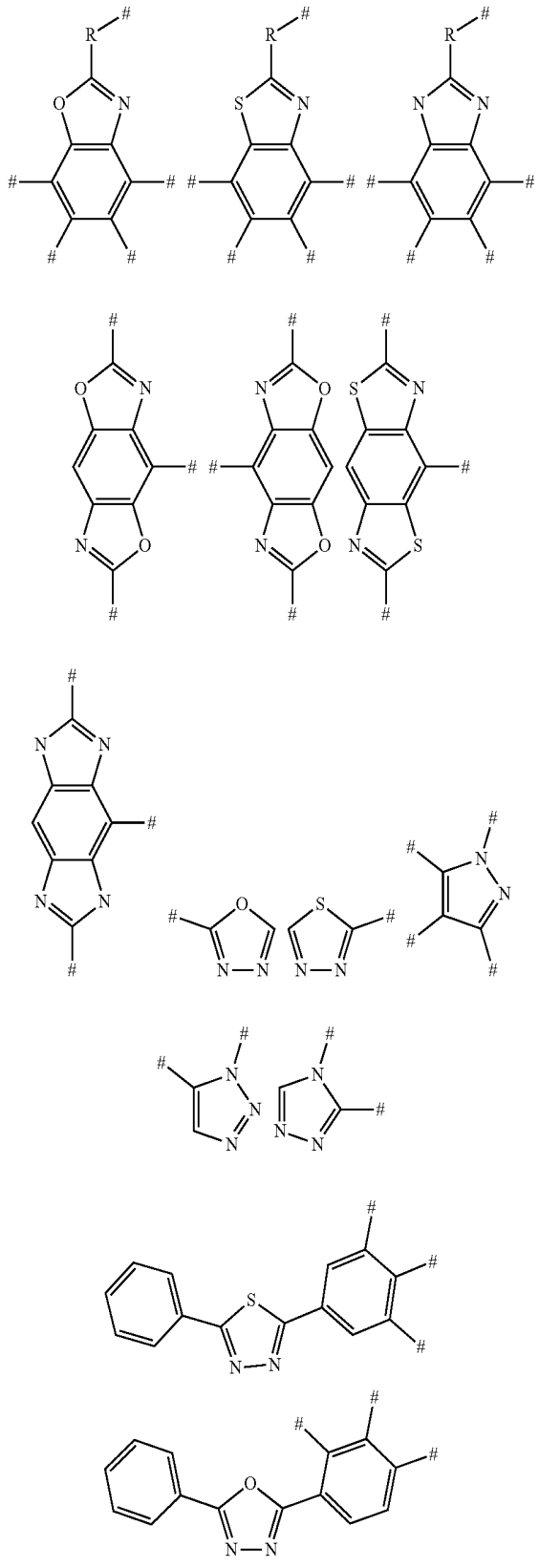


[0053] in which R_1, R_2, R_3 and R_4 are each independently selected from the group consisting of hydrogen, a substituted or unsubstituted C1-C20 alkyl, a substituted or unsubstituted C3-C20 cycloalkyl, a substituted or unsubstituted C1-C20 alkoxy, a substituted or unsubstituted C3-C20 heterocyclic group, a substituted or unsubstituted C6-C40 aryl, and a substituted or unsubstituted C4-C40 heteroaryi.

[0054] According to an embodiment of the compound of the present disclosure, the electron acceptor A is further selected from the following substituents:



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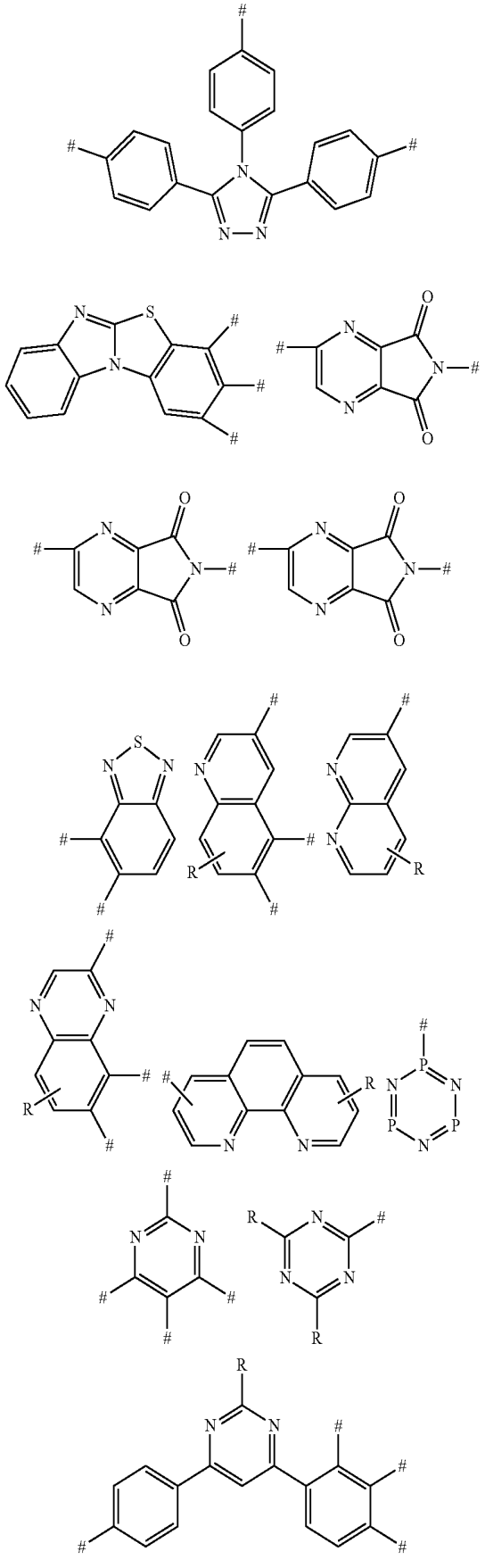

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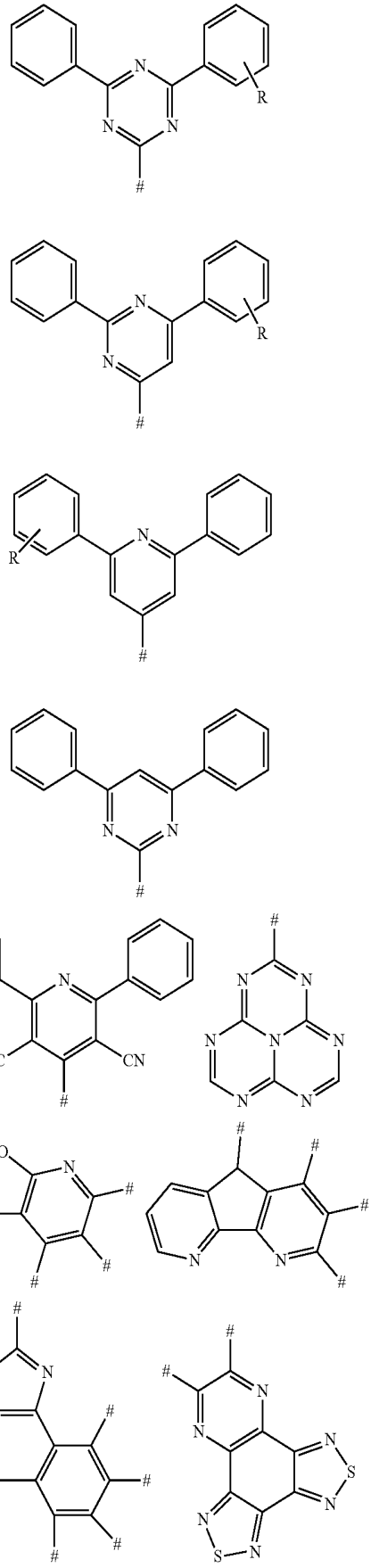

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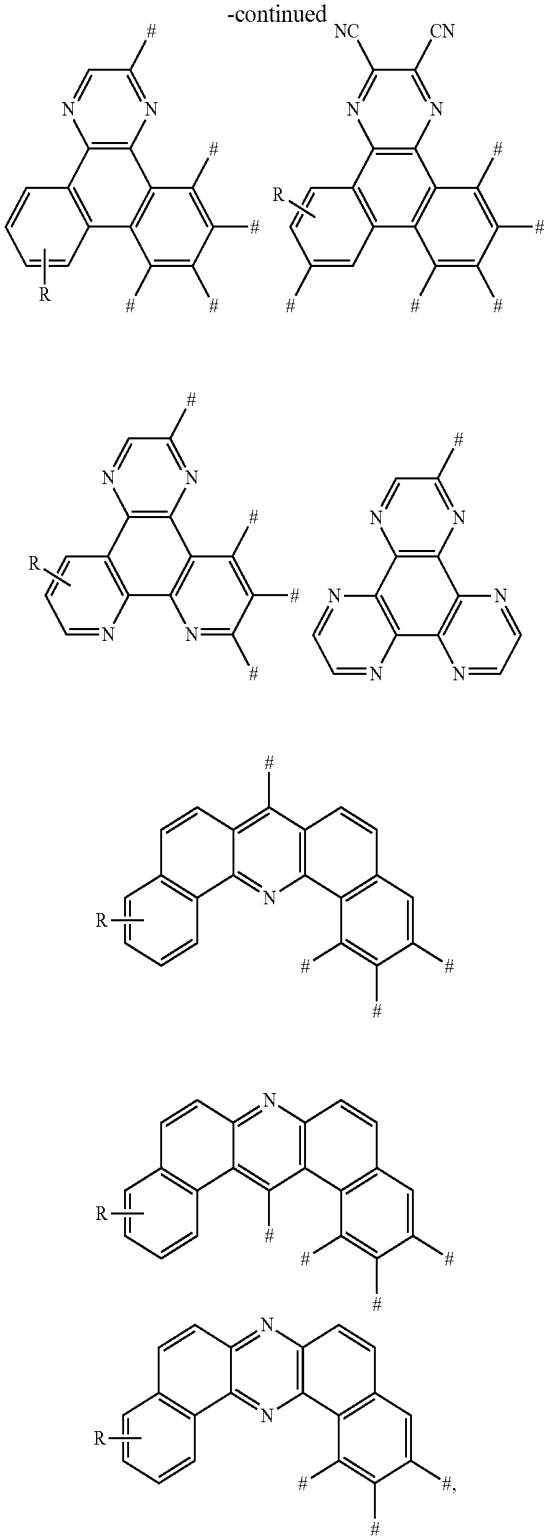
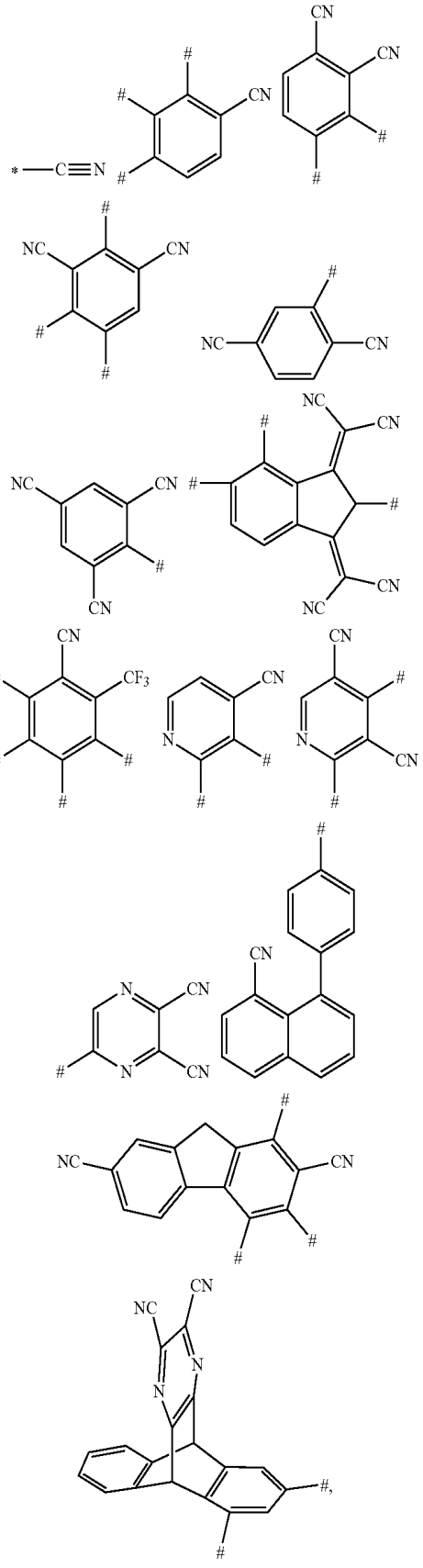




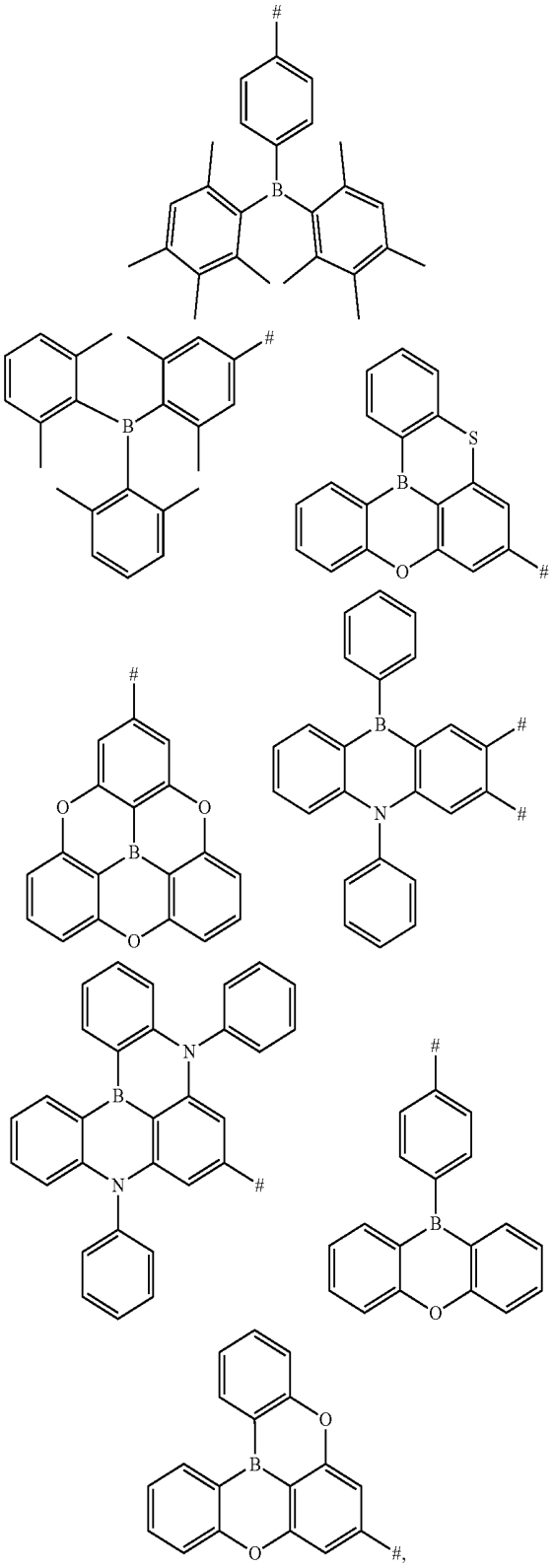
[0055] in which R is hydrogen, a C1-C20 alkyl, a C1-C20 alkoxy, a C4-C8 cycloalkyl, a C6-C40 aryl, or a C4-C40 heteroaryl, and

[0056] # represents a bonding position.

[0057] According to an embodiment of the compound of the present disclosure, the electron acceptor A is further selected from the following substituents:

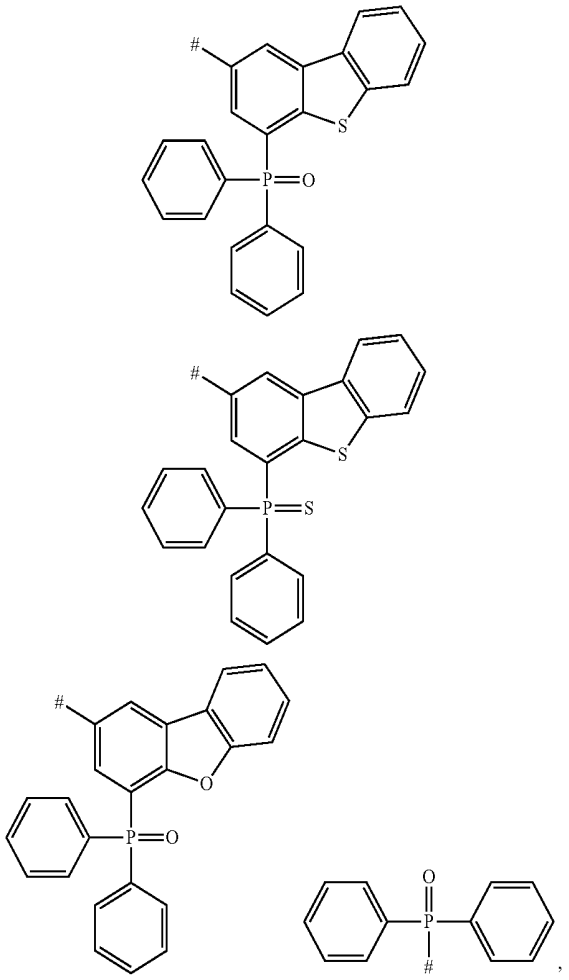
[0058] in which # represents a bonding position.

[0059] According to an embodiment of the compound of the present disclosure, the electron acceptor A is further selected from the following substituents:



[0060] in which # represents a bonding position.

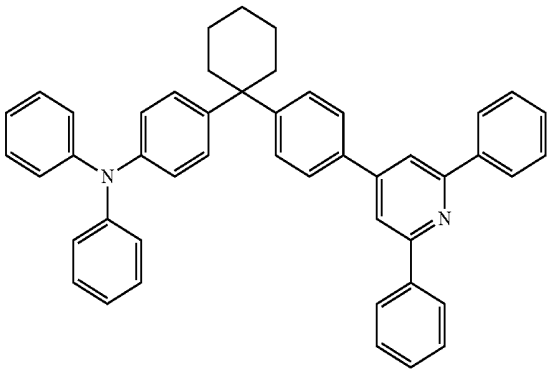
[0061] According to an embodiment of the compound of the present disclosure, the electron acceptor A is further selected from the following substituents:



[0062] in which # represents a bonding position.

[0063] According to an embodiment of the compound of the present disclosure, the compound is further selected from the following compounds:

H001



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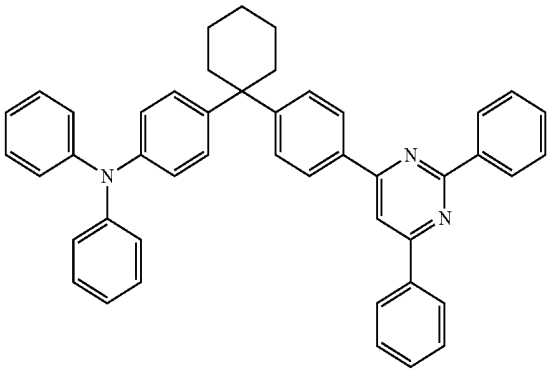
H002



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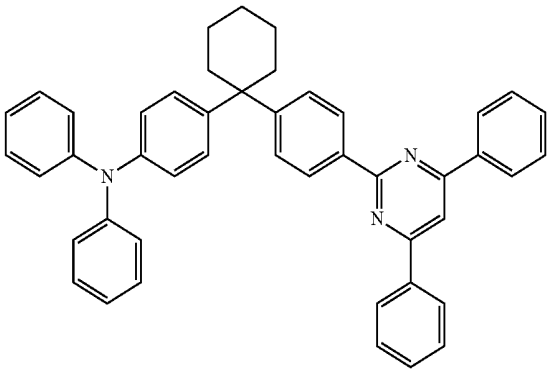

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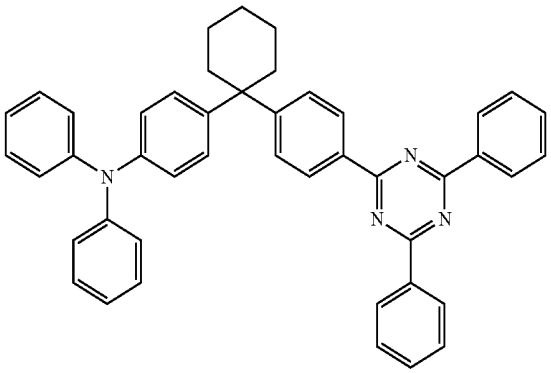

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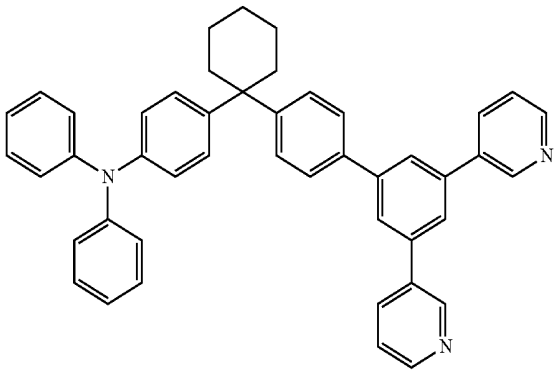

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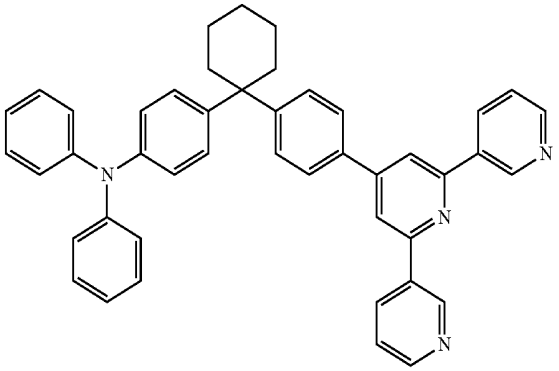

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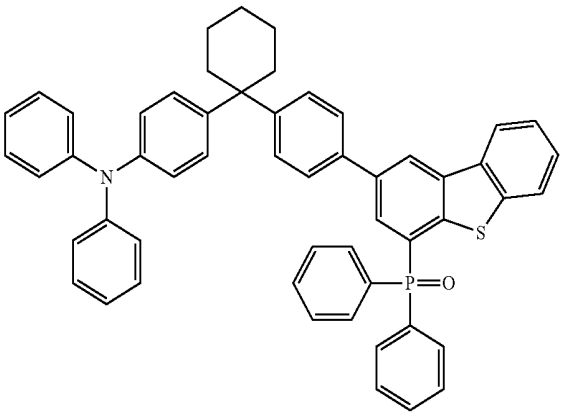

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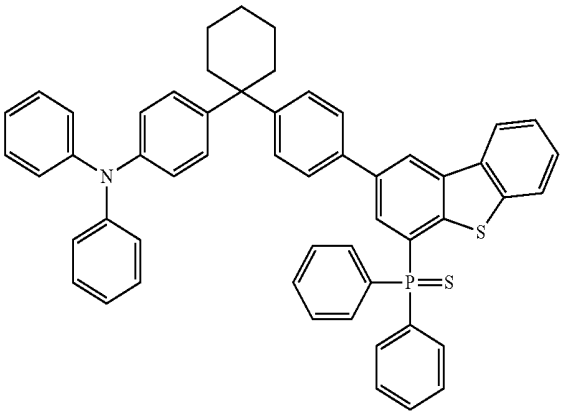

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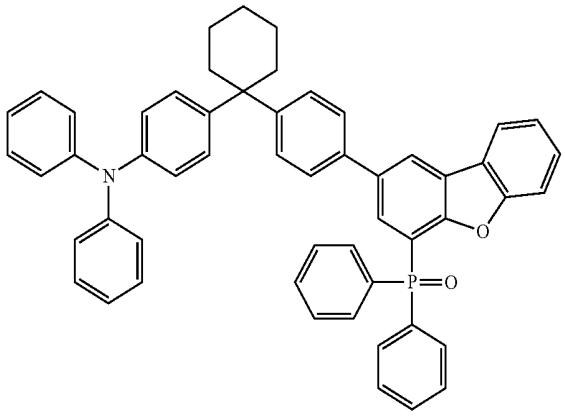

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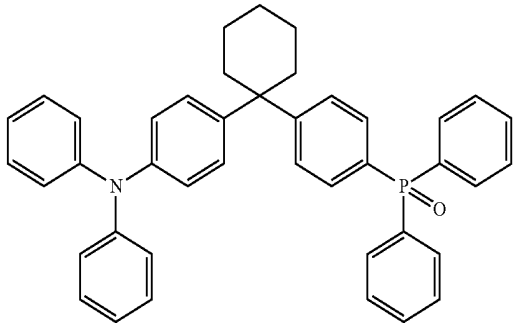

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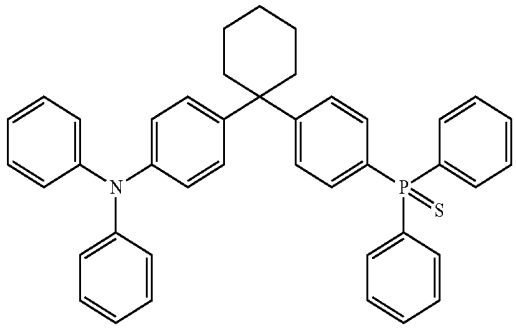

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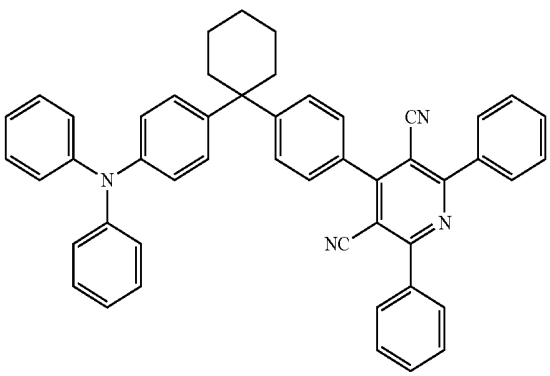

