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(54) **MULTI-COMPONENT HOST MATERIAL AND AN ORGANIC ELECTROLUMINESCENCE DEVICE COMPRISING THE SAME**

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(57) **ABSTRACT**

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The present invention relates to a multi-component host material and an organic electroluminescent device comprising the same. By comprising a specific combination of the multi-component host compounds, the organic electroluminescent device according to the present invention can provide high luminous efficiency and excellent lifespan characteristics.

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**MULTI-COMPONENT HOST MATERIAL  
AND AN ORGANIC  
ELECTROLUMINESCENCE DEVICE  
COMPRISING THE SAME**

TECHNICAL FIELD

**[0001]** The present invention relates to a multi-component host material and an organic electroluminescence device comprising the same.

BACKGROUND ART

**[0002]** An electroluminescence device (EL device) is a self-light-emitting device which has advantages in that it provides a wider viewing angle, a greater contrast ratio, and a faster response time. An organic EL device was first developed by Eastman Kodak, by using small aromatic diamine molecules, and aluminum complexes as materials for forming a light-emitting layer [Appl. Phys. Lett. 51, 913, 1987].

**[0003]** An organic EL device (OLED) is a device changing electronic energy to light by applying electricity to an organic electroluminescent material, and generally has a structure comprising an anode, a cathode, and an organic layer between the anode and the cathode. The organic layer of an organic EL device may be comprised of a hole injection layer, a hole transport layer, an electron blocking layer, a light-emitting layer (which comprises host and dopant materials), an electron buffer layer, a hole blocking layer, an electron transport layer, an electron injection layer, etc., and the materials used for the organic layer are categorized by their functions in hole injection material, hole transport material, electron blocking material, light-emitting material, electron buffer material, hole blocking material, electron transport material, electron injection material, etc. In the organic EL device, due to an application of a voltage, holes are injected from the anode to the light-emitting layer, electrons are injected from the cathode to the light-emitting layer, and excitons of high energies are formed by a recombination of the holes and the electrons. By this energy, luminescent organic compounds reach an excited state, and light emission occurs by emitting light from energy due to the excited state of the luminescent organic compounds returning to a ground state.

**[0004]** The most important factor determining luminous efficiency in an organic EL device is the light-emitting material. A light-emitting material must have high quantum efficiency, high electron and hole mobility, and the formed light-emitting material layer must be uniform and stable. Light-emitting materials are categorized into blue, green, and red light-emitting materials dependent on the color of the light emission, additionally yellow or orange light-emitting materials. In addition, Light-emitting materials can also be categorized into host and dopant materials according to their functions. Recently, the development of an organic EL device providing high efficiency and long lifespan is an urgent issue. In particular, considering EL characteristic requirements for a middle or large-sized panel of OLED, materials showing better characteristics than conventional ones must be urgently developed. The host material which acts as a solvent in a solid state and transfers energy needs to have high purity and a molecular weight appropriate for vacuum deposition. Furthermore, the host material needs to have high glass transition temperature and high thermal

degradation temperature to achieve thermal stability, high electro-chemical stability to achieve long lifespan, ease of forming amorphous thin film, good adhesion to materials of adjacent layers, and non-migration to other layers.

**[0005]** A light-emitting material can be used as a combination of a host and a dopant to improve color purity, luminous efficiency, and stability. Generally, an EL device having excellent characteristics has a structure comprising a light-emitting layer formed by doping a dopant to a host. Since host materials greatly influence the efficiency and lifespan of the EL device when using a dopant/host material system as a light emitting material, their selection is important.

**[0006]** International Publication Nos. WO 2013/168688 A1 and WO 2009/060757 A1, and Japanese Patent Appl. Laying-Open No. 2013-183036 A1, etc. disclose organic electroluminescent devices using a biscarbazole derivative as a host material. However, the references fail to disclose an organic electroluminescent device using a multi-component host comprising a biscarbazole derivative and a carbazole derivative including a nitrogen-containing heteroaryl.

DISCLOSURE OF THE INVENTION

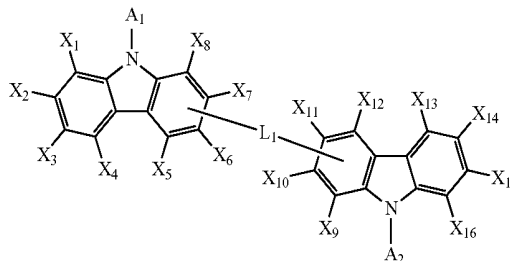
Problems to be Solved

**[0007]** The objective of the present invention is to provide an organic electroluminescent device having high efficiency and long lifespan.

Solution to Problems

**[0008]** The present inventors found that the above objective can be achieved by an organic electroluminescent device comprising at least one light-emitting layer between an anode and a cathode, wherein the light-emitting layer comprises a host and a phosphorescent dopant, the host consists of multi-component host compounds, at least a first host compound of the multi-component host compounds is represented by the following formula 1, and a second host compound is represented by the following formula 2:

(1)



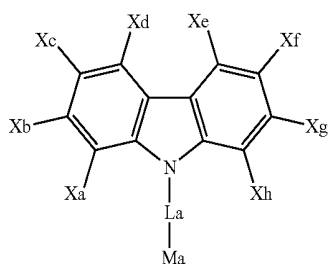
**[0009]** wherein

**[0010]** A<sub>1</sub> and A<sub>2</sub> each independently represent a substituted or unsubstituted (C6-C30)aryl;

**[0011]** L<sub>1</sub> represents a substituted or unsubstituted (C6-C30)arylene;

**[0012]** X<sub>1</sub> to X<sub>16</sub> each independently represent hydrogen, deuterium, a halogen, a cyano, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C2-C30)alkenyl, a substituted or unsubstituted (C2-C30)alkynyl, a substituted or unsubstituted (C3-C30)cycloalkyl, a substi-

tuted or unsubstituted (C6-C60)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, a substituted or unsubstituted tri(C1-C30)alkylsilyl, a substituted or unsubstituted tri(C6-C30)arylsilyl, a substituted or unsubstituted di(C1-C30)alkyl(C6-C30)arylsilyl, a substituted or unsubstituted (C1-C30)alkyldi(C6-C30)arylsilyl, or a substituted or unsubstituted mono- or di-(C6-C30)arylamino; or are linked to an adjacent substituent(s) to form a substituted or unsubstituted, mono- or polycyclic, (C3-C30) alicyclic or aromatic ring, whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen and sulfur;



[0013] wherein

[0014] Ma represents a substituted or unsubstituted nitrogen-containing (5- to 11-membered)heteroaryl;

[0015] La represents a single bond, or a substituted or unsubstituted (C6-C30)arylene;

[0016] Xa to Xh each independently represent hydrogen, deuterium, a halogen, a cyano, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C2-C30)alkenyl, a substituted or unsubstituted (C2-C30)alkynyl, a substituted or unsubstituted (C3-C30)cycloalkyl, a substituted or unsubstituted (C6-C60)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, a substituted or unsubstituted tri(C1-C30)alkylsilyl, a substituted or unsubstituted tri(C6-C30)arylsilyl, a substituted or unsubstituted di(C1-C30)alkyl(C6-C30)arylsilyl, or a substituted or unsubstituted mono- or di-(C6-C30)arylamino; or are linked to an adjacent substituent(s) to form a substituted or unsubstituted, mono- or polycyclic, (C3-C30) alicyclic or aromatic ring, whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen and sulfur; and the heteroaryl contains at least one hetero atom selected from B, N, O, S, P(=O), Si, and P.

#### Effects of the Invention

[0017] According to the present invention, an organic electroluminescent device having high efficiency and long lifespan is provided, and it is possible to manufacture a display device or a lighting device using the organic electroluminescent device.

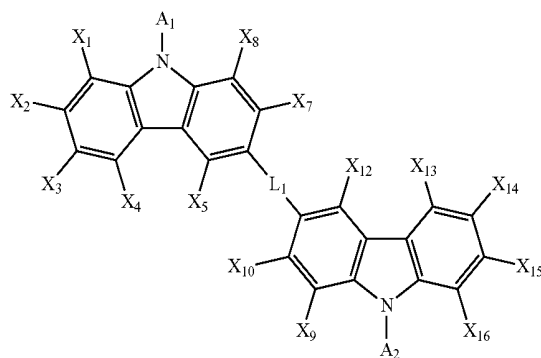
#### EMBODIMENTS OF THE INVENTION

[0018] Hereinafter, the present invention will be described in detail. However, the following description is intended to explain the invention, and is not meant in any way to restrict the scope of the invention.

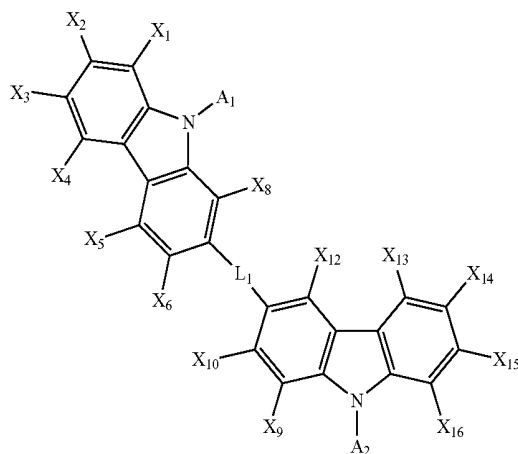
[0019] Hereinafter, the organic electroluminescent device comprising the organic electroluminescent compounds of formulae 1 and 2 will be described in detail.

[0020] The compound represented by formula 1 can be represented by formula 3, 4, 5, or 6:

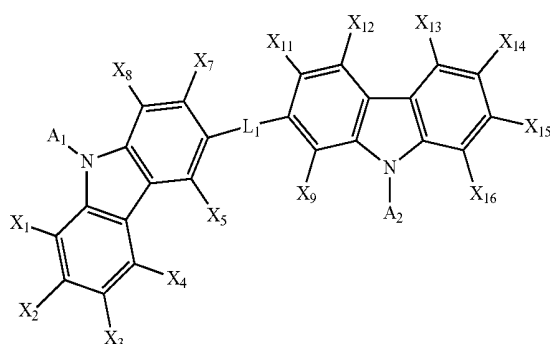
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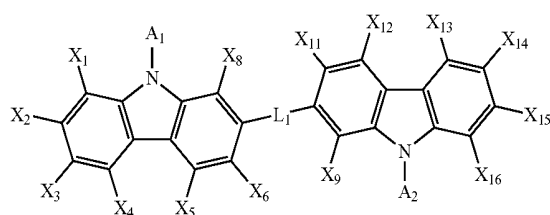
(4)



(5)



(6)



wherein

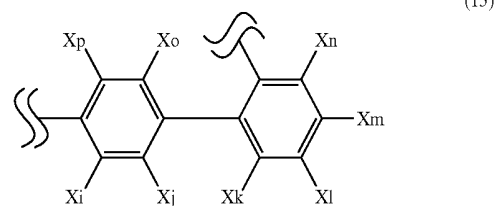
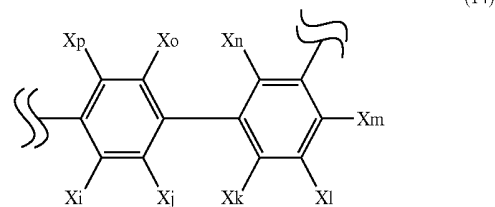
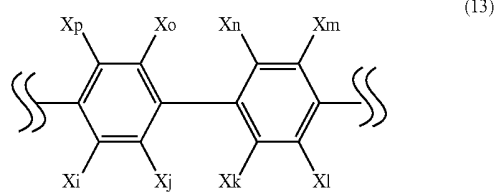
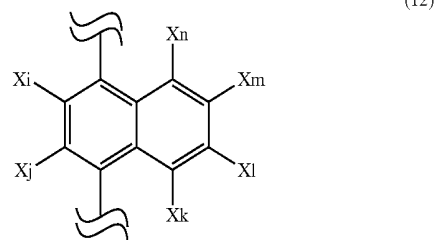
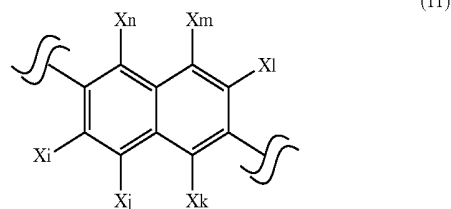
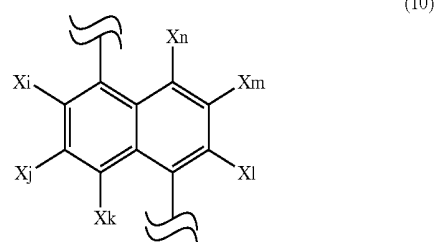
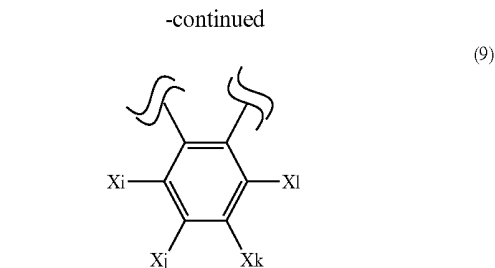
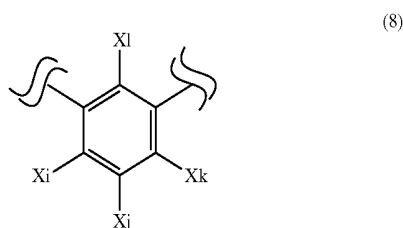
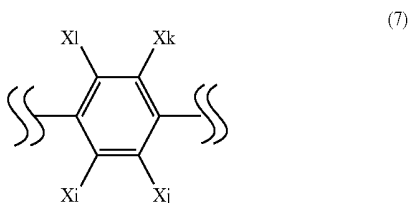
[0021] A<sub>1</sub>, A<sub>2</sub>, L<sub>1</sub>, and X<sub>1</sub> to X<sub>16</sub> are as defined in formula 1.

**[0022]** In formula 1 above,  $A_1$  and  $A_2$  each independently represent a substituted or unsubstituted (C6-C30)aryl, preferably, each independently represent a substituted or unsubstituted (C6-C18)aryl, more preferably, each independently represent a (C6-C18)aryl unsubstituted or substituted with a cyano, a (C1-C6)alkyl, a (C6-C12)aryl, or a tri(C6-C12)arylsilyl, and even more preferably, each independently represent phenyl, biphenyl, terphenyl, naphthyl, fluorenyl, phenanthrenyl, anthracenyl, indenyl, triphenylenyl, pyrenyl, tetracenyl, perylenyl, chrysenyl, or fluoranthenyl.

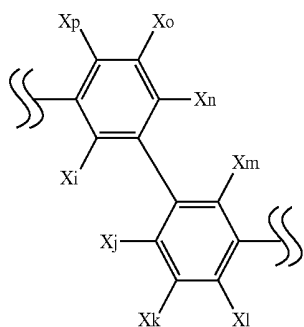
**[0023]** In formula 1 above,  $X_1$  to  $X_{16}$  each independently represent hydrogen, deuterium, a halogen, a cyano, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C2-C30)alkenyl, a substituted or unsubstituted (C2-C30)alkynyl, a substituted or unsubstituted (C3-C30)cycloalkyl, a substituted or unsubstituted (C6-C60)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, a substituted or unsubstituted tri(C1-C30)alkylsilyl, a substituted or unsubstituted tri(C6-C30)arylsilyl, a substituted or unsubstituted di(C1-C30)alkyl(C6-C30)arylsilyl, a substituted or unsubstituted (C1-C30)alkyldi(C6-C30)arylsilyl, or a substituted or unsubstituted mono- or di-(C6-C30)arylamino; or are linked to an adjacent substituent(s) to form a substituted or unsubstituted, mono- or polycyclic, (C3-C30) alicyclic or aromatic ring, whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen and sulfur, preferably, each independently represent hydrogen, a cyano, a substituted or unsubstituted (C6-C20)aryl, a substituted or unsubstituted (5- to 20-membered)heteroaryl, or a substituted or unsubstituted tri(C6-C12)arylsilyl, and more preferably, each independently represent hydrogen, a cyano, a (C6-C20)aryl unsubstituted or substituted with a cyano, an unsubstituted (5- to 20-membered)heteroaryl, or an unsubstituted tri(C6-C12)arylsilyl.

**[0024]** In formula 1 above,  $L_1$  represents a substituted or unsubstituted (C6-C30)arylene, preferably, represents a substituted or unsubstituted (C6-C15)arylene, and more preferably, represents a (C6-C15)arylene unsubstituted or substituted with a cyano, a (C1-C6)alkyl, or a tri(C6-C12)arylsilyl.

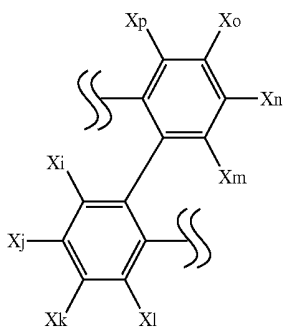
**[0025]** In addition,  $L_1$  can be represented by one of formulae 7 to 19:



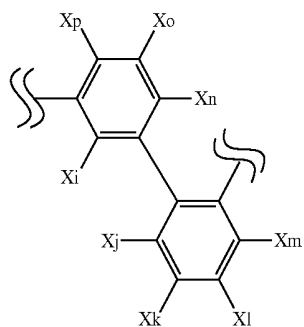
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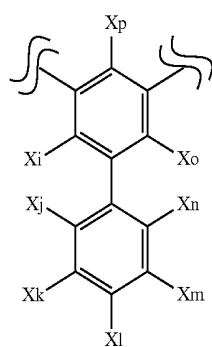
(16)



(17)



(18)



(19)

[0026] wherein

[0027] Xi to Xp each independently represent hydrogen, deuterium, a halogen, a cyano, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C2-C30)alkenyl, a substituted or unsubstituted (C2-C30)alkynyl, a substituted or unsubstituted (C3-C30)cycloalkyl, a substituted or unsubstituted (C6-C60)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, a substituted or unsubstituted tri(C1-C30)alkylsilyl, a substituted or unsubstituted tri(C6-C30)arylsilyl, a substituted or unsubstituted di(C1-C30)alkyl(C6-C30)arylsilyl, a substituted or unsubstituted (C1-C30)alkyldi(C6-C30)arylsilyl, or a substituted

or unsubstituted mono- or di-(C6-C30)arylamino; or are linked to an adjacent substituent(s) to form a substituted or unsubstituted, mono- or polycyclic, (C3-C30) alicyclic or aromatic ring, whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen and sulfur.

[0028] Preferably, Xi to Xp may each independently represent hydrogen, a halogen, a cyano, a (C1-C10)alkyl, a (C3-C20)cycloalkyl, a (C6-C12)aryl, a (C1-C6)alkyldi(C6-C12)arylsilyl, or a tri(C6-C12)arylsilyl, and more preferably, each independently represent hydrogen, a cyano, a (C1-C6)alkyl, or a tri(C6-C12)arylsilyl.

[0029] In formula 2 above, Ma represents a substituted or unsubstituted nitrogen-containing (5- to 11-membered)heteroaryl, preferably, represents a substituted or unsubstituted nitrogen-containing (6- to 10-membered)heteroaryl, and more preferably, represents a nitrogen-containing (6- to 10-membered)heteroaryl substituted with an unsubstituted (C6-C18)aryl, a (C6-C12)aryl substituted with a cyano, a (C6-C12)aryl substituted with a (C1-C6)alkyl, a (C6-C12)aryl substituted with a tri(C6-C12)arylsilyl, or a (6- to 15-membered)heteroaryl.

[0030] In addition, Ma may represent a monocyclic heteroaryl selected from the group consisting of pyrrolyl, imidazolyl, pyrazolyl, triazinyl, tetrazinyl, triazolyl, tetrazolyl, pyridyl, pyrazinyl, pyrimidinyl, and pyridazinyl, or a fused heteroaryl selected from the group consisting of benzoimidazolyl, isoindolyl, indolyl, indazolyl, benzothiadiazolyl, quinolyl, isoquinolyl, cinnolyl, quinazolyl, naphthyridinyl, and quinoxalyl, and preferably may represent triazinyl, pyrimidinyl, pyridyl, quinolyl, isoquinolyl, quinazolyl, naphthyridinyl, or quinoxalyl.

[0031] In formula 2 above, La represents a single bond, or a substituted or unsubstituted (C6-C30)arylene, preferably, represents a single bond, or a substituted or unsubstituted (C6-C12)arylene, and more preferably, represents a single bond, or a (C6-C12)arylene unsubstituted or substituted with a tri(C6-C10)arylsilyl.

[0032] In addition, La can represent a single bond, or be represented by one of formulae 7 to 19 as above.

[0033] In formula 2 above, Xa to Xh each independently represent hydrogen, deuterium, a halogen, a cyano, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C2-C30)alkenyl, a substituted or unsubstituted (C2-C30)alkynyl, a substituted or unsubstituted (C3-C30)cycloalkyl, a substituted or unsubstituted (C6-C60)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, a substituted or unsubstituted tri(C1-C30)alkylsilyl, a substituted or unsubstituted tri(C6-C30)arylsilyl, a substituted or unsubstituted di(C1-C30)alkyl(C6-C30)arylsilyl, or a substituted or unsubstituted mono- or di-(C6-C30)arylamino; or are linked to an adjacent substituent(s) to form a substituted or unsubstituted, mono- or polycyclic, (C3-C30) alicyclic or aromatic ring, whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen and sulfur, preferably, each independently represent hydrogen, a cyano, a substituted or unsubstituted (C6-C15)aryl, a substituted or unsubstituted (10- to 20-membered)heteroaryl, or a substituted or unsubstituted tri(C6-C10)arylsilyl; or are linked to an adjacent substituent(s) to form a substituted or unsubstituted, mono- or polycyclic, (C6-C20) aromatic ring, and more preferably, each independently represent hydrogen; a cyano; a (C6-C15)aryl unsubstituted or substituted with a tri(C6-C10)arylsilyl; a

(10- to 20-membered)heteroaryl unsubstituted or substituted with a (C6-C12)aryl or a cyano(C6-C12)aryl; or an unsubstituted tri(C6-C10)arylsilyl; or are linked to an adjacent substituent(s) to form a substituted or unsubstituted benzene, a substituted or unsubstituted indole, a substituted or unsubstituted benzoindole, a substituted or unsubstituted indene, a substituted or unsubstituted benzofuran, or a substituted or unsubstituted benzothiophene.

**[0034]** Herein, “(C1-C30)alkyl” is meant to be a linear or branched alkyl having 1 to 30 carbon atoms, in which the number of carbon atoms is preferably 1 to 20, more preferably 1 to 10, and includes methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, etc.; “(C2-C30)alkenyl” is meant to be a linear or branched alkenyl having 2 to 30 carbon atoms, in which the number of carbon atoms is preferably 2 to 20, more preferably 2 to 10, and includes vinyl, 1-propenyl, 2-propenyl, 1-butenyl, 2-butenyl, 3-butenyl, 2-methylbut-2-enyl, etc.; “(C2-C30)alkynyl” is meant to be a linear or branched alkynyl having 2 to 30 carbon atoms, in which the number of carbon atoms is preferably 2 to 20, more preferably 2 to 10, and includes ethynyl, 1-propynyl, 2-propynyl, 1-butylnyl, 2-butylnyl, 3-butylnyl, 1-methylpent-2-ynyl, etc.; “(C3-C30)cycloalkyl” is a mono- or polycyclic hydrocarbon having 3 to 30 carbon atoms, in which the number of carbon atoms is preferably 3 to 20, more preferably 3 to 7, and includes cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, etc.; “(3- to 7-membered)heterocycloalkyl” is a cycloalkyl having 3 to 7 ring backbone atoms, preferably 5 to 7, including at least one heteroatom selected from B, N, O, S, P(=O), Si and P, preferably O, S and N, and includes tetrahydrofuran, pyrrolidine, thiolan, tetrahydropyran, etc.; “(C6-C30)aryl(ene)” is a monocyclic or fused ring derived from an aromatic hydrocarbon having 6 to 30 carbon atoms, in which the number of carbon atoms is preferably 6 to 20, more preferably 6 to 15, and includes phenyl, biphenyl, terphenyl, naphthyl, binaphthyl, phenyl-naphthyl, naphthylphenyl, fluorenyl, phenylfluorenyl, benzofluorenyl, dibenzofluorenyl, phenanthrenyl, phenyl-phenanthrenyl, anthracenyl, indenyl, triphenylenyl, pyrenyl, tetracenyl, perylenyl, chrysenyl, naphthacenyl, fluoranthenyl, etc.; “(3- to 30-membered)heteroaryl” is an aryl having 3 to 30 ring backbone atoms, including at least one, preferably 1 to 4 heteroatoms selected from the group consisting of B, N, O, S, P(=O), Si and P; is a monocyclic ring, or a fused ring condensed with at least one benzene ring; may be partially saturated; may be one formed by linking at least one heteroaryl or aryl group to a heteroaryl group via a single bond(s); and includes a monocyclic ring-type heteroaryl including furyl, thiophenyl, pyrrolyl, imidazolyl, pyrazolyl, thiazolyl, thiadiazolyl, isothiazolyl, isoxazolyl, oxazolyl, oxadiazolyl, triazinyl, tetrazinyl, triazolyl, tetrazolyl, furazanyl, pyridyl, pyrazinyl, pyrimidinyl, pyridazinyl, etc., and a fused ring-type heteroaryl including benzofuranyl, benzothiophenyl, isobenzofuranyl, dibenzofuranyl, dibenzothiophenyl, benzoimidazolyl, benzothiazolyl, ben-

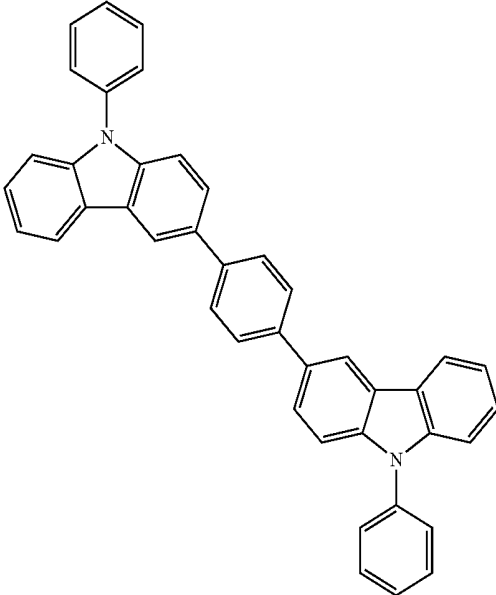
zothiazolyl, benzoisoxazolyl, benzoxazolyl, isoindolyl, indolyl, benzindolyl, indazolyl, benzothiadiazolyl, quinolyl, isoquinolyl, cinnolyl, quinazolyl, quinoxalyl, carbazolyl, phenoxazinyl, phenanthridinyl, benzodioxolyl, etc.; “nitrogen-containing (5- to 30-membered)heteroaryl” is an aryl having 5 to 30 ring backbone atoms, preferably 5 to 20, and more preferably 5 to 15, including at least one heteroatom, N; is a monocyclic ring, or a fused ring condensed with at least one benzene ring; may be partially saturated; may be one formed by linking at least one heteroaryl or aryl group to a heteroaryl group via a single bond(s); and includes a monocyclic ring-type heteroaryl including pyrrolyl, imidazolyl, pyrazolyl, triazinyl, tetrazinyl, triazolyl, tetrazolyl, pyridyl, pyrazinyl, pyrimidinyl, pyridazinyl, etc., and a fused ring-type heteroaryl including benzoimidazolyl, isoindolyl, indolyl, indazolyl, benzothiadiazolyl, quinolyl, isoquinolyl, cinnolyl, quinazolyl, quinoxalyl, carbazolyl, phenanthridinyl, etc. Further, “halogen” includes F, Cl, Br, and I.

**[0035]** Herein, “substituted” in the expression “substituted or unsubstituted” means that a hydrogen atom in a certain functional group is replaced with another atom or group, i.e. a substituent. The substituents of the substituted alkyl, the substituted alkenyl, the substituted alkynyl, the substituted cycloalkyl, the substituted aryl(ene), the substituted heteroaryl, the substituted trialkylsilyl, the substituted triarylsilyl, the substituted dialkylarylsilyl, the substituted alkyl-diarylsilyl, the substituted mono- or di-arylamino, and the substituted nitrogen-containing heteroaryl in A<sub>1</sub>, A<sub>2</sub>, L<sub>1</sub>, X<sub>1</sub> to X<sub>16</sub>, Ma, La, and Xa to Xh in formulae 1 and 2 each independently are at least one selected from the group consisting of deuterium, a halogen, a cyano, a carboxyl, a nitro, a hydroxyl, a (C1-C30)alkyl, a halo(C1-C30)alkyl, a (C2-C30)alkenyl, a (C2-C30)alkynyl, a (C1-C30)alkoxy, a (C1-C30)alkylthio, a (C3-C30)cycloalkyl, a (C3-C30)cycloalkenyl, a (3- to 7-membered)heterocycloalkyl, a (C6-C30)aryloxy, a (C6-C30)arylthio, a (3- to 30-membered)heteroaryl unsubstituted or substituted with a (C6-C30)aryl, a (C6-C30)aryl unsubstituted or substituted with a cyano, a (3- to 30-membered)heteroaryl, or a tri(C6-C30)arylsilyl, a tri(C1-C30)alkylsilyl, a tri(C6-C30)arylsilyl, a di(C1-C30)alkyl(C6-C30)arylsilyl, a (C1-C30)alkyl-di(C6-C30)arylsilyl, an amino, a mono- or di-(C1-C30)alkylamino, a mono- or di-(C6-C30)arylamino, a (C1-C30)alkyl(C6-C30)arylamino, a (C1-C30)alkylcarbonyl, a (C1-C30)alkoxycarbonyl, a (C6-C30)arylcarbonyl, a di(C6-C30)arylboronyl, a di(C1-C30)alkylboronyl, a (C1-C30)alkyl(C6-C30)arylboronyl, a (C6-C30)aryl(C1-C30)alkyl, and a (C1-C30)alkyl(C6-C30)aryl, and preferably are at least one selected from the group consisting of a cyano, a (C1-C6)alkyl, a (5- to 15-membered)heteroaryl, a (C6-C18)aryl unsubstituted or substituted with a cyano or a tri(C6-C12)arylsilyl, a tri(C6-C12)arylsilyl, and a (C1-C6)alkyl(C6-C12)aryl.

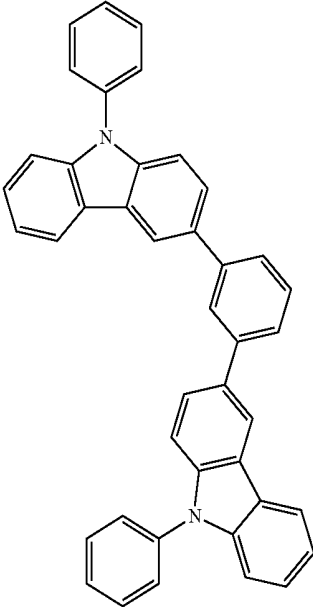
**[0036]** In formula 1, a triarylsilyl as X<sub>1</sub> to X<sub>16</sub> is preferably a triphenylsilyl.

**[0037]** The first host compound represented by formula 1 includes the following compounds, but is not limited thereto:

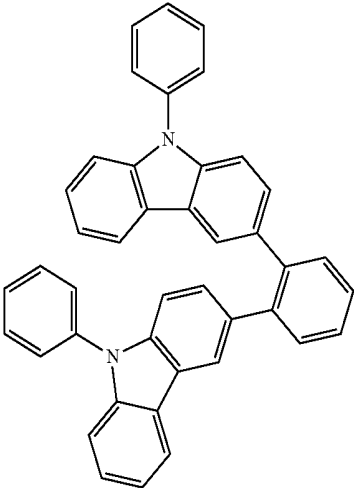
H1-1



H1-2

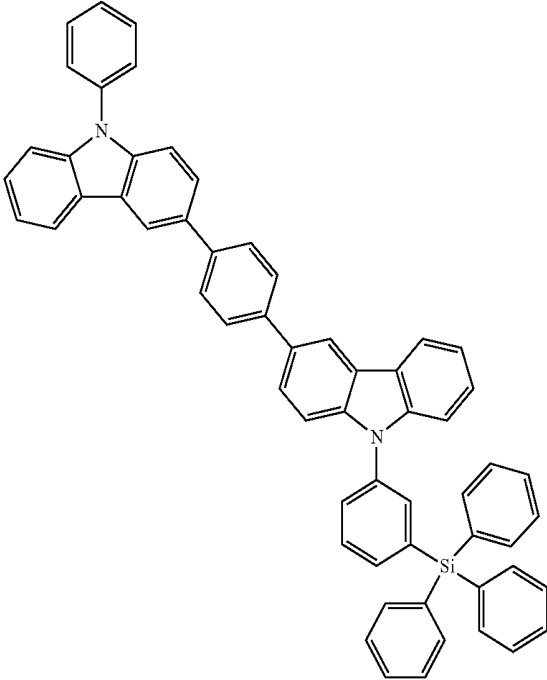


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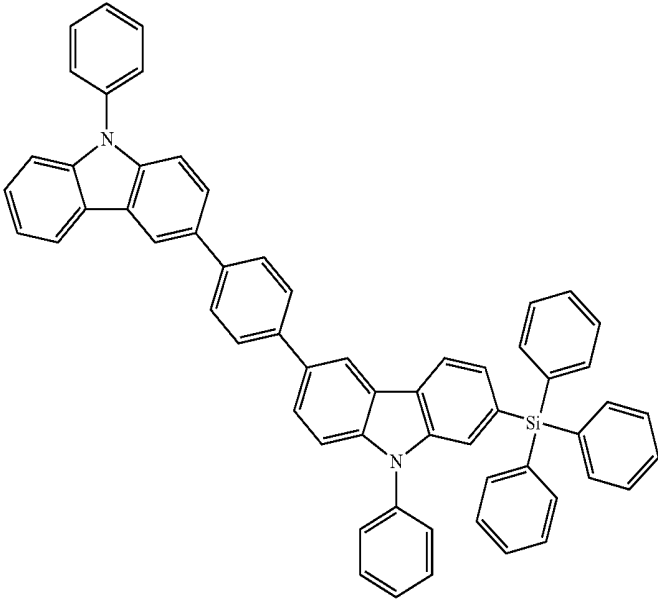


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H1-4

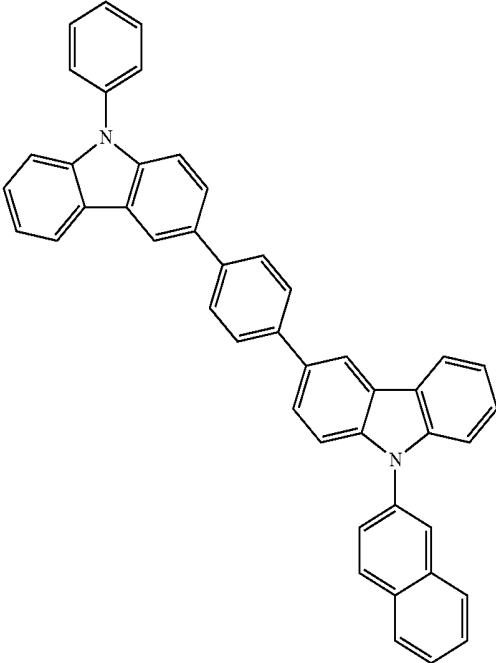
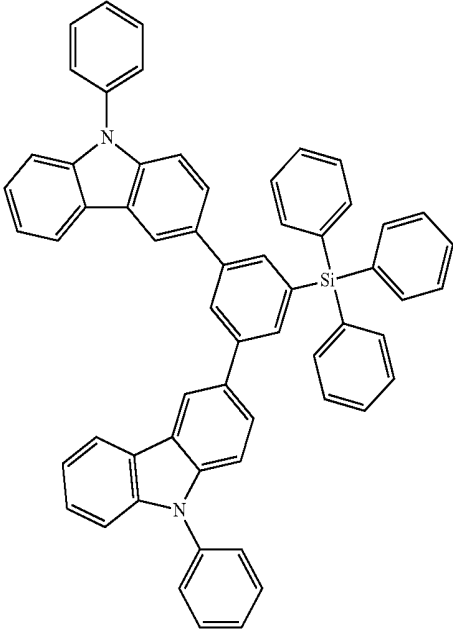


H1-5



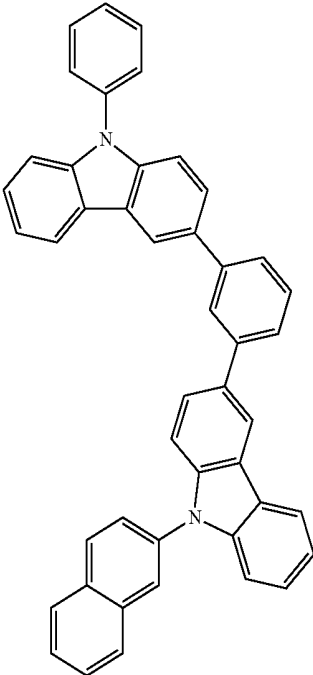
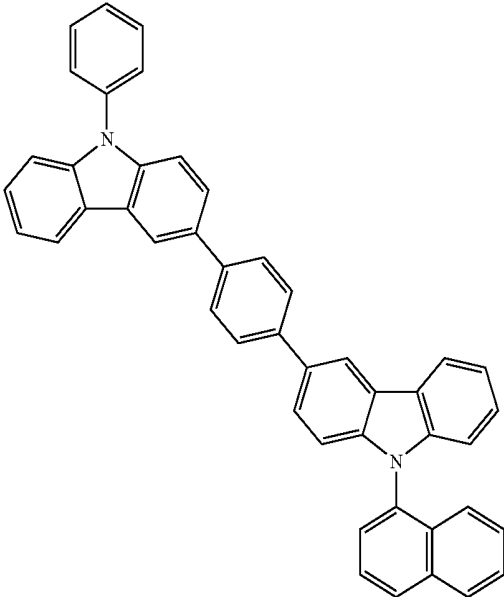
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H1-6

H1-7

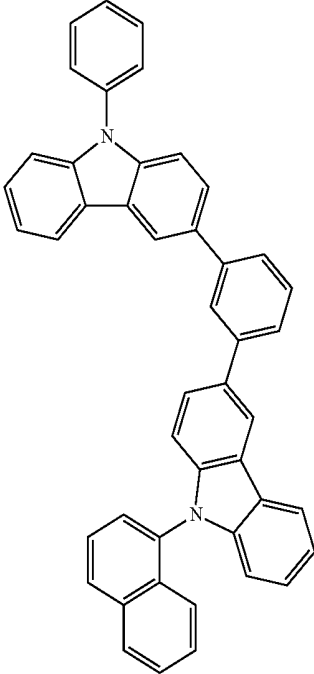


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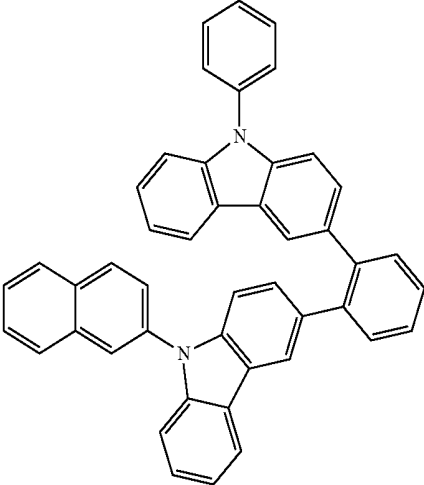
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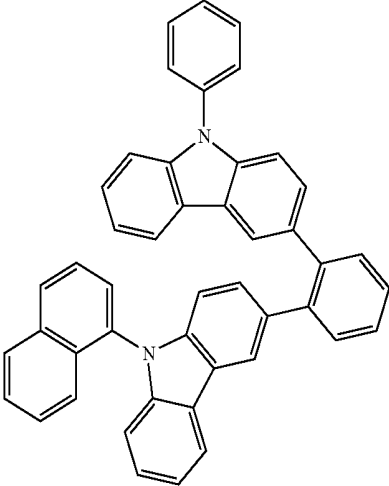
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H1-10



H1-11



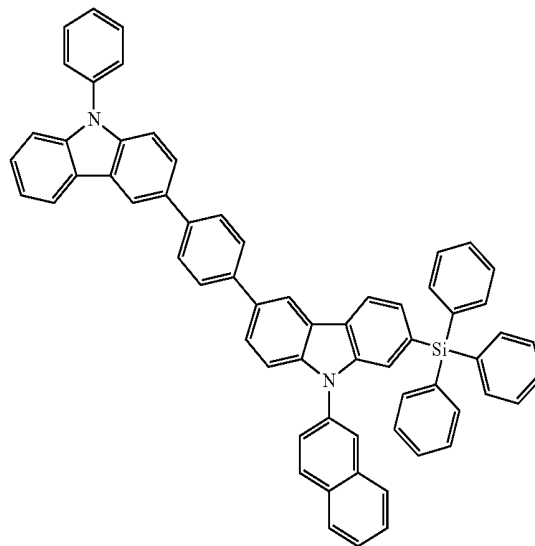
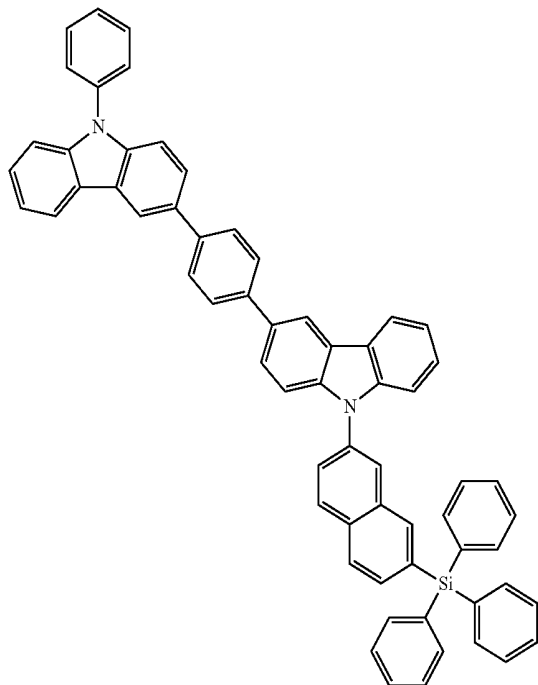
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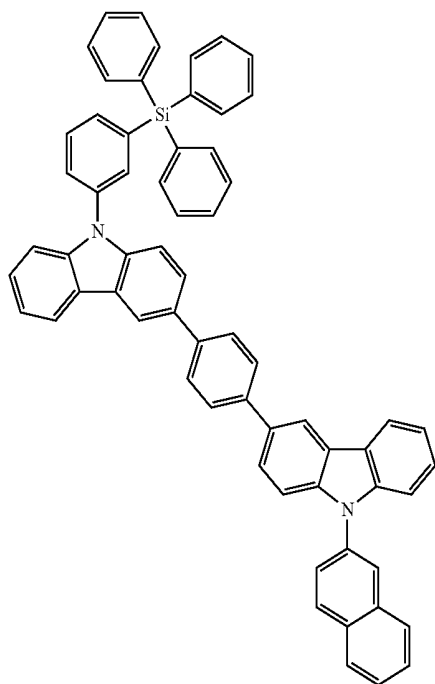
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HI-13

HI-14

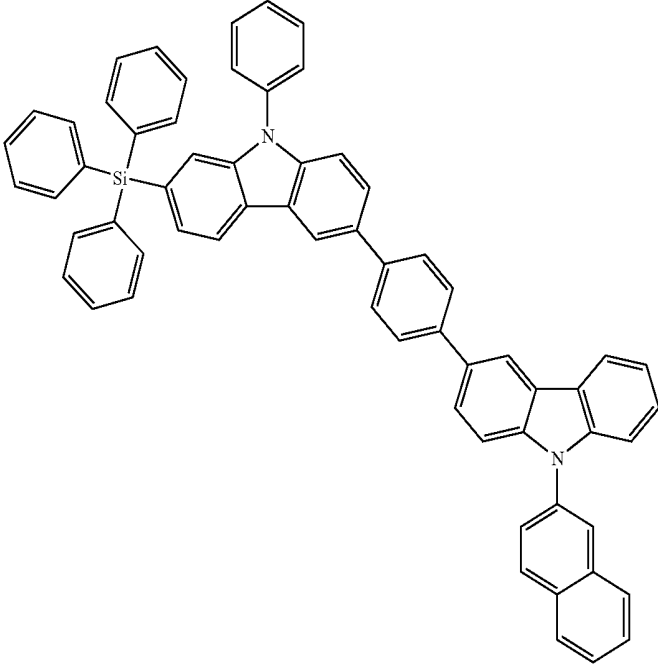


HI-15

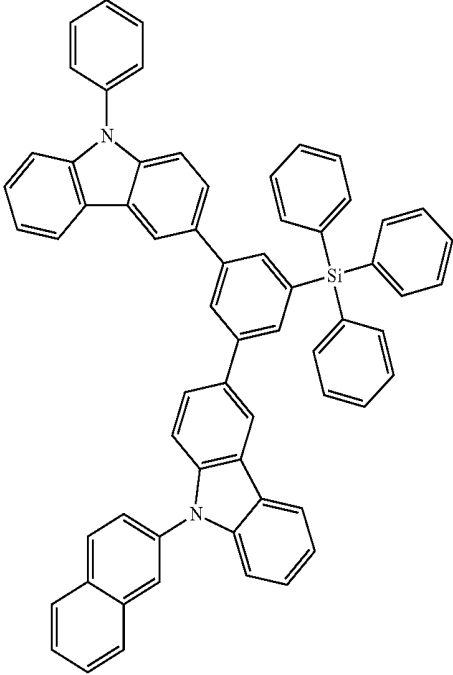


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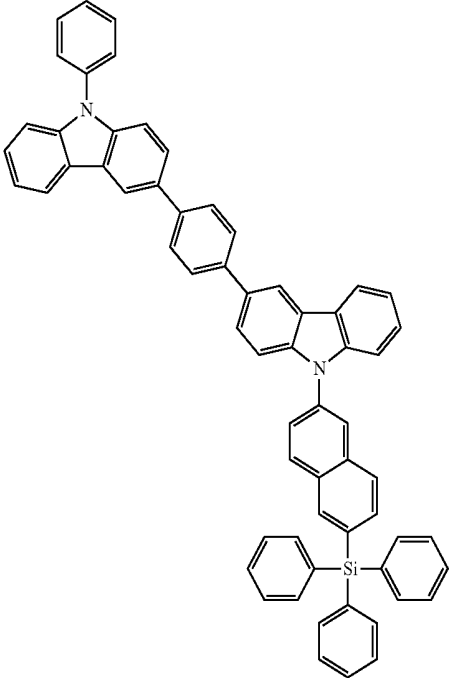
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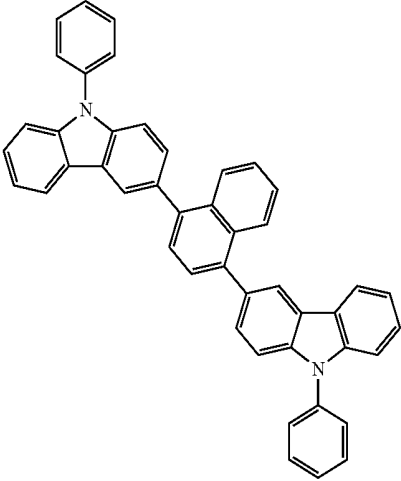
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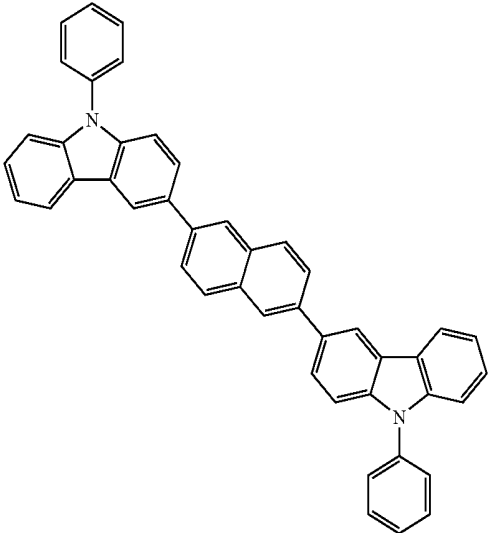
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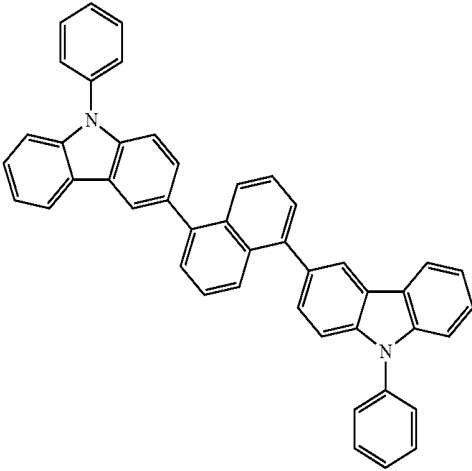
H1-19



H1-20

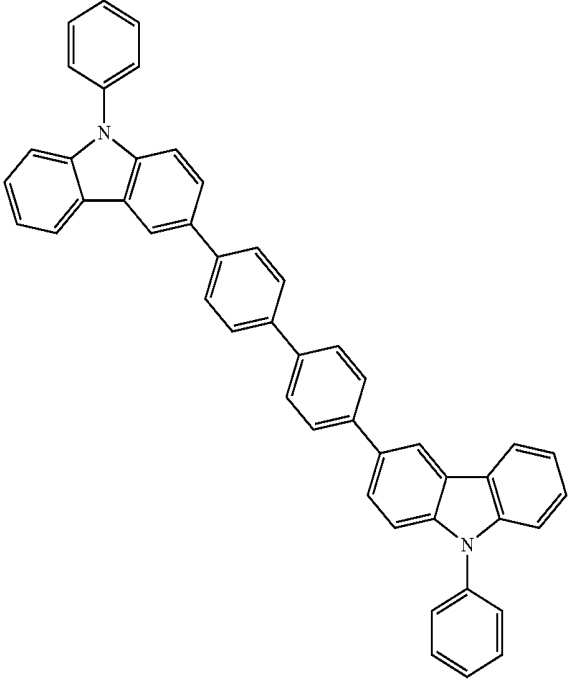


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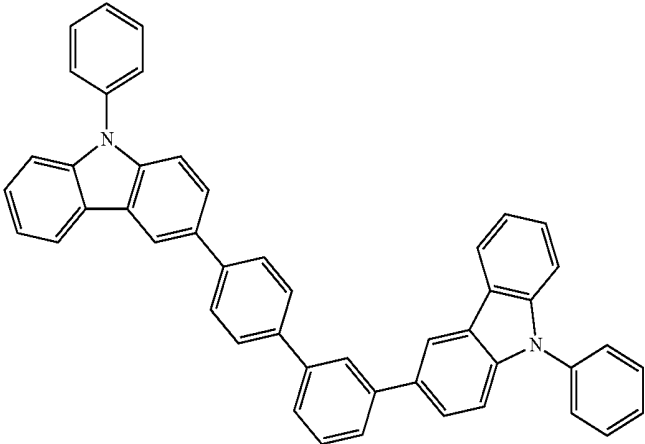


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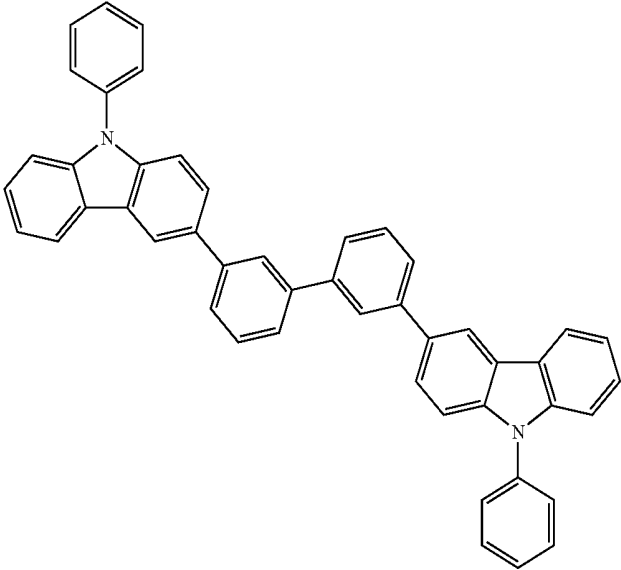


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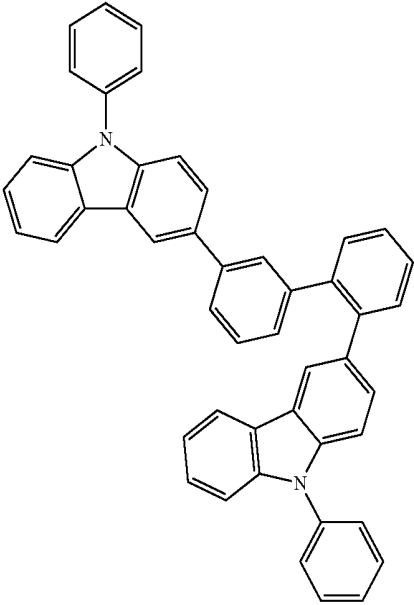
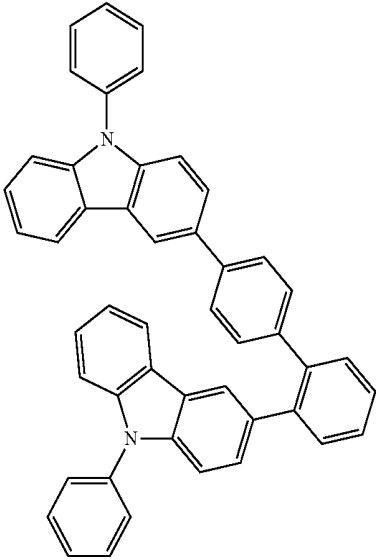
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H1-24