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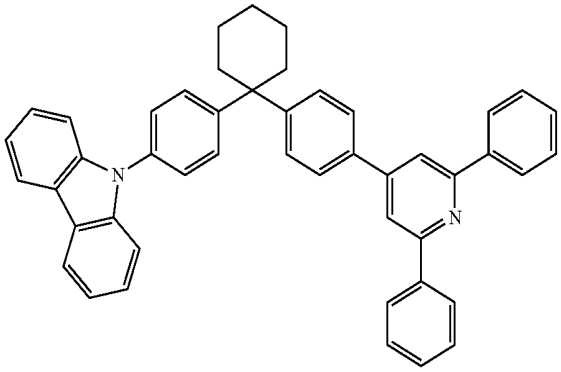

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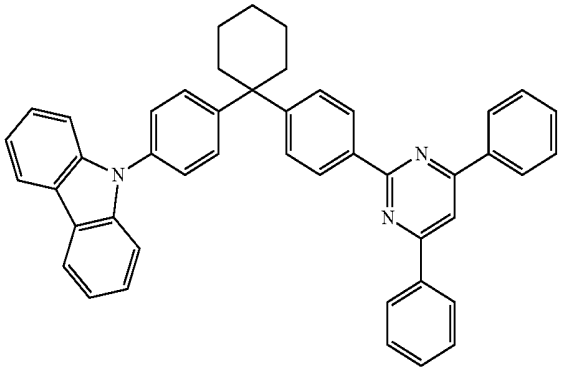

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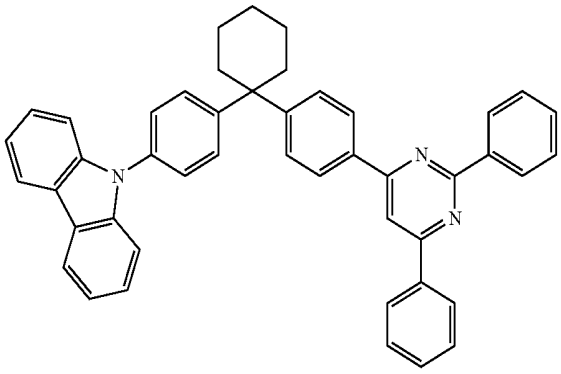

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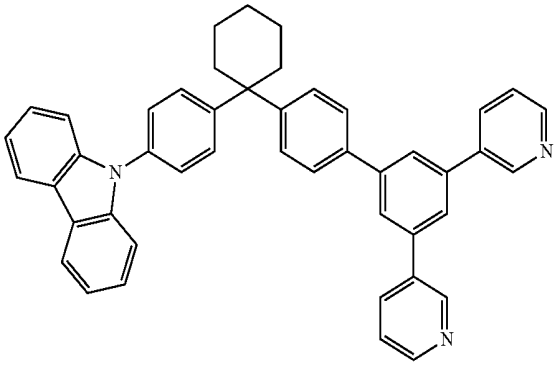

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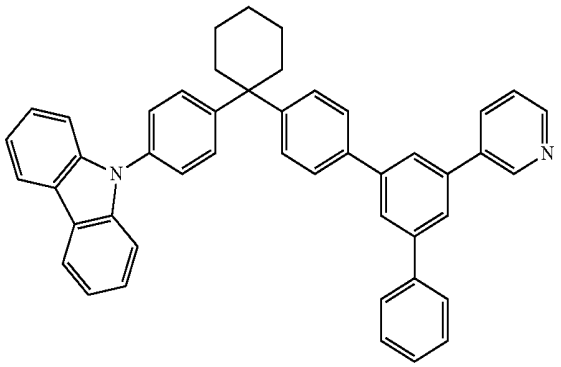

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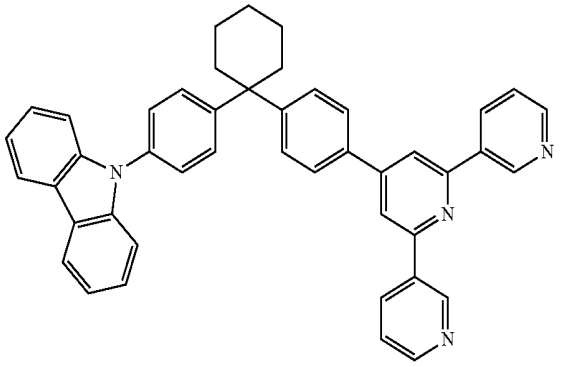

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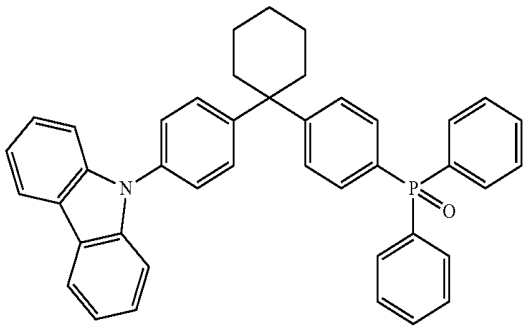

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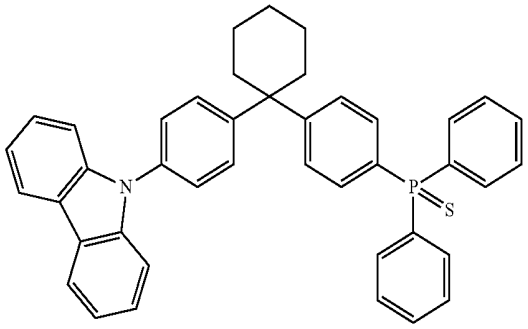

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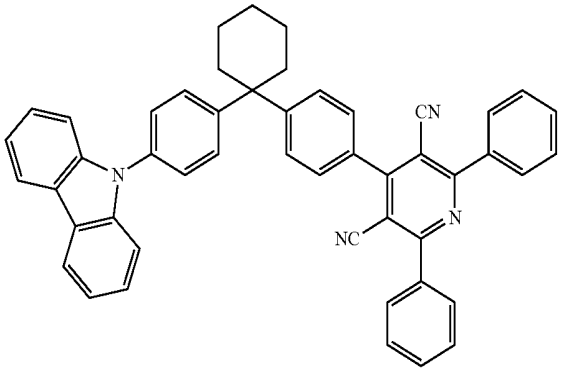

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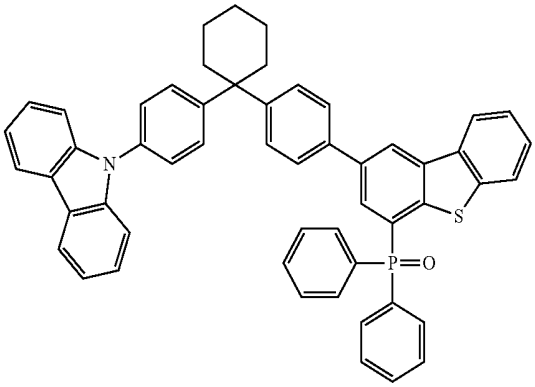

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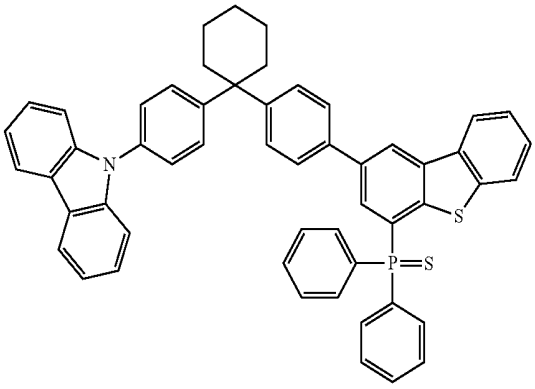

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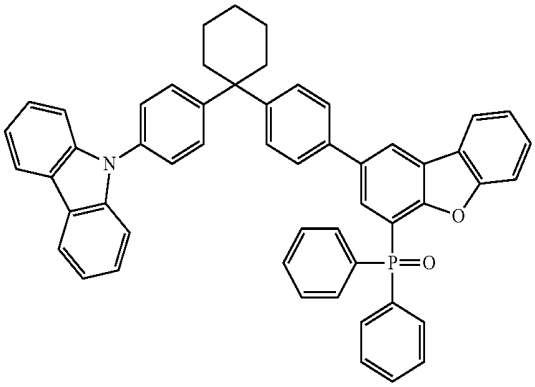

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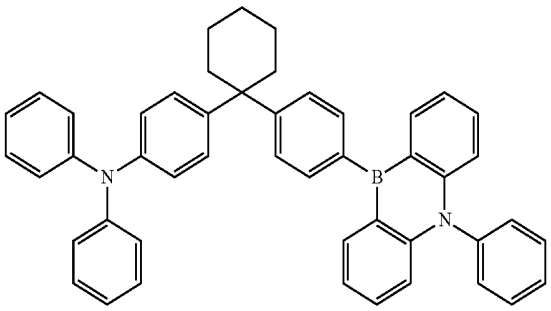

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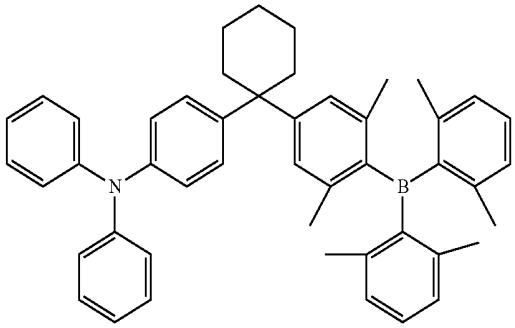

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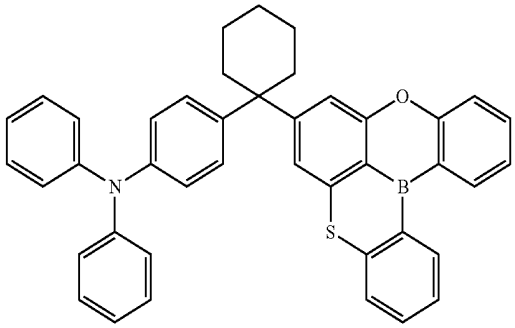

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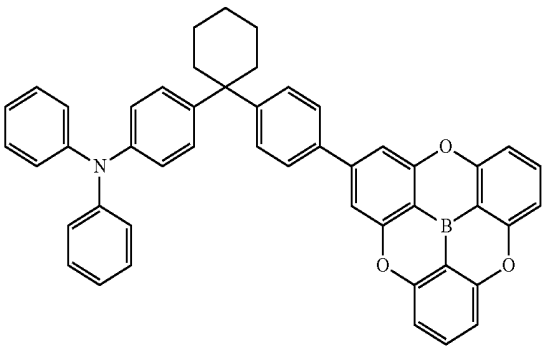

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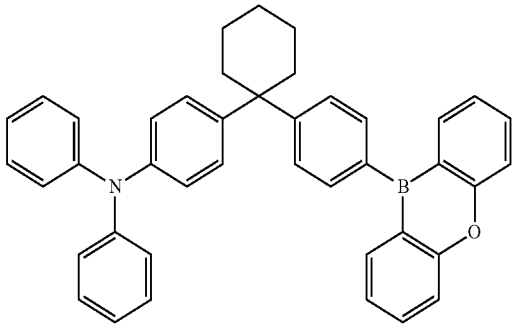

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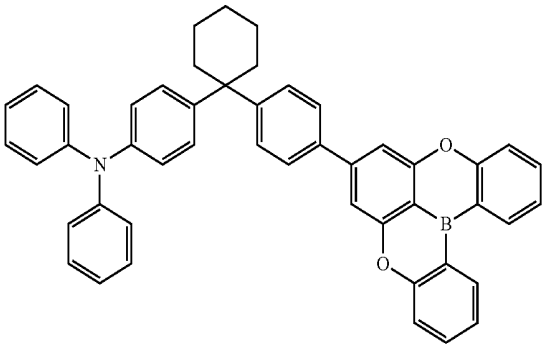

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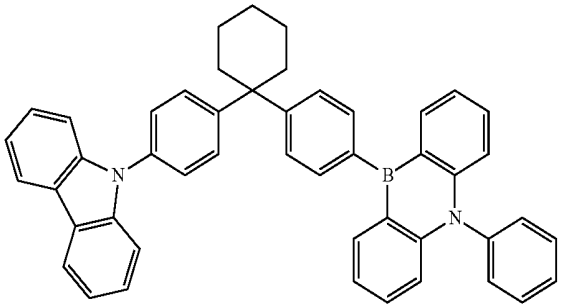

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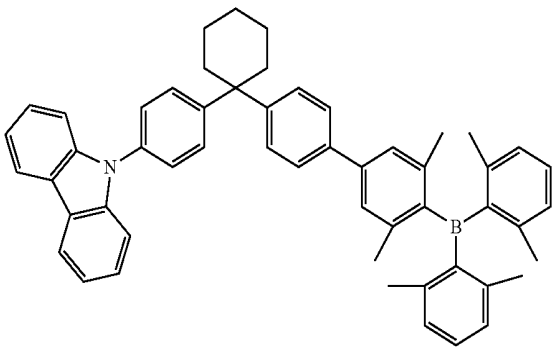

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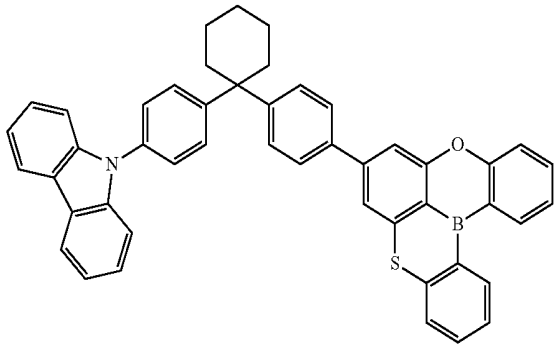

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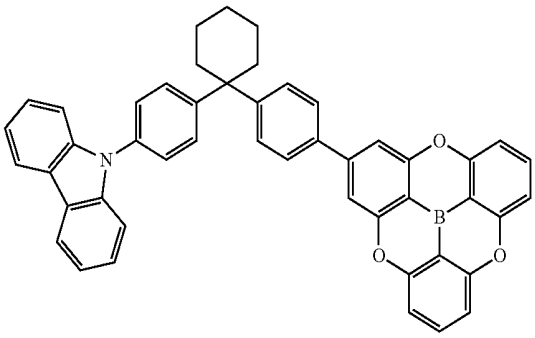

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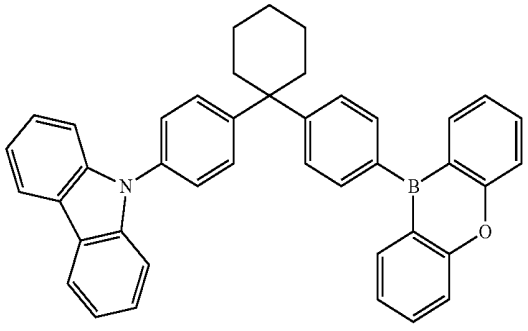

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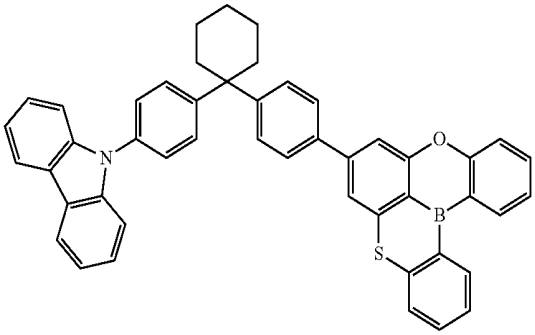

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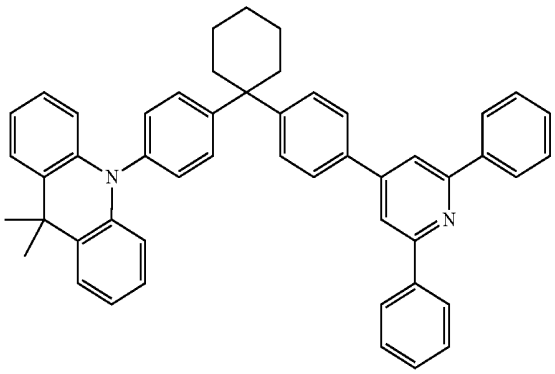

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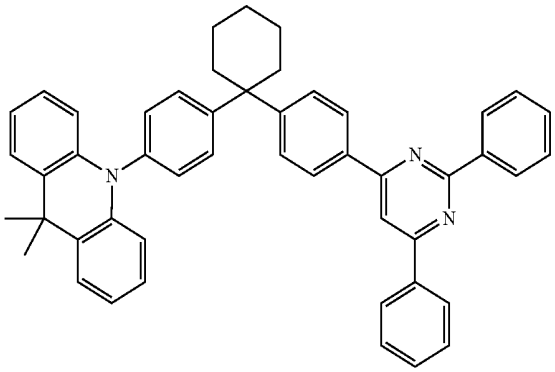

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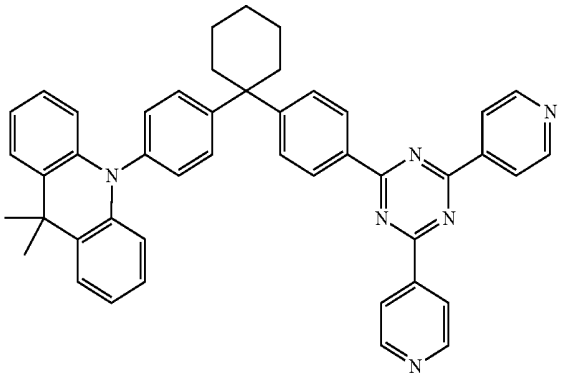

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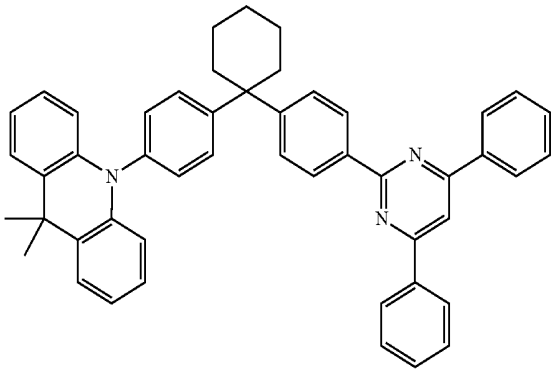

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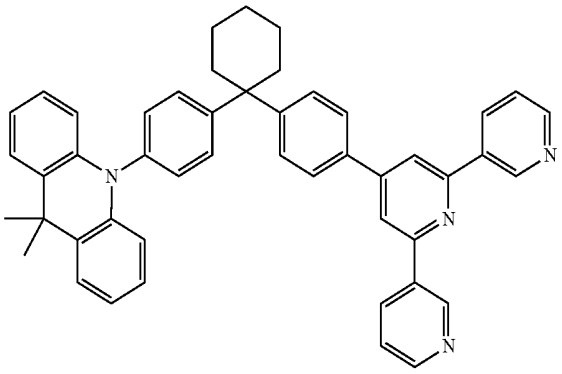

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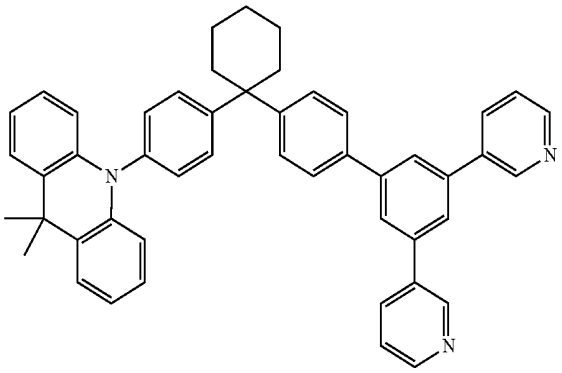

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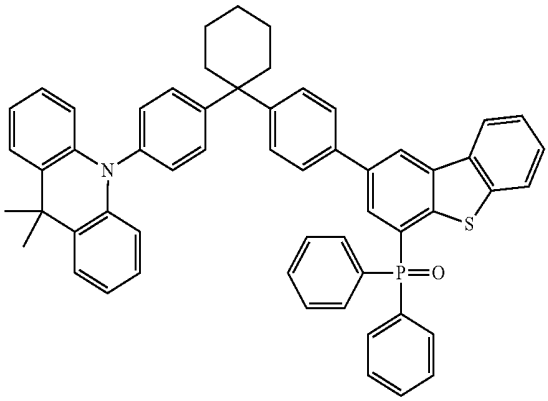

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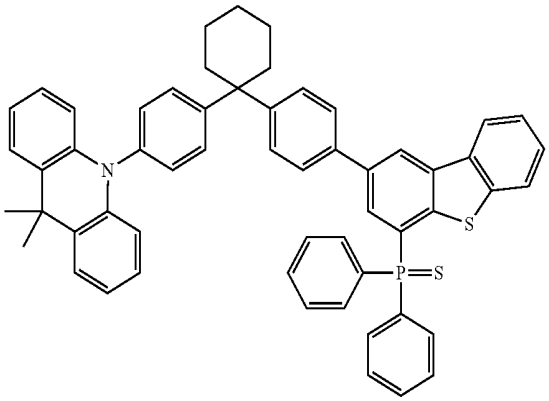

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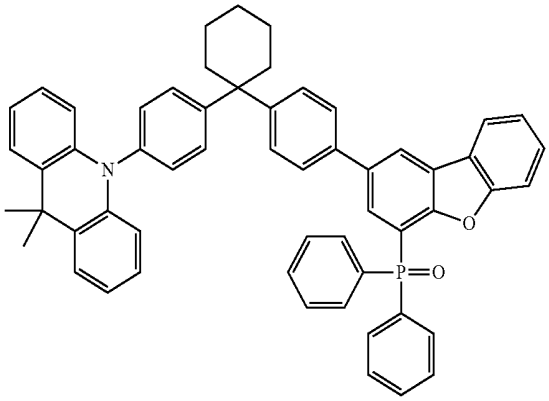

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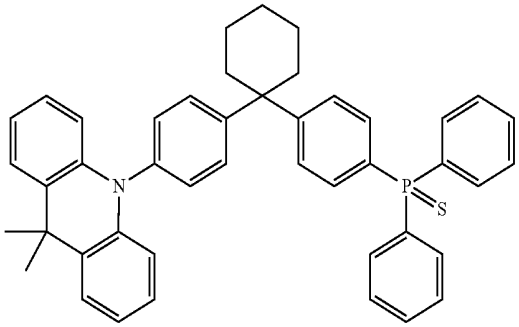

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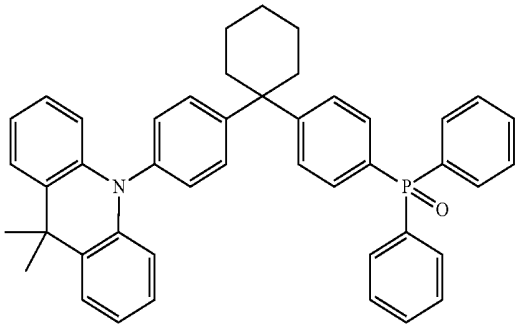

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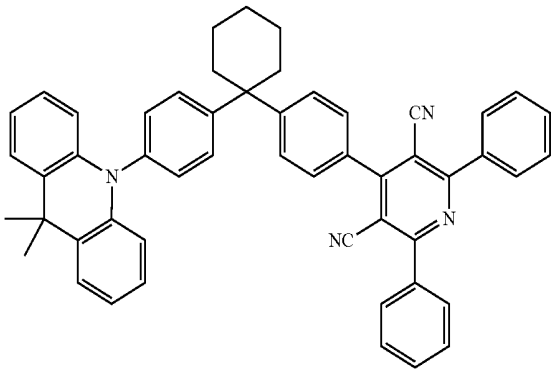

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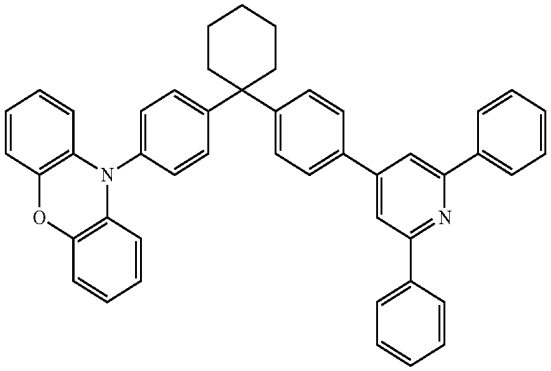

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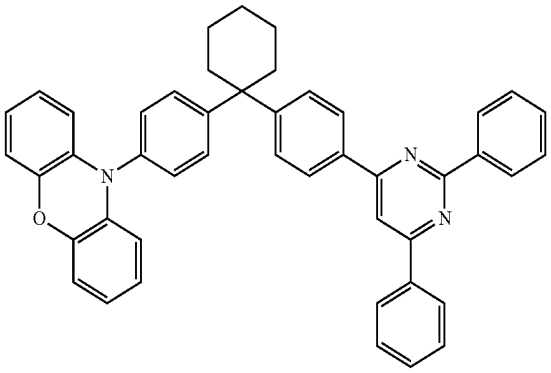

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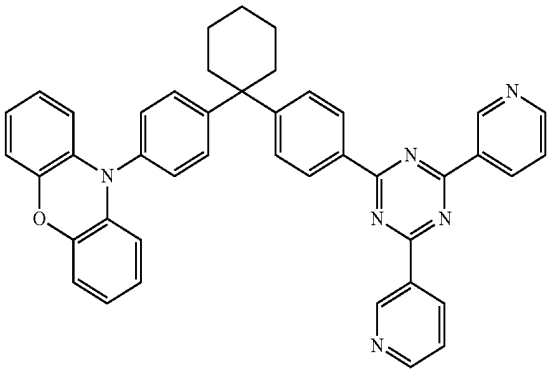

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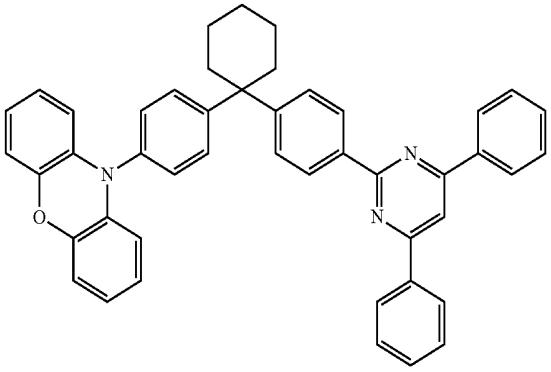

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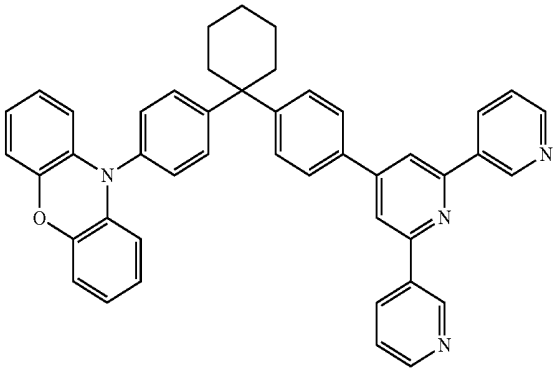

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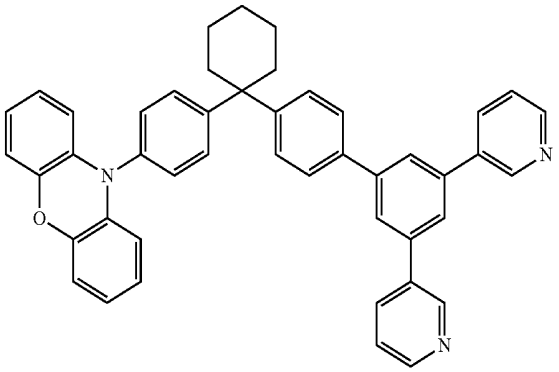

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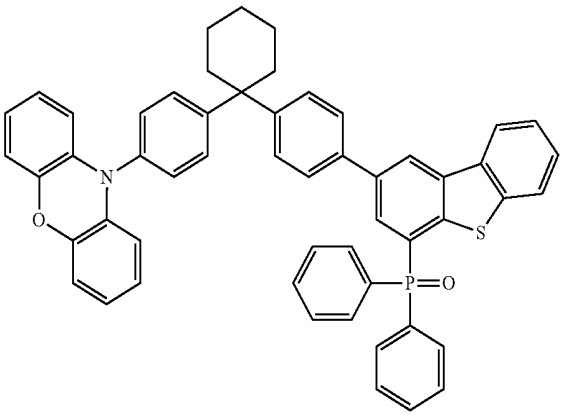

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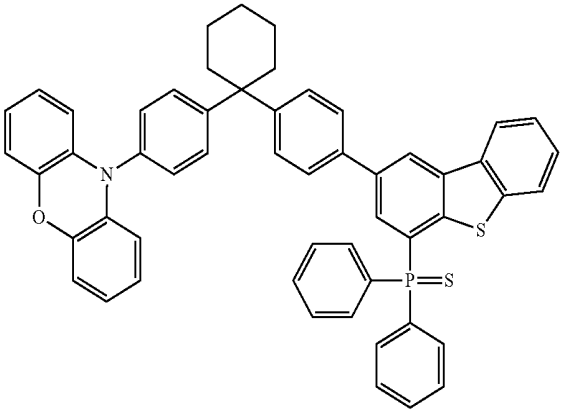

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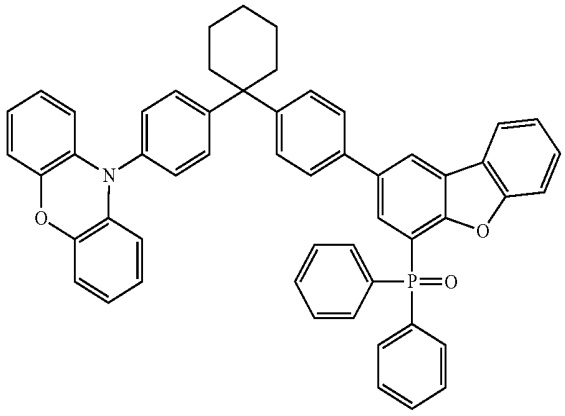

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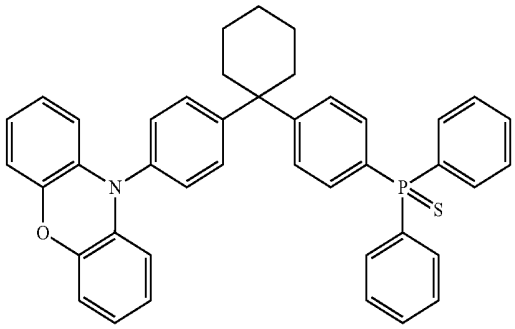

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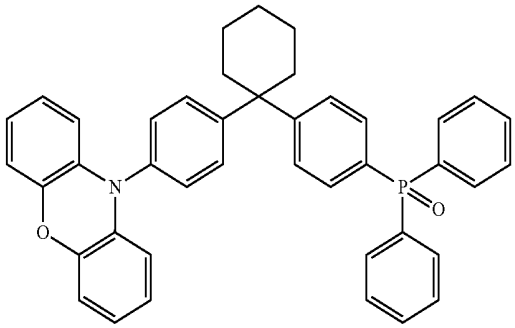

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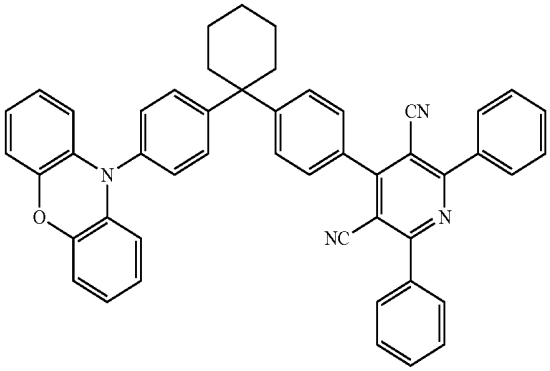

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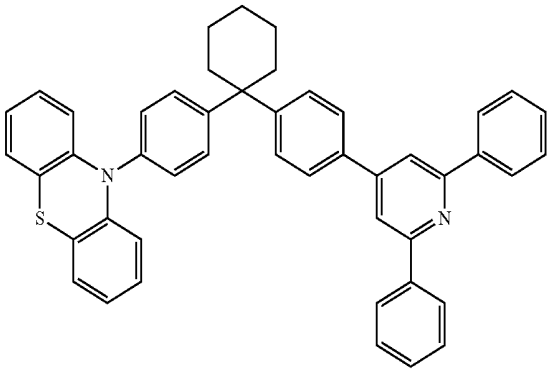

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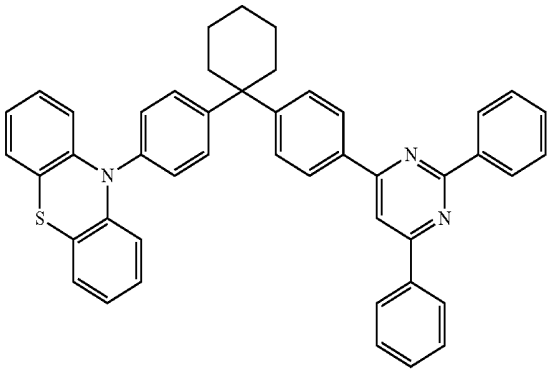

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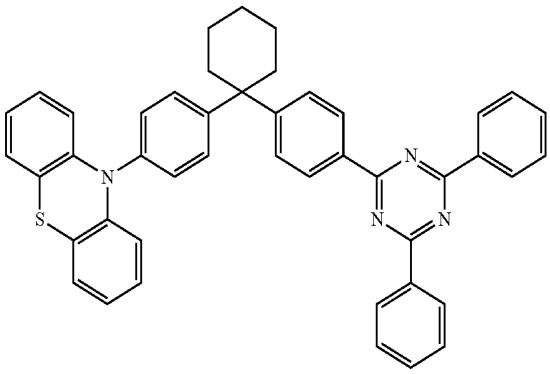

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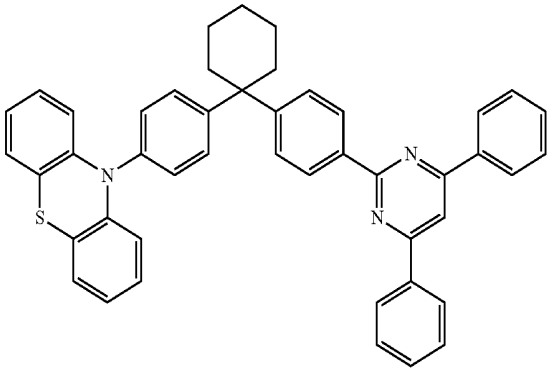

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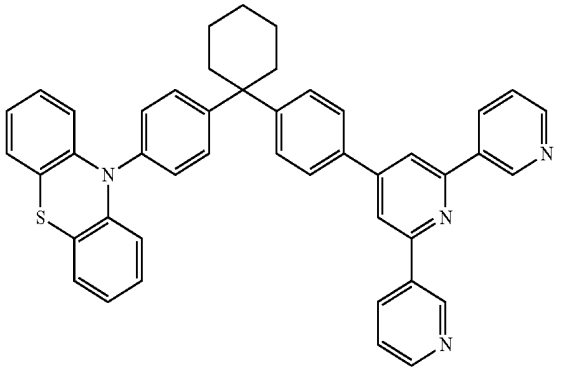

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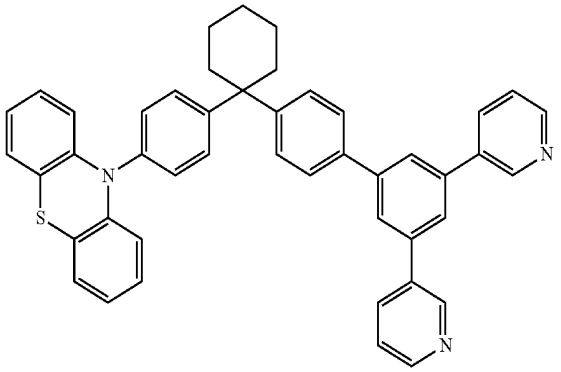

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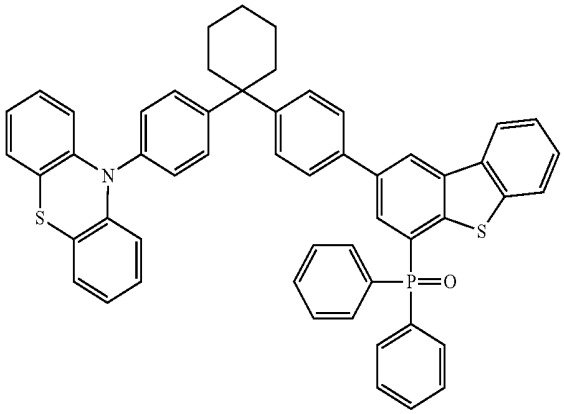

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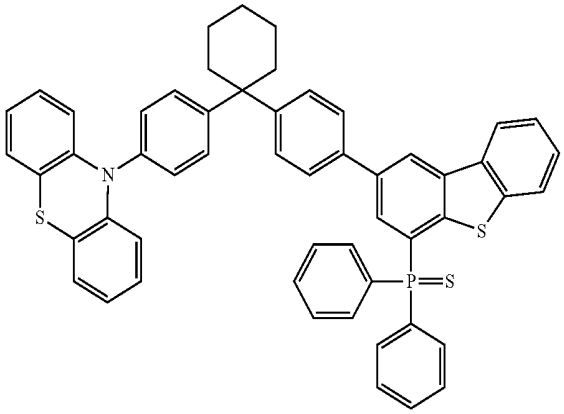

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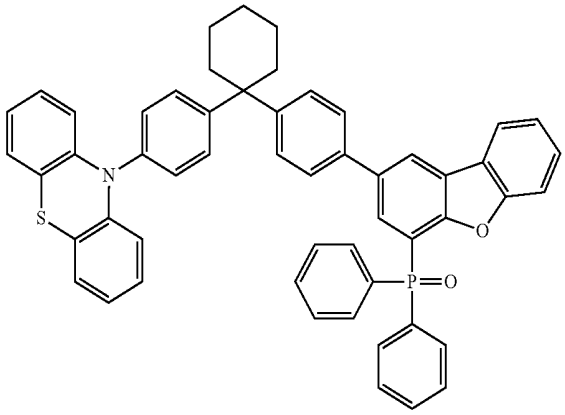

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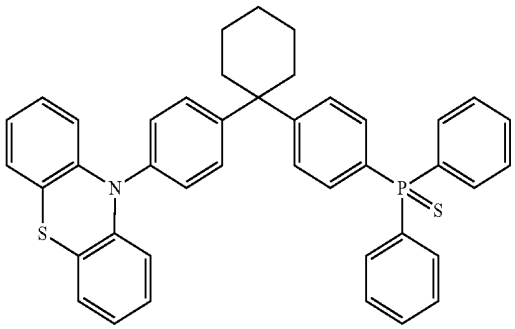

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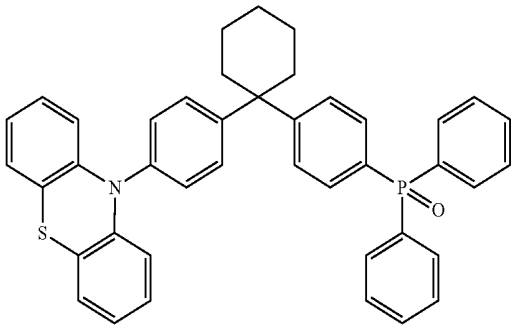

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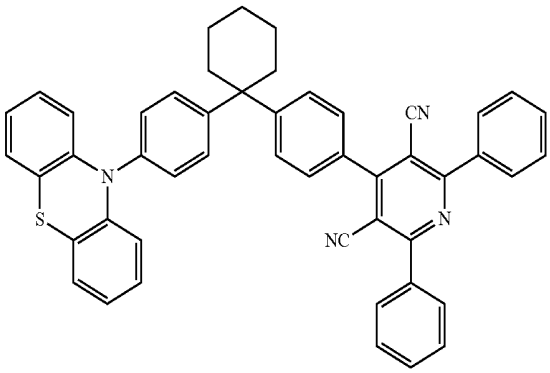

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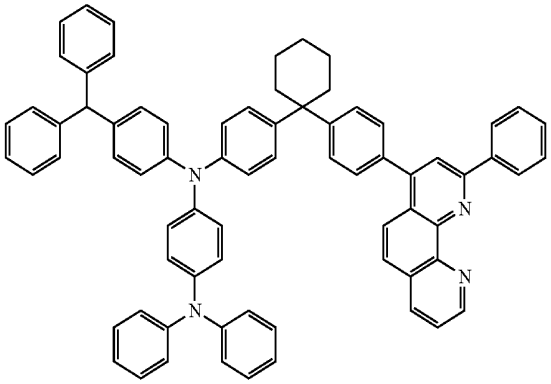

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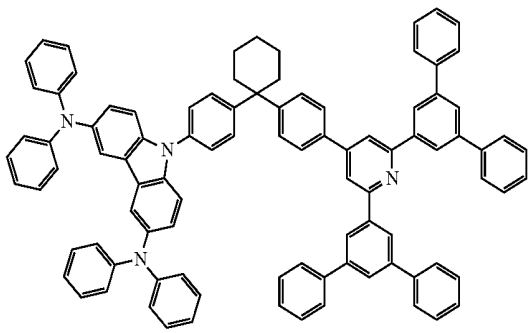

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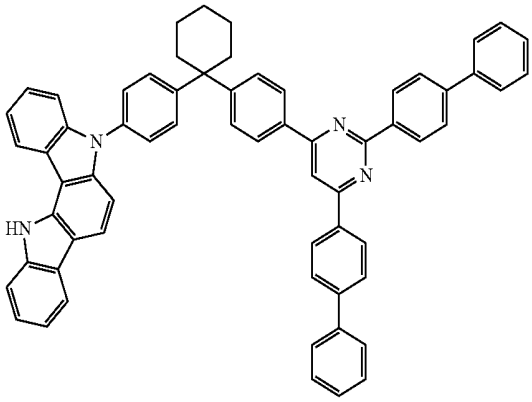

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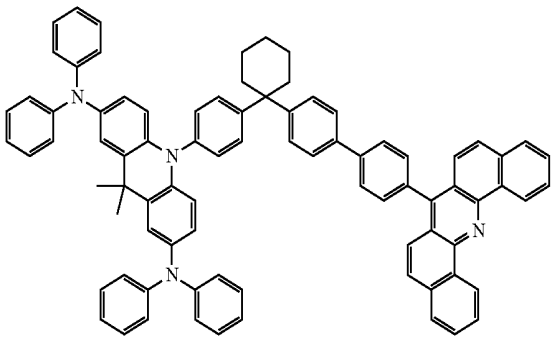

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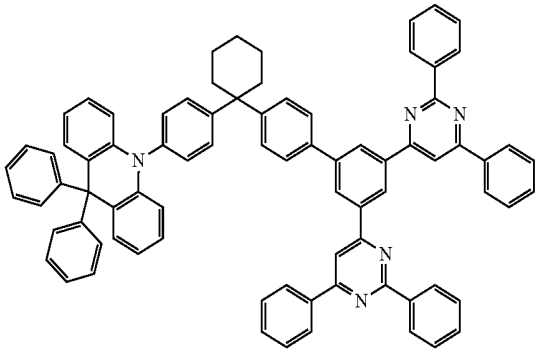

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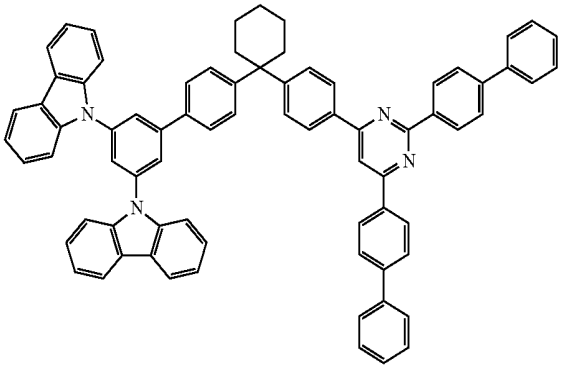

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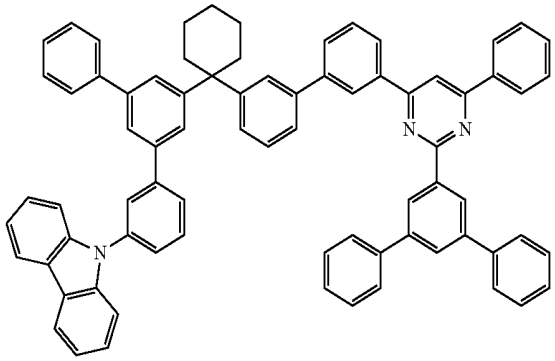

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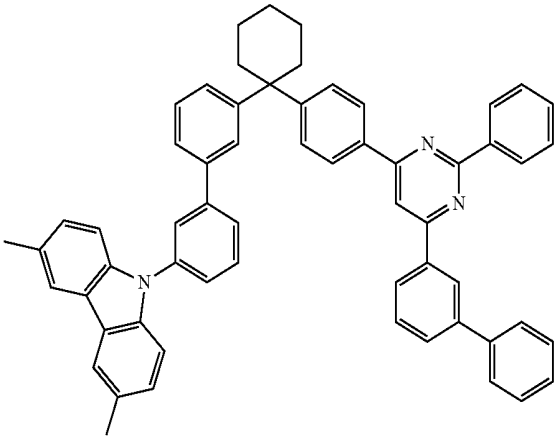

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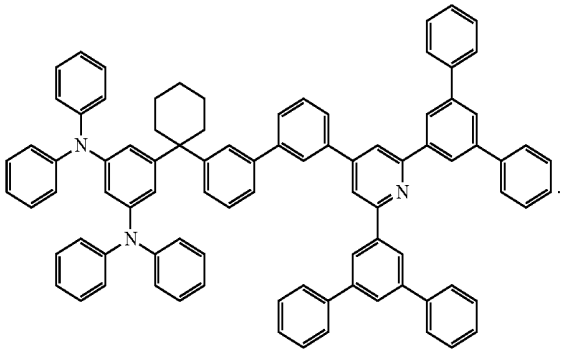
H081



[0064] The present disclosure further provides a display panel including an organic light-emitting device. The organic light-emitting device includes an anode, a cathode disposed oppositely to the anode, a light-emitting layer disposed between the anode and the cathode. The light-emitting layer includes a host material and a guest material. The host material is one or more compounds according to the present disclosure.

[0065] In the display panel according to the present disclosure, the singlet energy level of the host material is higher than the singlet energy level of the guest material, and the energy difference between the singlet energy level of the host material and the singlet energy level of the guest material is less than 0.8 eV. In addition, the triplet energy level of the host material is higher than the triplet energy level of the guest material, and an energy difference between the triplet energy level of the host material and the triplet energy level of the guest material is less than 0.4 eV.

[0066] In the display panel according to the present disclosure, when the host material of the light-emitting layer is a red-light-emitting material, the triplet energy level of the red-light-emitting material has energy greater than or equal to 2.2 eV.

[0067] In the display panel according to the present disclosure, when the host material of the light-emitting layer is a green-light-emitting material, the triplet energy level of the green-light-emitting material has energy greater than or equal to 2.5 eV.

[0068] In the display panel according to the present disclosure, when the host material of the light-emitting layer is a blue-light-emitting material, the triplet energy level of the blue-light-emitting material has energy greater than or equal to 2.7 eV.

[0069] According to an embodiment of the display panel of the present disclosure, the organic light-emitting device further includes one or more of a hole injection layer, a hole transmission layer, an electron blocking layer, a hole blocking layer, an electron transmission layer, and an electron injection layer.

[0070] According to an embodiment of the display panel of the present disclosure, the display panel includes an organic light-emitting device. The organic light-emitting device includes an anode, a cathode disposed oppositely to the anode, a capping layer disposed on a side of the cathode facing away from the anode, and an organic layer disposed between the anode and the cathode. The organic layer includes an electron transmission layer, a hole transmission layer, and a light-emitting layer. At least one of the capping layer, the electron transmission layer, the hole transmission layer, and the light-emitting layer is made of the compound according to the present disclosure.

[0071] In the display panel provided by the present disclosure, the anode of the organic light-emitting device can be made of a material selected from a group consisting of metals, such as copper, gold, silver, iron, chromium, nickel, manganese, palladium, platinum, etc., and alloys thereof; metal oxides, such as indium oxide, zinc oxide, indium tin oxide (ITO), indium zinc oxide (IZO), and the like; and conductive polymers, such as polyaniline, polypyrrole, poly (3-methylthiophene) and the like. In addition to the above-mentioned anode materials and the combinations thereof that are conductive to injecting holes, the anode also can be made of other suitable material known in the related art.

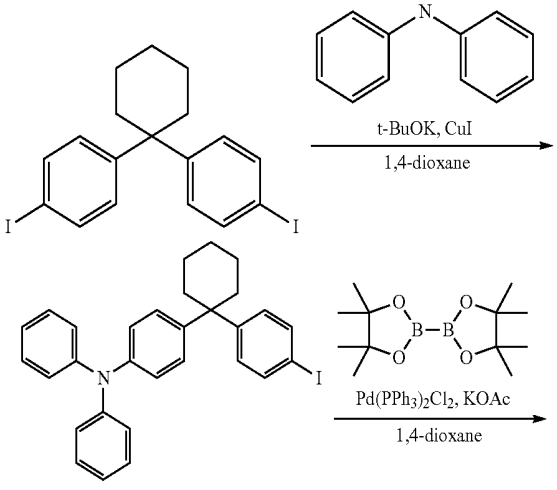
[0072] In the display panel provided by the present disclosure, the cathode of the organic light-emitting device can be made of a material selected from metals, such as aluminum, magnesium, silver, indium, tin, titanium, etc., and alloys thereof; and multi-layered metal materials, such as LiF/Al, LiO_2/Al, BaF_2/Al, and the like. In addition to the above-mentioned cathode materials and the combinations thereof that are conductive to injecting electrons, the cathode also can be made of other suitable material known in the related art.

[0073] According to an embodiment of the present disclosure, the organic light-emitting device of the display panel can be manufactured by forming an anode on a transparent or opaque smooth substrate, forming a thin organic layer on the anode, and further forming a cathode on the thin organic layer. The thin organic layer can be formed by a known film forming method such as vapor deposition, sputtering, spin coating, dipping, ion plating, and the like. Finally, an organic optical capping layer CPL (covering layer) was formed on the cathode. The optical capping layer CPL can be made of the compound according to the present disclosure. The optical capping layer CPL can be prepared by vapor deposition or solution processing method. The solution processing method include ink jet printing, spin coating, knife coating, screen printing, roll-to-roll printing, and the like.

[0074] The synthesis of several exemplary compounds is described below.

EXAMPLE 1

[0075] Synthesis of Compound H004



H004-1

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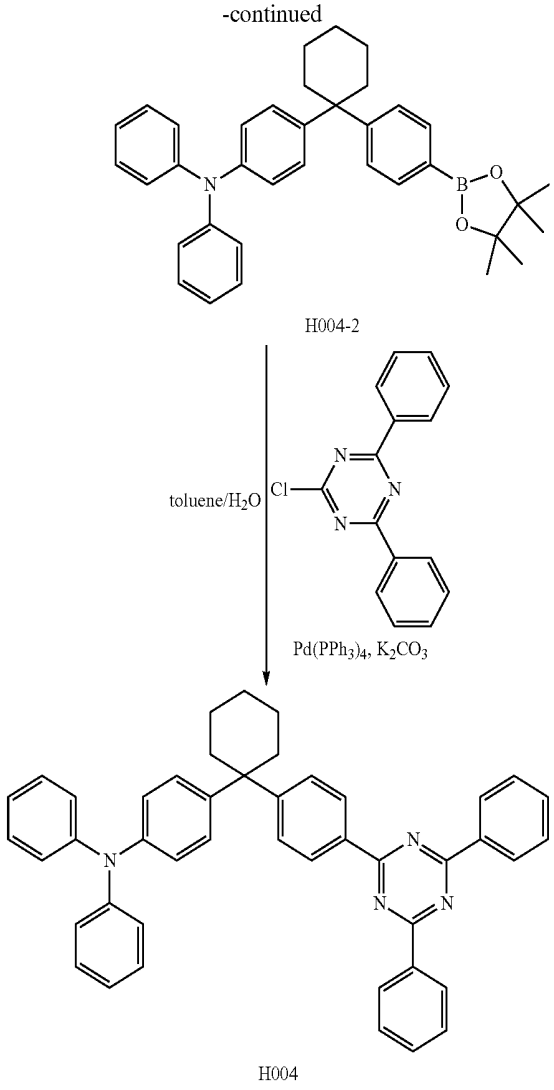


[0076] 1,1-bis(4-iodophenyl)cyclohexane (15 mmol), copper iodide (15 mmol), potassium tert-butoxide (65 mmol), 1,2-diamino cyclohexane (12 mmol) and diarylamine (25 mmol) were added to dry 1,4-dioxane (400 mL) in a round bottom flask (250 mL), and the mixture was refluxed under nitrogen atmosphere for 48 hours. The obtained intermediate was cooled to room temperature, added to water, and then filtered through a diatomite pad. The filtrate was extracted with dichloromethane, then washed with water and dried over anhydrous magnesium sulfate. A crude product was obtained after filtration and evaporation, and then purified by silica gel column chromatography to yield an intermediate product H004-1.