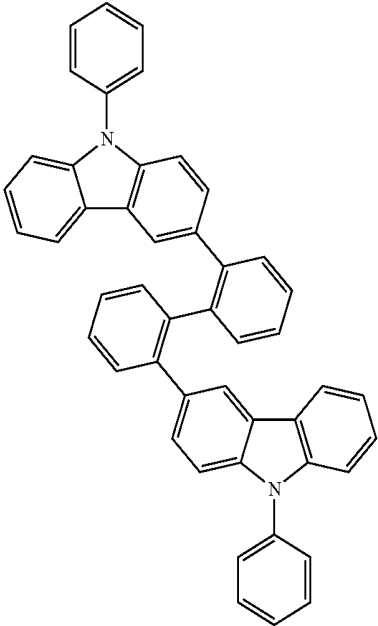
H1-25

H1-26

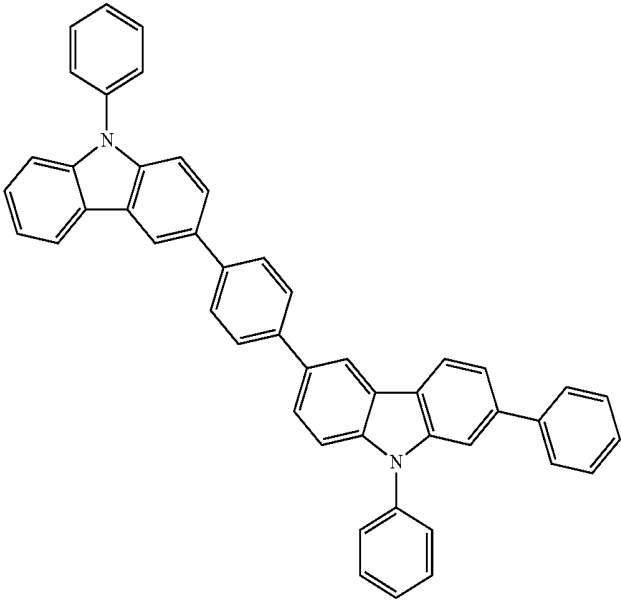


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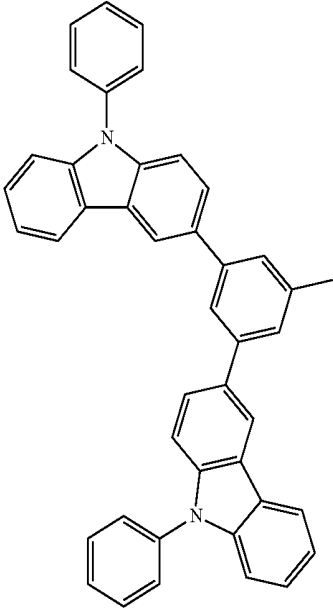


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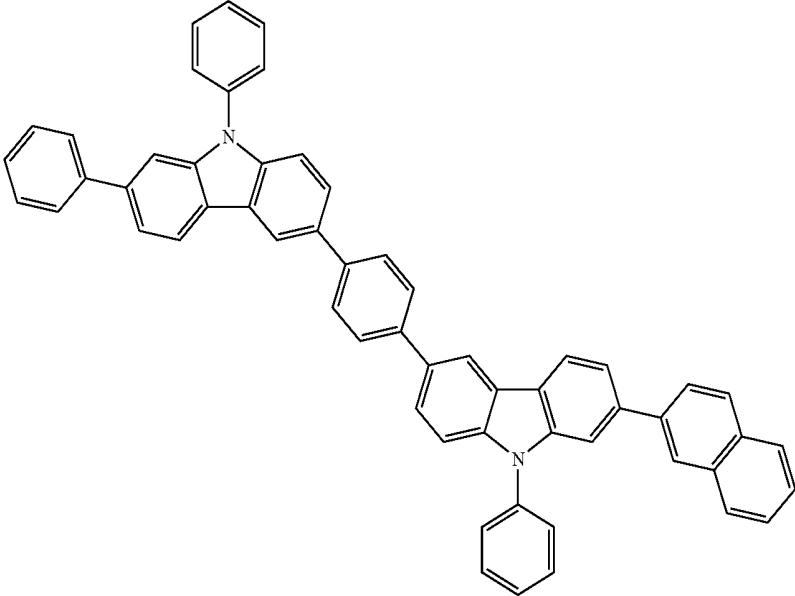


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H1-29

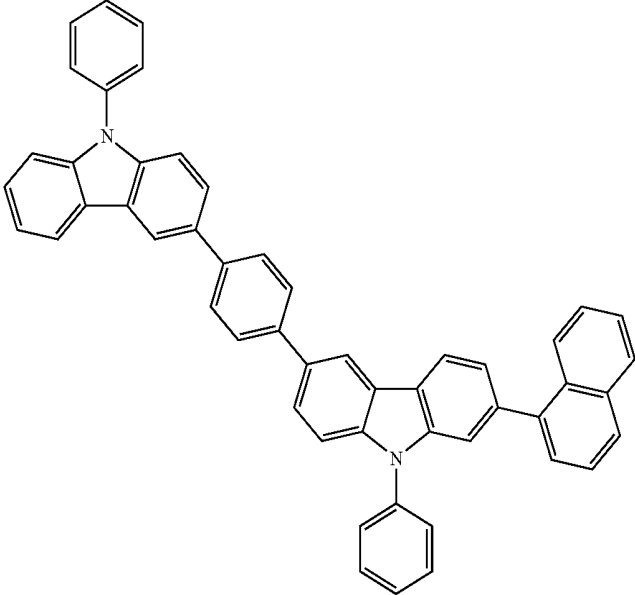


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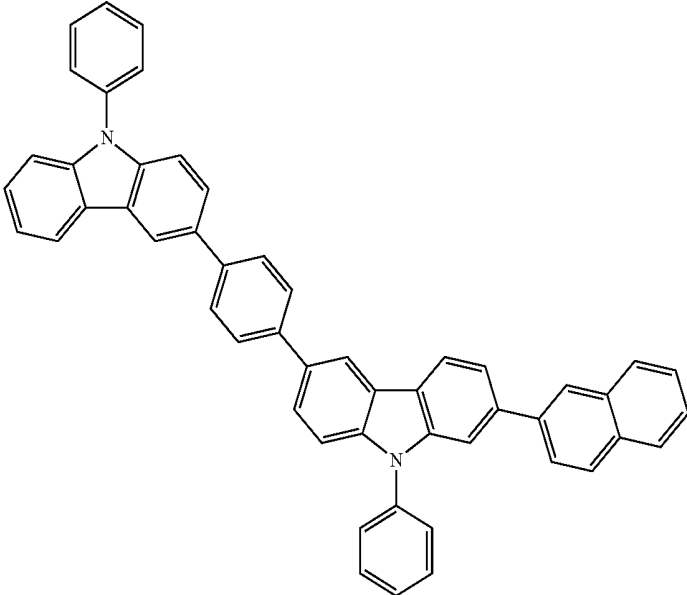


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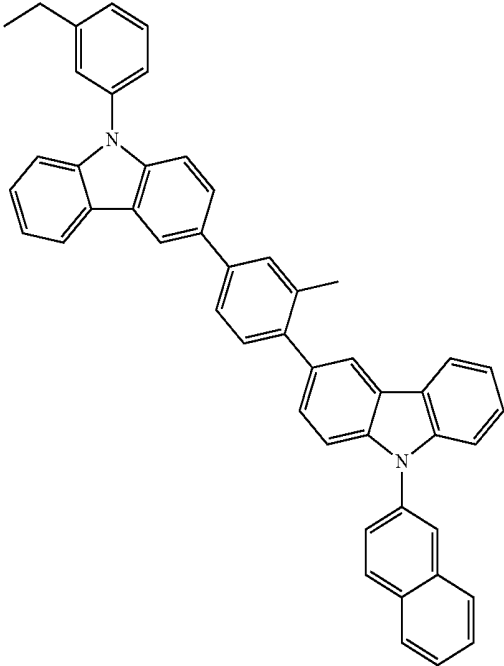


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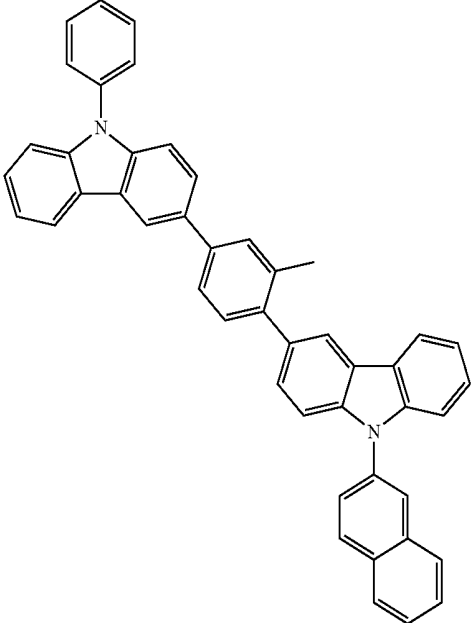


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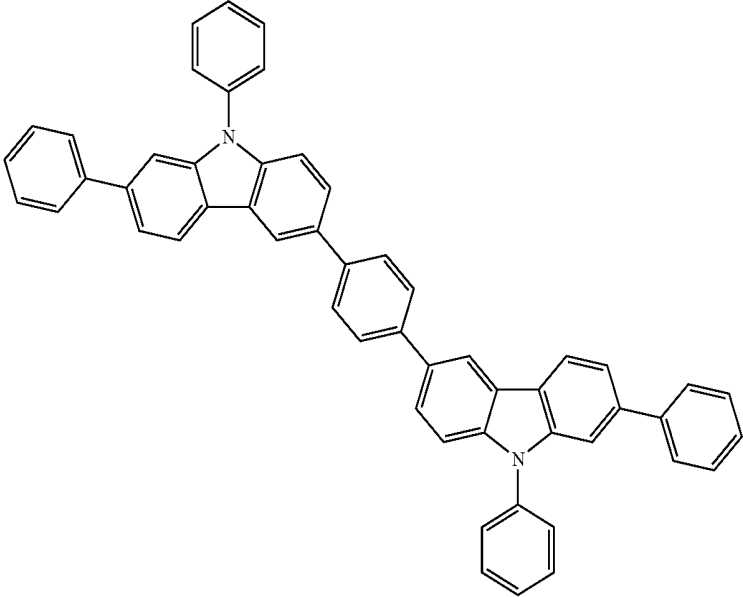


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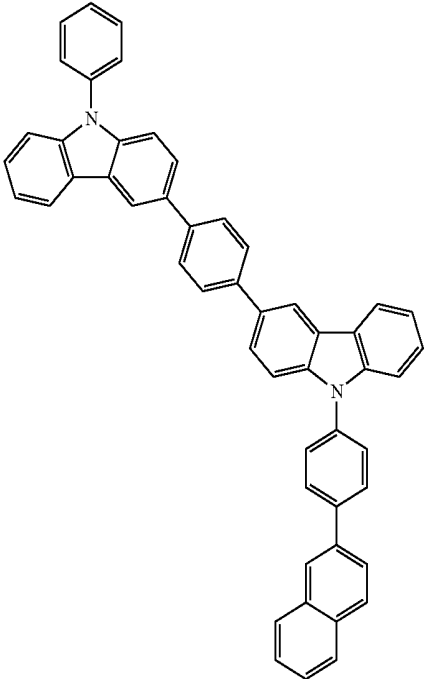


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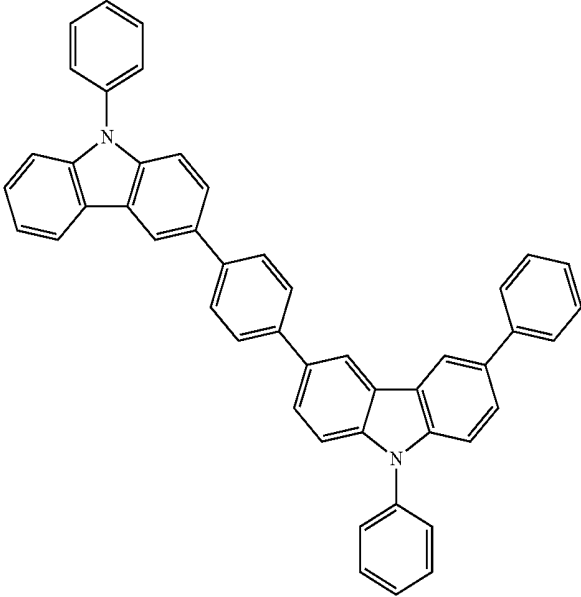


H1-36

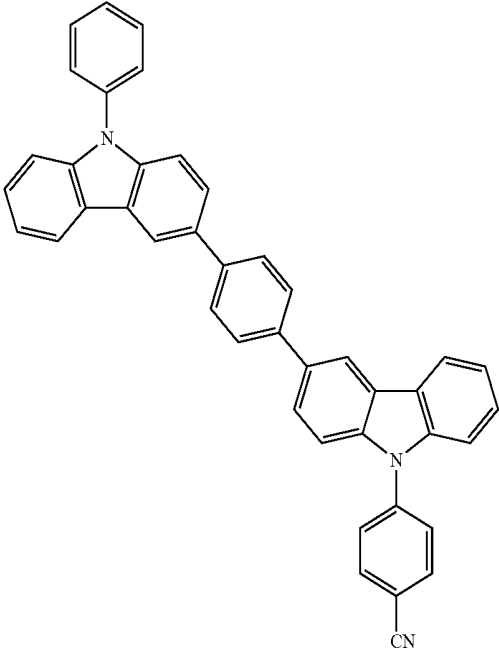


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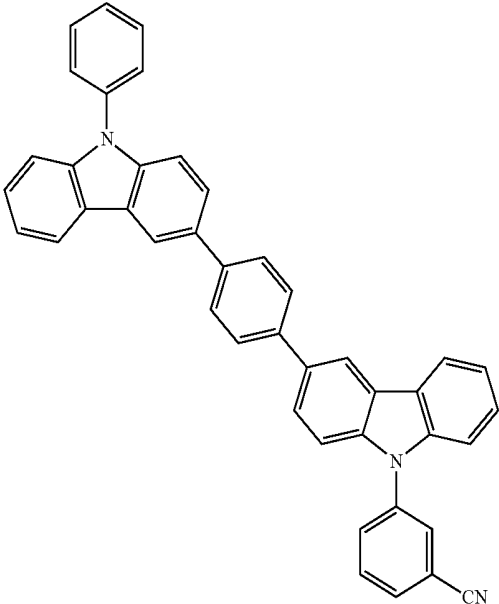
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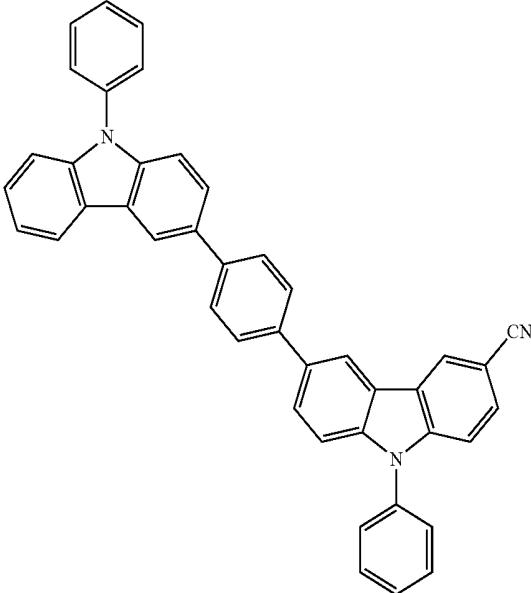
H1-38



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H1-39

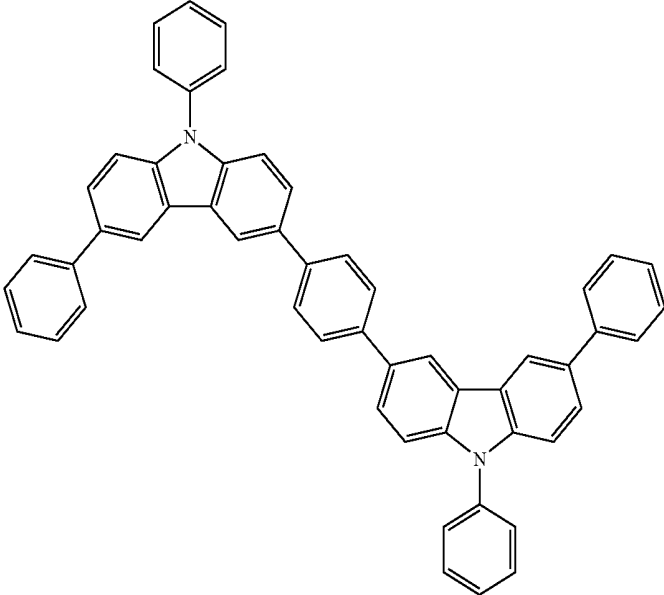


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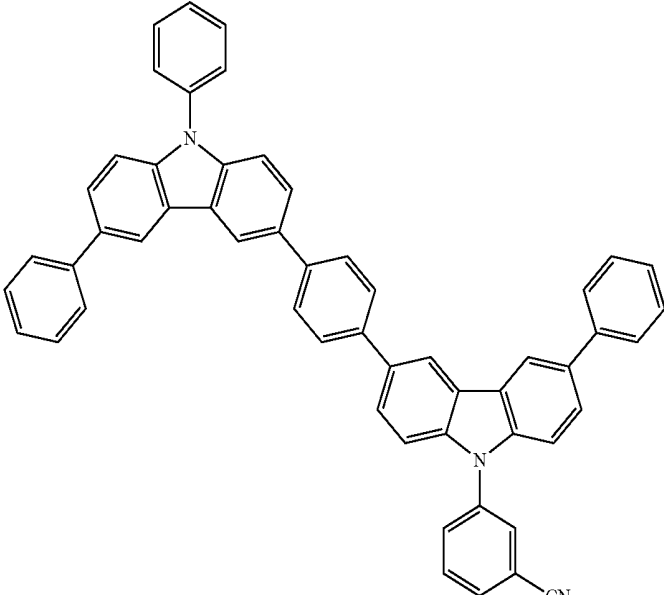


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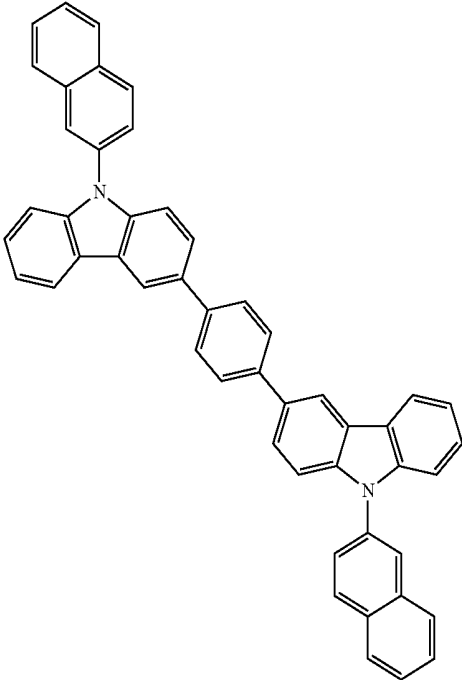


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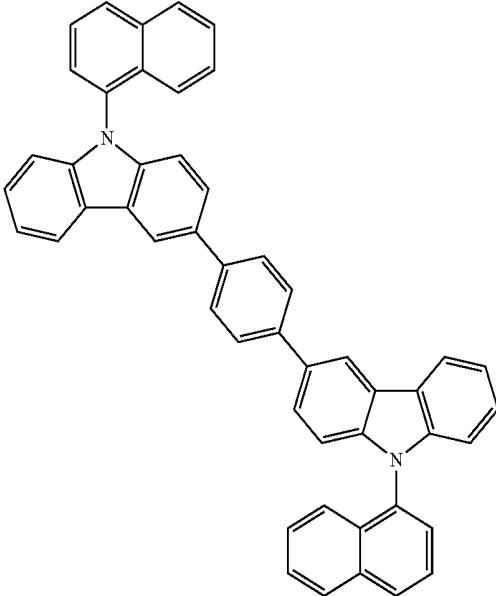


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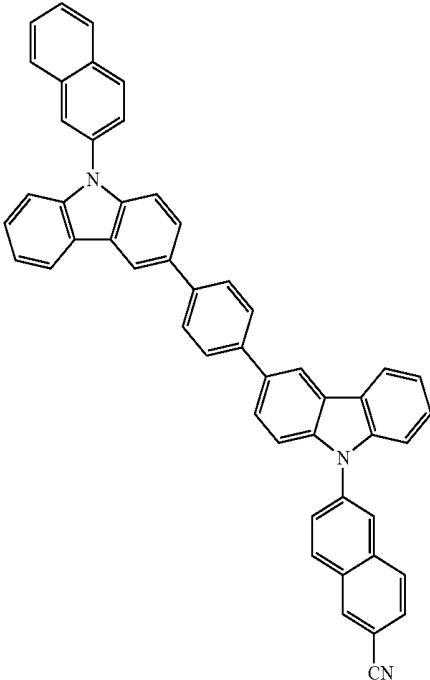
H1-43



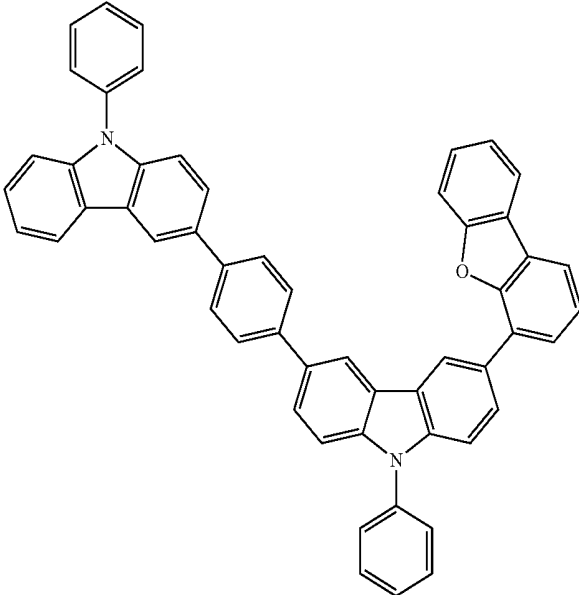
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H1-45

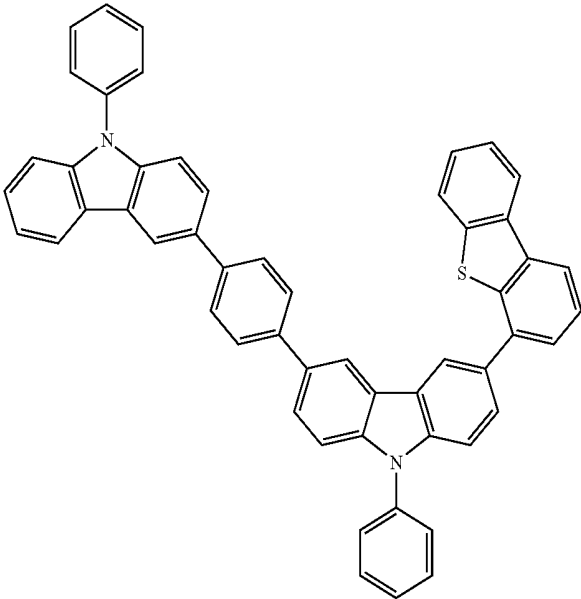


H1-46

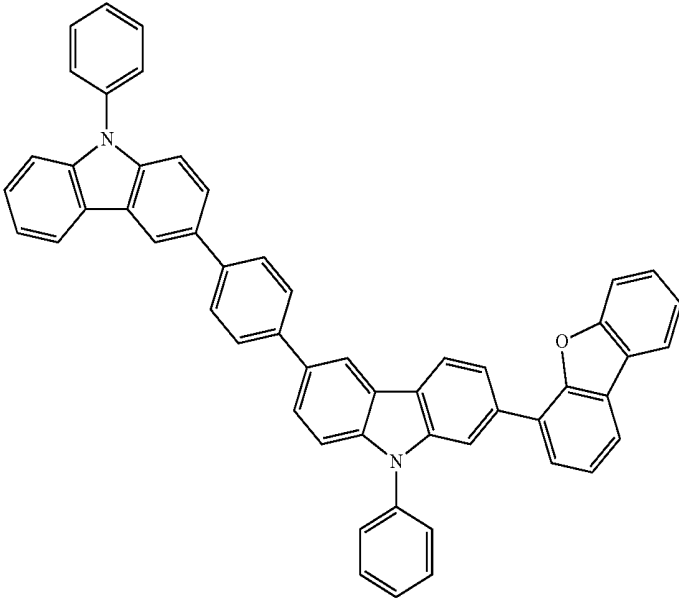


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H1-47

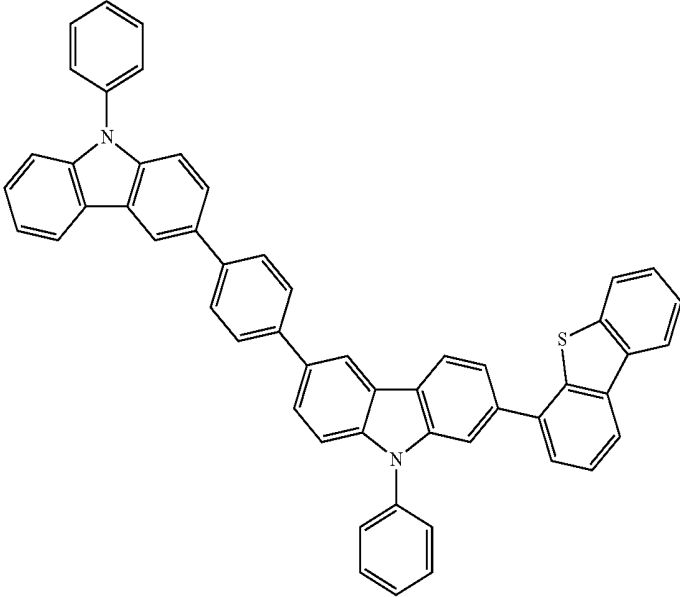


H1-48

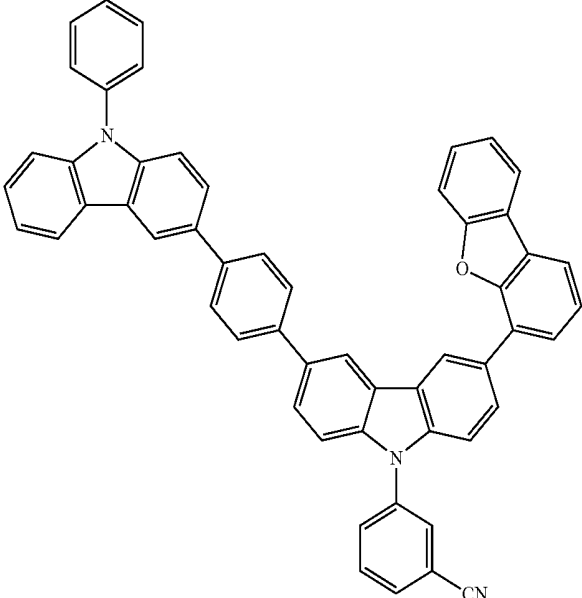


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H1-49

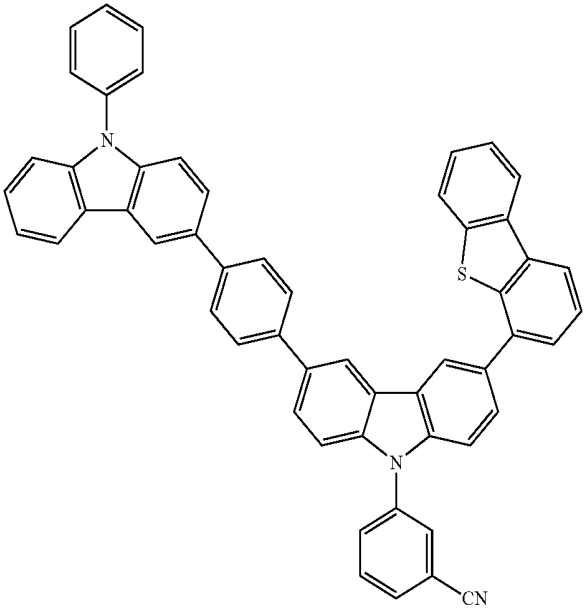


H1-50

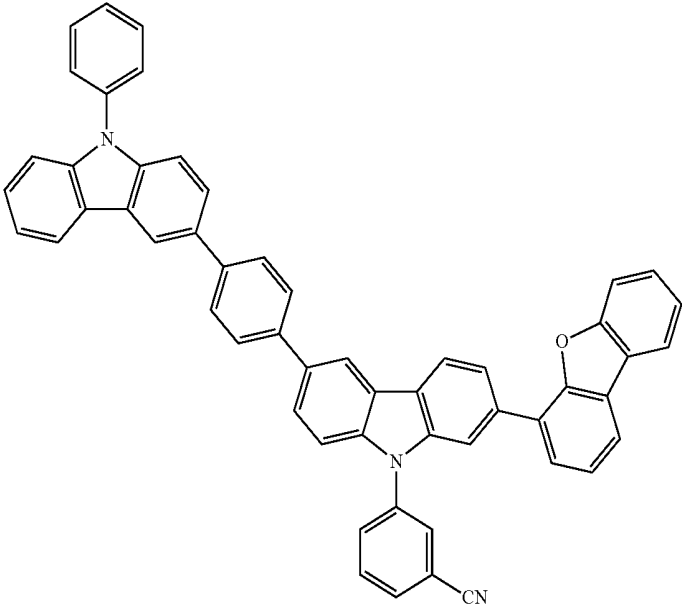


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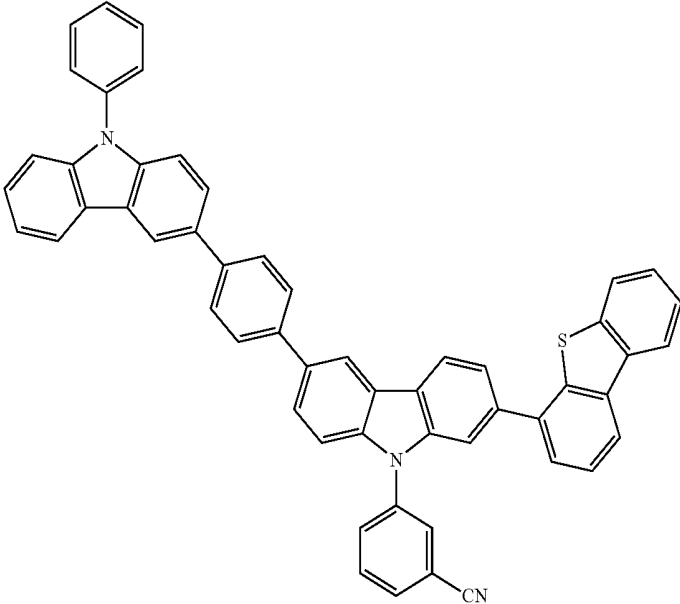


H1-52

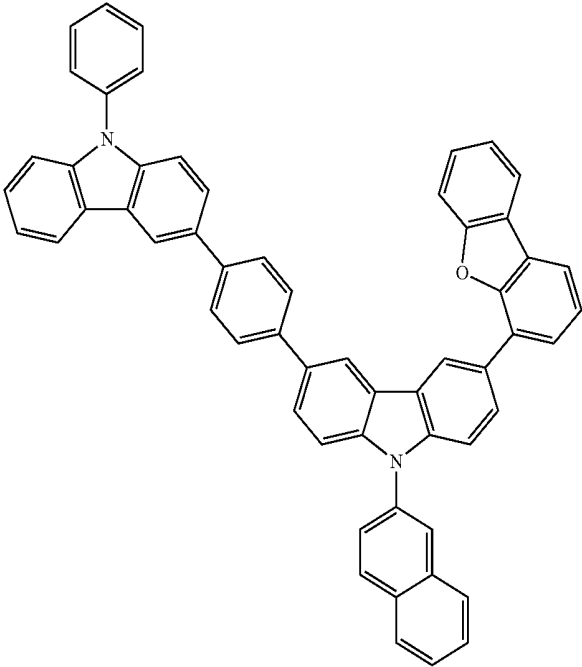


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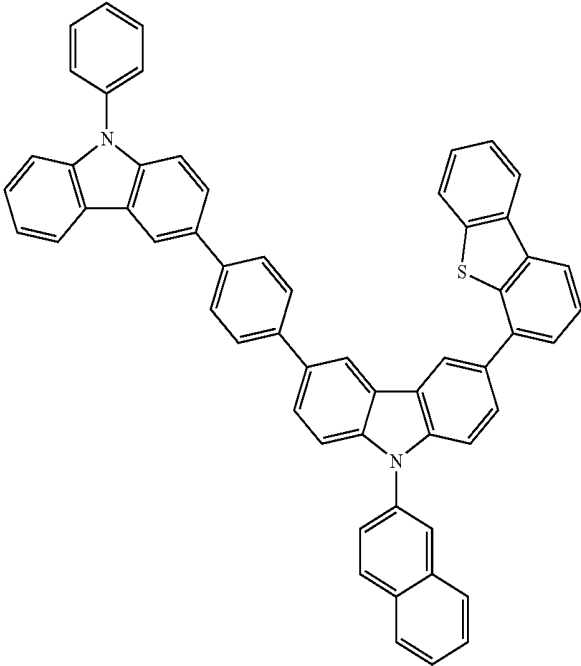


H1-54

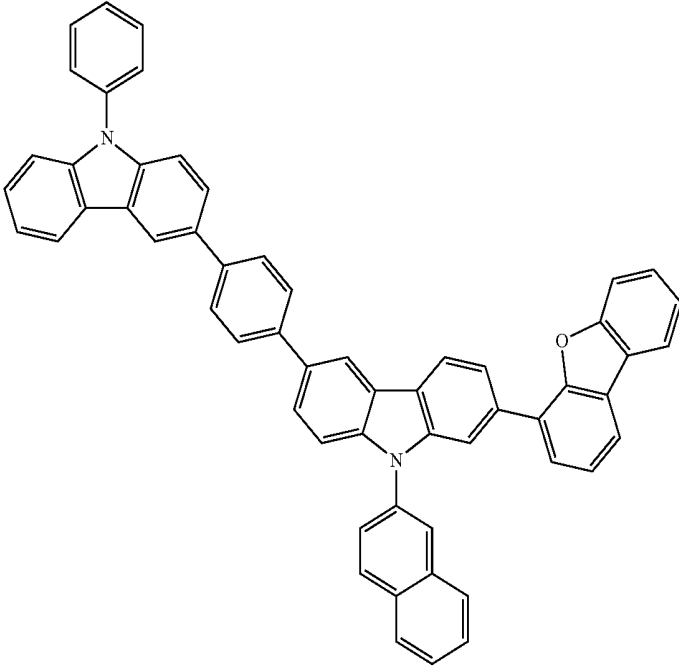


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H1-55

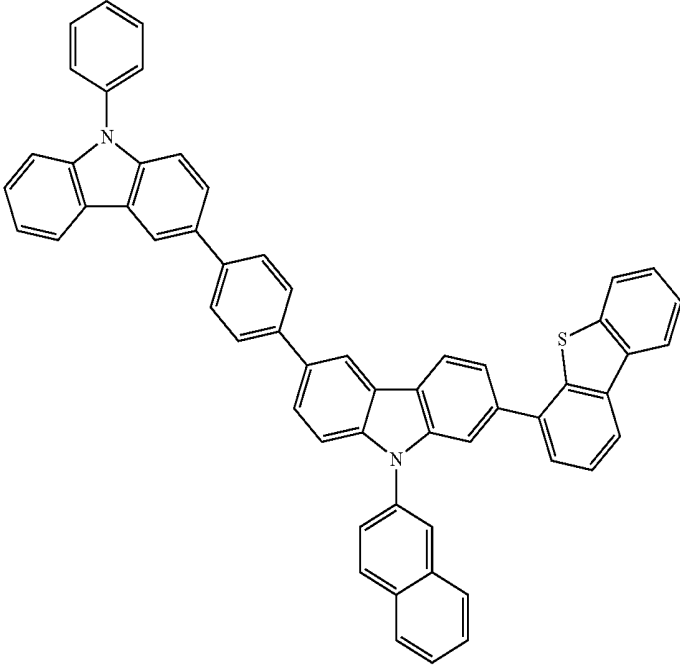


H1-56

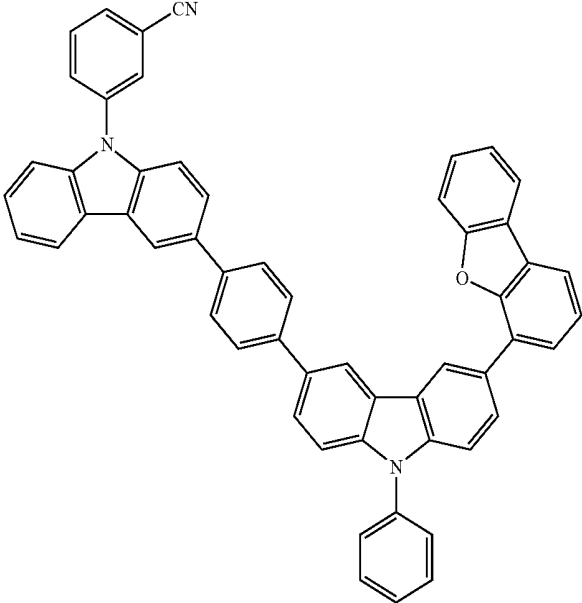


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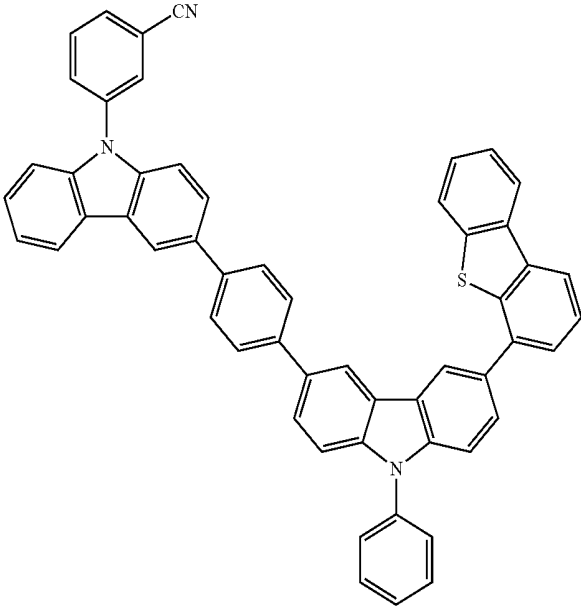


H1-58

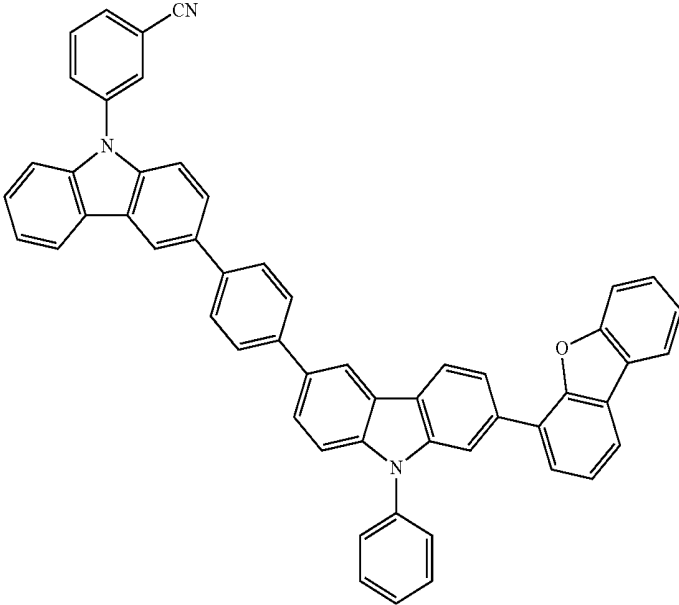


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H1-59

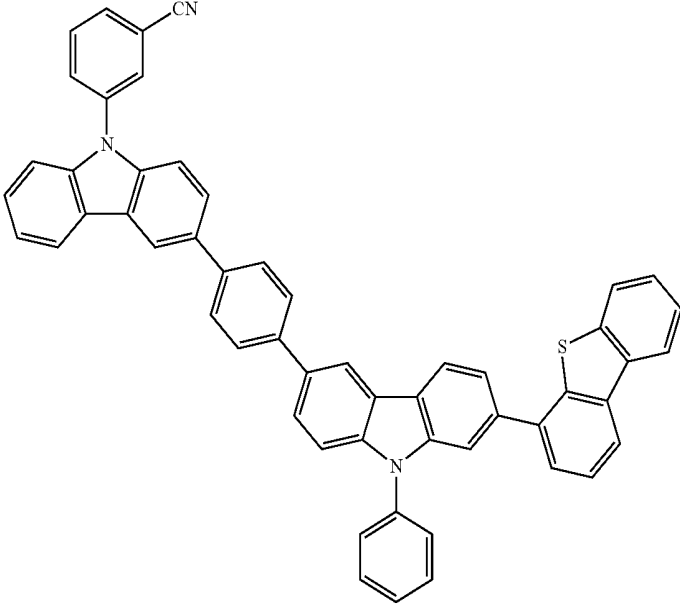


H1-60

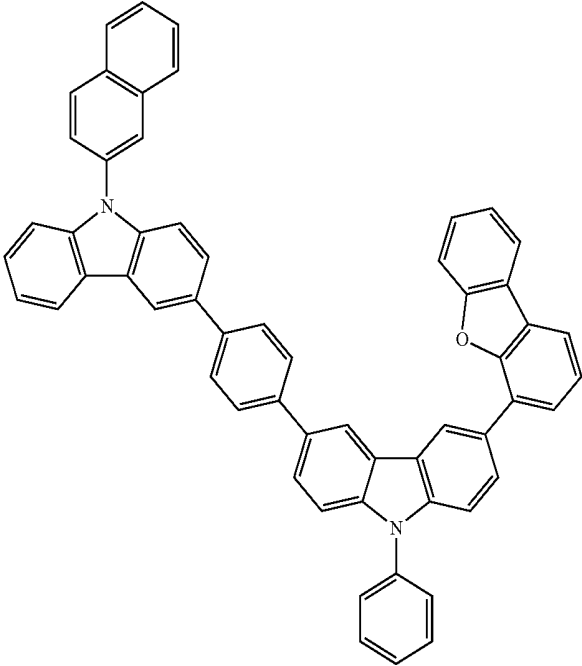


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H1-61

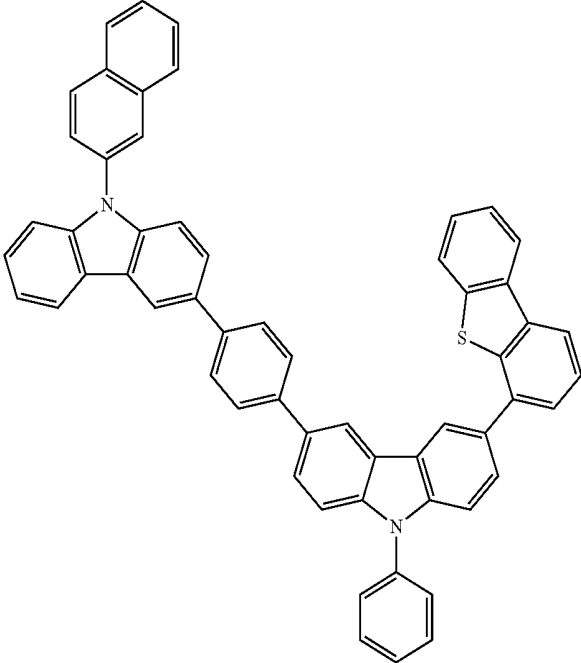


H1-62

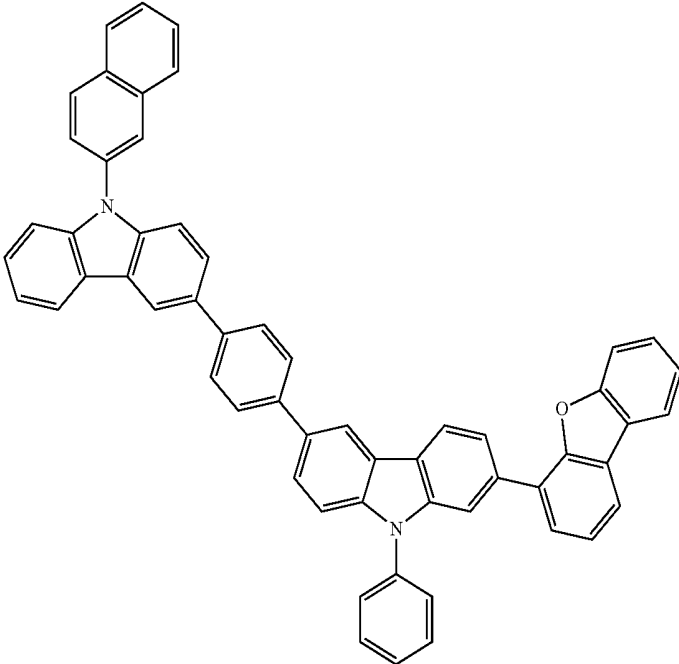


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H1-63

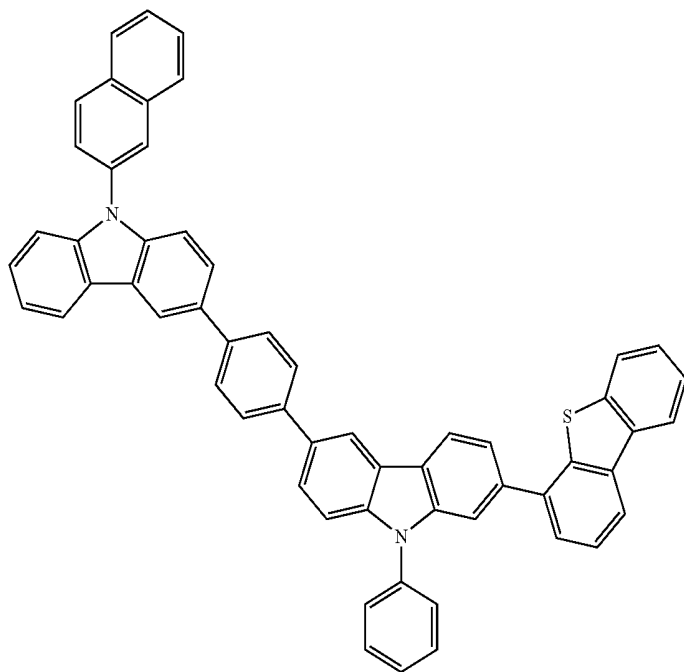


H1-64



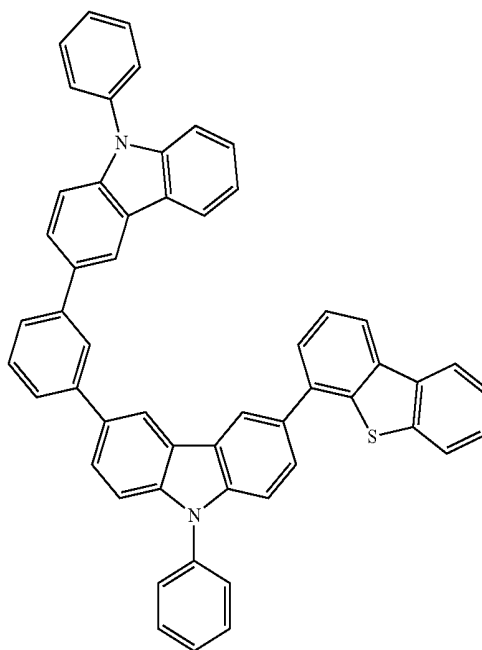
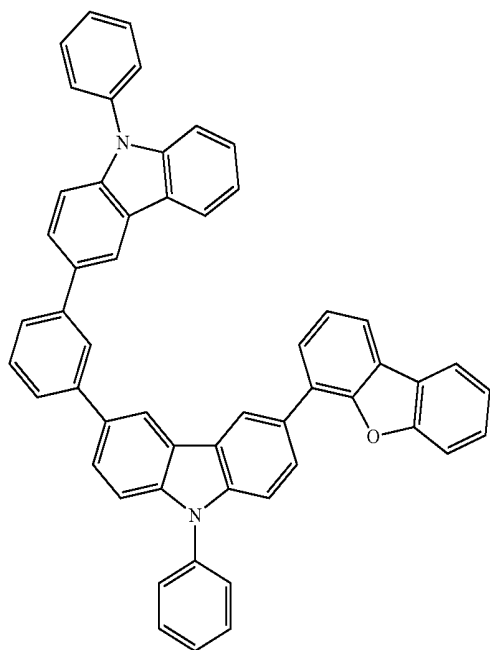
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H1-65



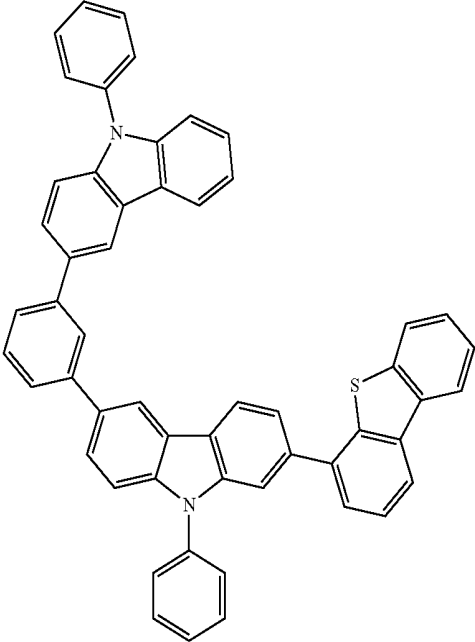
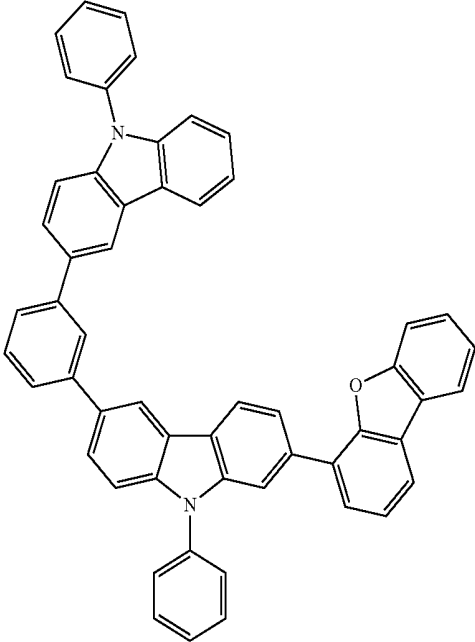
H1-66

H1-67



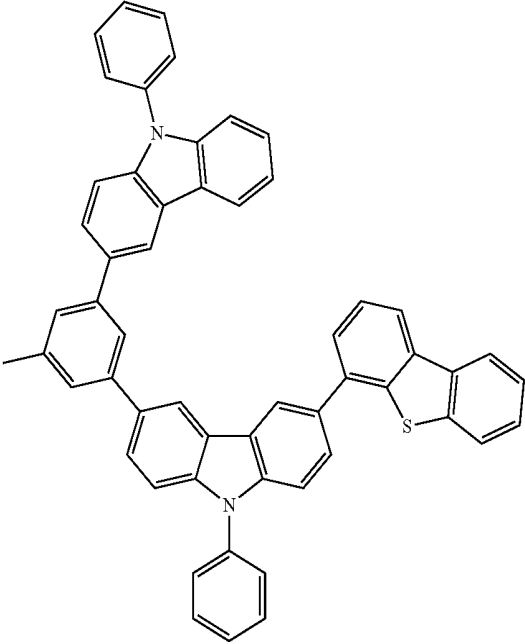
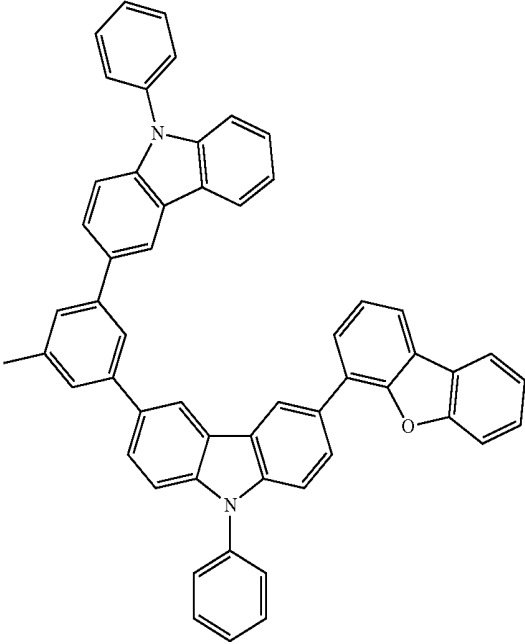
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H1-69