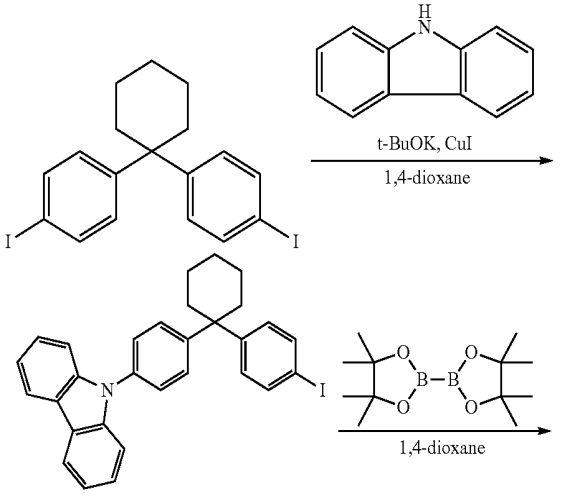
[0077] The intermediate product H004-1 (15 mmol) and potassium acetate (40 mmol) were mixed with dry 1,4-dioxane (60 mL), $Pd(PPh_3)_2Cl_2$ (0.4 mmol) and bis(pinacolato)diboron (25 mmol) in a round bottom flask (250 mL). The mixture was stirred at 90° C. for 48 hours under nitrogen atmosphere. The obtained intermediate was cooled to room temperature, added to water, and then filtered through a diatomite pad. The filtrate was extracted with dichloromethane, then washed with water and dried over anhydrous magnesium sulfate. A crude product was obtained after filtration and evaporation, and then purified by silica gel column chromatography to yield an intermediate product H004-2.

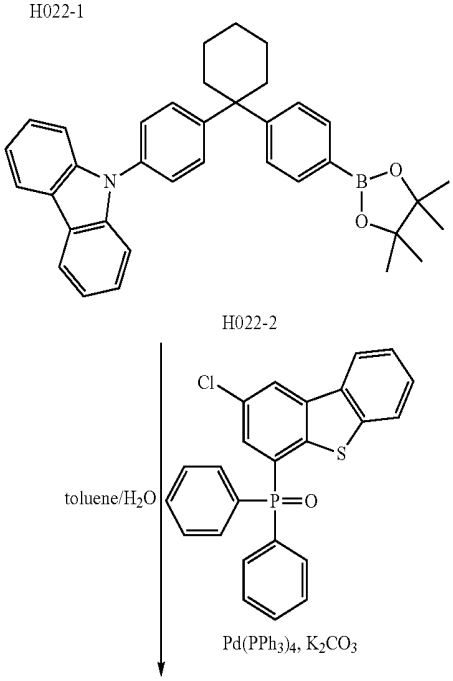
[0078] The intermediate product H004-2 (10 mmol), 2-chloro-4,6-diphenyl-triazine (12 mmol) and $Pd(PPh_3)_4$ (0.3 mmol) were added to a mixture of toluene (30 mL)/ethanol (20 mL) and an aqueous solution (10 mL) of potassium carbonate (12 mmol) in a round bottom flask (250 mL). The obtained mixture was refluxed for 12 hours under nitrogen atmosphere, added to water after being cooled to room temperature, and then filtered through a diatomite pad. The filtrate was extracted with dichloromethane, then washed with water and dried over anhydrous magnesium sulfate. A crude product was obtained after filtration and evaporation, and then purified by silica gel column chromatography to yield a final product H004.

[0079] Elemental analysis of the Compound H004 (molecular formula $C_{45}H_{38}N_4$): theoretical values: C, 85.14; H, 6.03; N, 8.83; tested values: C, 85.14; H, 6.02; N, 8.84. Liquid chromatography-mass spectrometry ESI-MS (m/z) (M+): theoretical value: 634.31; tested value: 634.51.

EXAMPLE 2

[0080] Synthesis of Compound H022





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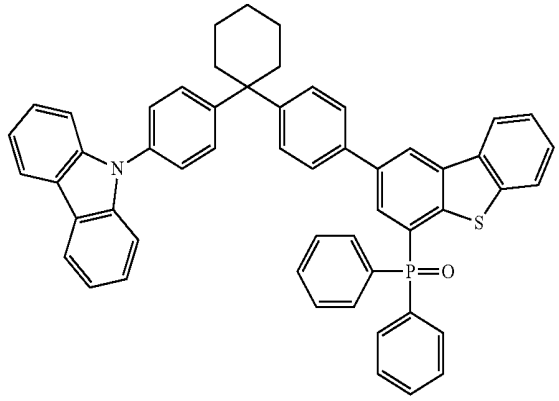


H022

[0081] 1,1-bis(4-iodophenyl)cyclohexane (15 mmol), copper iodide (15 mmol), potassium tert-butoxide (65 mmol), 1,2-diamino cyclohexane (12 mmol) and 9-carbazole (25 mmol) were added to dry 1,4-dioxane (400 mL) in a round bottom flask (250 mL), and the mixture was refluxed under nitrogen atmosphere for 48 hours. The obtained intermediate was cooled to room temperature, added to water, and then filtered through a diatomite pad. The filtrate was extracted with dichloromethane, then washed with water and dried over anhydrous magnesium sulfate. A crude product was obtained after filtration and evaporation, and then purified by silica gel column chromatography to yield an intermediate product H022-1.

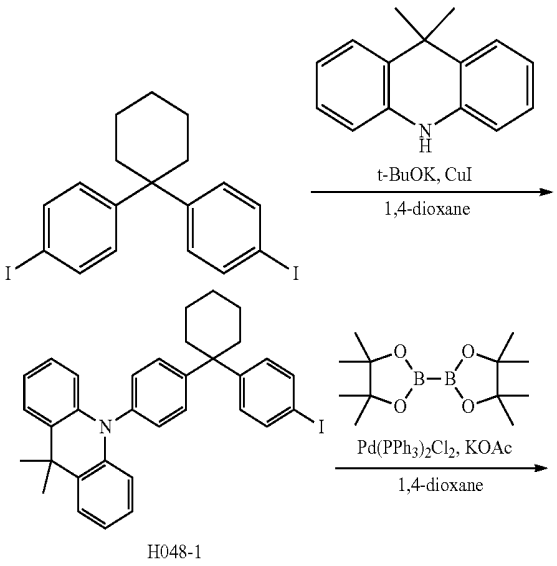
[0082] The intermediate product H022-1 (15 mmol) and potassium acetate (40 mmol) were mixed with dry 1,4-dioxane (60 mL), $Pd(PPh_3)_2Cl_2$ (0.4 mmol) and bis(pinacolato)diboron (25 mmol) in a round bottom flask (250 mL). The mixture was stirred at 90° C. for 48 hours under nitrogen atmosphere. The obtained intermediate was cooled to room temperature, added to water, and then filtered through a diatomite pad. The filtrate was extracted with dichloromethane, then washed with water and dried over anhydrous magnesium sulfate. A crude product was obtained after filtration and evaporation, and then purified by silica gel column chromatography to yield an intermediate product H022-2.

[0083] The intermediate product H022-2 (10 mmol), 2-chloro-4-(diphenylphosphono)-dibenzothiophene (12 mmol) and $Pd(PPh_3)_4$ (0.3 mmol) were added to a mixture of toluene (30 mL)/ethanol (20 mL) and an aqueous solution (10 mL) of potassium carbonate (12 mmol) in the round bottom flask (250 mL). The obtained mixture was refluxed for 12 hours under nitrogen atmosphere, added to water after being cooled to room temperature, and then filtered through a diatomite pad. The filtrate was extracted with dichloromethane, then washed with water and dried over anhydrous magnesium sulfate. A crude product was obtained after filtration and evaporation, and then purified by silica gel column chromatography to yield a final product H022.

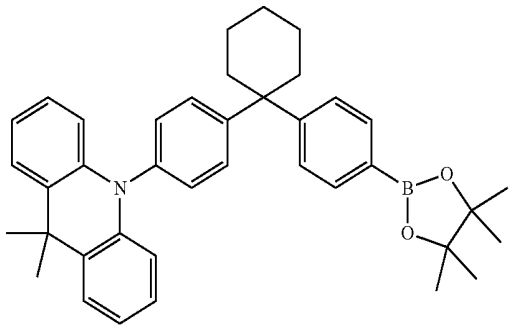
[0084] Elemental analysis of the Compound H022 (molecular formula $C_{54}H_{42}NOPS$): theoretical values: C, 82.73; H, 5.40; N, L79; O, 2.04; P, 3.95; S, 4.09; tested values: C, 82.73; H, 5.41; N, 1.78; O, 2.04; P, 3.95; S, 4.09. Liquid chromatography-mass spectrometry ESI-MS (m/z) (M+): theoretical value: 783.27; tested value: 783.86.

EXAMPLE 3

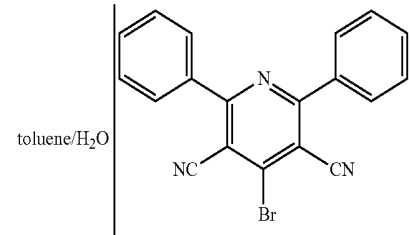
[0085] Synthesis of Compound H048

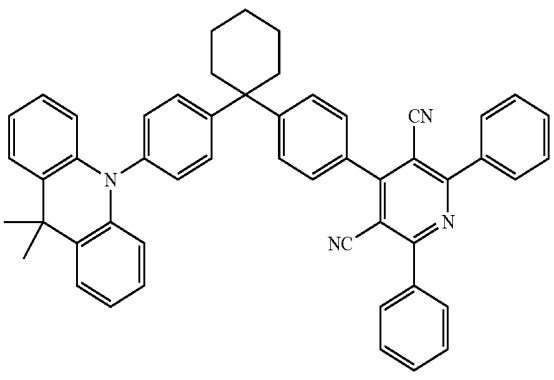


H048-1



H048-2





H048

[0086] 1,1-bis(4-iodophenyl)cyclohexane (15 mmol), copper iodide (15 mmol), potassium tert-butoxide (65 mmol), 1,2-diamino cyclohexane (12 mmol) and 9,9-dimethyl acridine (25 mmol) were added to dry 1,4-dioxane (400 mL) in a round bottom flask (250 mL), and the mixture was refluxed under nitrogen atmosphere for 48 hours. The obtained intermediate was cooled to room temperature, added to water, and then filtered through a diatomite pad. The filtrate was extracted with dichloromethane, then washed with water and dried over anhydrous magnesium sulfate. A crude product was obtained after filtration and evaporation, and then purified by silica gel column chromatography to yield an intermediate product H048-1.

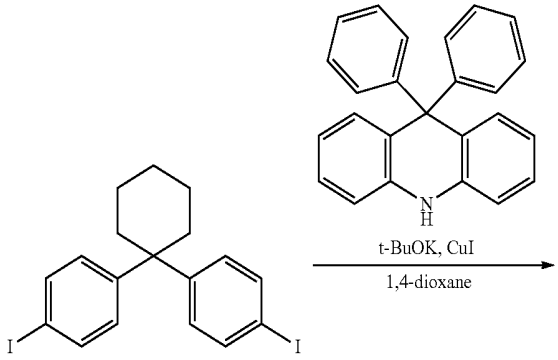
[0087] The intermediate product H048-1 (15 mmol) and potassium acetate (40 mmol) were mixed with dry 1,4-dioxane (60 mL), $Pd(PPh_3)_2Cl_2$ (0.4 mmol) and bis(pinacolato)diboron (25 mmol) in the round bottom flask (250 mL). The mixture was stirred at 90° C. for 48 hours under nitrogen atmosphere. The obtained intermediate was cooled to room temperature, added to water, and then filtered through a diatomite pad. The filtrate was extracted with dichloromethane, then washed with water and dried over anhydrous magnesium sulfate. A crude product was obtained after filtration and evaporation, and then purified by silica gel column chromatography to yield an intermediate product H048-2.

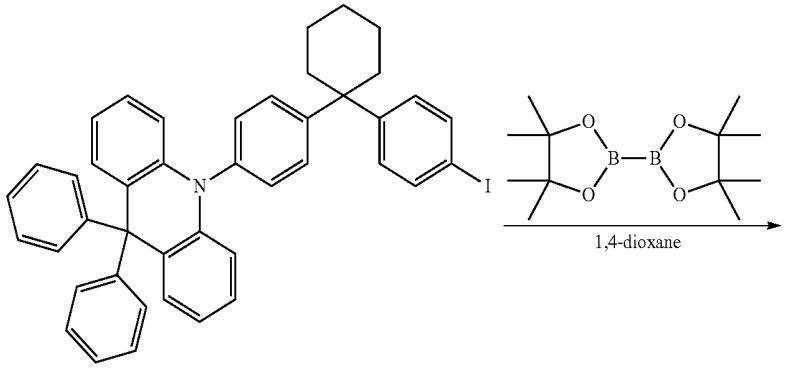
[0088] The intermediate product H048-2 (10 mmol), 4-bromo-2,6-diphenylpyridine-3,5-dicarbonitrile (12 mmol) and $Pd(PPh_3)_4$ (0.3 mmol) were added to a mixture of toluene (30 mL)/ethanol (20 mL) and an aqueous solution (10 mL) of potassium carbonate (12 mmol) in a round bottom flask (250 mL). The obtained mixture was refluxed for 12 hours under nitrogen atmosphere, added to water after being cooled to room temperature, and then filtered through a diatomite pad. The filtrate was extracted with dichloromethane, then washed with water and dried over anhydrous magnesium sulfate. A crude product was obtained after filtration and evaporation, and then purified by silica gel column chromatography to yield a final product H048.

[0089] Elemental analysis of the Compound H048 (molecular formula $C_{52}H_{42}N_4$): theoretical values: C, 86.39; H, 5.86; N, 7.75; tested values: C 86.39; H, 5.87; N, 7.74. Liquid chromatography-mass spectrometry ESI-MS (m/z) (M+): theoretical value: 722.34; tested values: 722.67.

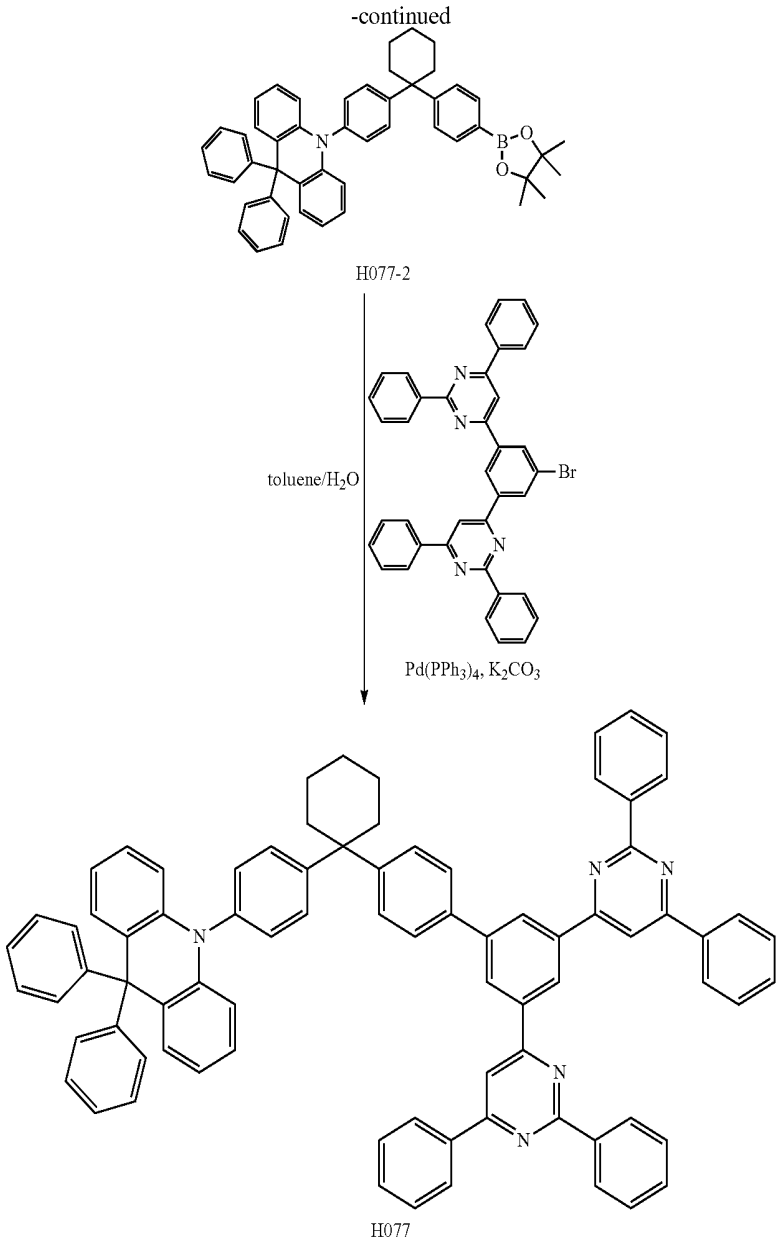
EXAMPLE 4

[0090] Synthesis of Compound H077





H077-1



[0091] 1,1-bis(4-iodophenyl)cyclohexane (15 mmol), copper iodide (15 mmol), potassium tert-butoxide (65 mmol), 1,2-diamino cyclohexane (12 mmol) and 9,9-diphenyl-9,10-dihydroacridine (25 mmol) were added to dry 1,4-dioxane (400 mL) in a round bottom flask (250 mL), and the mixture was refluxed under nitrogen atmosphere for 48 hours. The obtained intermediate was cooled to room temperature, added to water, and then filtered through a diatomite pad. The filtrate was extracted with dichloromethane, then washed with water and dried over anhydrous magnesium sulfate. A crude product was obtained after filtration and evaporation, and then purified by silica gel column chromatography to yield an intermediate product H077-1.

[0092] The intermediate product H077-1 (15 mmol) and potassium acetate (40 mmol) were mixed with dry 1,4-dioxane (60 mL), $Pd(PPh_3)_2Cl_2$ (0.4 mmol) and bis(pinacolato)diboron (25 mmol) in the round bottom flask (250 mL). The mixture was stirred at 90° C. for 48 hours under nitrogen atmosphere. The obtained intermediate was cooled to room temperature, added to water, and then filtered through a diatomite pad. The filtrate was extracted with dichloromethane, then washed with water and dried over anhydrous magnesium sulfate. A crude product was obtained after filtration and evaporation, and then purified by silica gel column chromatography to yield an intermediate product H077-2.

[0093] The intermediate product H077-2 (10 mmol), 1-bromo-3,5-bis(2,6-diphenylpyrimidine)benzene (12 mmol) and $Pd(PPh_3)_4$ (0.3 mmol) were added to a mixture of toluene (30 mL)/ethanol (20 mL) and an aqueous solution (10 mL) of potassium carbonate (12 mmol) in a round bottom flask (250 mL). The obtained mixture was refluxed for 12 hours under nitrogen atmosphere, added to water after being cooled to room temperature, and then filtered through a diatomite pad. The filtrate was extracted with dichloromethane, then washed with water and dried over anhy-

drous magnesium sulfate. A crude product was obtained after filtration and evaporation, and then purified by silica gel column chromatography to yield a final product H077.

[0094] Elemental analysis of the Compound H077 (molecular formula $C_{81}H_{61}N_5$): theoretical values: C, 88.09; H, 5.57; N, 6.34; tested values: C, 88.09; H, 5.58; N, 6.33. Liquid chromatography-mass spectrometry ESI-MS (m/z) (M+): theoretical value: 1103.49; tested values: 1103.84.

TABLE 1

Energy level of compounds

Compound	HOMO (eV)	LUMO (eV)	Eg (eV)	E_T (eV)
H004	−5.423	−2.327	3.096	2.9147
H022	−5.459	−2.291	3.168	2.9983
H048	−5.416	−2.315	3.101	2.9208
H077	−5.503	−2.372	3.131	2.9314

[0095] It can be seen from the above Table 1 that the Compounds H004, H022, H048 and H077, as the host material, show appropriate HOMO and LUMO energy levels and extremely high triplet energy E_T (>2.9 eV). Thus, these compounds are suitable to be applied as the host materials of red light (at least E_T>2.2 eV), green light (at least E_T >2.5 eV), and blue light (at least E_T>2.7 eV), and can effectively achieve the energy transfer between the host material and the guest material without the risk of reverse charge transfer.

EXAMPLE 5

[0096] This example provides an organic light-emitting device. As shown in FIG. **2**, the organic light-emitting device includes a glass substrate **1**, an ITO anode **2**, a first hole transmission layer **3**, a second hole transmission layer **4**, a light-emitting layer **5**, a first electron transmission layer **6**, a second electron transmission layer **7**, a cathode **8** (magnesium silver electrode with a mass ratio of magnesium to silver of 9:1) and a capping layer (CPL) **9**. The ITO anode **2** has a thickness of 15 nm, the first hole transmission layer **3** has a thickness of 10 nm, and the second hole transmission layer **4** has a thickness of 95 nm, the light-emitting layer **5** has a thickness of 30 nm, the first electron transmission layer **6** has a thickness of 35 nm, the second electron transmission layer **7** has a thickness of 5 nm, the magnesium silver electrode **8** has a thickness of 15 nm, and the capping layer (CPL) **9** has a thickness of 100 nm.

[0097] The organic light-emitting device of this example was manufactured according to the following steps:

[0098] (1) The glass substrate **1** was cut into a size of 50 mm×50 mm×0.7 mm, then subjected to ultrasonic treatment in isopropyl alcohol and deionized water for 30 minutes, respectively, and then exposed to ozone for about 10 minutes for cleaning. The obtained glass substrate **1** with the ITO anode **2** was placed on a vacuum deposition equipment.

[0099] (2) A material HAT-CN was vacuum evaporated onto the ITO anode **2** to form the first hole transmission layer **3** having a thickness of 10 nm.

[0100] (3) A second hole transmission layer material TAPC was vapor evaporated onto the first hole transmission layer **3** to form the second hole transmission layer **4** having a thickness of 95 nm.

[0101] (4) The light-emitting layer **5** having a thickness of 30 nm was co-deposited on the hole transmission layer **4**, where in the light-emitting layer **5** Compound H004 was used as the host material, and $Ir(ppy)_3$ was used as the dopeing material with a mass ratio of Compound H004 to $Ir(ppy)_3$ of 19:1.

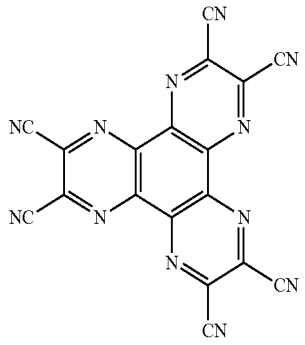
[0102] (5) A material BPen was vacuum evaporated onto the light-emitting layer **5** to form the first electron transmission layer **6** having a thickness of 30 nm.

[0103] (6) A material Alq3 was vacuum evaporated onto the first electron transmission layer **6** to form the second electron transmission layer **7** having a thickness of 5 nm.

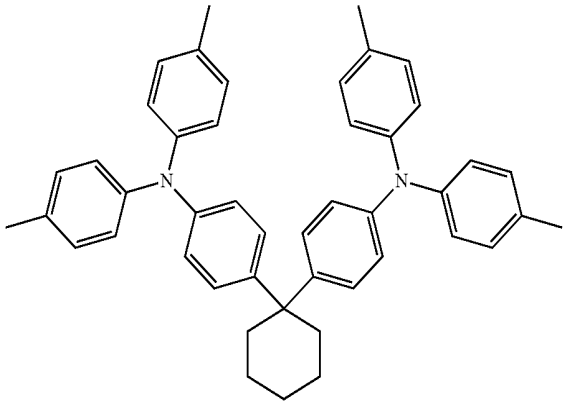
[0104] (7) The magnesium silver electrode having a thickness of 15 nm, as the cathode **8**, was formed on the second electron transmission layer **7** by vacuum evaporating magnesium and silver with a mass ratio of mamesium to silver of 9:1.

[0105] (8) A hole type material CBP having a high refraction index was vacuum evaporated onto the cathode **8** to form a cathode covering layer (capping layer or CPL) **9** having a thickness of 100 nm.

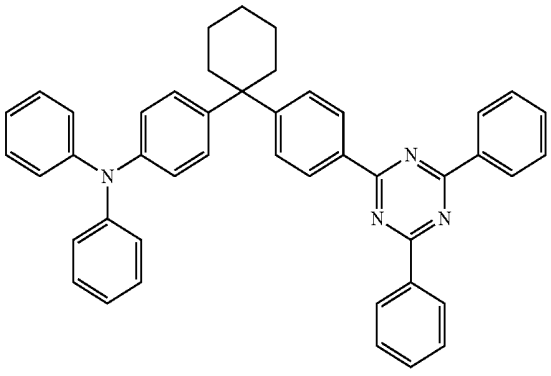
[0106] The compounds and the structures thereof involved in the present embodiment are shown as follow.