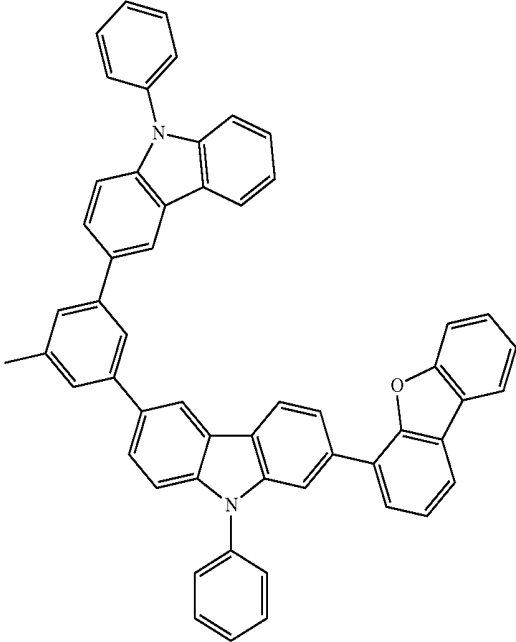
H1-70

H1-71

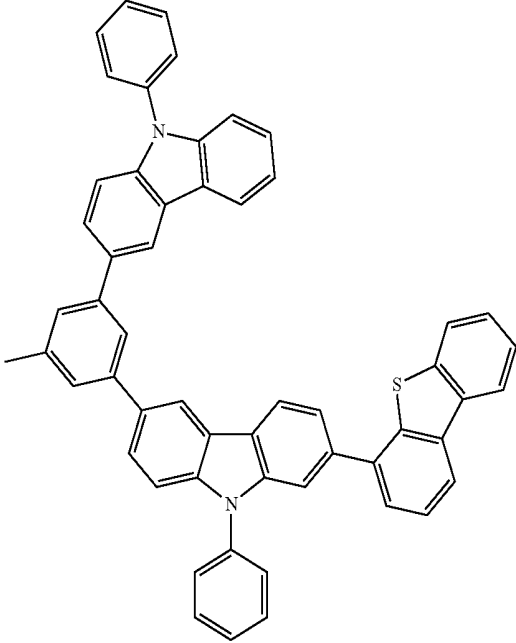


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H1-72

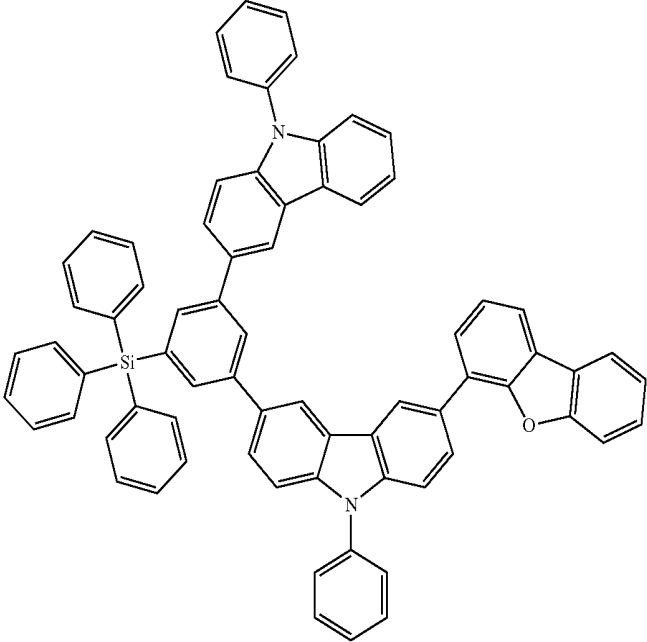


H1-73

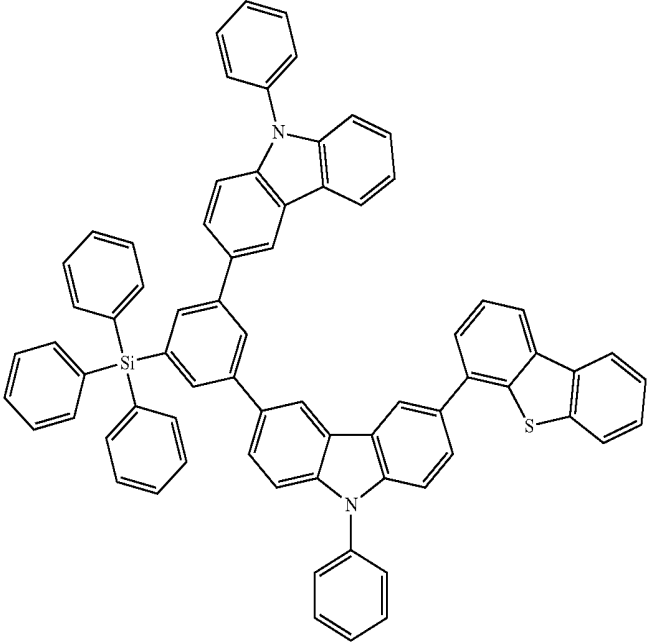


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H1-74

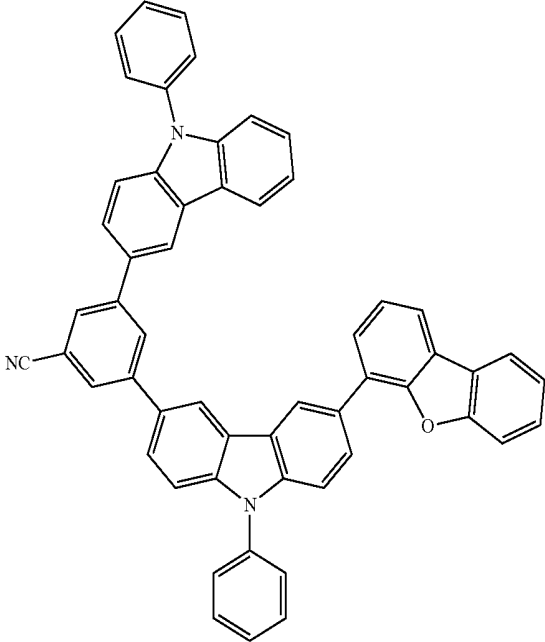


H1-75

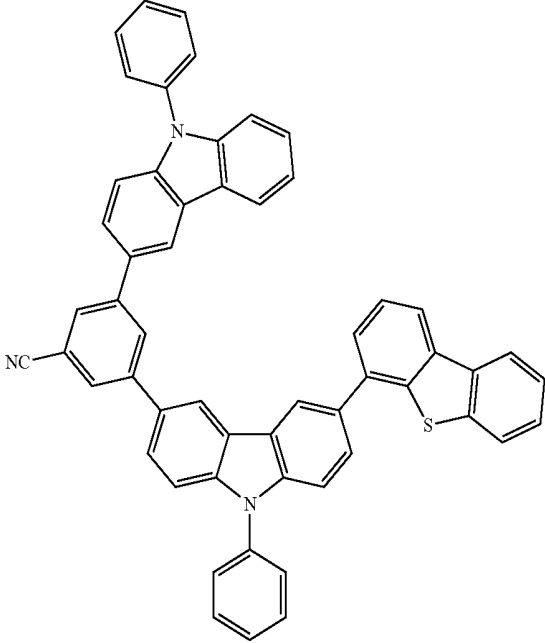


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H1-76

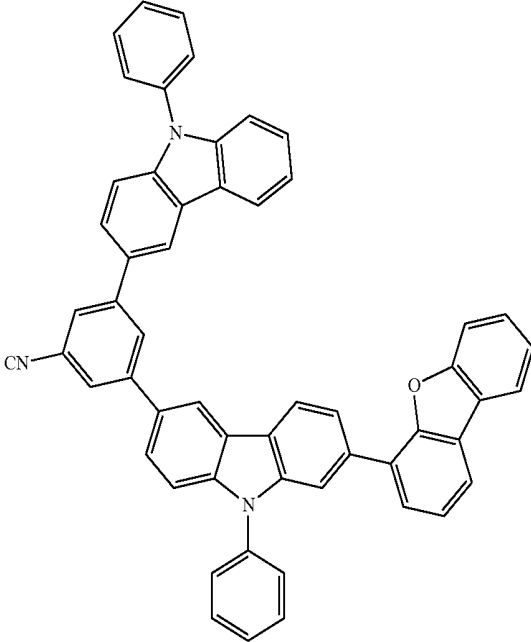


H1-77

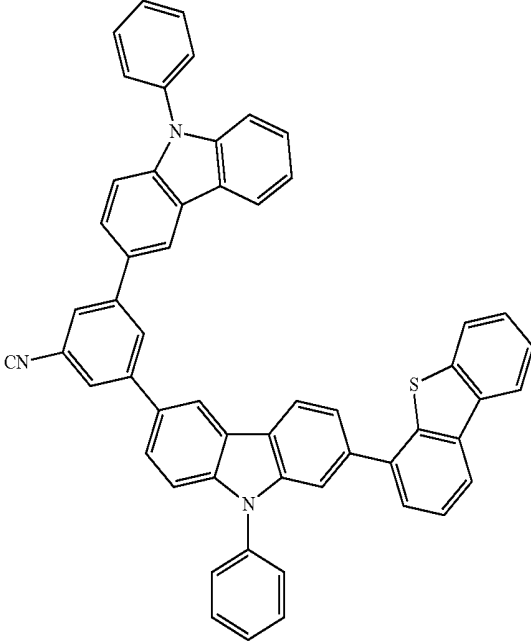


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H1-78

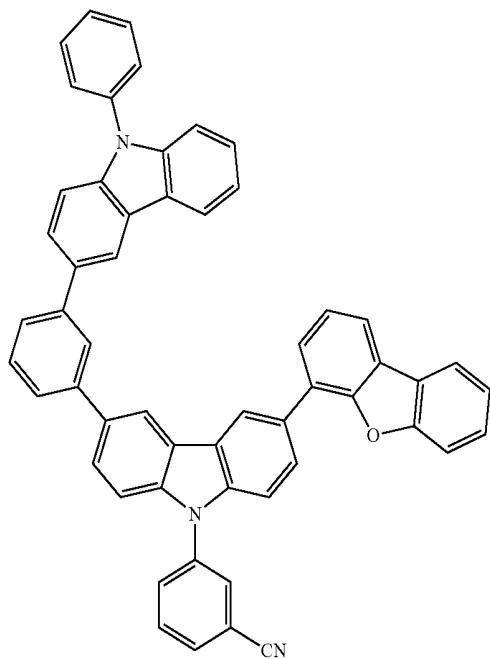


H1-79

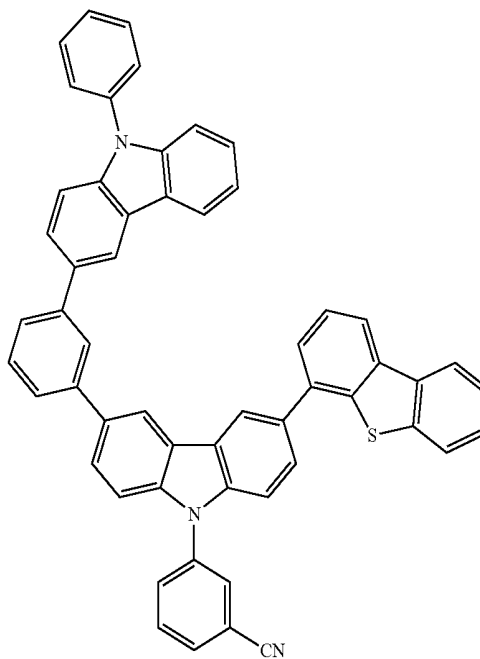


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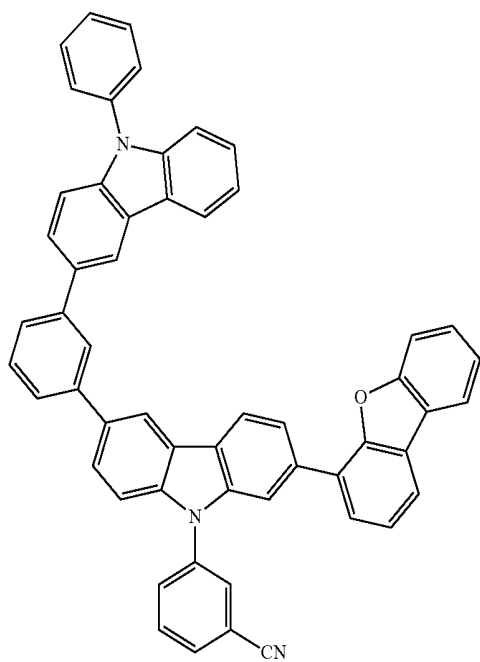
H1-80



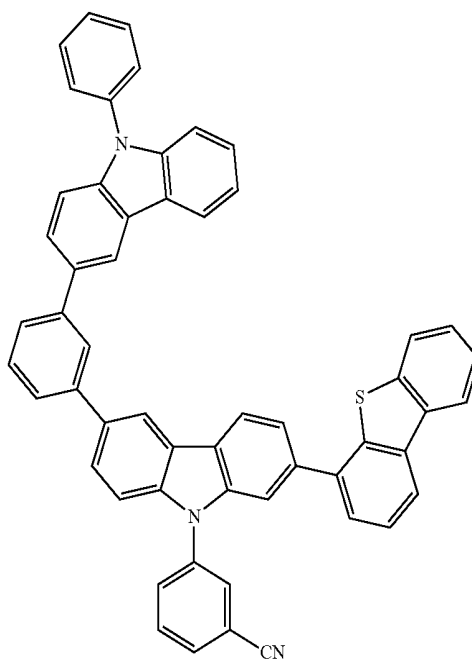
H1-81



H1-82

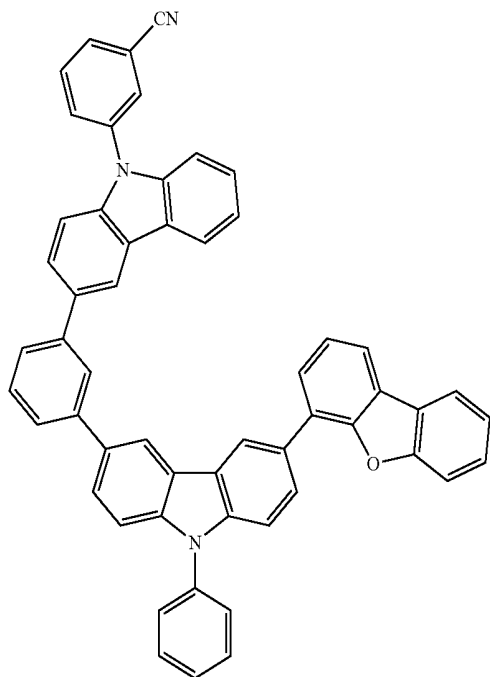


H1-83

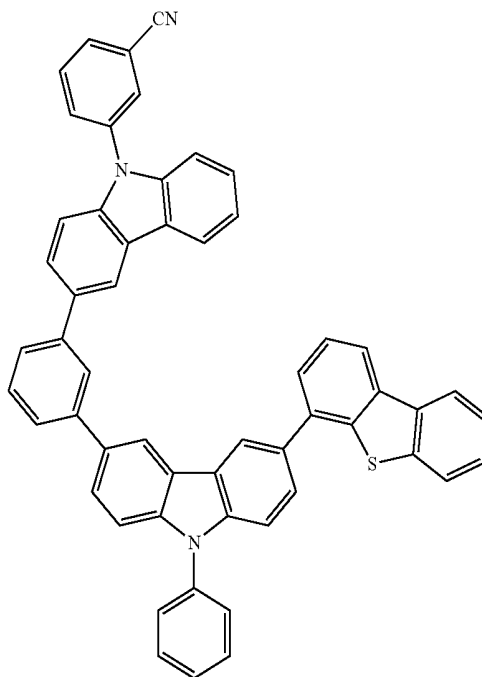


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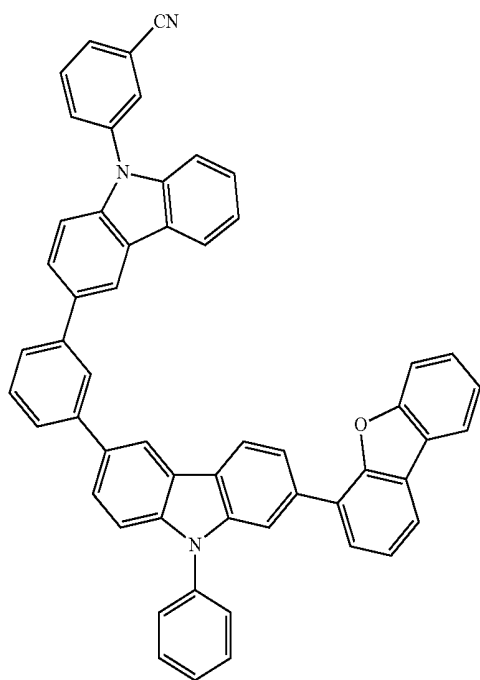
H1-84



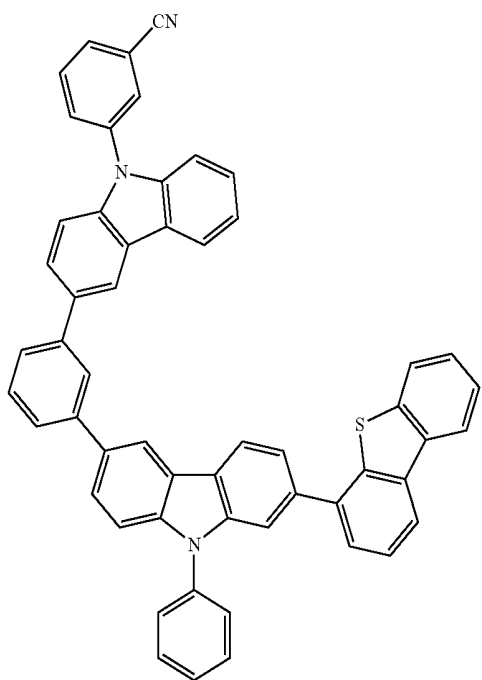
H1-85



H1-86

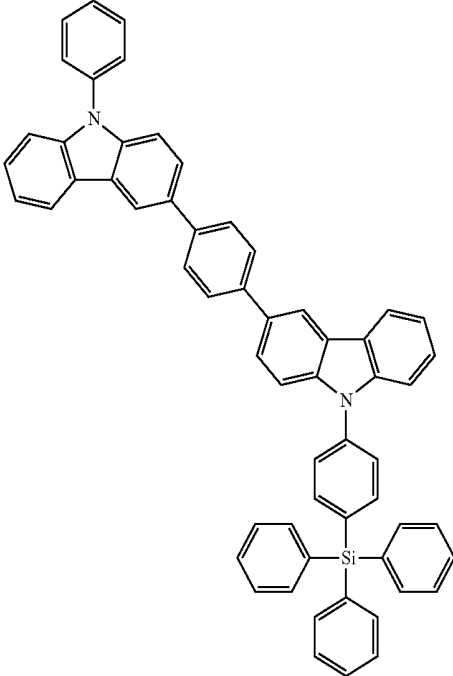


H1-87

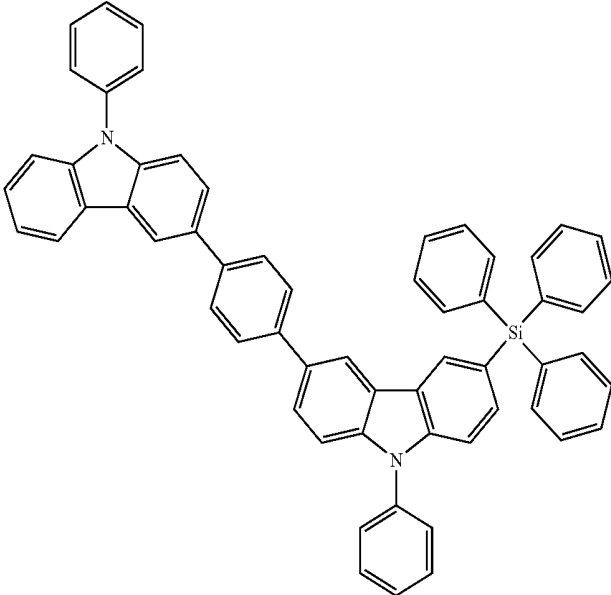


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HI-88

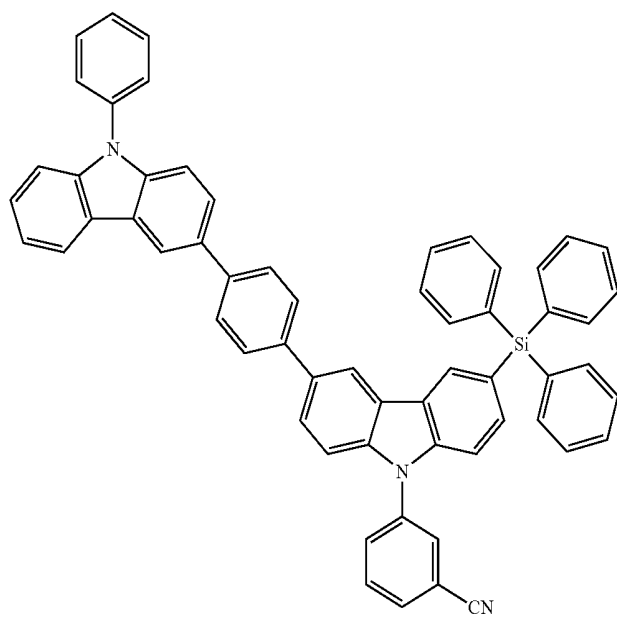


HI-89

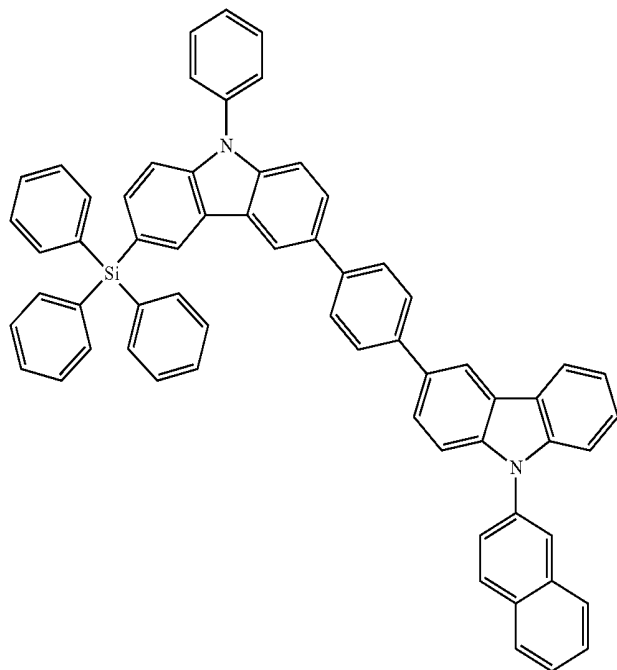


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H1-90

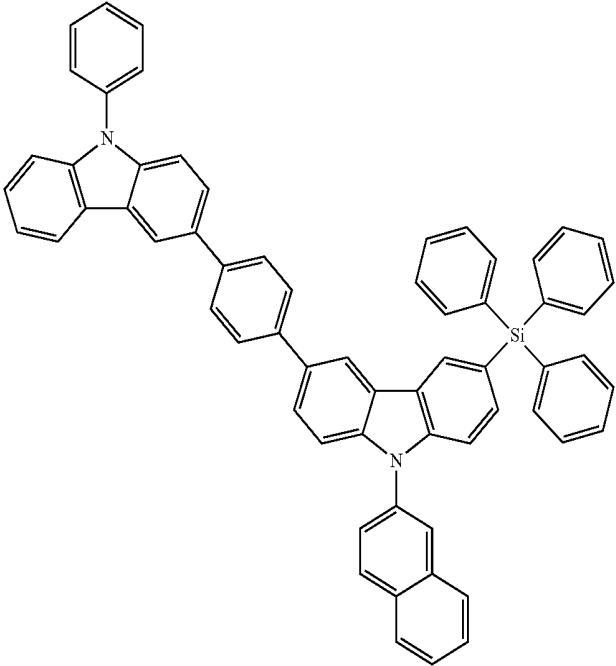


H1-91

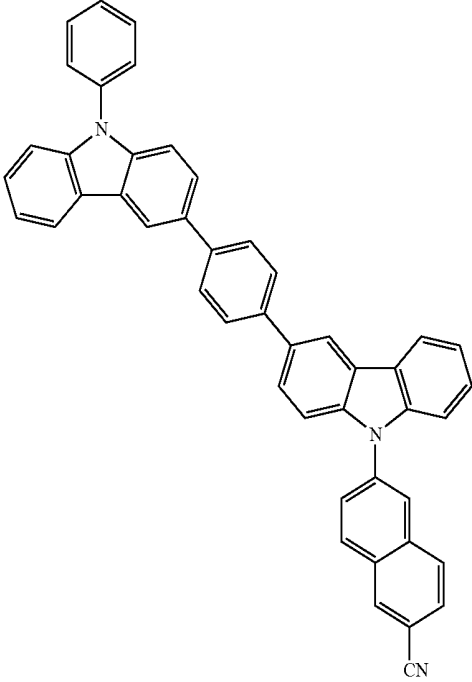


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H1-92

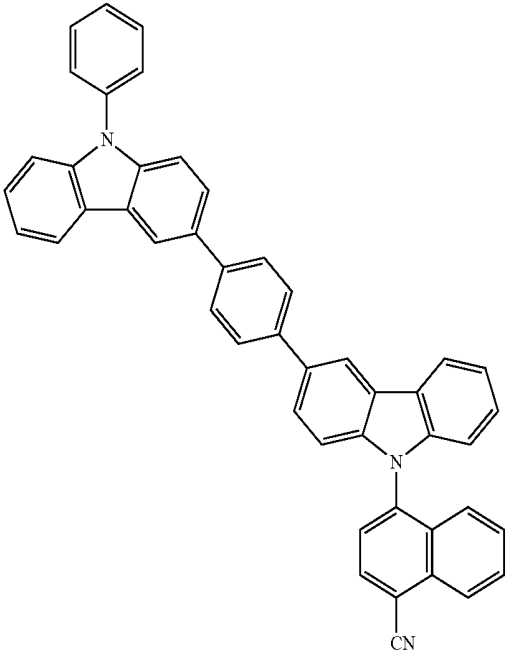


H1-93

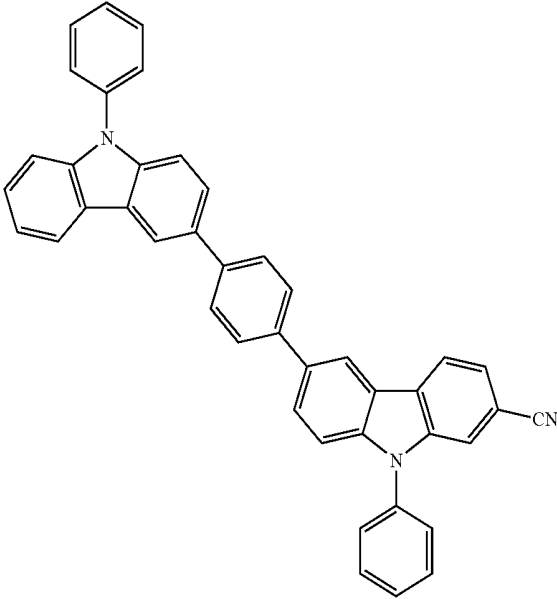


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H1-94

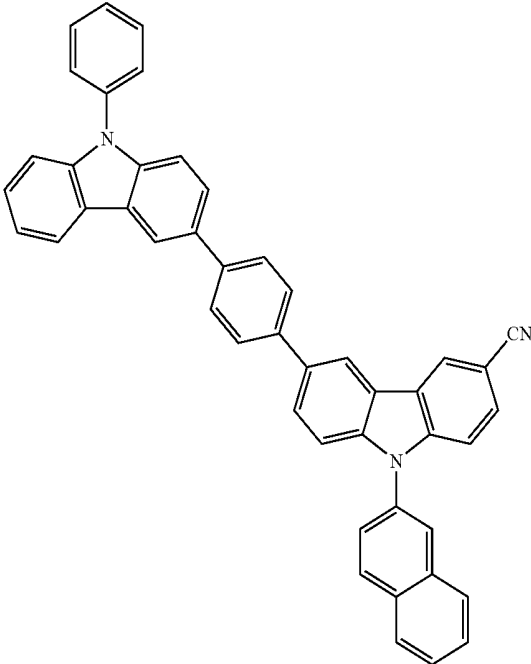


H1-95

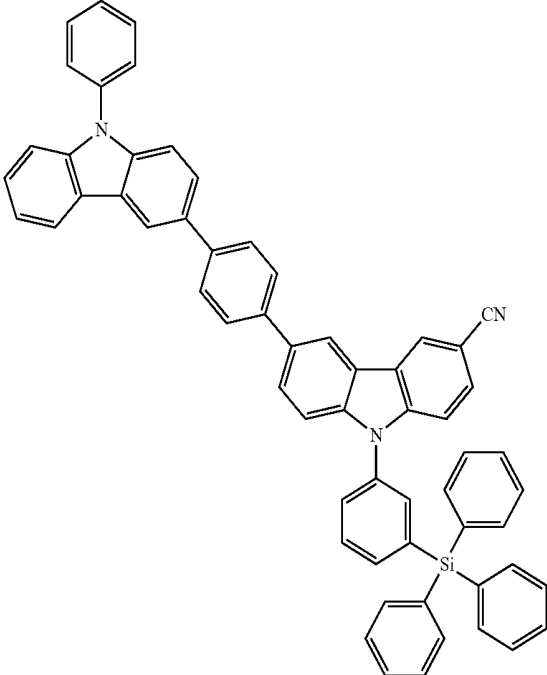


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H1-96

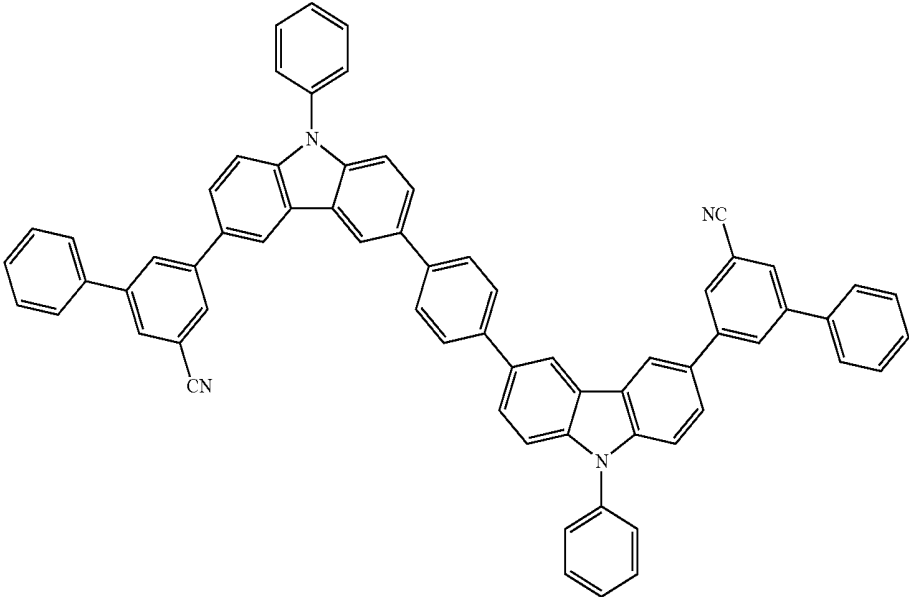


H1-97

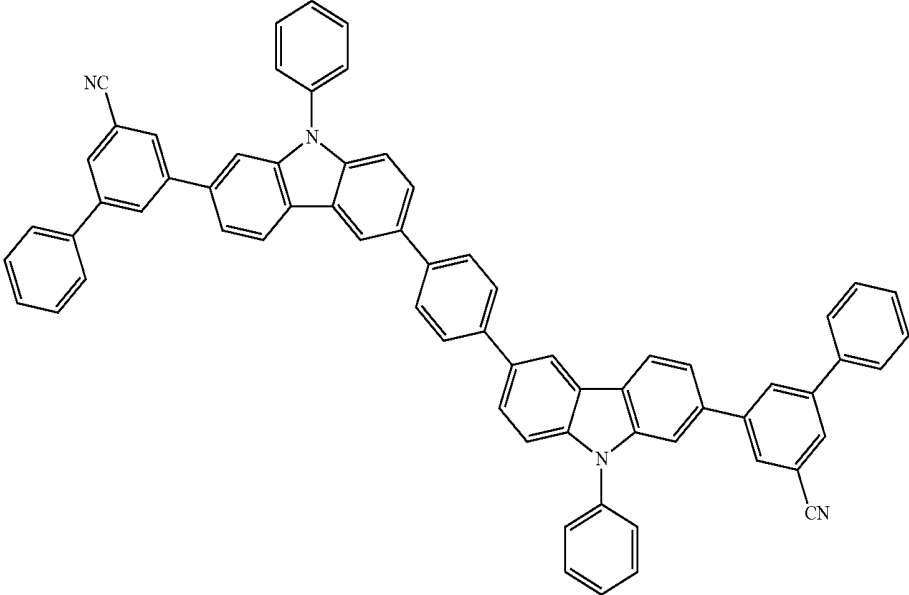


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H1-98

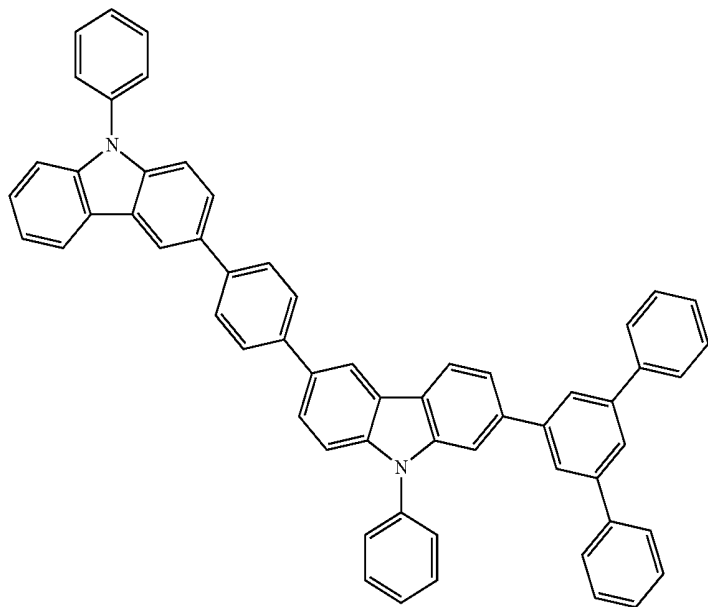


H1-99

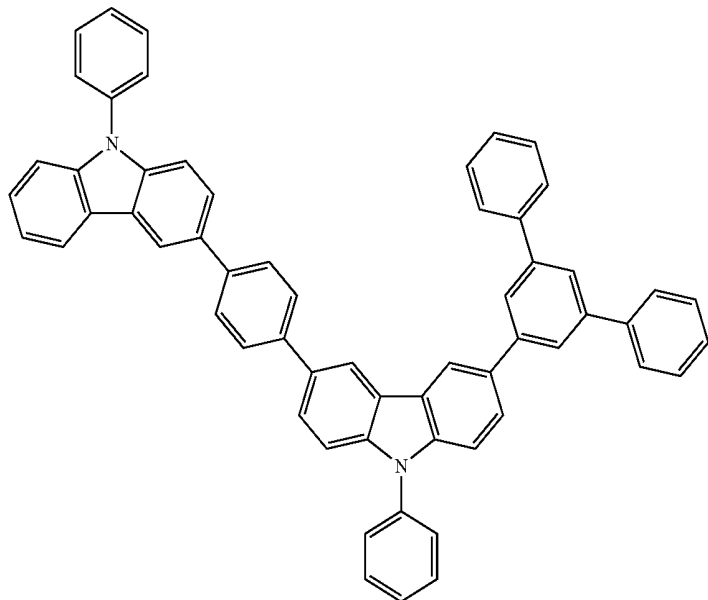


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H1-100

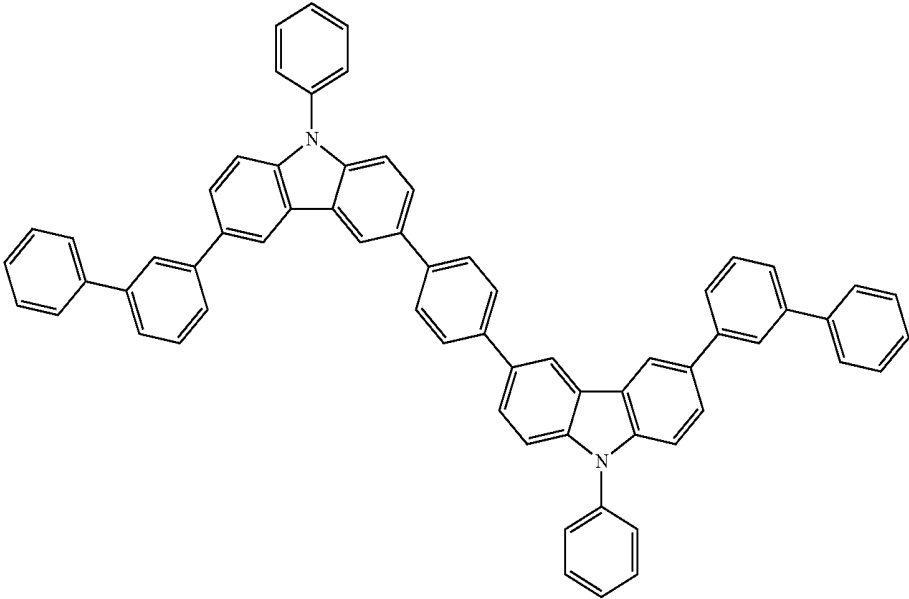


H1-101

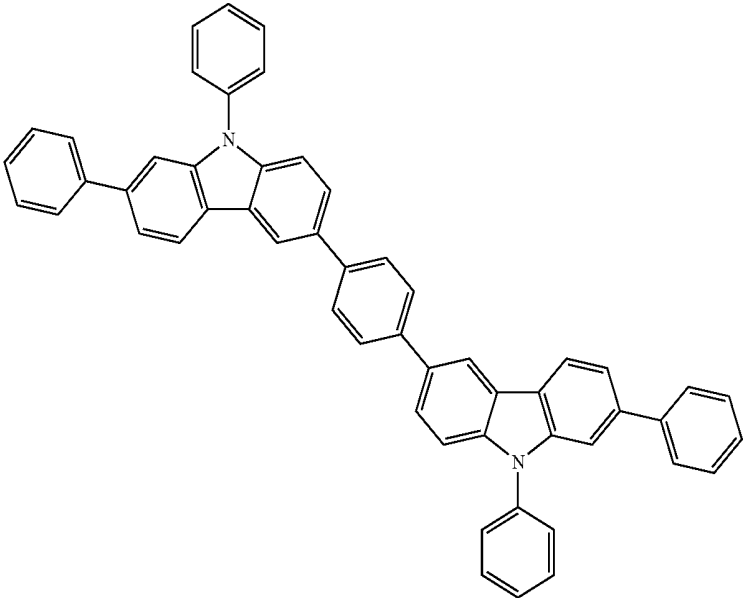


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HI-102

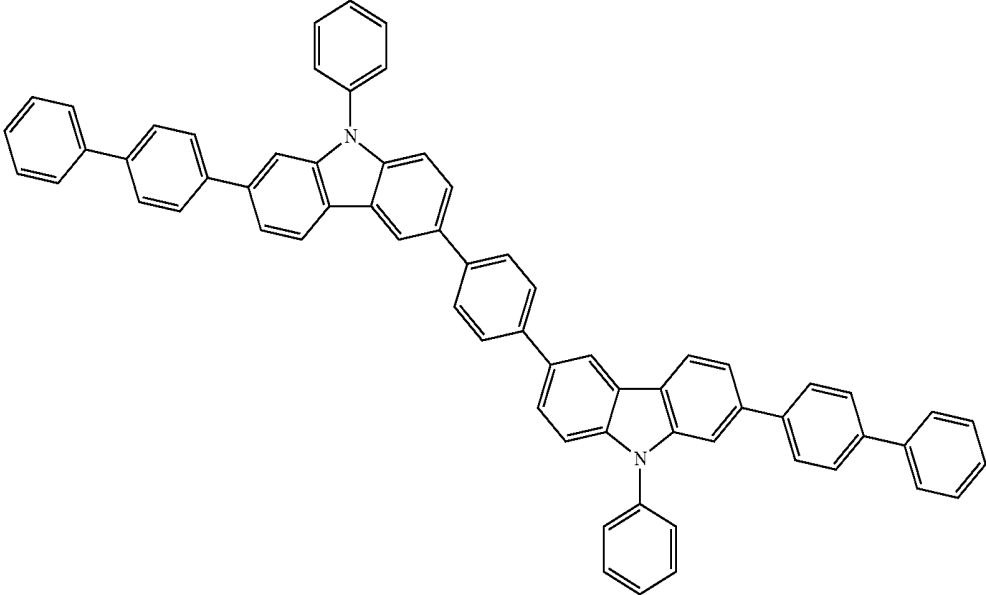


HI-103

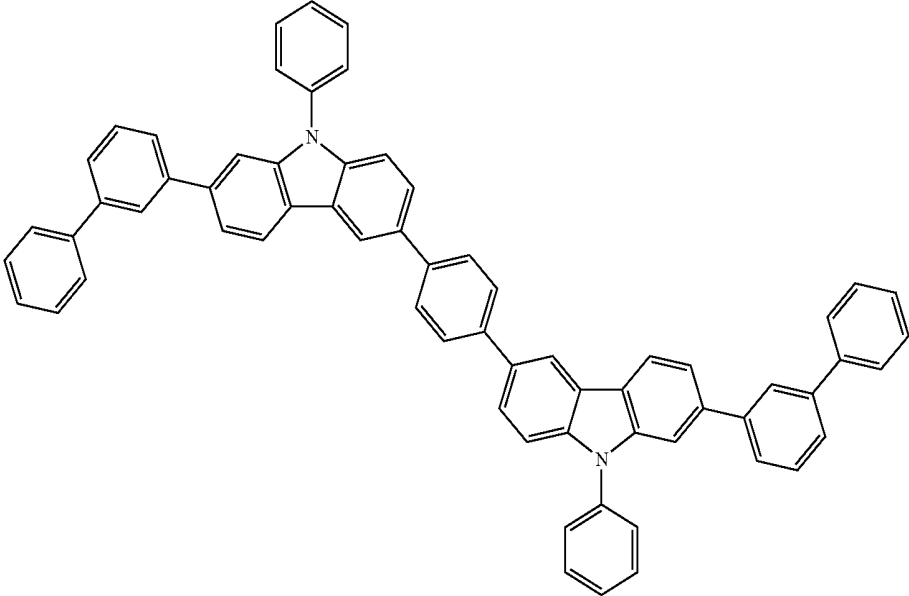


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H1-104

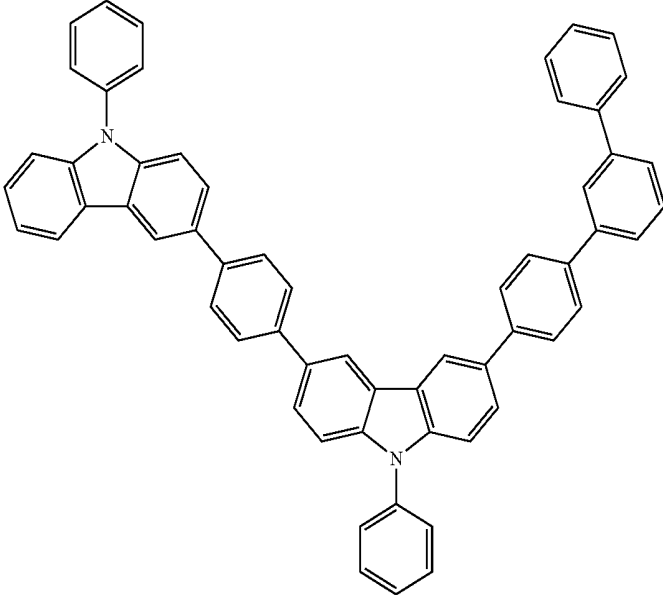


H1-105

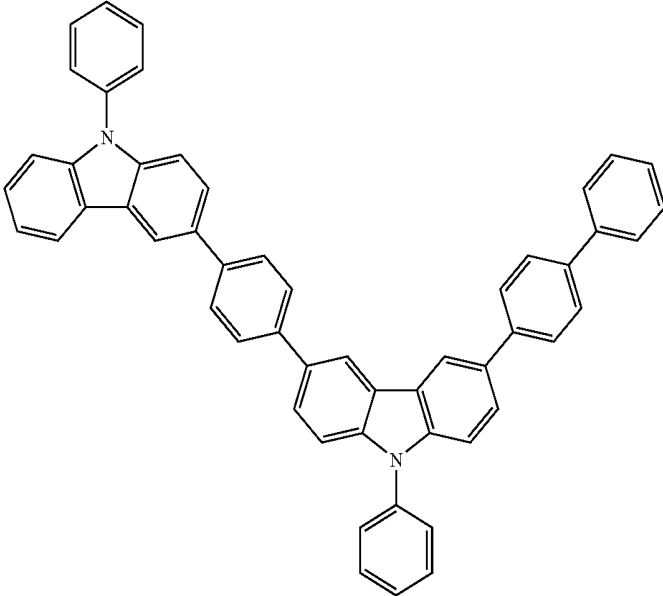


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H1-106

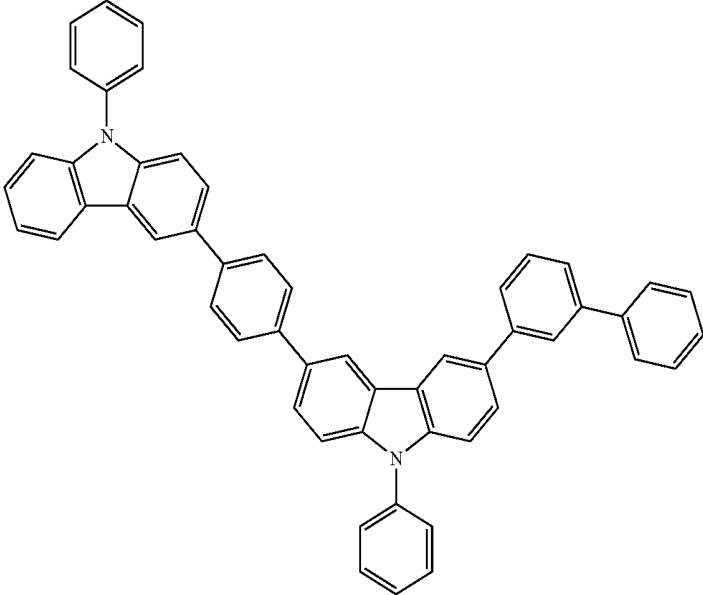


H1-107

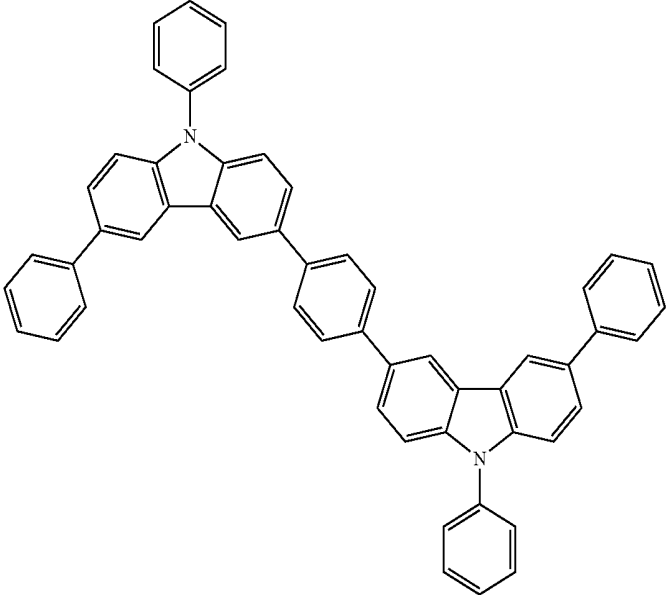


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H1-108

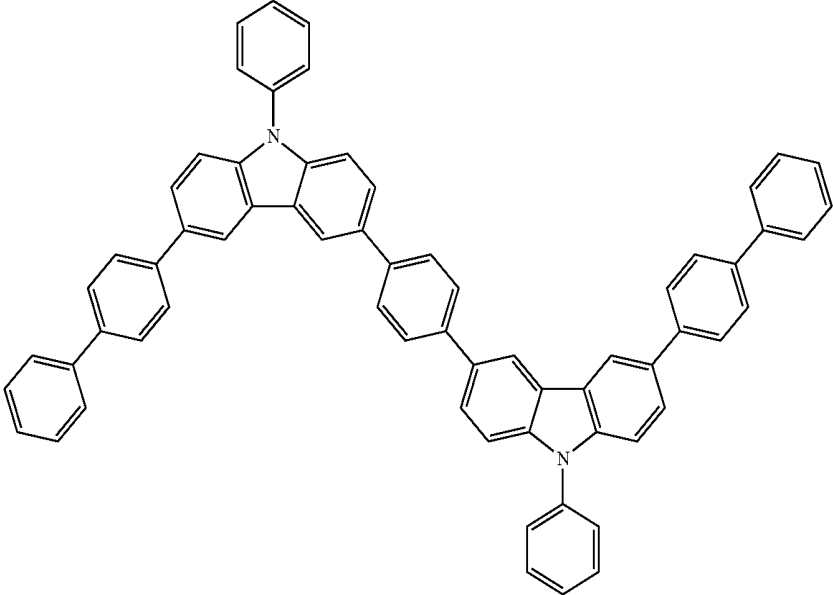


H1-109

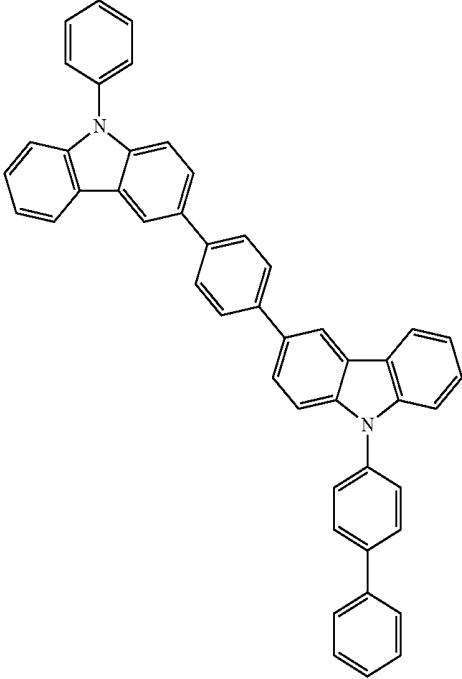


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HI-110

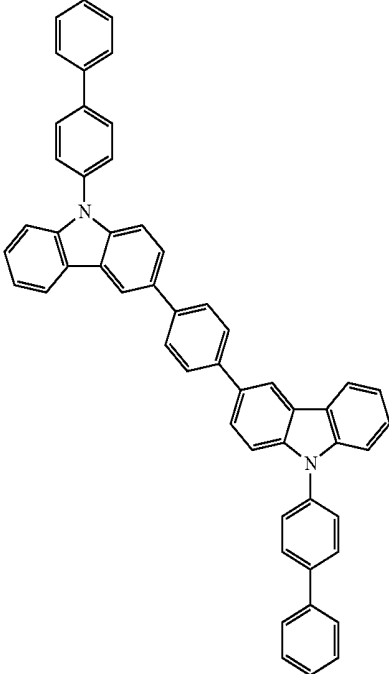


HI-111

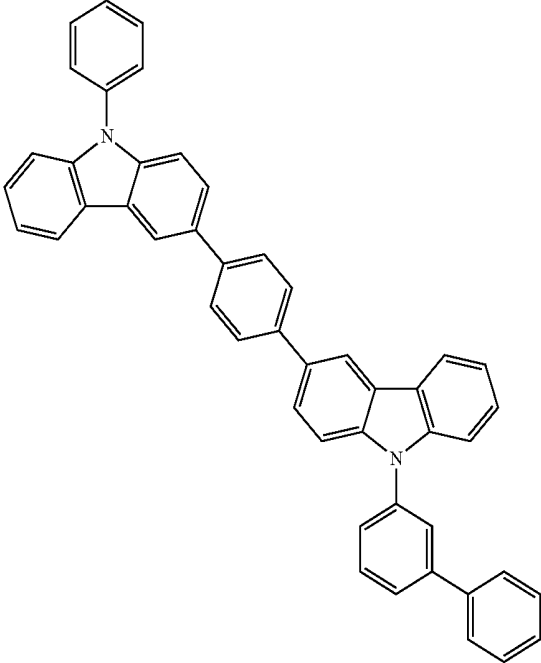


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H1-112

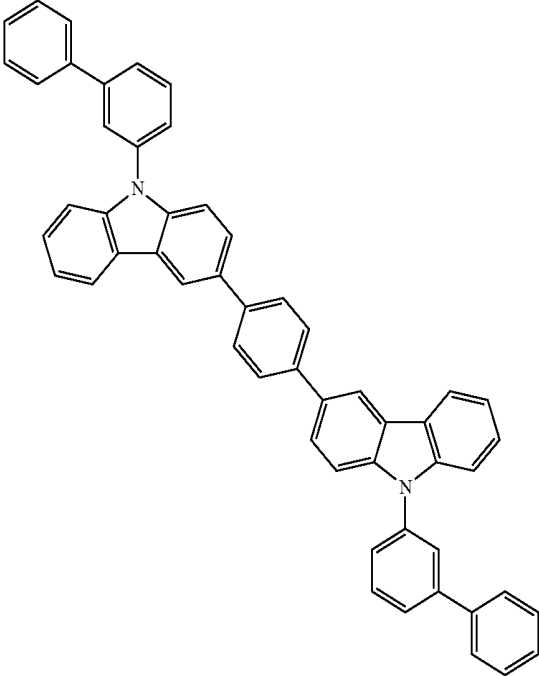


H1-113

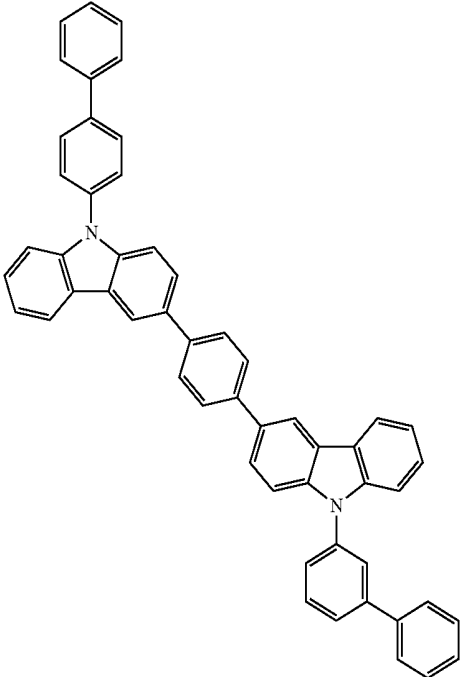


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H1-114

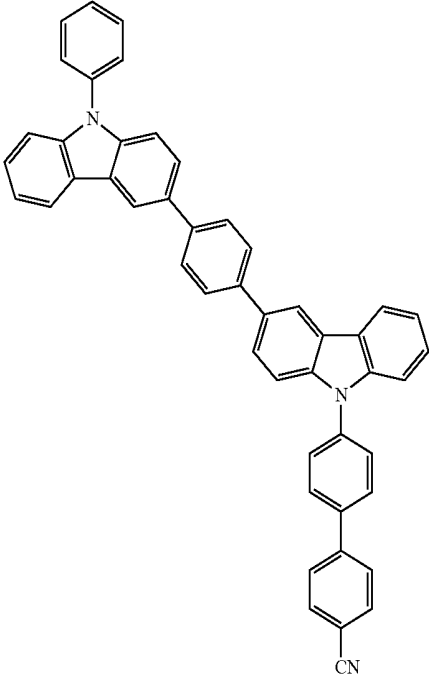


H1-115

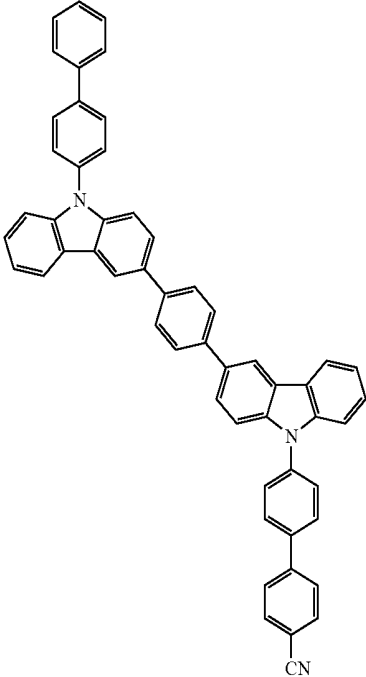


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H1-116

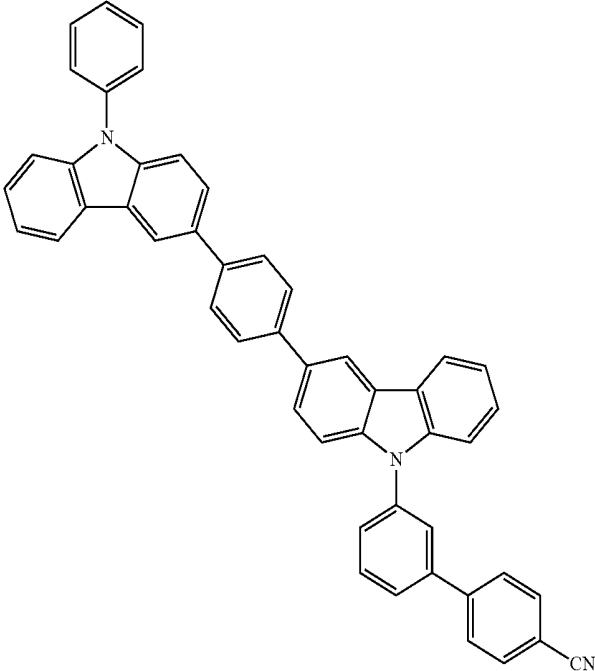


H1-117

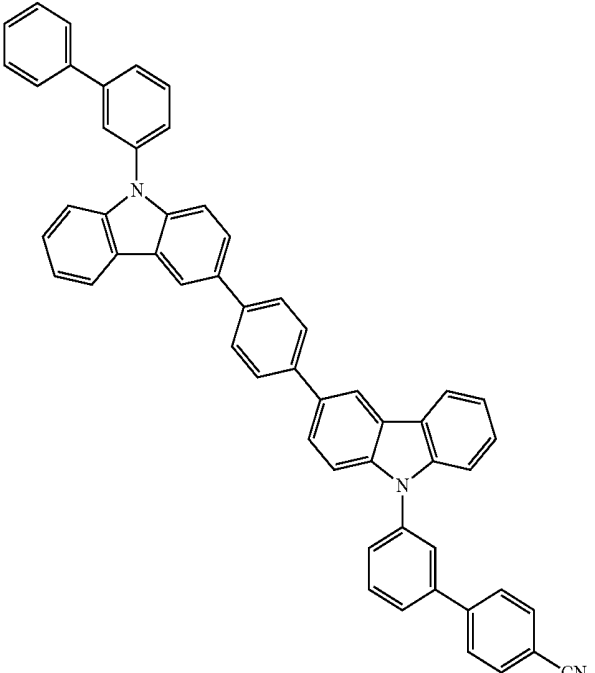


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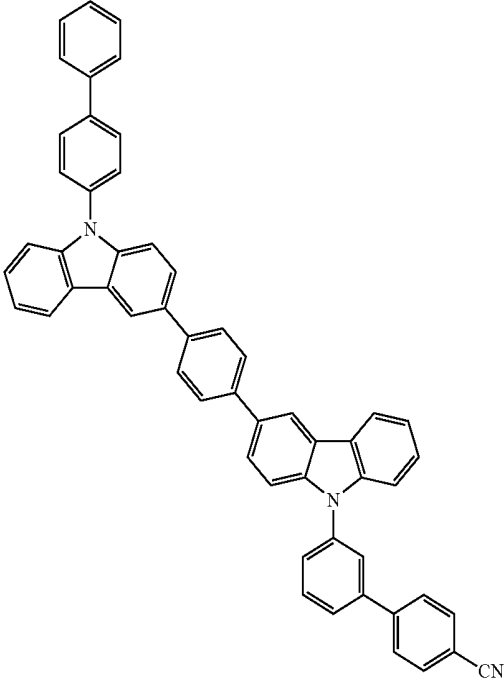
H1-118