HAT-CN



TAPC



H004

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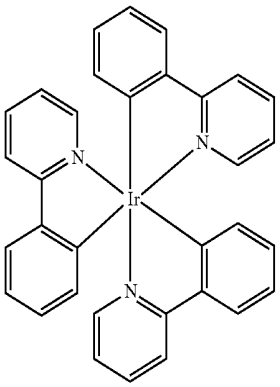
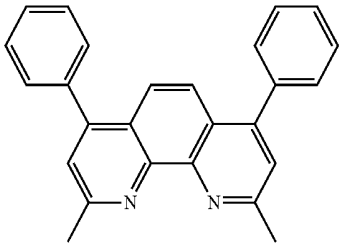
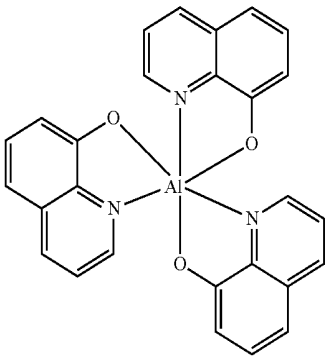


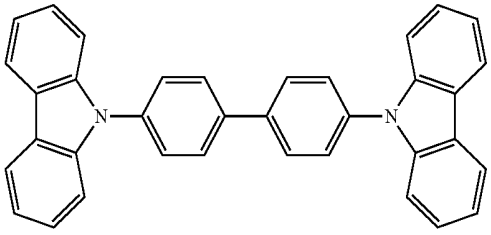
$Ir(pyy)_3$



BPen



Alq_3

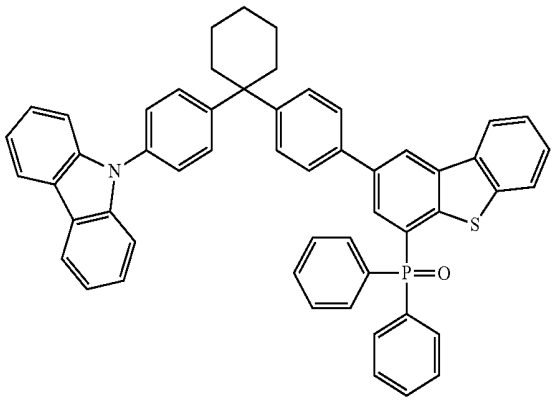


CBP

EXAMPLE 6

[0107] In Example 6, the device was manufactured according to the steps described in Example 5, and the material of each layer was the same except the Compound H022 was used as the host material.

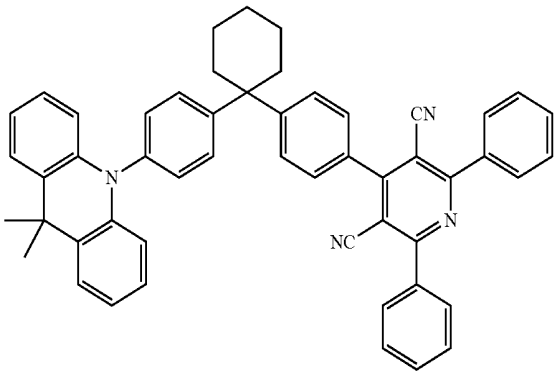
H022



EXAMPLE 7

[0108] In Example 7, the device was manufactured according to the steps described in Example 5, and the material of each layer was the same except the Compound H048 was used as the host material.

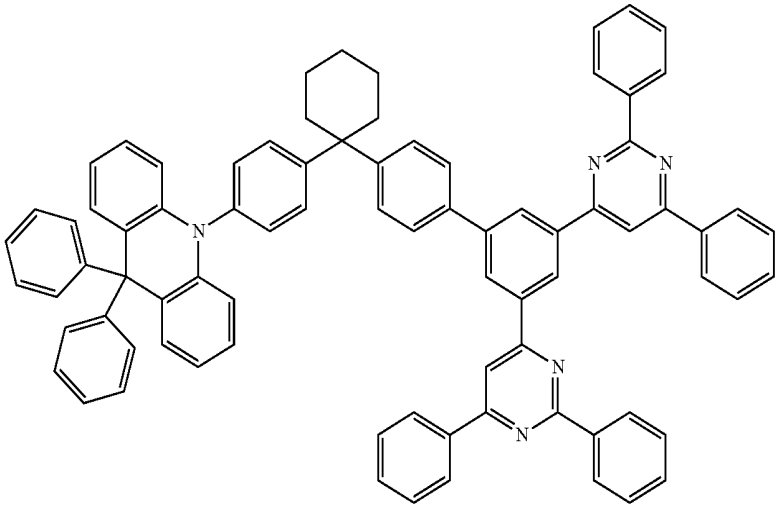
H048



EXAMPLE 8

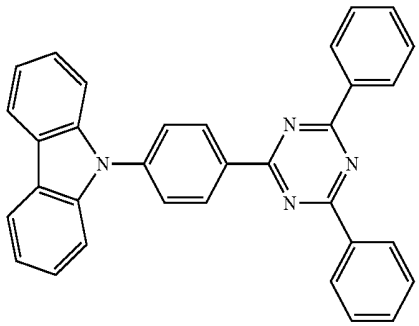
[0109] In Example 8, the device was manufactured according to the steps described in Example 5, and the material of each layer was the same except the Compound H077 was used as the host material.

H077



COMPARATIVE EXAMPLE 1

[0110] In Comparative Example 1, the device was manufactured according to the steps described in Example 5, the material of each layer was the same except the host material is CzTRZ.



CzTRZ

TABLE 2

Measurement results of luminescence performance of devices

No.	host material	driving voltage (V)	EQE/%	CE (cd/A)	LT95 (at 50 mA/cm^2)
Example 5	H004	3.79	30.9%	126.5	79.4
Example 6	H022	3.85	31.5%	125.9	80.1
Example 7	H048	3.82	29.7%	127.4	78.8
Example 8	H077	3.77	31.2%	126.0	82.9
Comparative Example 1	CzTRZ	4.10	24.2%	103.2	67.2

[0111] It can he seen from Table 2 that the driving voltages of the light-emitting devices adopting the compounds of the present disclosure are about 8.5% lower than the driving voltage of the device of the comparative example 1, so that power consumption of the device can be effectively reduced. Compared with the device of the comparative example 1, the luminous efficiency of the light-emitting devices using the compounds of the present disclosure as the host material is improved by about 10 -25%, thereby effectively improving the brightness of the devices; and the service life of the light-emitting devices adopting the compounds of the present disclosure as the host material is also prolonged by about 18% or more.

[0112] In another example, the present disclosure provides a display panel including the above-mentioned organic light-emitting device.

[0113] In still another example, the present disclosure provides a display apparatus including the above-mentioned display panel.

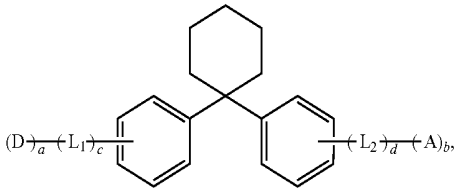
[0114] In the present disclosure, the organic light-emitting device may be an OLED used in an organic light-emitting display apparatus. The organic light-emitting display apparatus can be display screen of various smart devices, such a mobile phone display screen, a computer display screen, a liquid crystal television display screen, a smart watch display screen, a display panel of smart car, a display screen of Virtual Reality (VR) or Augmented Reality (AR), etc. FIG. **3** is a schematic diagram of a display apparatus according to an embodiment of the present disclosure, in which **11** denotes a mobile phone display screen.

[0115] The embodiments of the present disclosure described above are not intended to limit the scope of the present disclosure. Those skilled in the art can make various changes and modifications without departing from the scope of the present disclosure. The protection scope of the present disclosure is defined by the appended claims.

What is claimed is:

1. A compound having a chemical structure represented by a Formula (I):

Formula (I)



wherein D represents an electron donor, A represents an electron acceptor, a is a number of an electron donor D, b is a number of an electron acceptor A, and a and b are each 1, 2, or 3 independently;

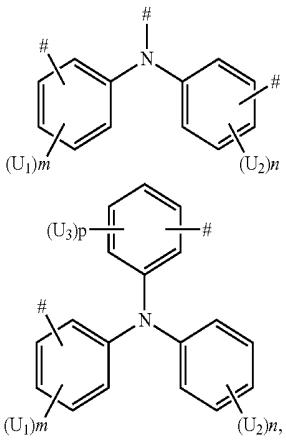
wherein c is a number of a group L_1, d is a number of a group L_2, and c and d are each 0, 1, or 2 independently;

wherein the groups L_1 and L_2 are each independently selected from the group consisting of a single bond, a substituted or unsubstituted C1-C20 alkylene, a substituted or unsubstituted C3-C20 cycloalkylene, a substituted or unsubstituted C3-C20 heterocycloalkylene, a substituted or unsubstituted C6-C40 arylene, a substituted or unsubstituted C4-C40 heteroarylene, a substituted or unsubstituted C10-C60 fused arylene, and a substituted or unsubstituted C10-C60 fused heteroarylene;

wherein the electron donor D is selected from the group consisting of a substituted or unsubstituted C1-C20 alkyl., a substituted or unsubstituted C3-C20 cycloalkyl, a substituted or unsubstituted C1-C20 alkoxy, a substituted or unsubstituted C3-C20 heterocyclic group, a substituted or unsubstituted C6-C40 aryl, a substituted or unsubstituted C4-C40 heteroaryl, a substituted or unsubstituted C10-C60 fused arylene, a substituted or unsubstituted Cl 0-C60 fused heteroarylene, a substituted or unsubstituted C12-C40 carbazolyl and a derivative group thereof, a substituted or unsubstituted C12-C40 diphenylamino and a derivative group thereof, and a substituted or unsubstituted C12-C40 acridinyl and a derivative group thereof; and

wherein the electron acceptor A is selected from the group consisting of nitrogen-containing heterocyclic substituents, cyano-containing substituents, triaryl-boron-derived substituents, and phosphoxy-containing substituents.

2. The compound according to claim **1**, wherein the electron donor D is further selected from the following groups:

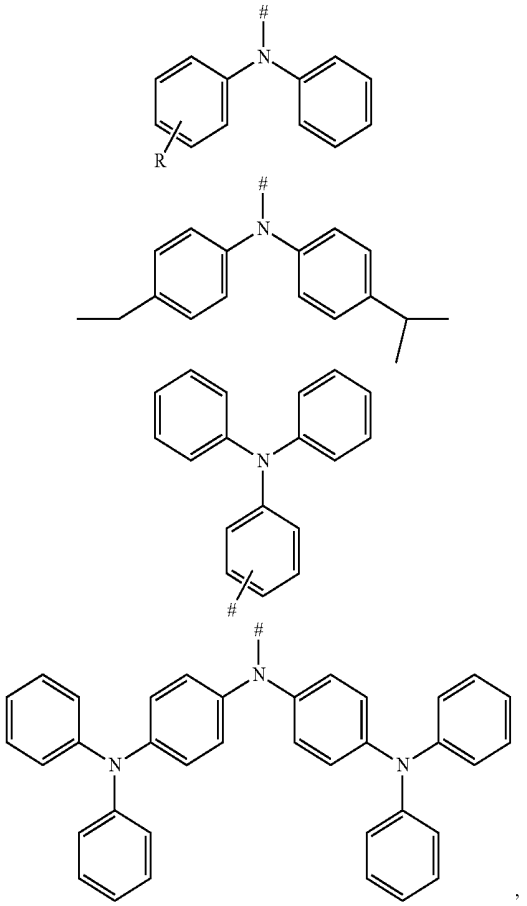


wherein m, n and p are each 0, 1, 2, or 3 independently,

wherein U_2 and U_3 are each independently selected from the group consisting of hydrogen, a substituted or unsubstituted C1-C30 alkyl, a substituted or unsubstituted silicylene, a substituted or unsubstituted C3-C20 cycloalkyl, a substituted or unsubstituted C1-C30 alkoxy, a substituted or unsubstituted C6-C30 aryl, and a substituted or unsubstituted C10-C30 fused aryl, and

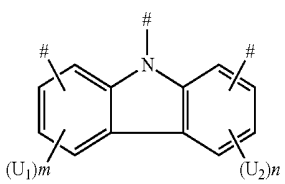
wherein # represents a bonding position.

3. The compound according to claim **2**, wherein the electron donor D is further selected from the following groups:



wherein R is selected from the group consisting of hydrogen, a substituted or unsubstituted C1-C20 alkyl, a substituted or unsubstituted silicylene, a substituted or unsubstituted C3-C20 cycloalkyl, a substituted or unsubstituted C1-C20 alkoxy, a substituted or unsubstituted C3-C20 heterocyclic group, a substituted or unsubstituted C6-C40 aryl, a substituted or unsubstituted C10-C30 fused aryl, and a substituted or unsubstituted C4-C40 heteroaryl.

4. The compound according to claim **1**, wherein the electron donor D is further selected from the following groups:



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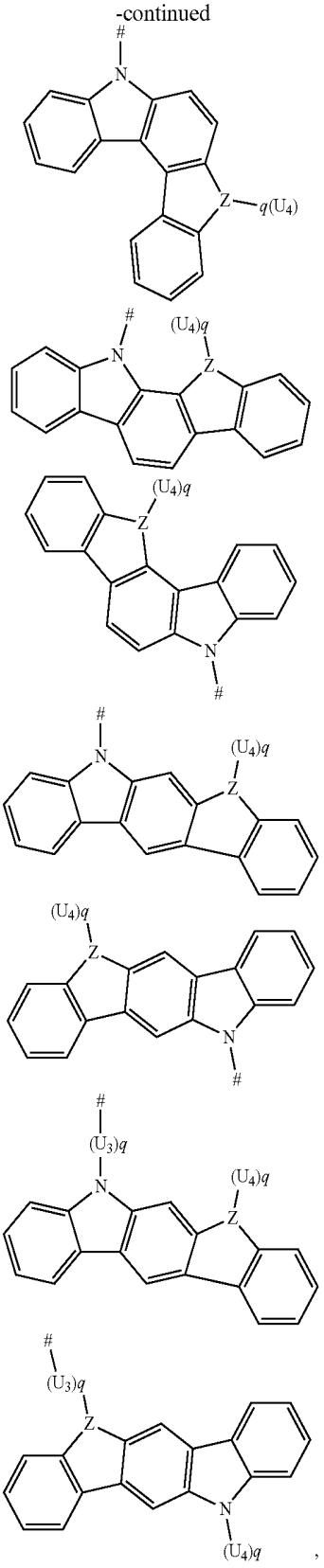


wherein Z is carbon, nitrogen, oxygen, sulfur, or silicon,

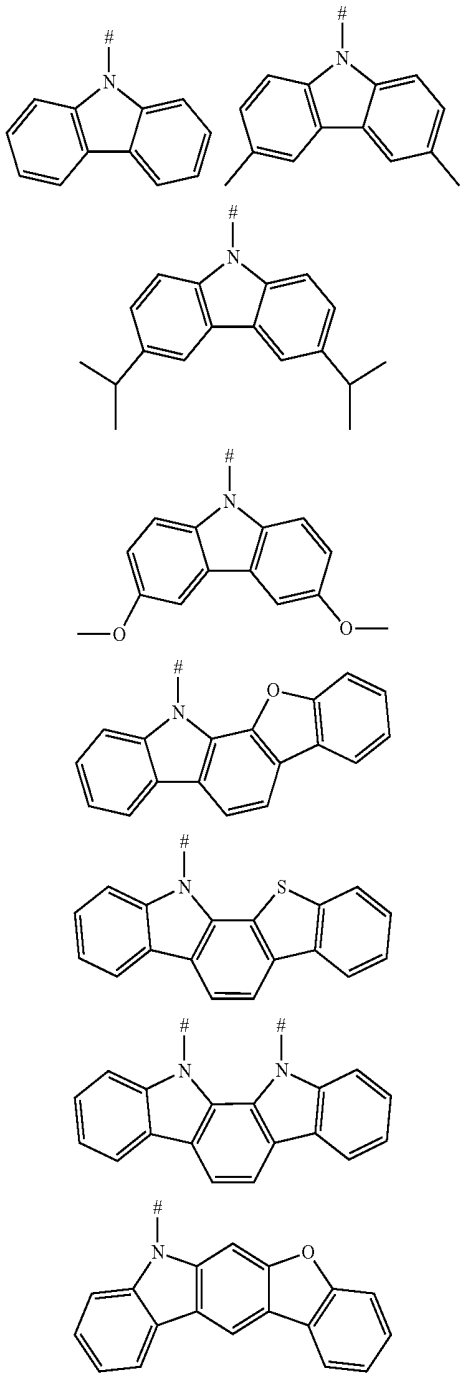
m, n and p are each 0, 1, 2, or 3 independently,

U_1, U_2, U_3 and U_4 are each independently selected from the group consisting of hydrogen, a substituted or unsubstituted C1-C30 alkyl, a substituted or unsubstituted silicylene, a substituted or unsubstituted C3-C20 cycloalkyl, a substituted or unsubstituted C1-C30 alkoxy, a substituted or unsubstituted C6-C30 aryl, and a substituted or unsubstituted C10-C30 fused aryl,

when Z is oxygen or sulfur, q is 0, and

represents a bonding position.

5. The compound according to claim **4**, wherein the electron donor D is further selected from the following groups:



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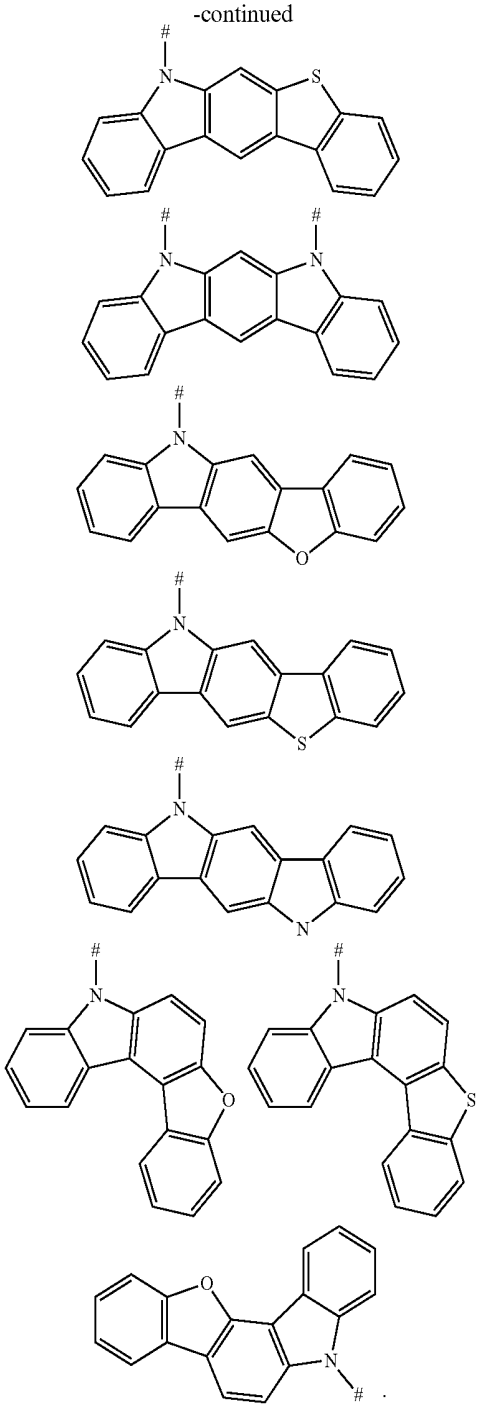
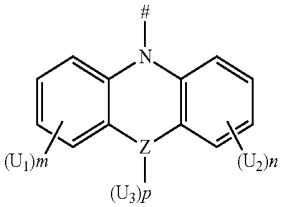


6. The compound according to claim **1**, wherein the electron donor D is further selected from the following groups:



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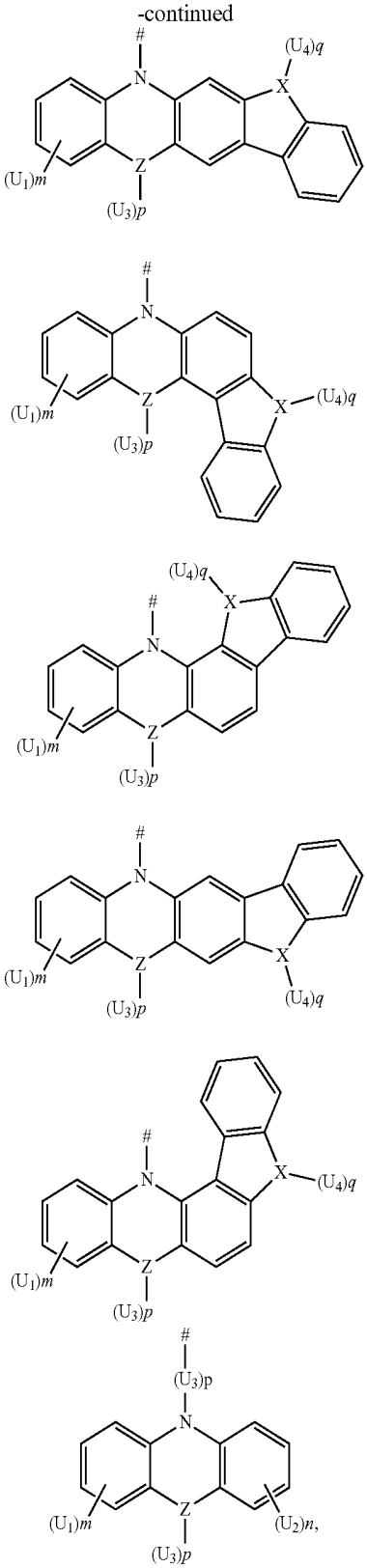


wherein Z is carbon, nitrogen, oxygen, sulfur, or silicon,

X is carbon, nitrogen, oxygen, or sulfur,

m, n, p and p are each 0, 1, 2, or 3 independently,

U_2, U_3 and U_4 are each independently selected from the group consisting of hydrogen, a substituted or unsubstituted C1-C30 alkyl, a substituted or unsubstituted

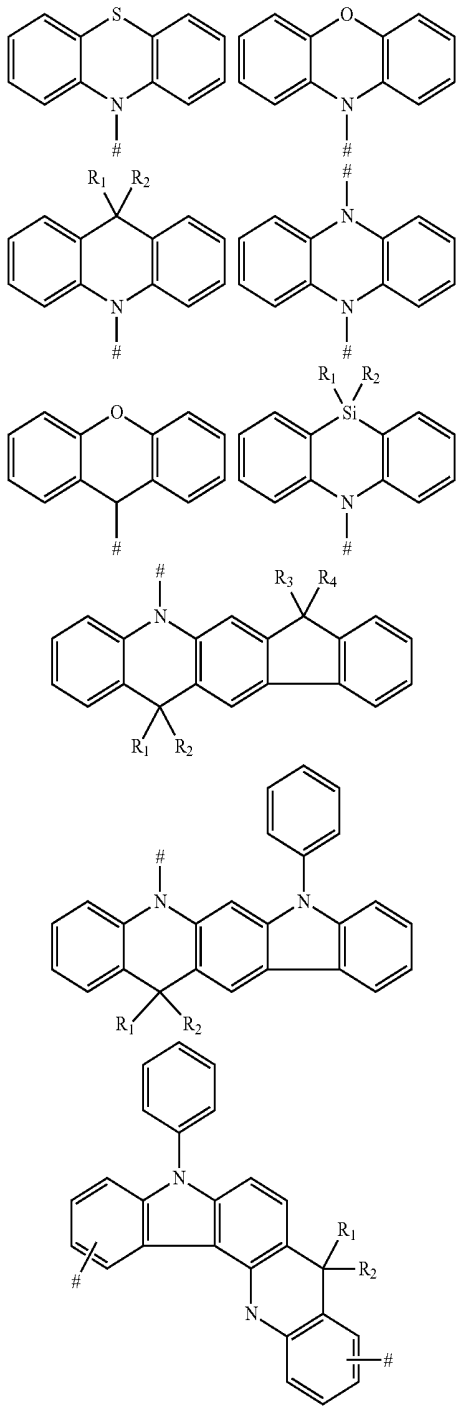
silicylene, a substituted or unsubstituted C3-C20 cycloalkyl, a substituted or unsubstituted C1-C30 alkoxy, a substituted or unsubstituted C6-C30 aryl, and a substituted or unsubstituted C10-C30 fused aryl,

when Z is oxygen or sulfur, p is 0,

when X is oxygen or sulfur, q is 0, and

represents a bonding position.

7. The compound according to claim **6**, wherein the electron donor D is further selected from the following groups:



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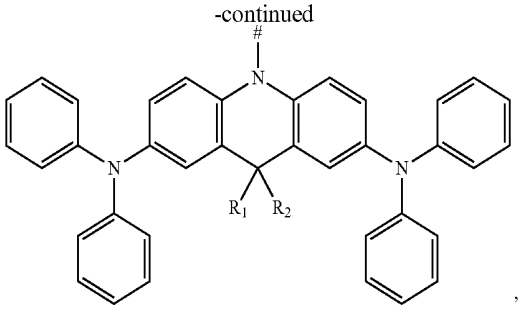
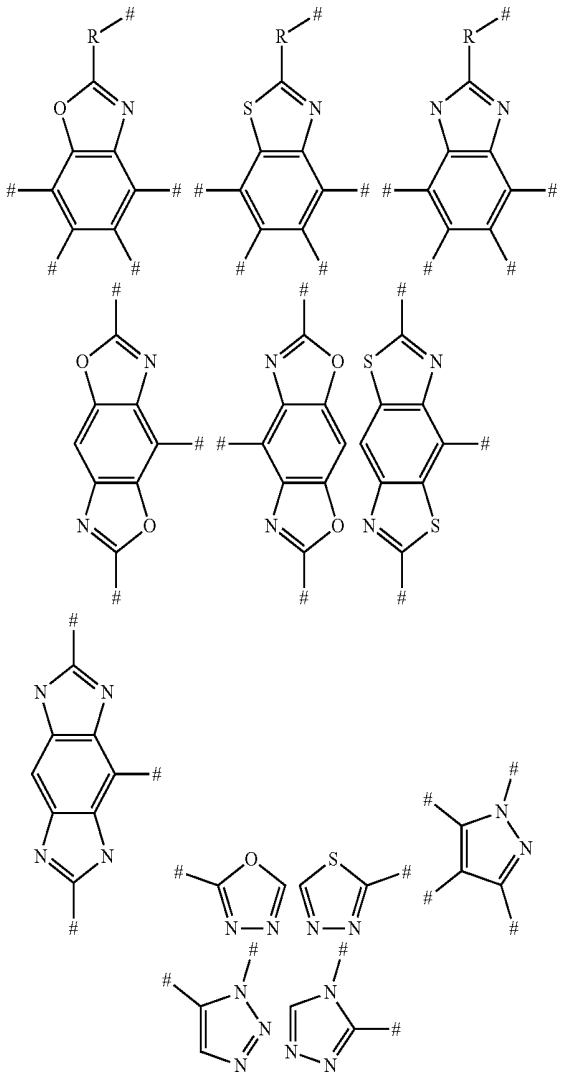


wherein R_1, R_2, R_3 and R_4 are each independently selected from the group consisting of hydrogen, a substituted or unsubstituted C1-C20 alkyl, a substituted or unsubstituted C3-C20 cycloalkyl, a substituted or unsubstituted C1-C20 alkoxy, a substituted or unsubstituted C3-C20 heterocyclic group, a substituted or unsubstituted C6-C40 aryl, and a substituted or unsubstituted C4-C40 heteroaryl.