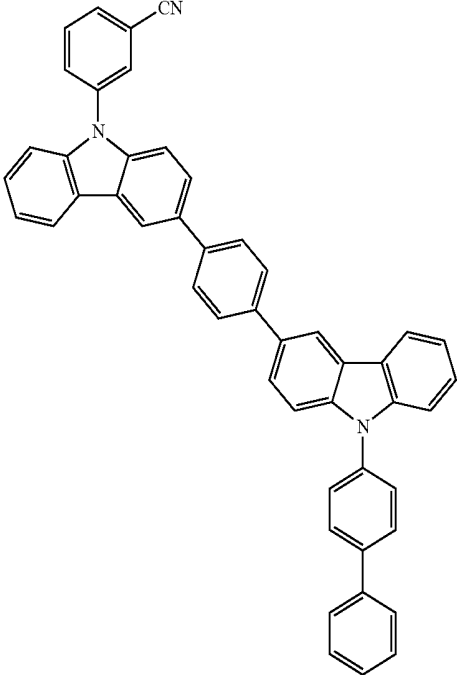
H1-119



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HI-120

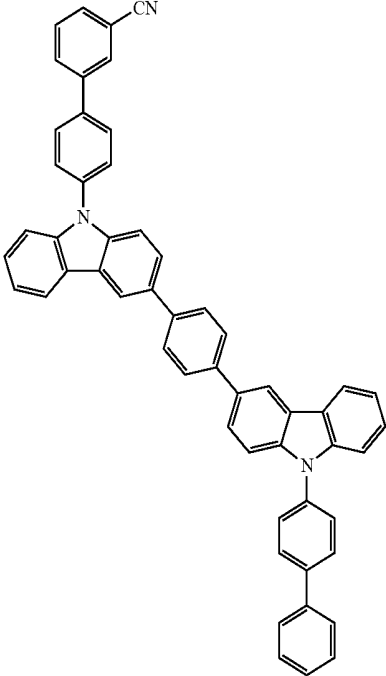


HI-121

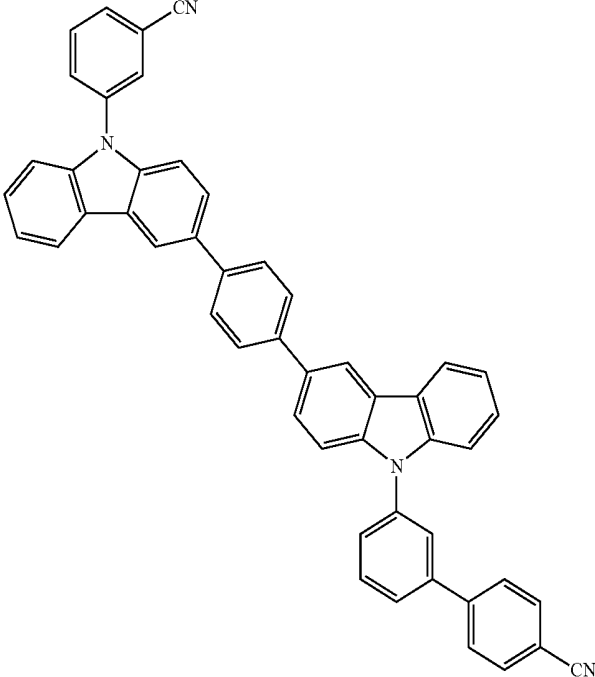


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H1-122

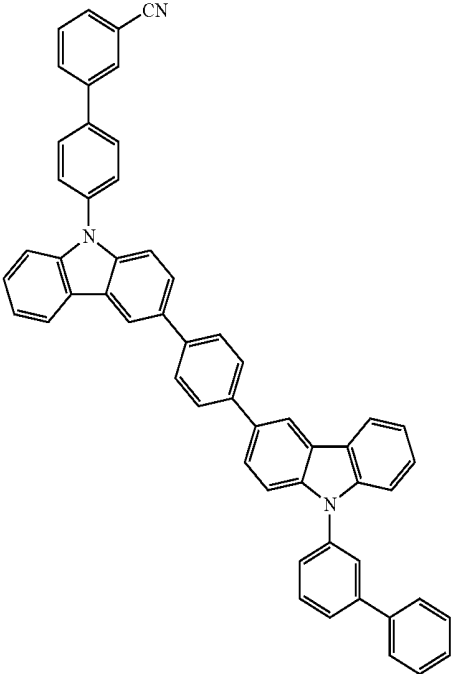
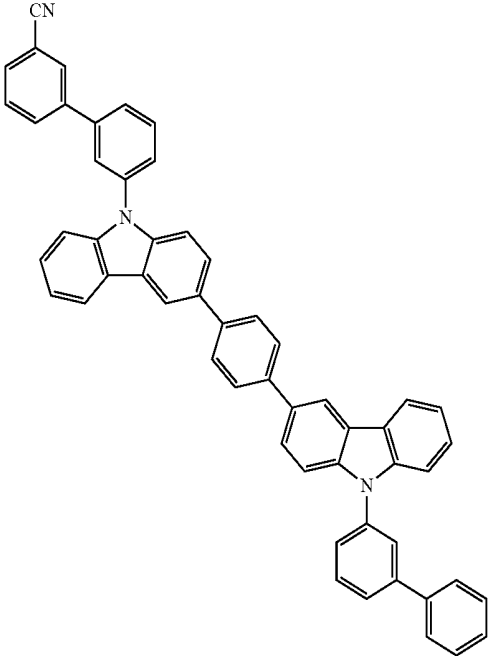


H1-123

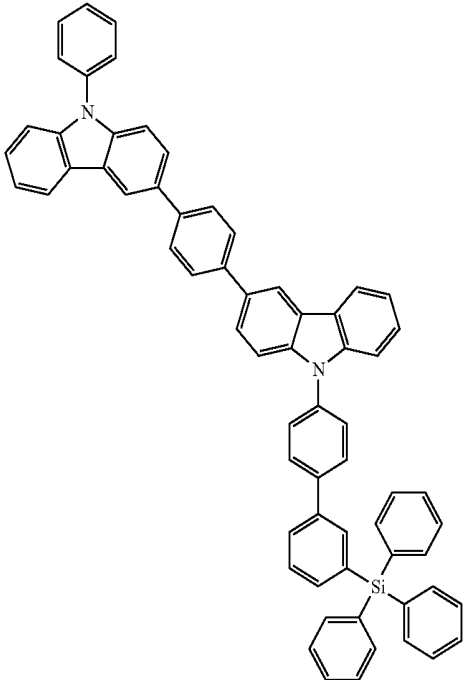


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H1-124

H1-125

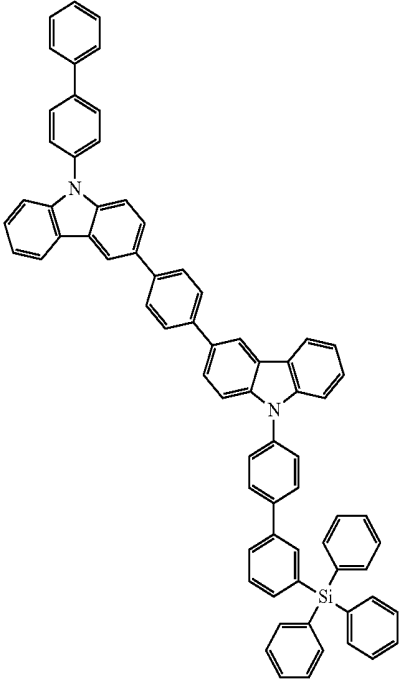


H1-126

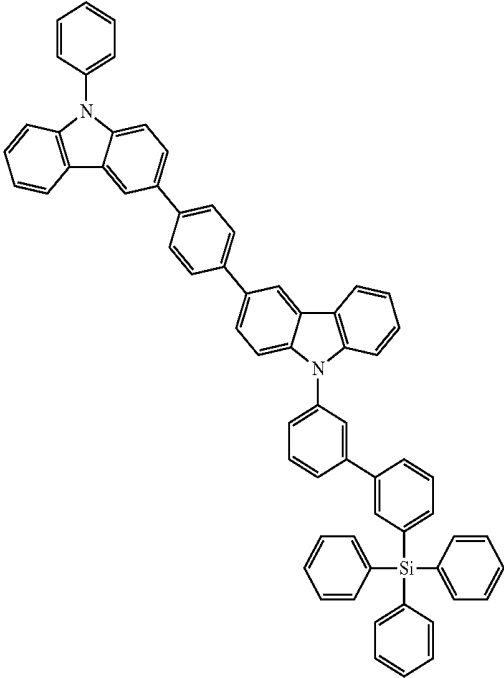


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H1-127

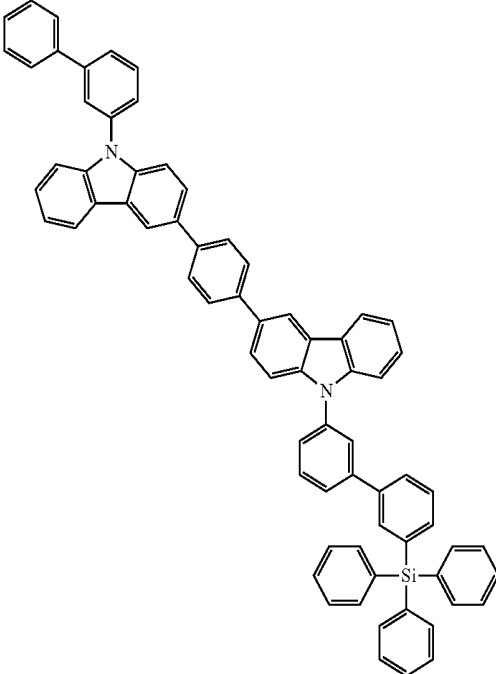


H1-128

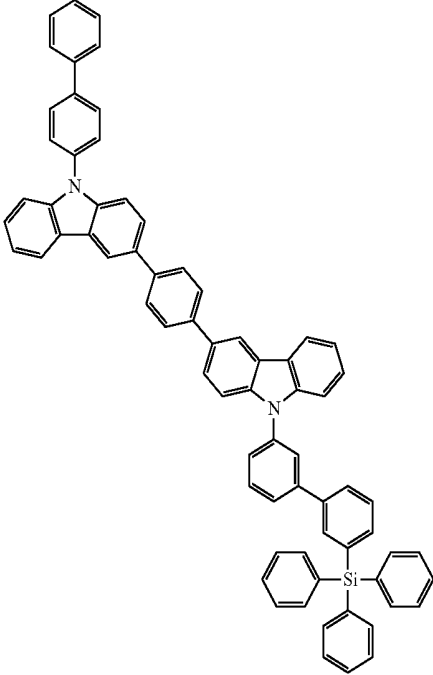


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H1-129

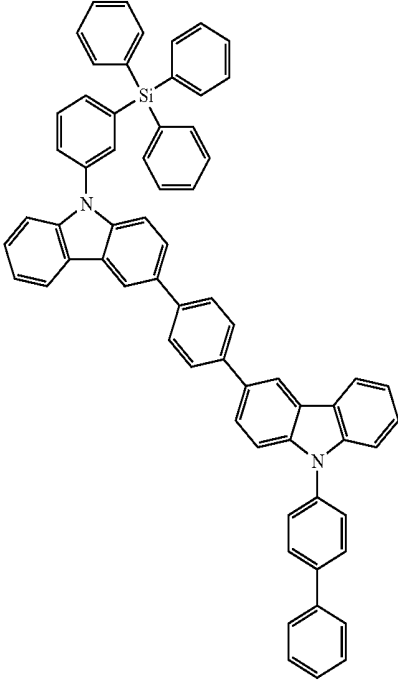


H1-130

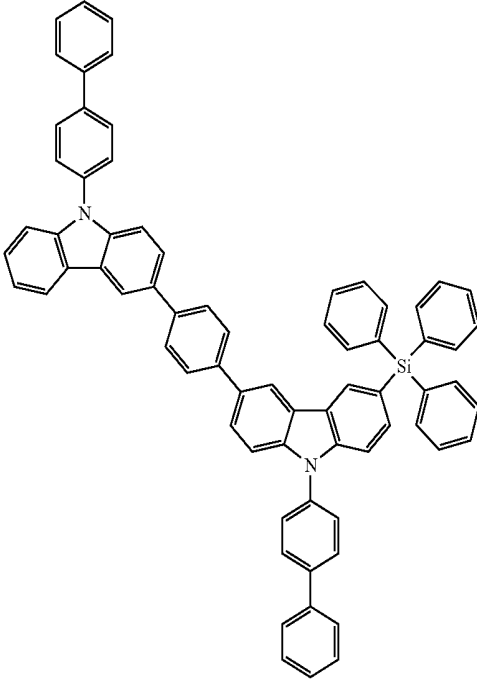


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HI-131

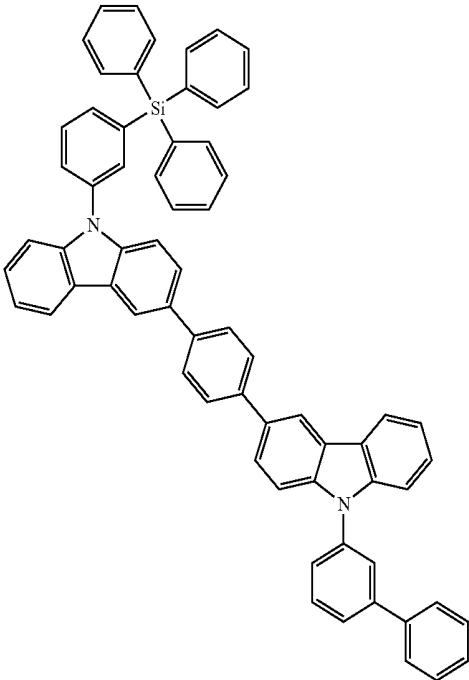


HI-132

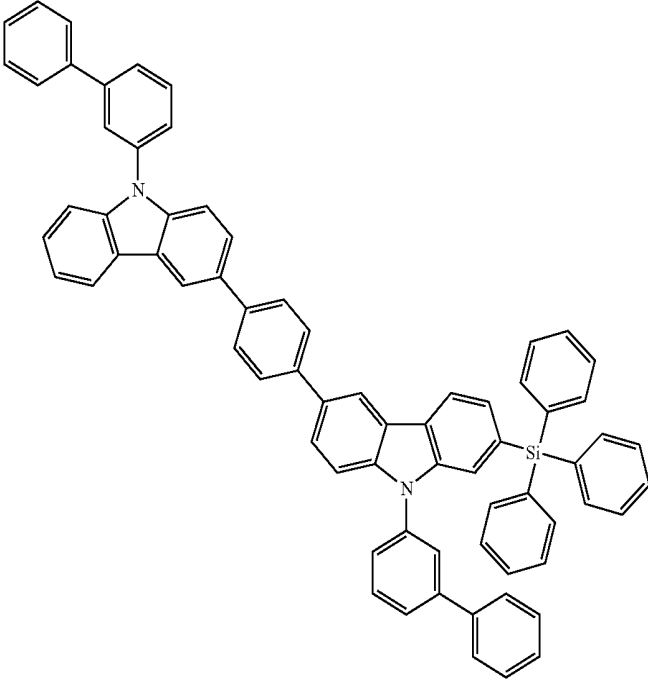


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H1-133

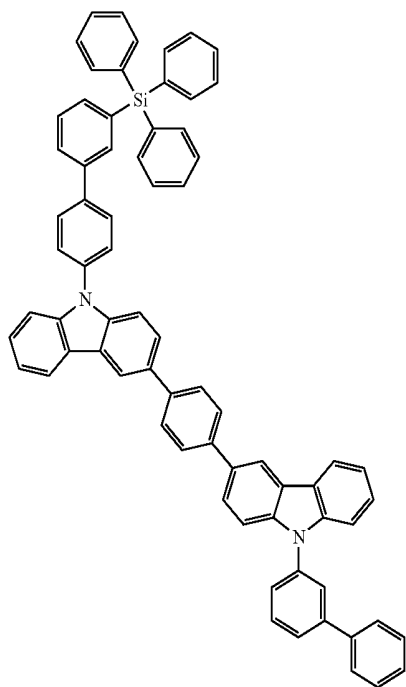


H1-134



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H1-135

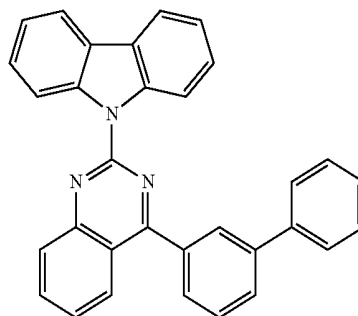
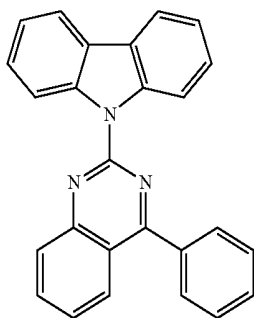


[0038] The second host compound represented by formula 2 includes the following compounds, but is not limited thereto:

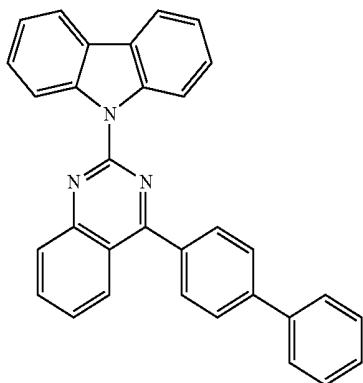
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H2-3

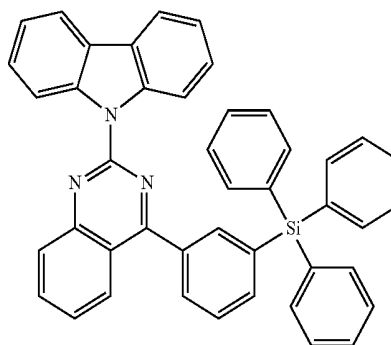
H2-1



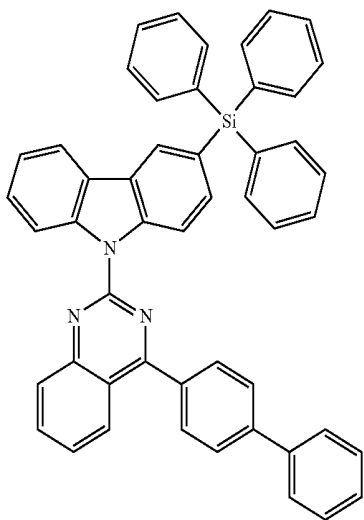
H2-2



H2-4

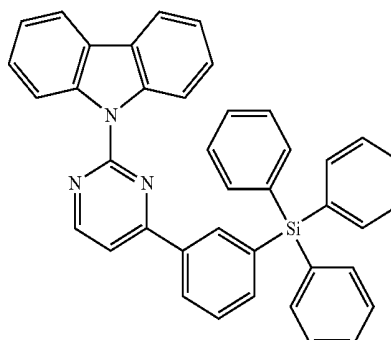


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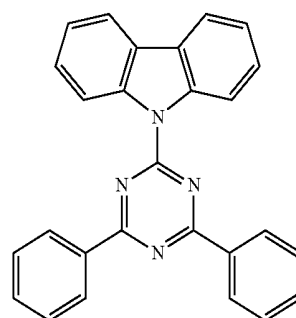


H2-5

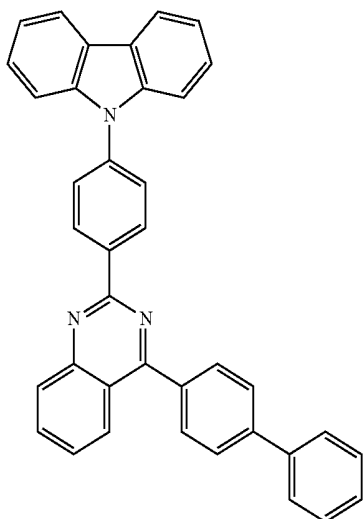
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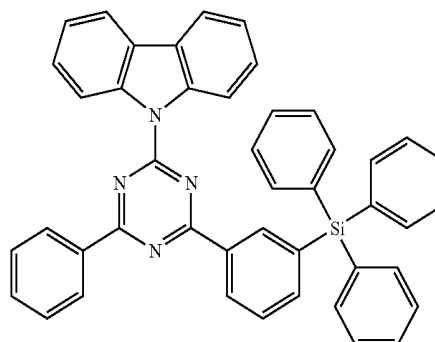
H2-8



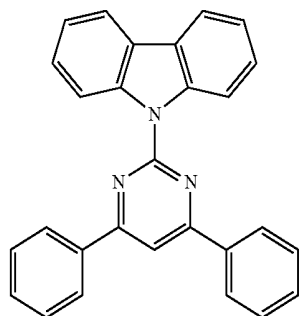
H2-9



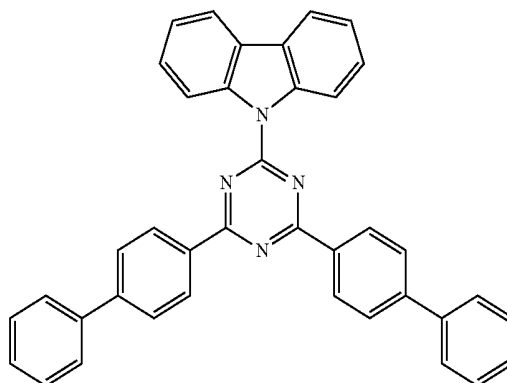
H2-6



H2-10

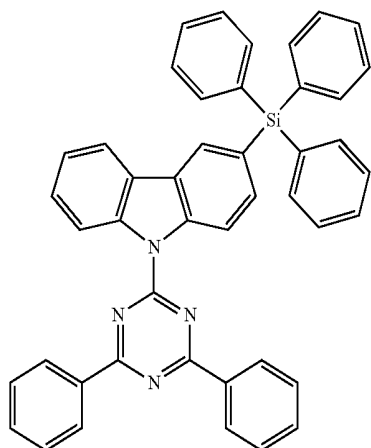


H2-7



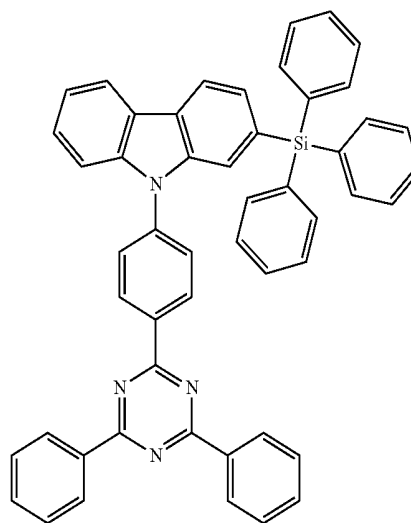
H2-11

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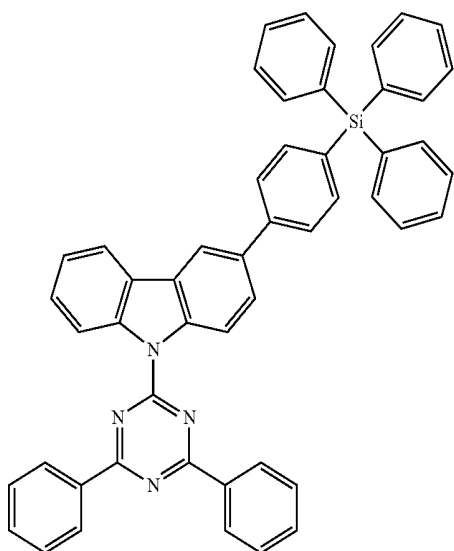
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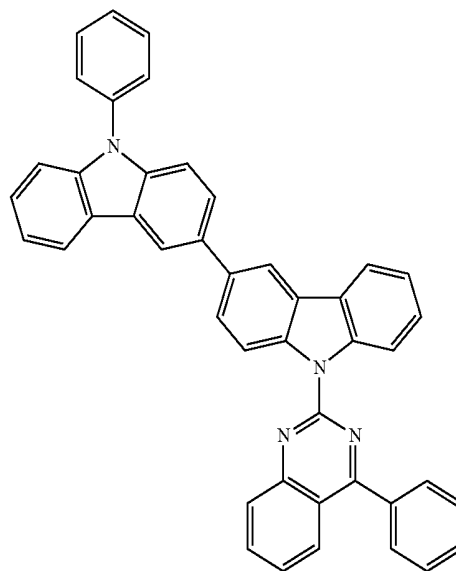
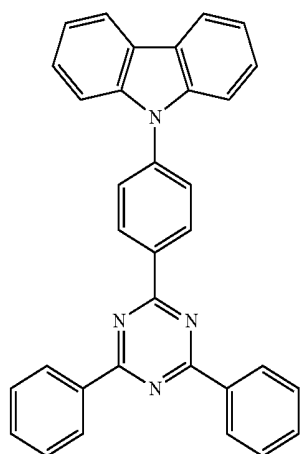