8. The compound according to claim **1**, wherein the electron acceptor A is further selected from the following substituents:



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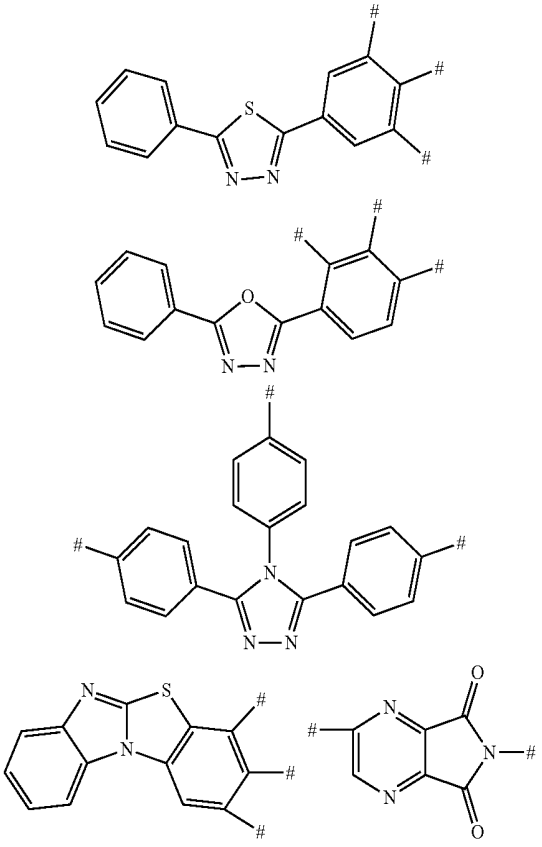

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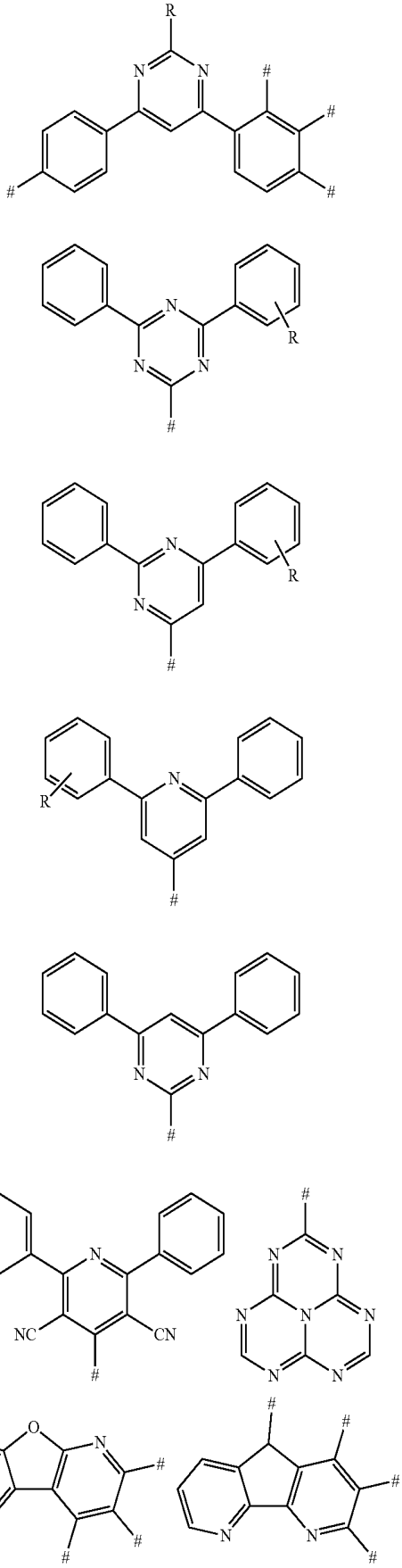

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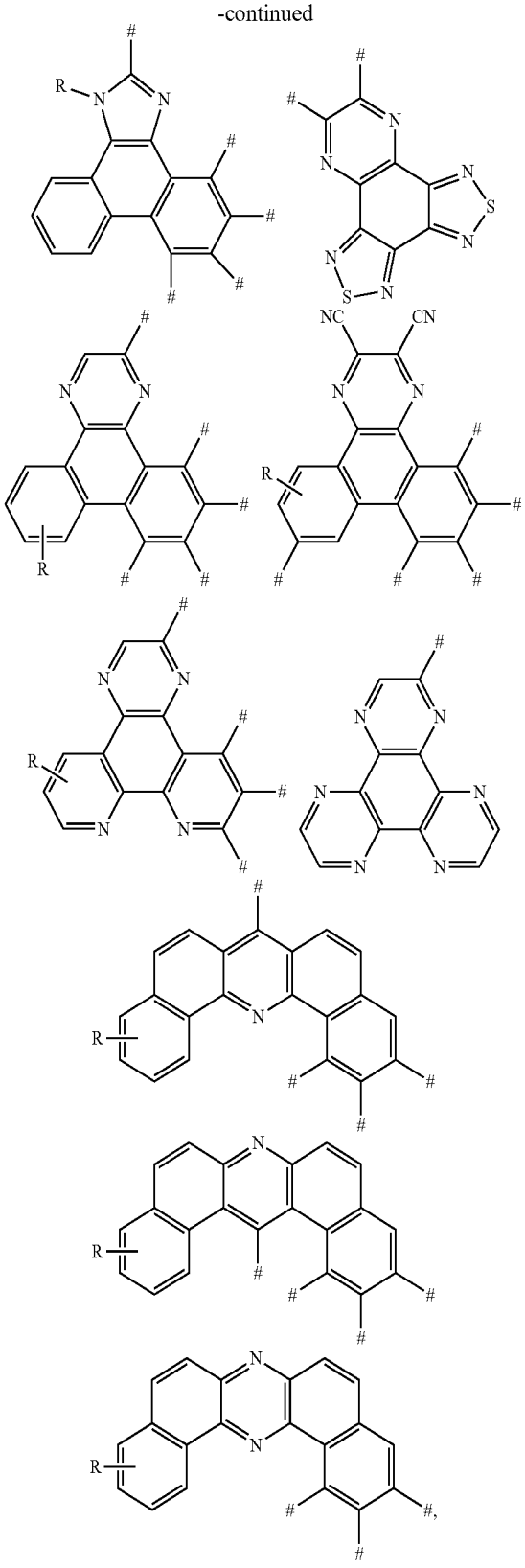
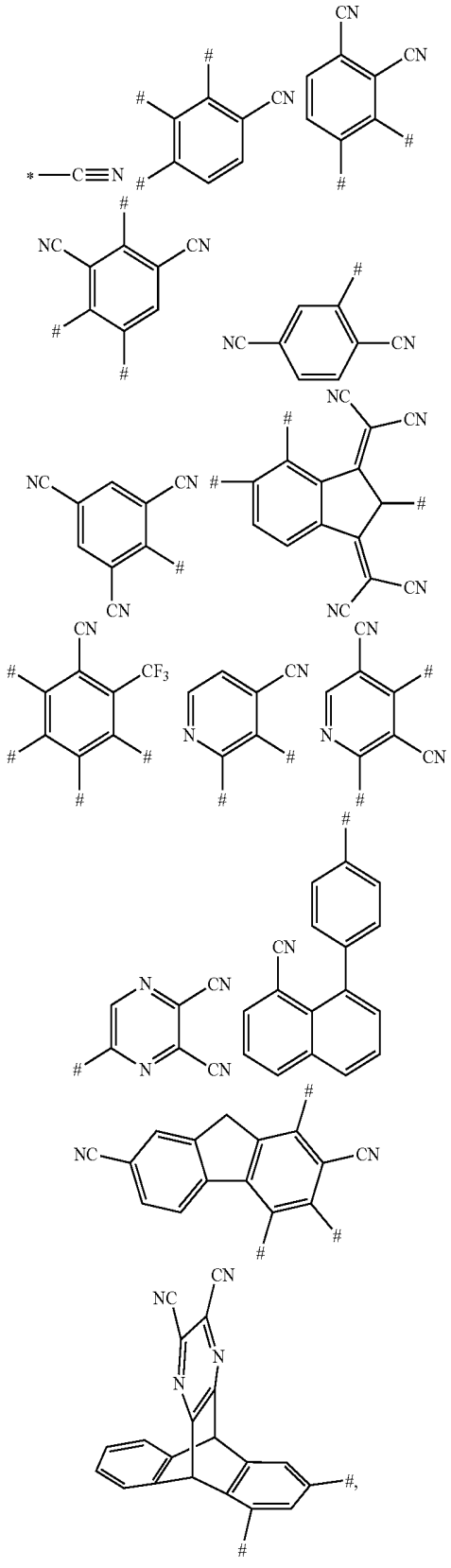


wherein R is hydrogen, a C1-C20 alkyl, a C1-C20 alkoxy, a C4-C8 cycloalkyl, a C6-C40 aryl, or a C4-C40 heteroaryl, and

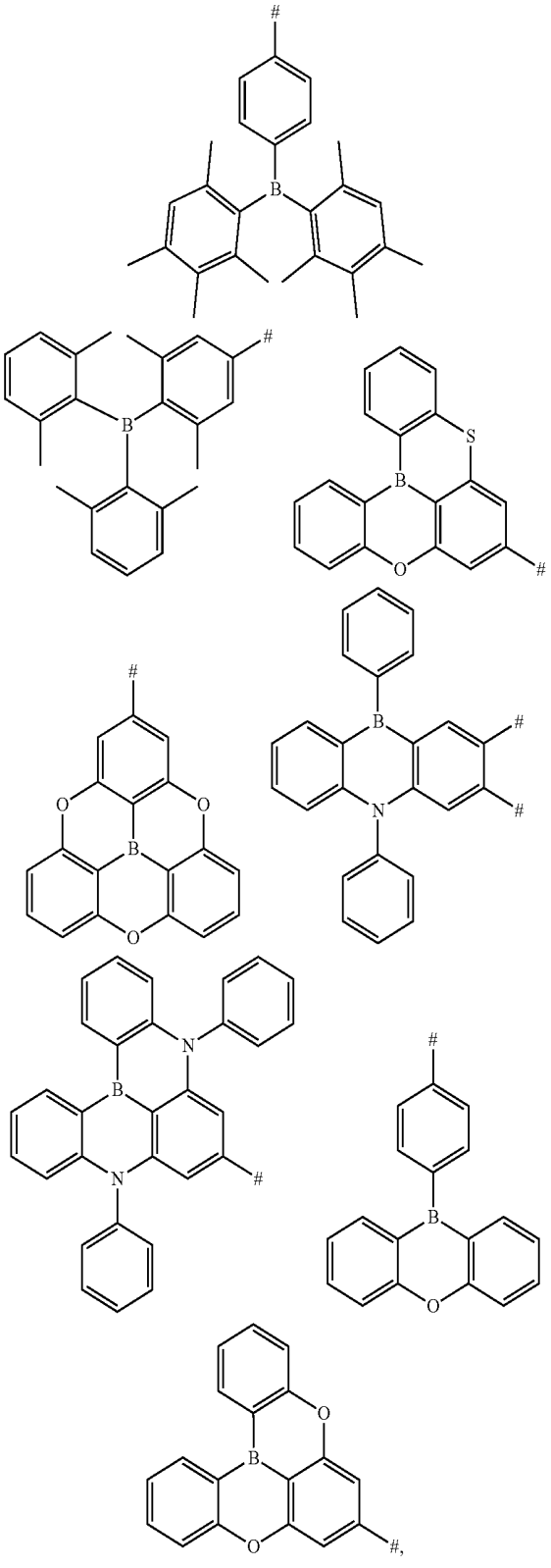
represents a bonding position.

9. The compound according to claim **1**, wherein the electron acceptor A is further selected from the following substituents:



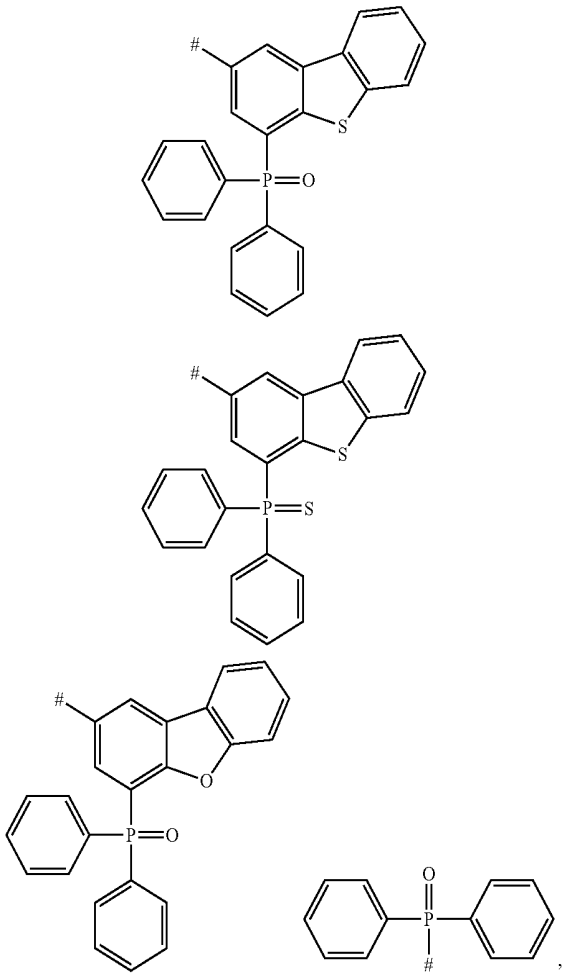
wherein # represents a bonding position.

10. The compound according to claim **1**, wherein the electron acceptor A is further selected from the following substituents:



wherein # represents a bonding position.

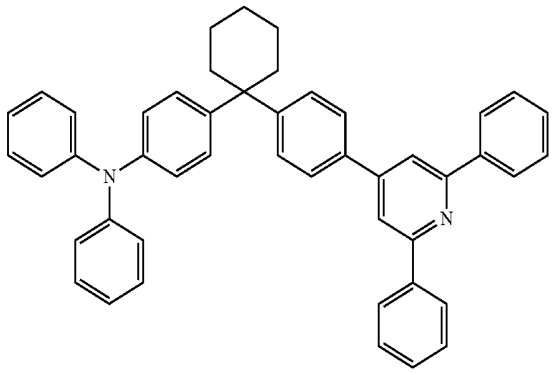
11. The compound according to claim **1**, wherein the electron acceptor A is further selected from the following substituents:



wherein # represents a bonding position.

12. The compound according to claim **1**, wherein the compound is further selected from the following compounds:

H001



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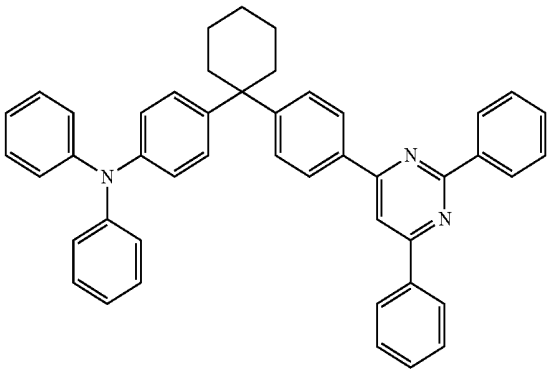
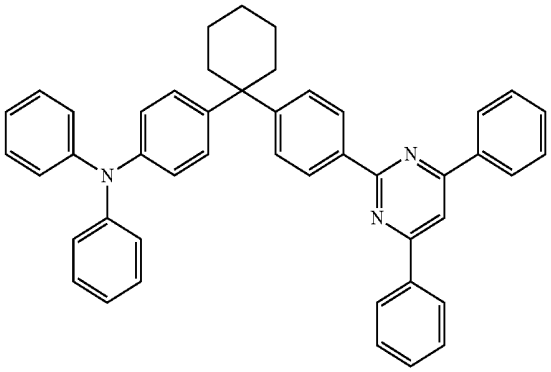
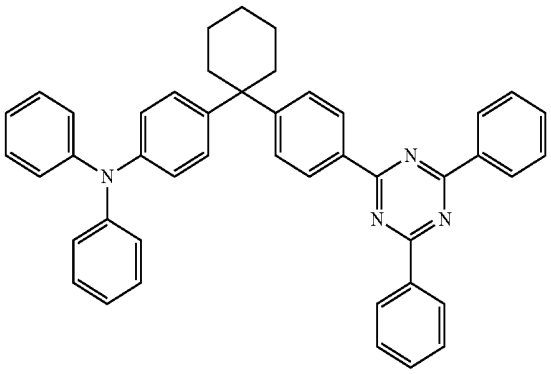
H002



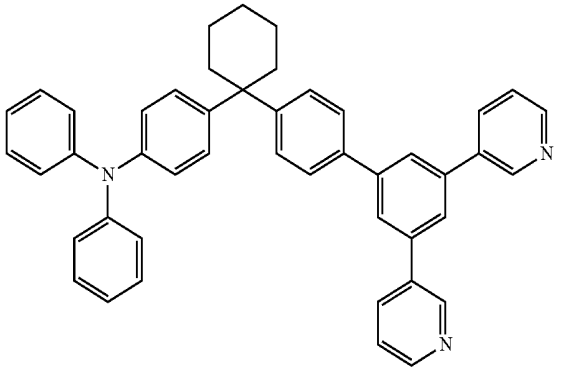
H003



H004



H005



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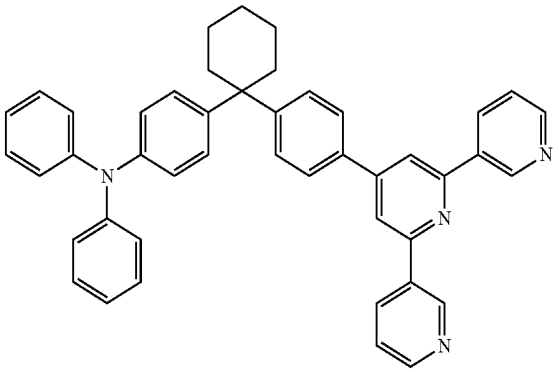
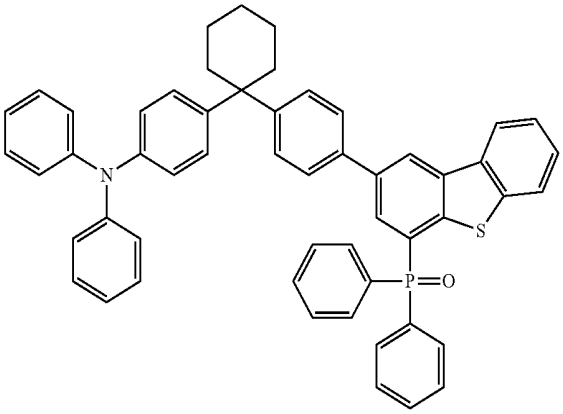
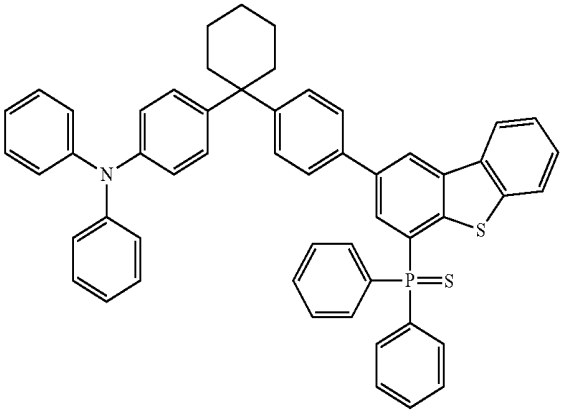
H006



H007



H008



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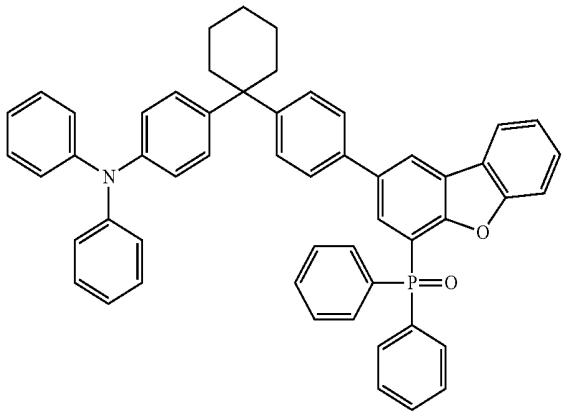
H009



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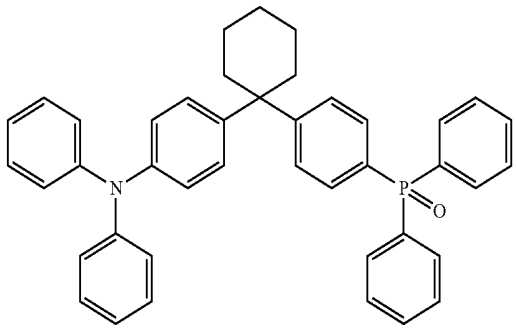

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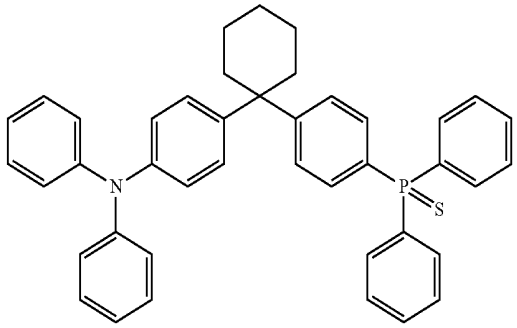

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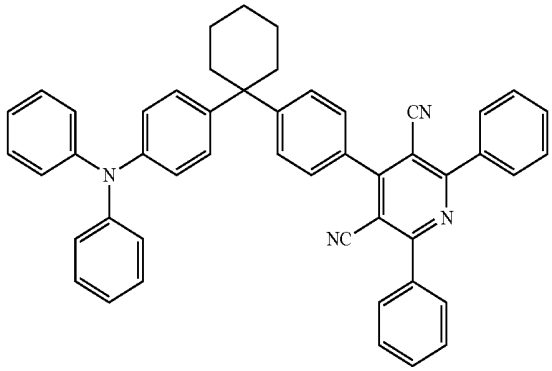

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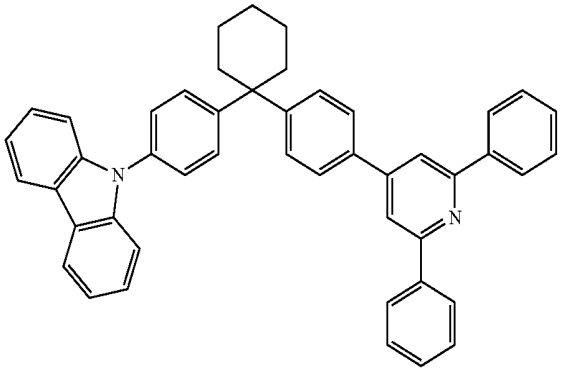

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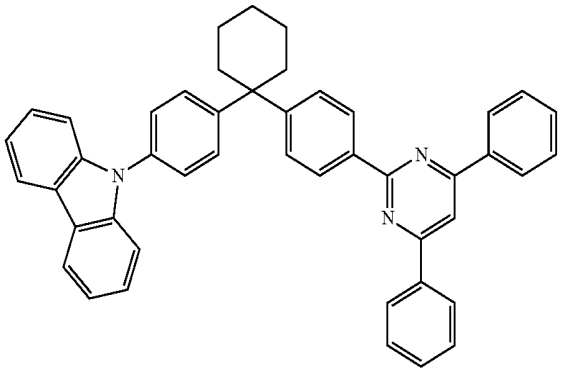

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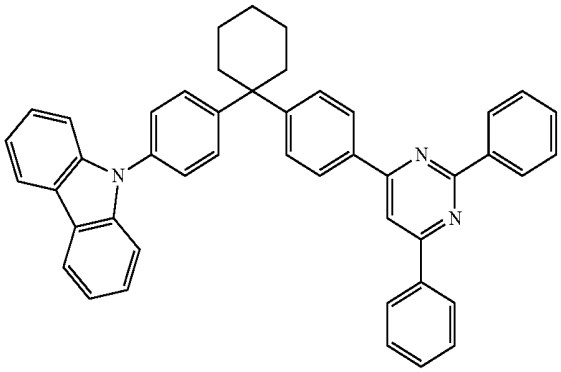

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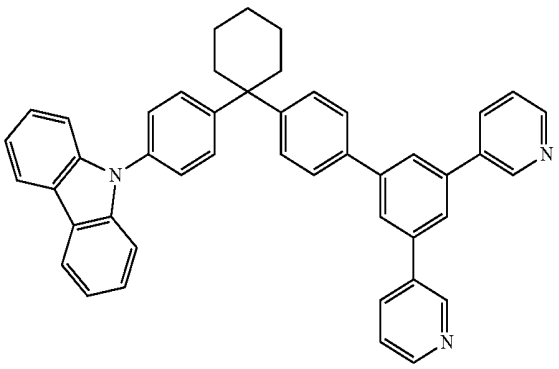

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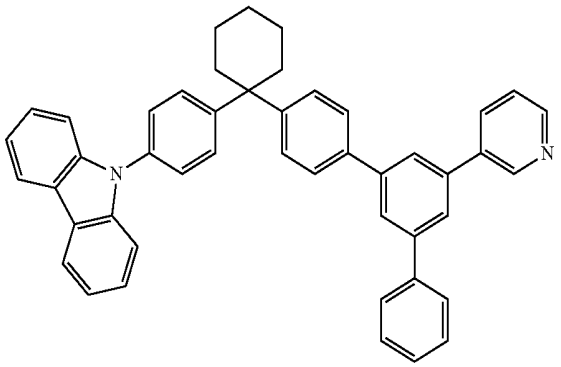

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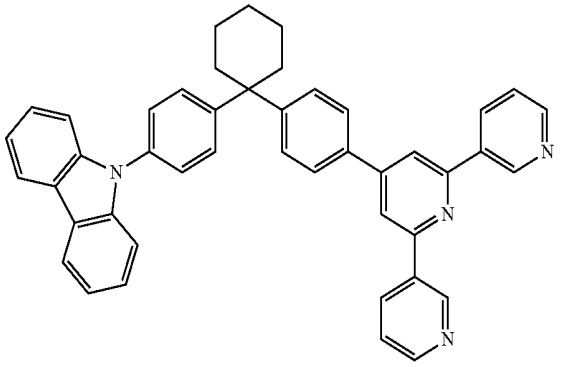

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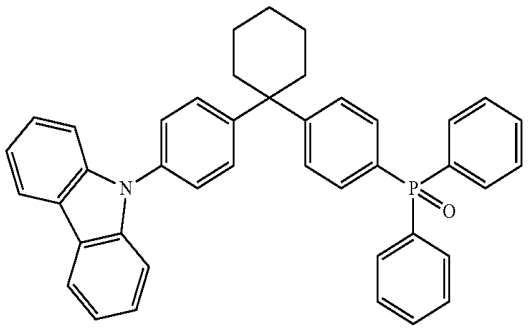

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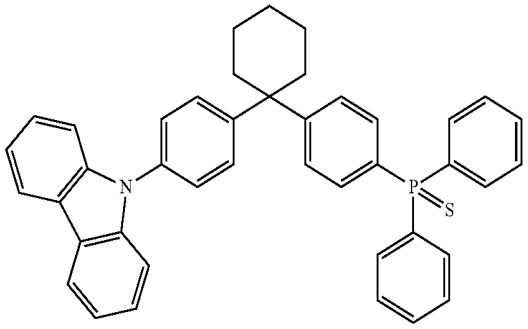

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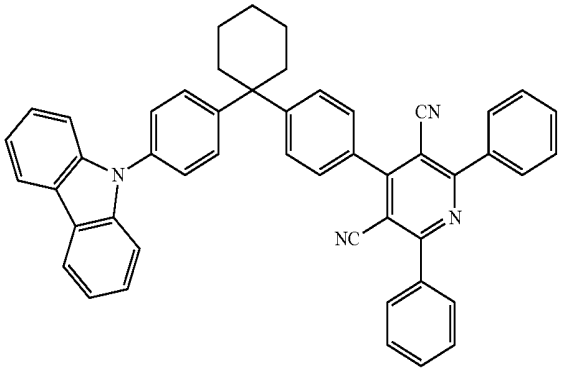

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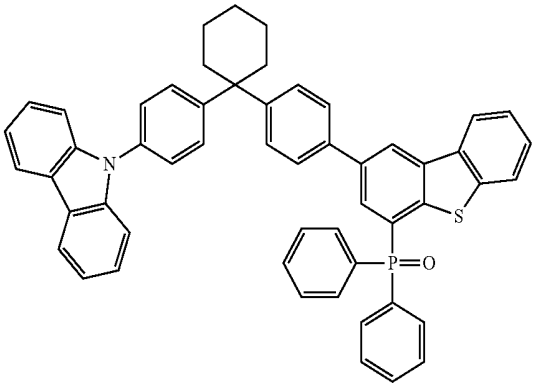

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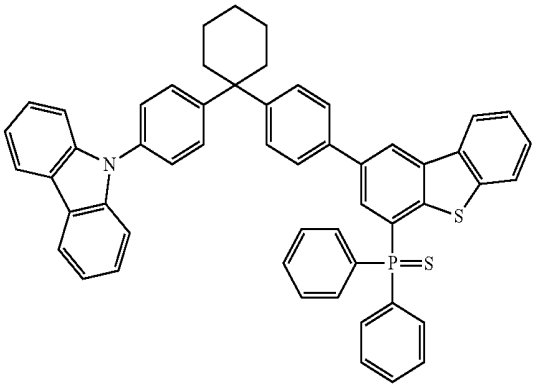

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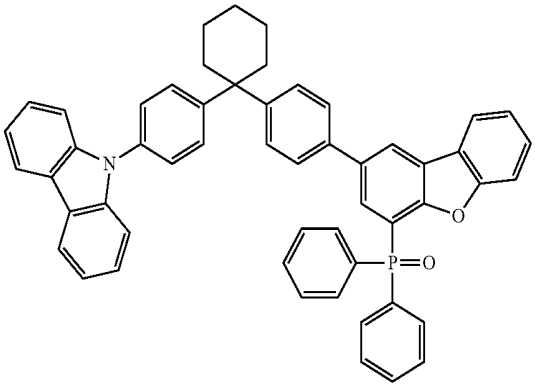

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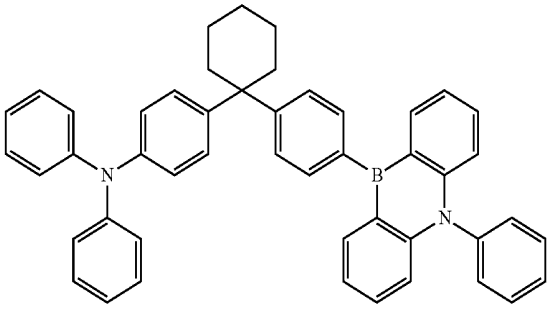

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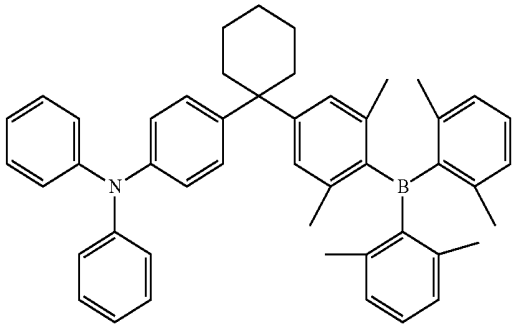

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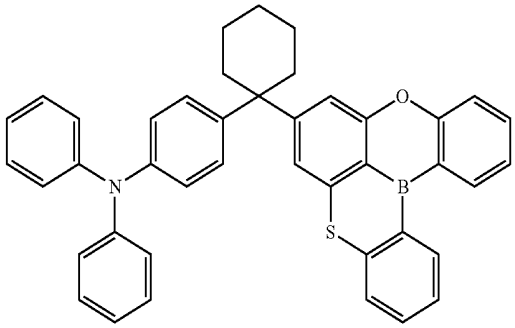

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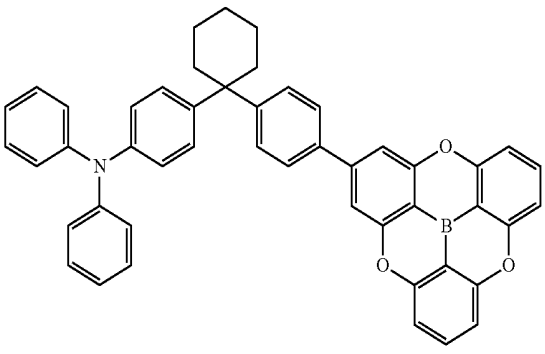

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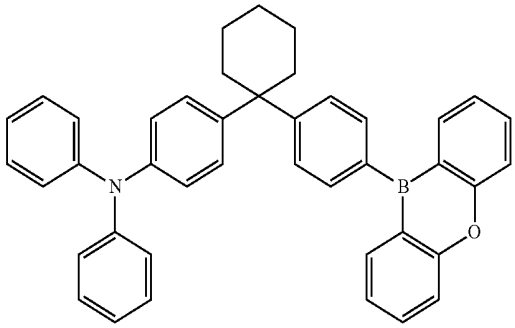

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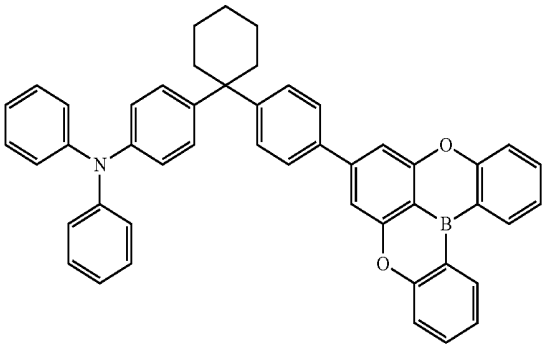

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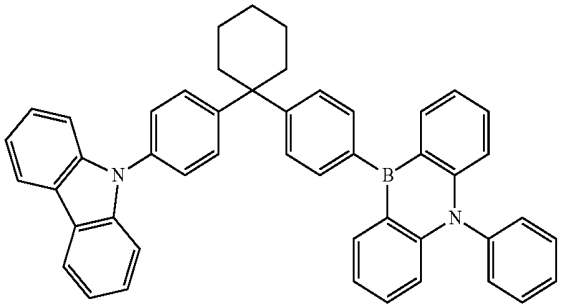

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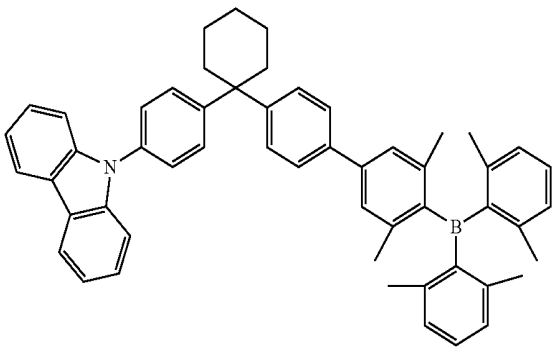

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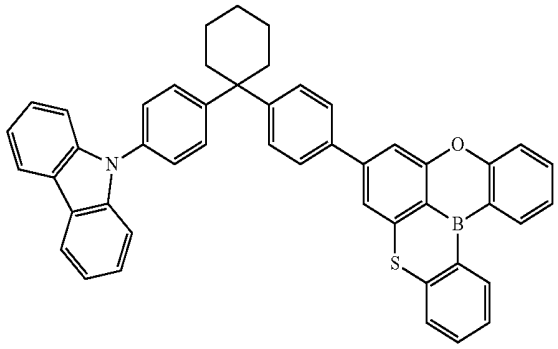

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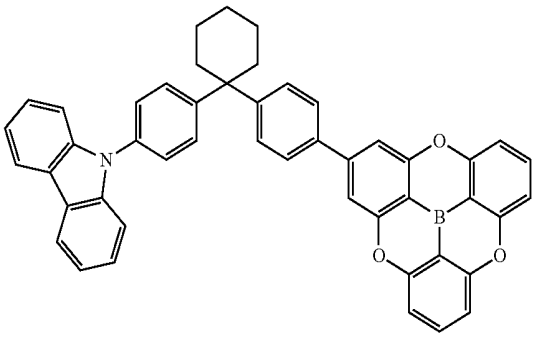

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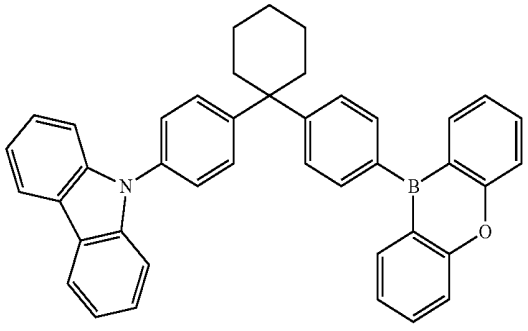

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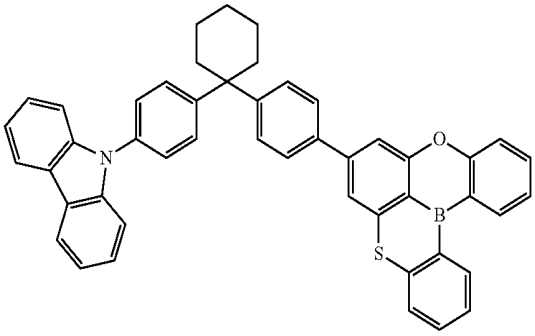

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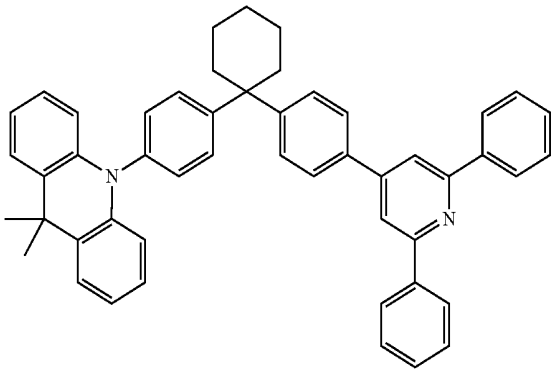

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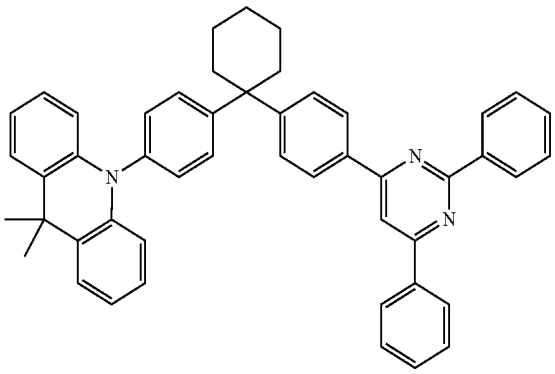

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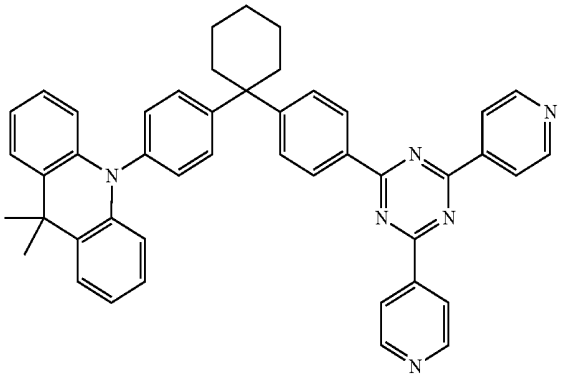

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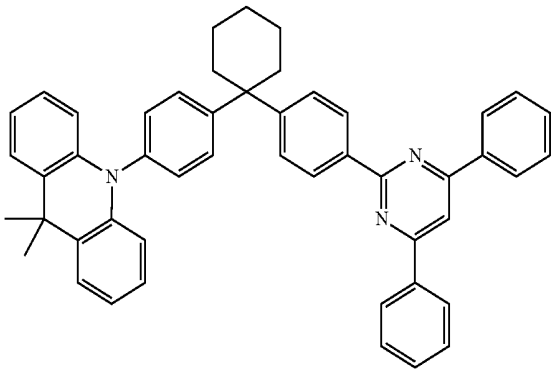

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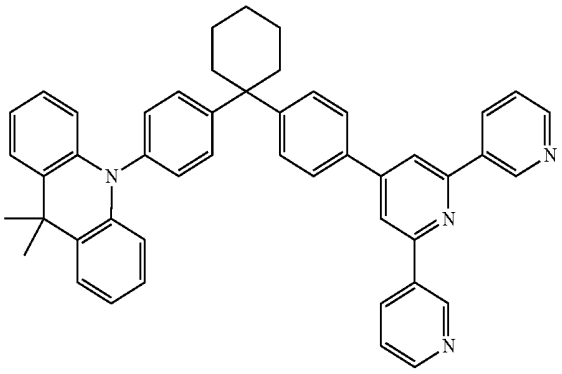

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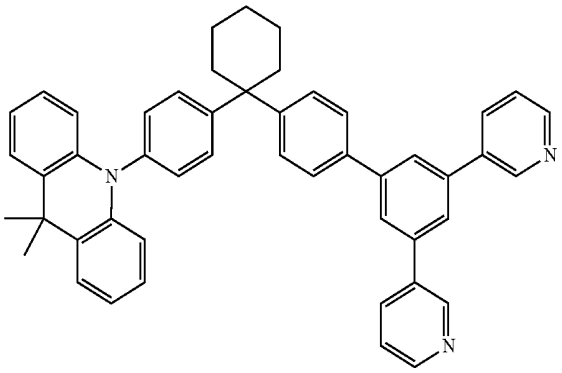

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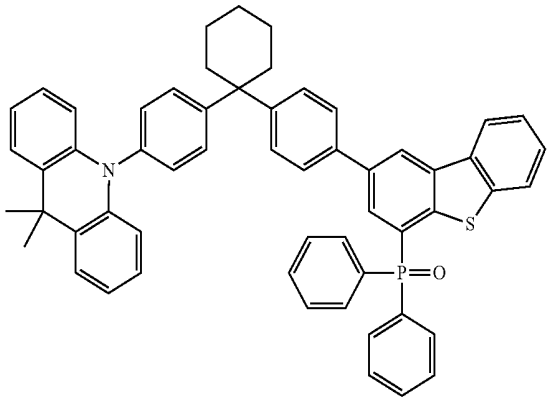

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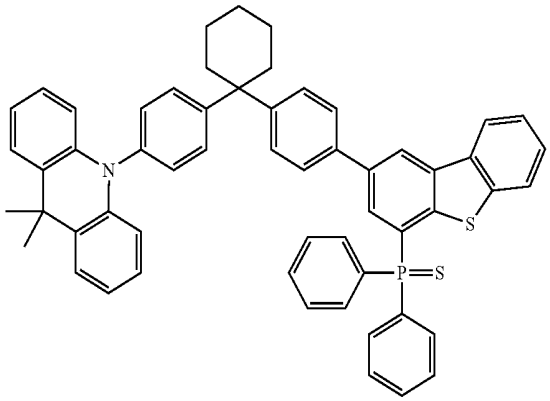

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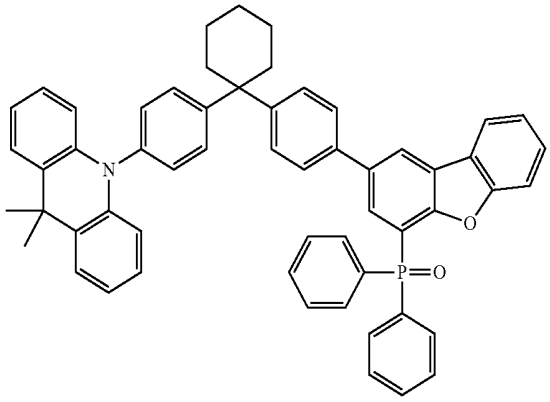

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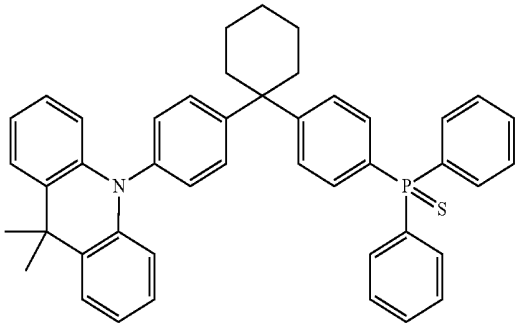

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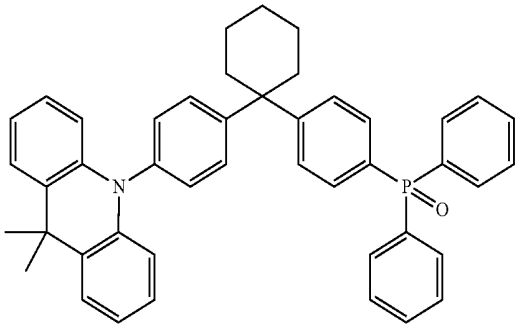

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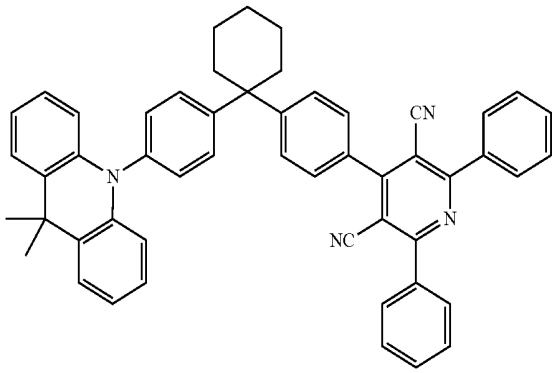

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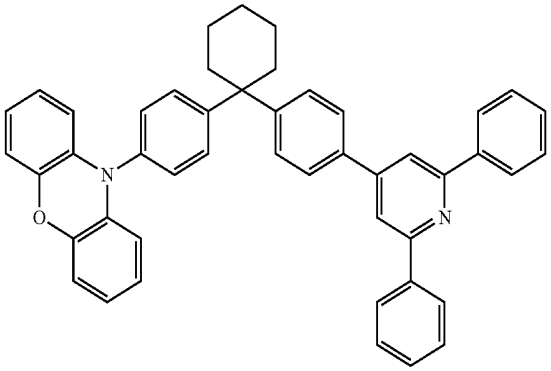

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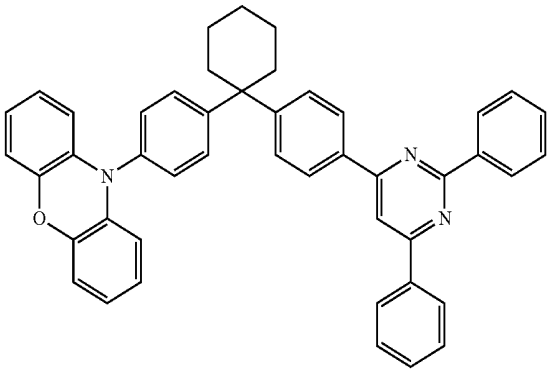

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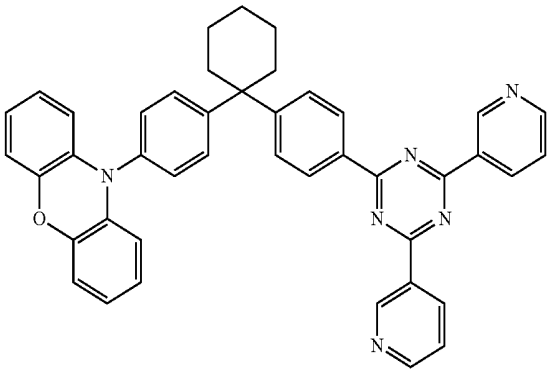

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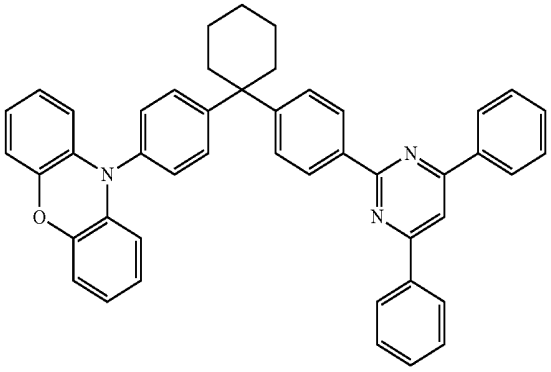

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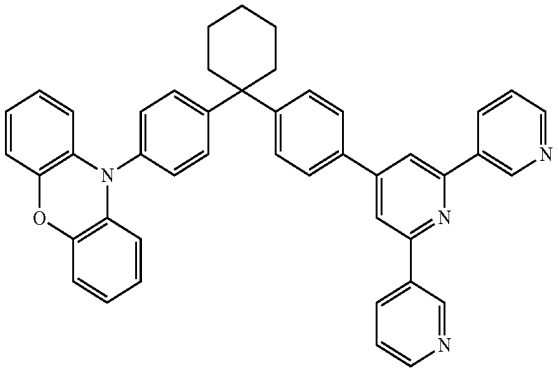

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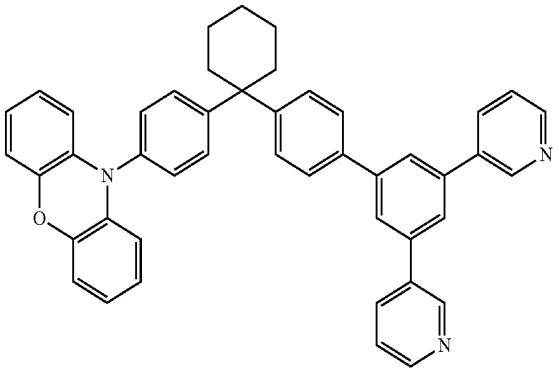

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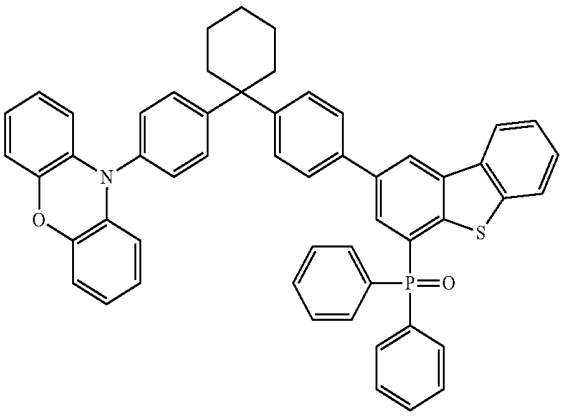

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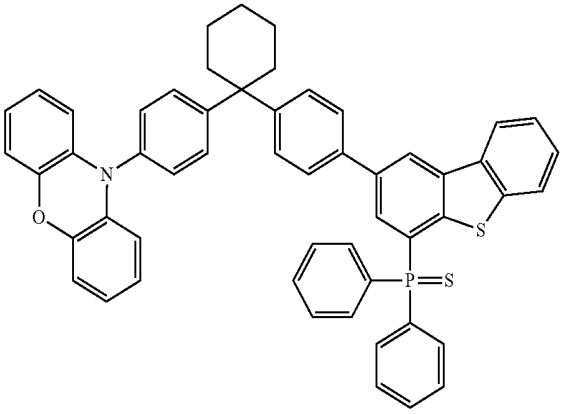

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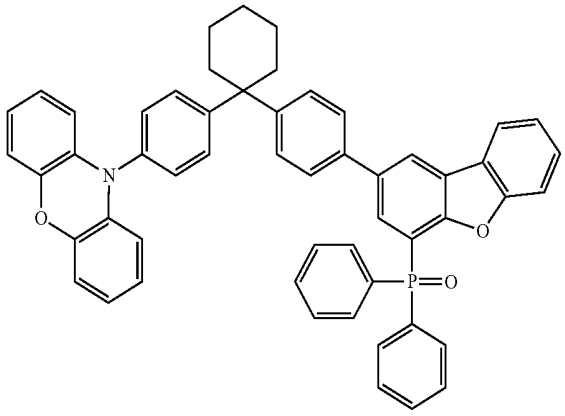

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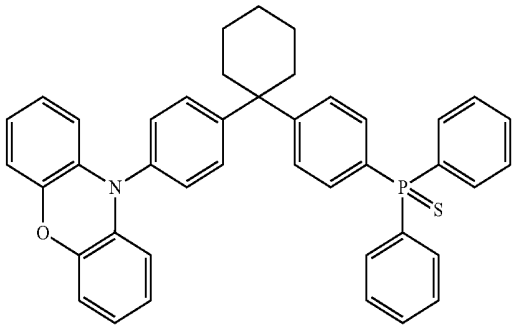

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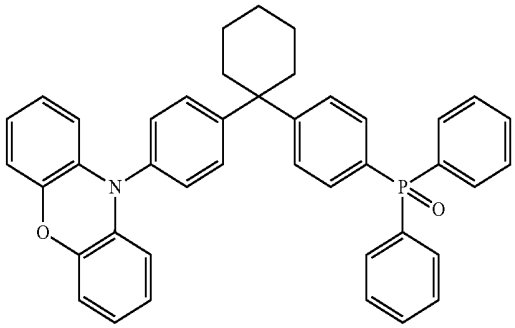

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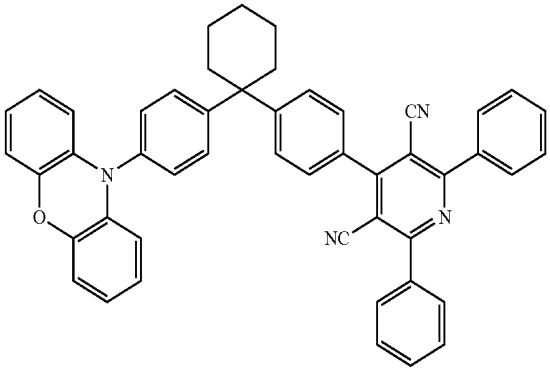

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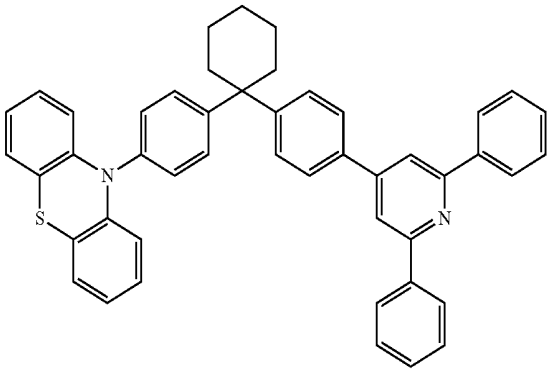

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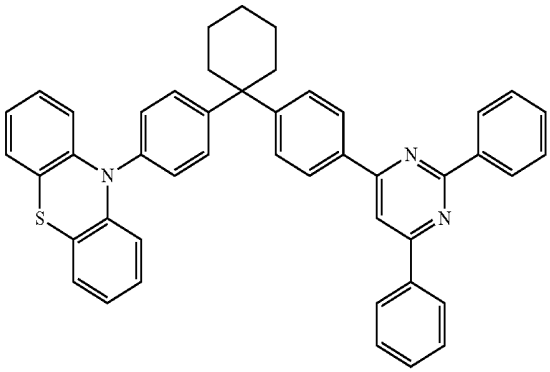

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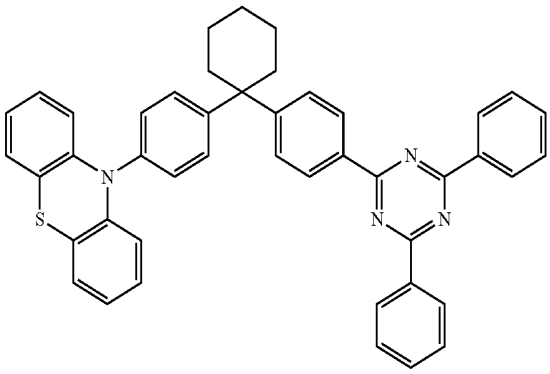

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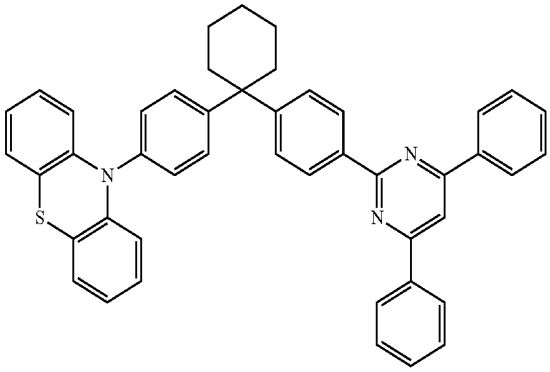

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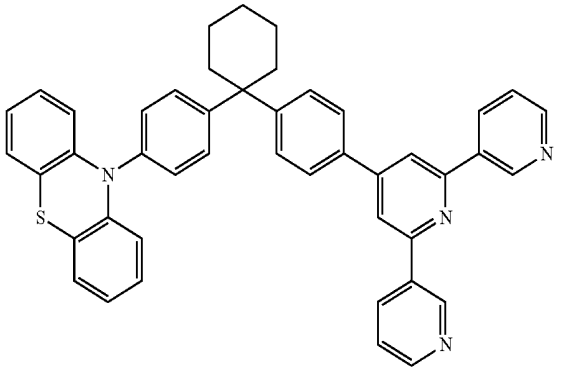

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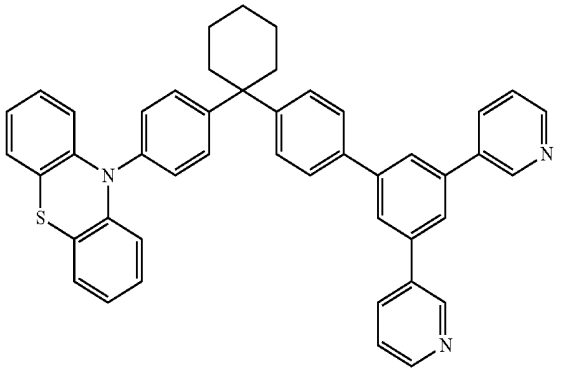

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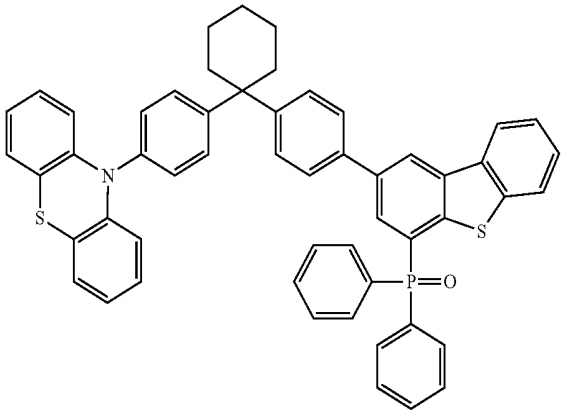

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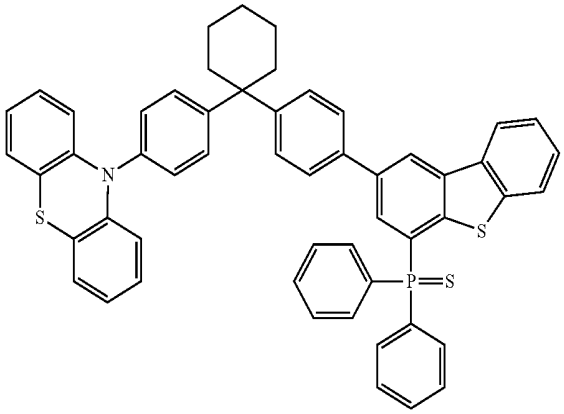

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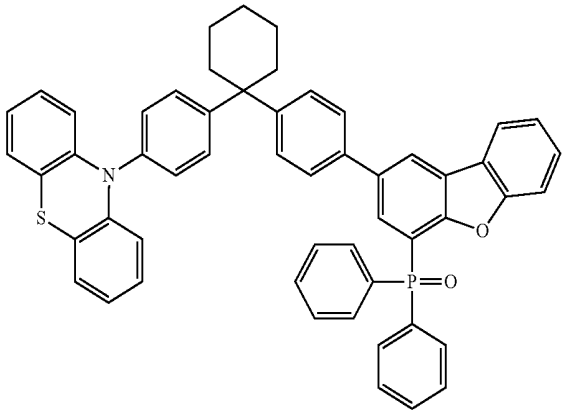
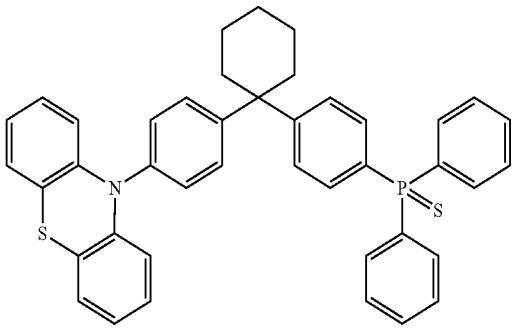
H069



H070



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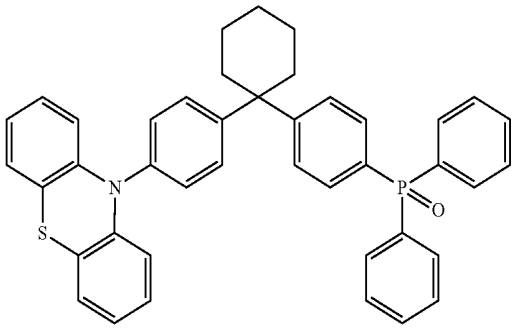

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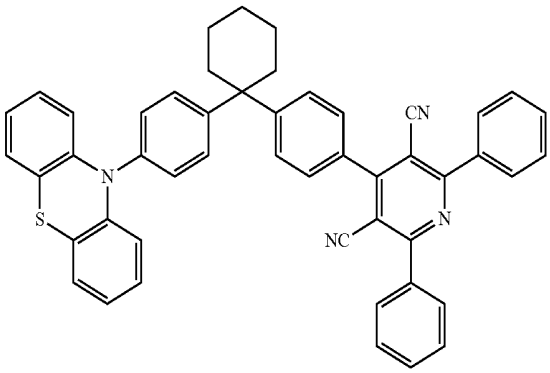

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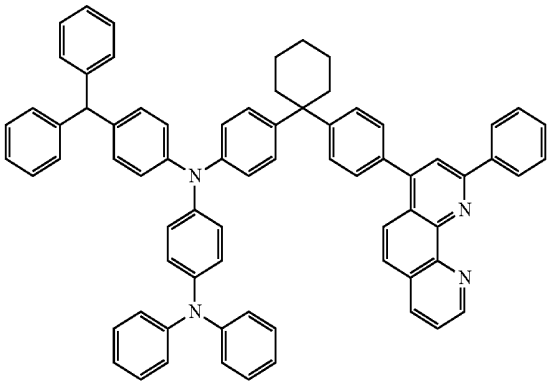

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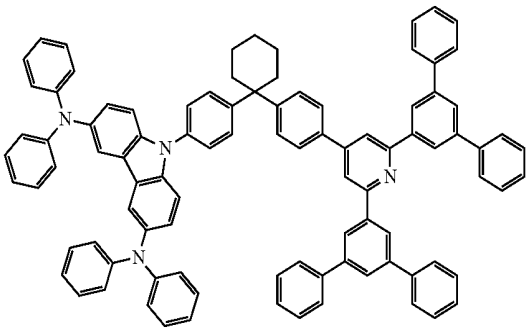

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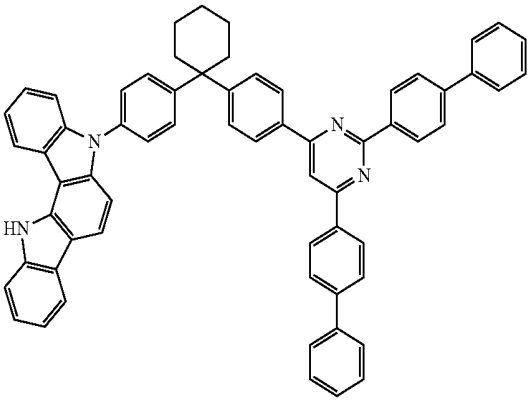

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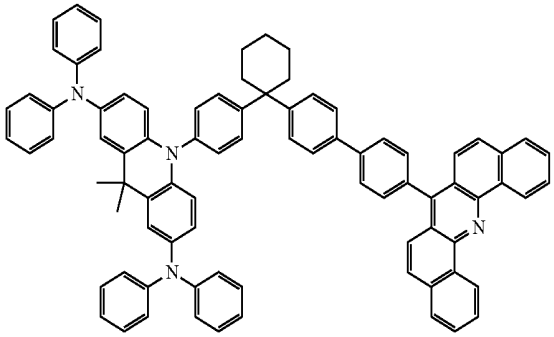

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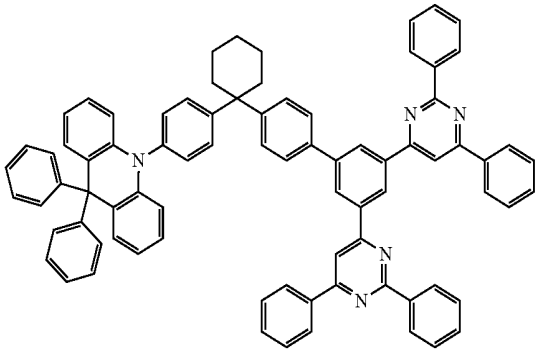

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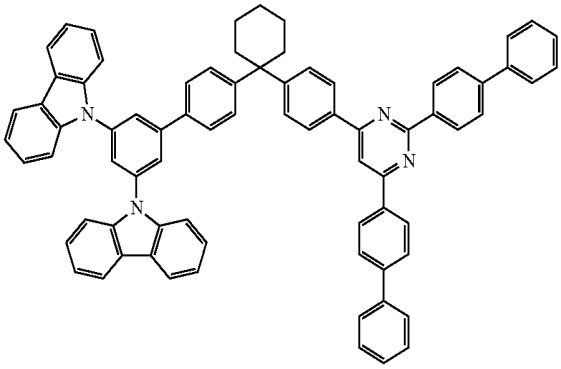

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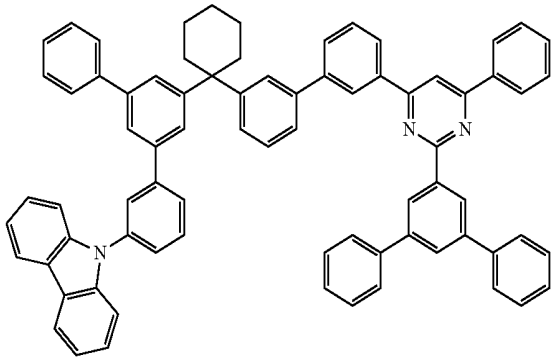

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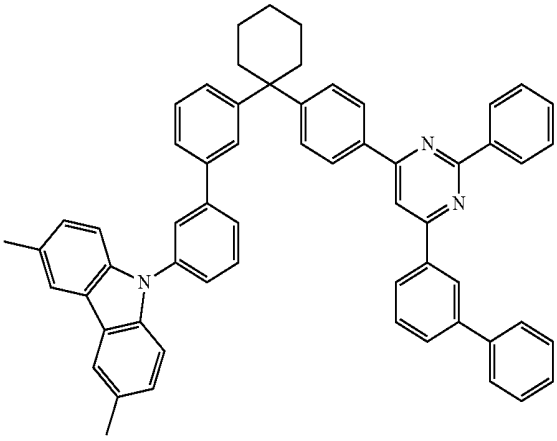

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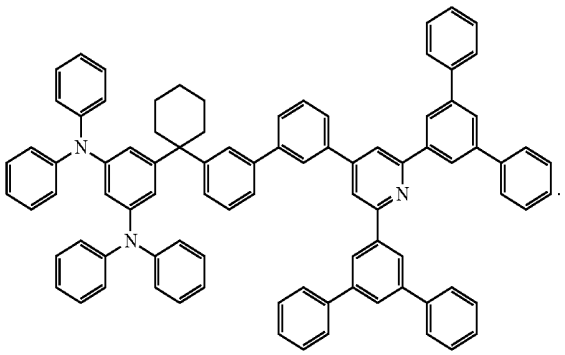
H081

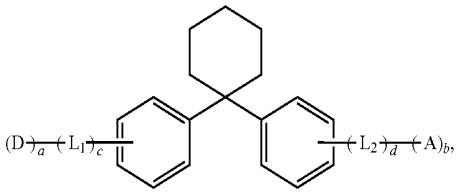


13. A display panel, comprising an organic light-emitting device, wherein the organic light-emitting device comprises an anode, a cathode disposed oppositely to the anode, and a light-emitting layer disposed between the anode and the cathode, wherein

the light-emitting layer comprises a host material and a guest material, and

the host material is one or more compounds having a chemical structure represented by Formula (I):

Formula (I)



wherein D represents an electron donor, A represents an electron acceptor, a is a number of the electron donor D, b is a number of the electron acceptor A, and a and b are each independently 1, 2, or 3,

c is a number of a group L_1, d is a number of a group L_2, and c and d are each 0, 1, or 2 independently,

wherein L_1 and L_2 are each independently selected from the group consisting of a single bond, a substituted or unsubstituted C1-C20 alkylene, a substituted or unsubstituted C3-C20 cycloalkylene, a substituted or unsubstituted C3-C20 heterocycloalkylene, a substituted or unsubstituted C6-C40 arylene, a substituted or unsubstituted C4-C40 heteroarylene, a substituted or unsubstituted C10-C60 fused arylene, and a substituted or unsubstituted C10-C60 fused heteroarylene,

wherein the electron donor D is selected from the group consisting of a substituted or unsubstituted C1-C20 alkyl, a substituted or unsubstituted C3-C20 cycloalkyl, a substituted or unsubstituted C1-C20 alkoxy, a substituted or unsubstituted C3-C20 heterocyclic group, a substituted or unsubstituted C6-C40 aryl, a substituted or unsubstituted C4-C40 heteroaryl, a substituted or unsubstituted C10-C60 fused arylene, a substituted or unsubstituted C10-C60 fused heteroarylene, a substituted or unsubstituted C12-C40 carbazolyl and a derivative group thereof, a substituted or unsubstituted C12-C40 diphenylamino and a derivative group thereof, and a substituted or unsubstituted C12-C40 acridinyl and a derivative group thereof, and

wherein the electron acceptor A is selected from the group consisting of nitrogen-containing heterocyclic substituents, cyano-containing substituents, triaryl-boron-derived substituents, and phosphoxy-containing substituents.

14. The display panel according to claim 13, wherein a singlet energy level of the host material is higher than a singlet energy level of the guest material, and an energy difference between the singlet energy level of the host material and the singlet energy level of the guest material is less than 0.8 eV, and

wherein a triplet energy level of the host material is higher than a triplet energy level of the guest material, and an energy difference between the triplet energy level of the host material and the triplet energy level of the guest material is less than 0.4 eV.

15. The display panel according to claim 13, wherein when the host material of the light-emitting layer is a red-light-emitting material, a triplet energy level of the red-light-emitting material has an energy greater than or equal to 2.2 eV;

when the host material of the light-emitting layer is a green-light-emitting material, a triplet energy level of the green-light-emitting material has an energy greater than or equal to 2.5 eV; and

when the host material of the light-emitting layer is a blue-light-emitting material, a triplet energy level of the blue-light-emitting material has an energy greater than or equal to 2.7 eV.

16. The display panel according to claim 13, wherein the organic light-emitting device further comprises one or more of a hole injection layer, a hole transmission layer, an electron blocking layer, a hole blocking layer, an electron transmission layer, and an electron injection layer.

17. The display panel according to claim 14, wherein the organic light-emitting device further comprises one or more of a hole injection layer, a hole transmission layer, an electron blocking layer, a hole blocking layer, an electron transmission layer, and an electron injection layer.

18. The display panel according to claim 15, wherein the organic light-emitting device further comprises one or more of a hole injection layer, a hole transmission layer, an electron blocking layer, a hole blocking layer, an electron transmission layer, and an electron injection layer.

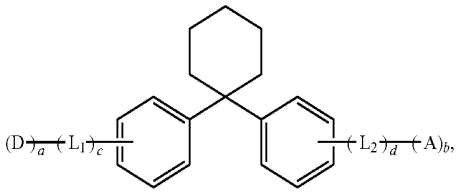
19. A display panel, comprising an organic light-emitting device,

wherein the organic light-emitting device comprises an anode, a cathode disposed oppositely to the anode, a capping layer disposed on a side of the cathode facing away from the anode, and an organic layer disposed between the anode and the cathode;

wherein the organic layer comprises an electron transmission layer, a hole transmission layer, and a light-emitting layer; and

wherein at least one of the capping layer, the electron transmission layer, the hole transmission layer and the light-emitting layer is made of a compound having a chemical structure represented by a Formula (I):

Formula (I)



wherein D represents an electron donor, A represents an electron acceptor, a is a number of an electron donor D, b is a number of an electron acceptor A, and a and b are each 1, 2, or 3 independently;

wherein c is a number of a group L_1, d is a number of a group L_2, and c and d are each 0, 1, or 2 independently;

wherein the groups L_1 and L_2 are each independently selected from the group consisting of a single bond, a substituted or unsubstituted C1-C20 alkylene, a substituted or unsubstituted C3-C20 cycloalkylene, a substituted or unsubstituted C3-C20 heterocycloalkylene, a substituted or unsubstituted C6-C40 arylene, a substituted or unsubstituted C4-C40 heteroarylene, a substituted or unsubstituted C10-C60 fused arylene, and a substituted or unsubstituted C10-C60 fused heteroarylene;

wherein the electron donor D is selected from the group consisting of a substituted or unsubstituted Cl-C20 alkyl, a substituted or unsubstituted C3-C20 cycloalkyl, a substituted or unsubstituted C1-C20 alkoxy, a substituted or unsubstituted C3-C20 heterocyclic group, a substituted or unsubstituted C6-C40 aryl, a substituted or unsubstituted C4-C40 heteroaryl, a substituted or unsubstituted C10-C60 fused arylene, a substituted or unsubstituted C10-C60 fused heteroarylene, a substituted or unsubstituted C12-C40 carbazolyl and a derivative group thereof, a substituted or unsubstituted C12-C40 diphenylamino and a derivative group thereof, and a substituted or unsubstituted C12-C40 acridinyl and a derivative group thereof; and

wherein the electron acceptor A is selected from the group consisting of nitrogen-containing heterocyclic substituents cyano-containing substituents, triaryl-boron-derived substituents, and phosphoxy-containing substituents.

* * * * *

专利名称(译)	化合物,显示面板和显示设备		
公开(公告)号	US20200212308A1	公开(公告)日	2020-07-02
申请号	US16/352663	申请日	2019-03-13
[标]申请(专利权)人(译)	武汉天马微电子有限公司		
申请(专利权)人(译)	武汉天马微电子有限公司.		
当前申请(专利权)人(译)	武汉天马微电子有限公司.		
[标]发明人	ZHANG LEI GAO WEI NIU JINGHUA LI YANG LU YAN HUANG GAOJUN		
发明人	ZHANG, LEI GAO, WEI NIU, JINGHUA LI, YANG LU, YAN HUANG, GAOJUN		
IPC分类号	H01L51/00 H01L51/50 C07D401/14 C07D401/10 C07D251/24		
CPC分类号	H01L51/0061 H01L51/5072 C07D401/14 H01L51/0067 H01L51/0073 H01L51/5036 C07D401/10 H01L51/5056 H01L51/5016 H01L51/0072 H01L51/0074 C07D251/24 C07D213/38 C07D213/85 C07D239/26 C07D403/10 C07D413/10 C07D413/14 C07D417/10 C07D417/14 C07D471/04 C07D487/04 C07F5/027 C07F9/5325 C07F9/5728 C07F9/65335 C07F9/65517 C07F9/655354 C07F9/65583 C07F9/65586 C09K11/06 C09K2211/1007 C09K2211/1014 C09K2211/1029 C09K2211/1033 C09K2211/104 C09K2211/1044 C09K2211/1059 C09K2211/1088 C09K2211/1092 C09K2211/1096 H01L51/0071 H01L51/5012 C07D403/14 C07F5/00 C07F9/00 H01L2251/552		
优先权	201811622667.X 2018-12-28 CN		
外部链接	Espacenet USPTO		

摘要(译)

可以将有机化合物用作OLED显示装置的主体材料。 该化合物具有由式(I)表示的结构: a和b分别独立地为1、2或3,分别表示电子给体D和电子受体A的数目; c和d分别为0、1或2,分别表示组L 1 的数目。 和组L 2 。 D, L 1 和L 2 各自为烷基,亚环烷基,杂环基,芳基,杂芳基,稠合芳基或稠合杂芳基; A选自含氮杂环取代基,含氰基取代基,三芳基硼衍生的取代基和含磷氧基的取代基。 该化合物具有双极性的D- (π)-σ-(π) -A结构,并且σ键可以中断D和A之间的分子内电荷转移,因此激发态仅限于部分的局部激发态 D或A,并且该化合物具有小的激发态偶极矩。