H2-13

H2-15



H2-14

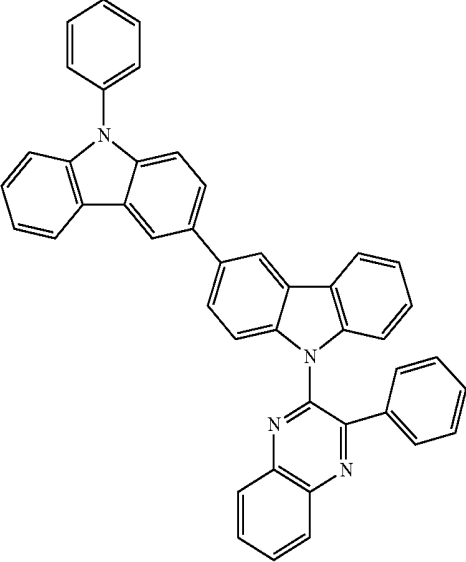


H2-16



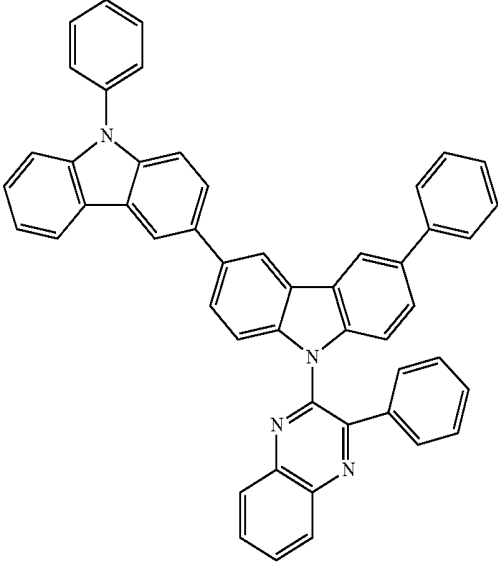
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H2-21

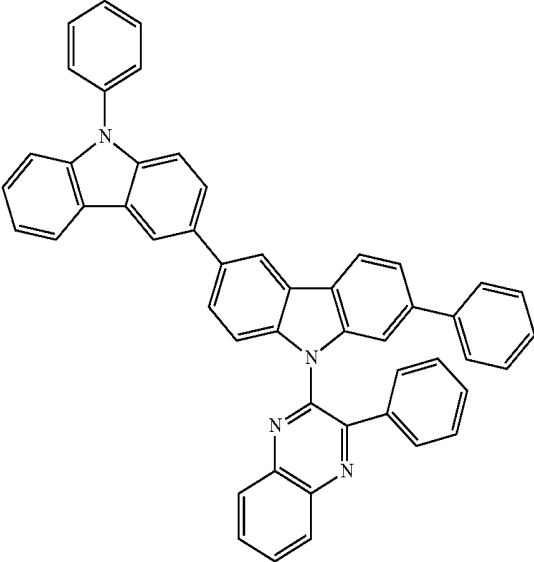


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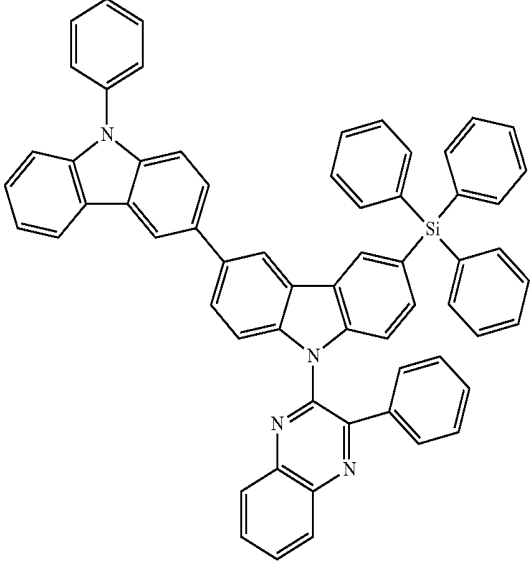
H2-23



H2-22

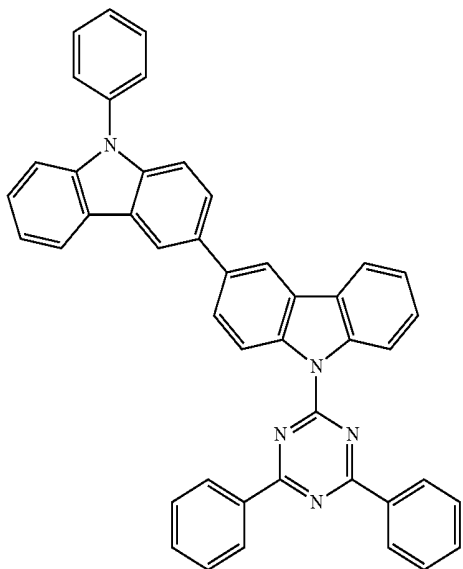


H2-24



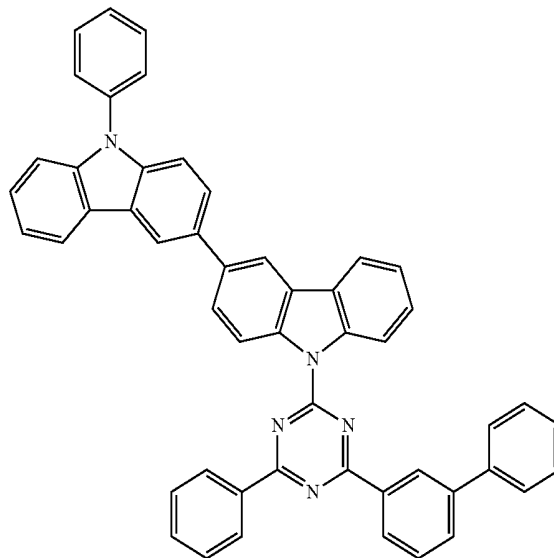
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H2-25

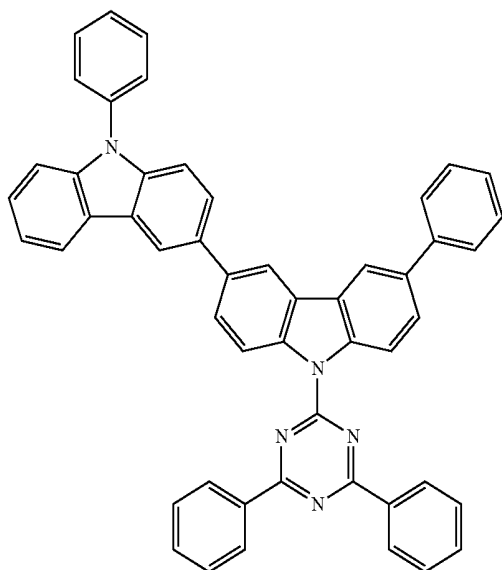


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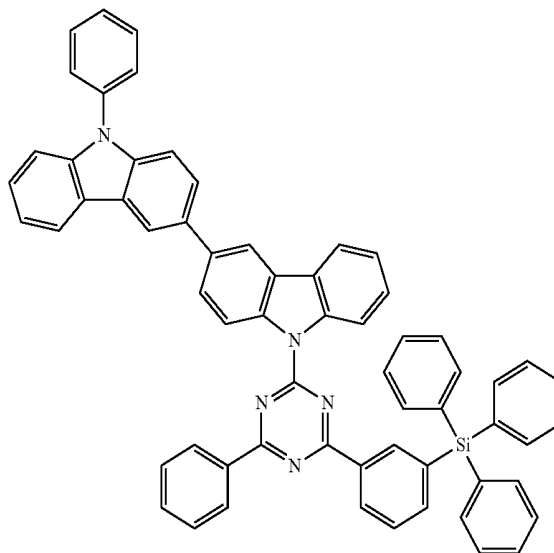
H2-27



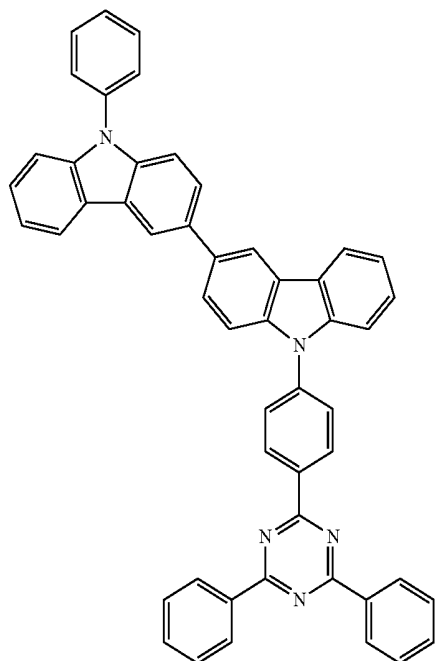
H2-26



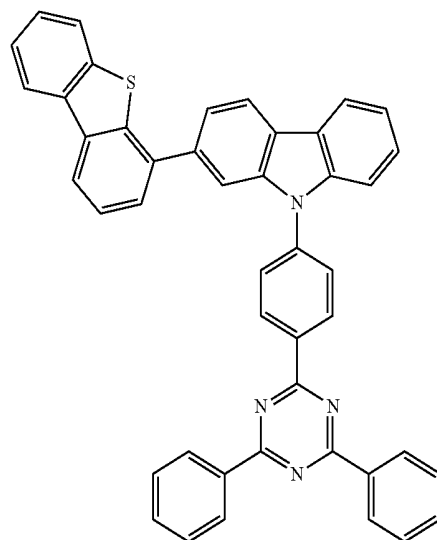
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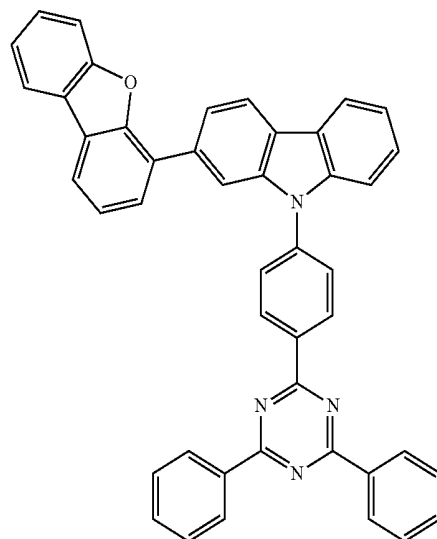


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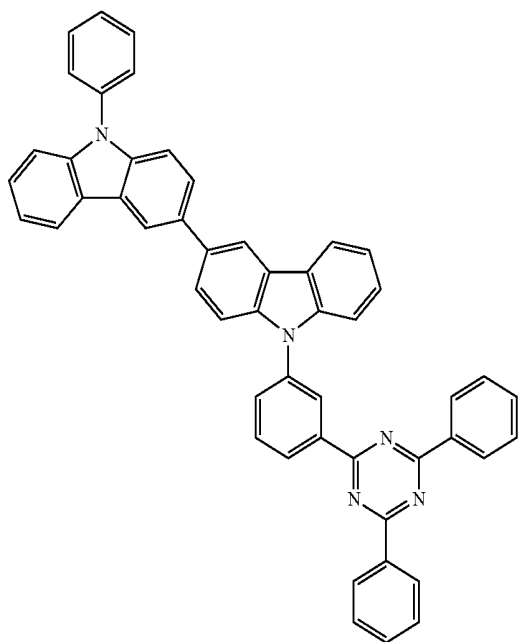


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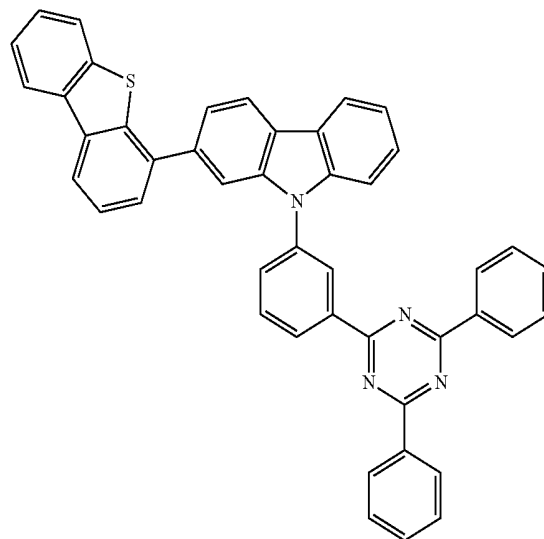
H2-32



H2-30

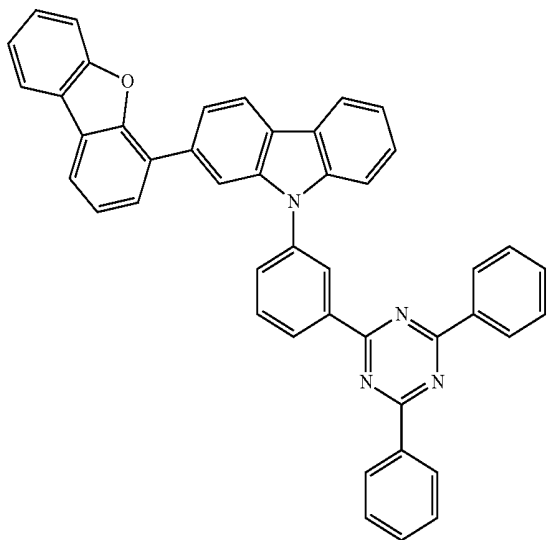


H2-33



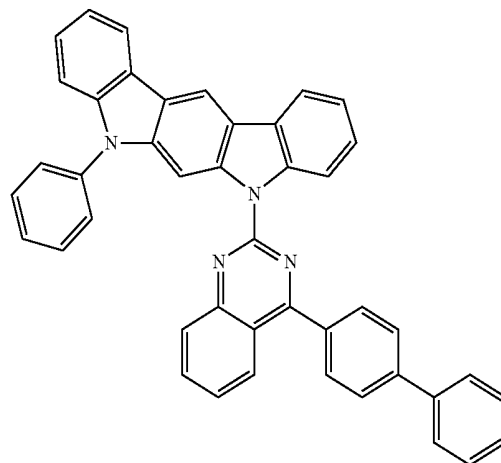
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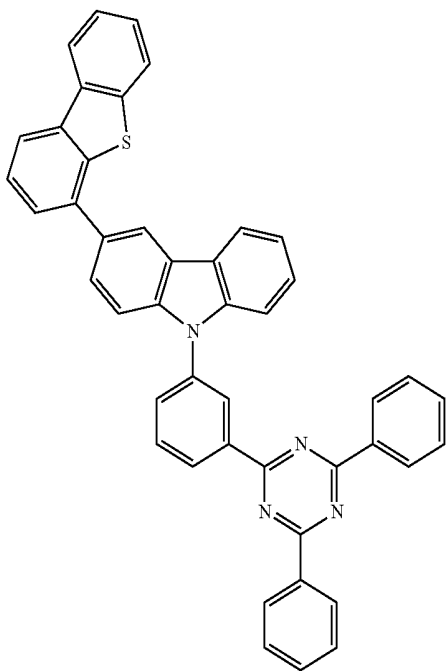


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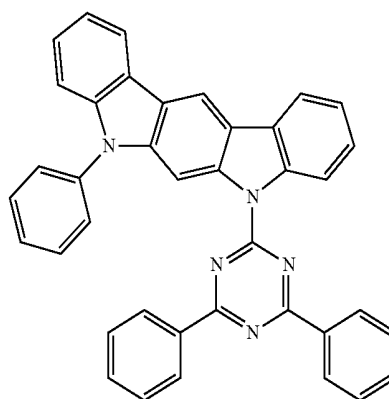
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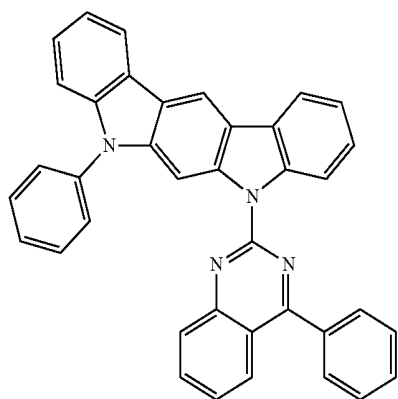
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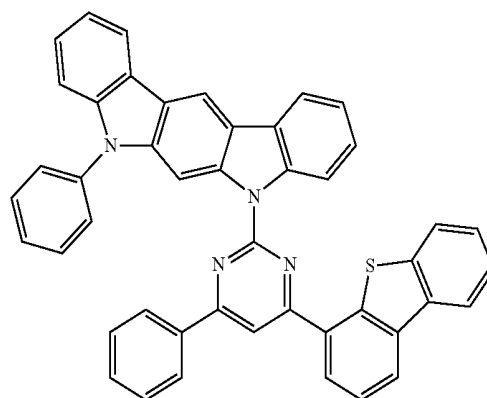
H2-38



H2-36

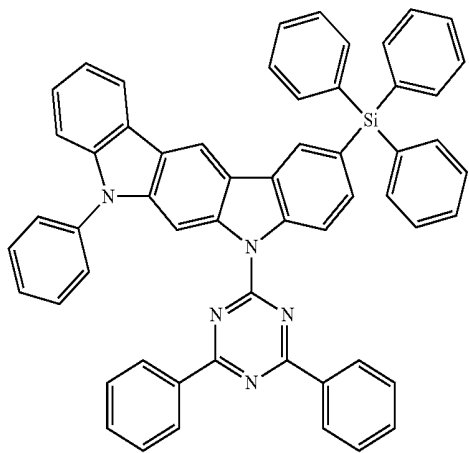


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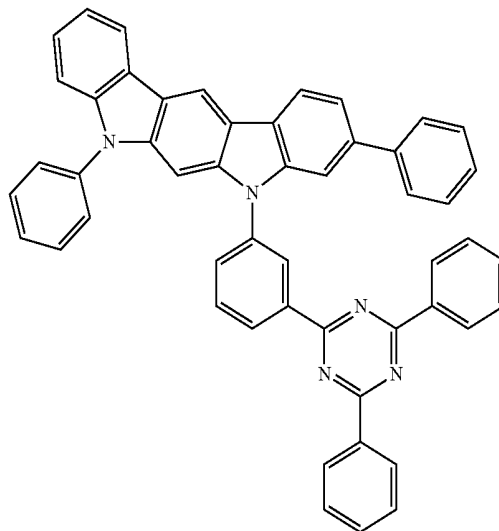
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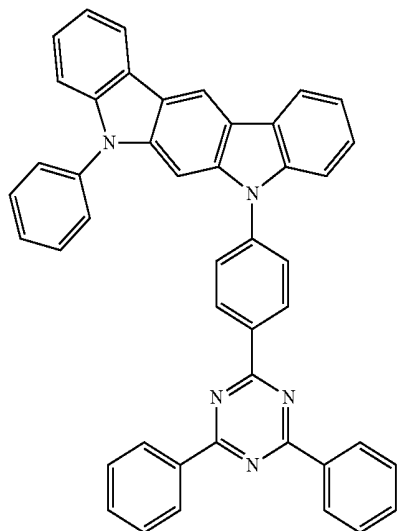


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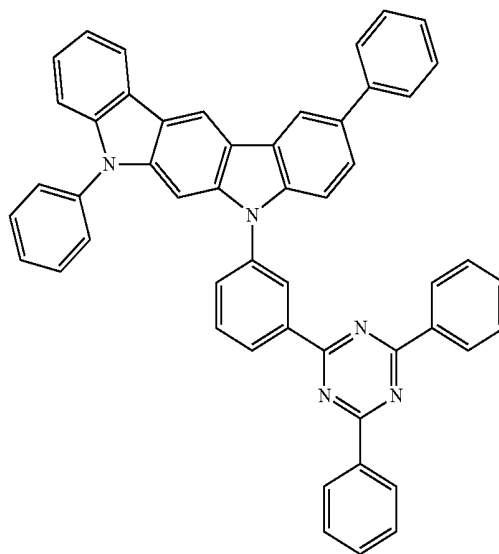
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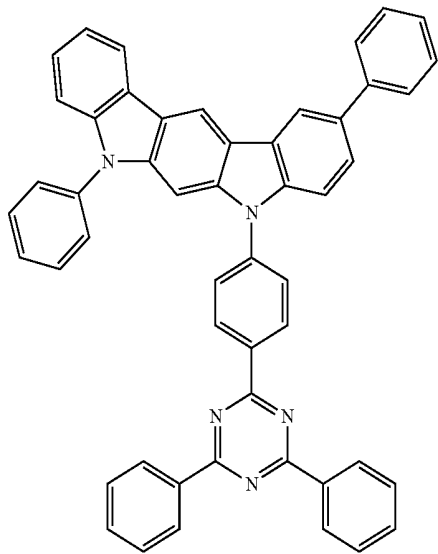
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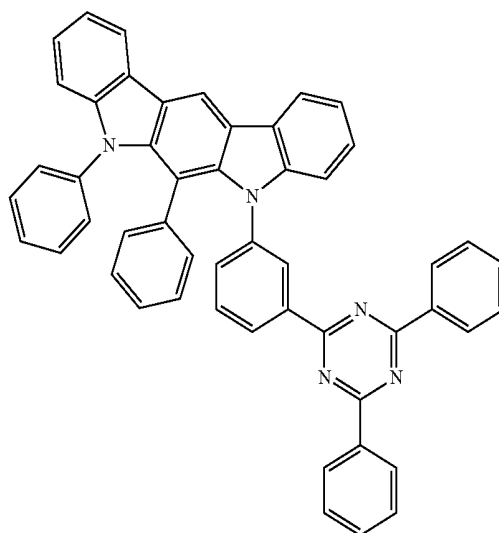
H2-44



H2-42

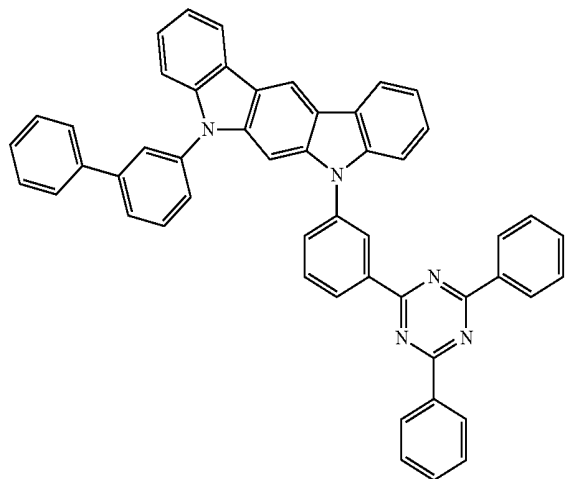


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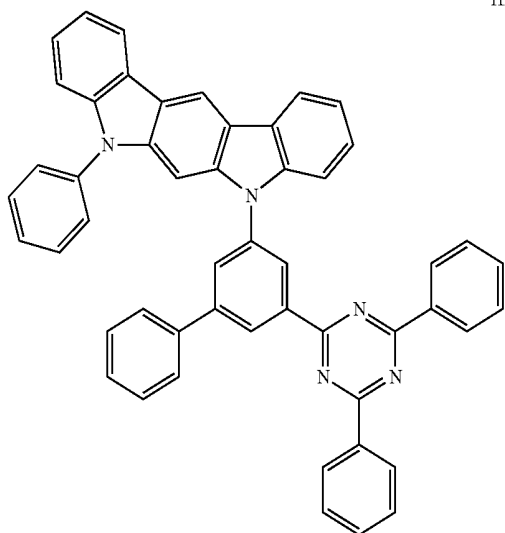


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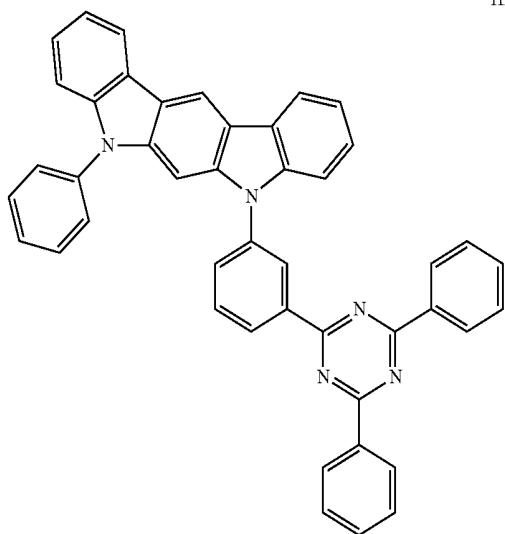
H2-46



H2-47

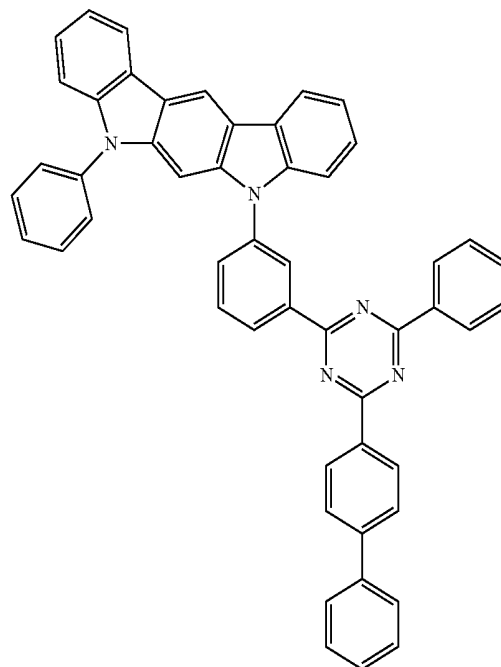


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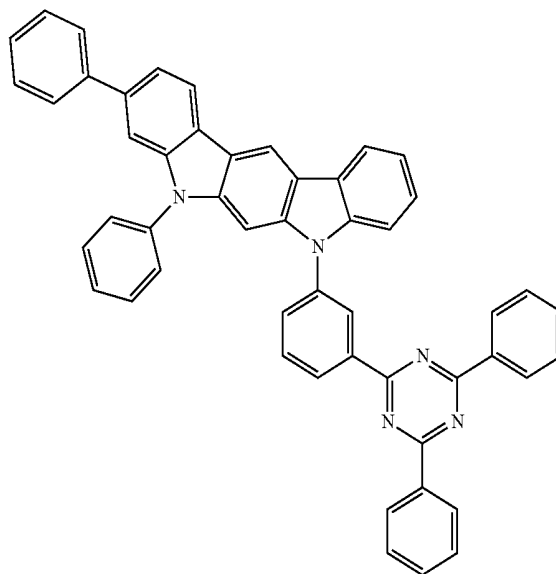


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H2-49

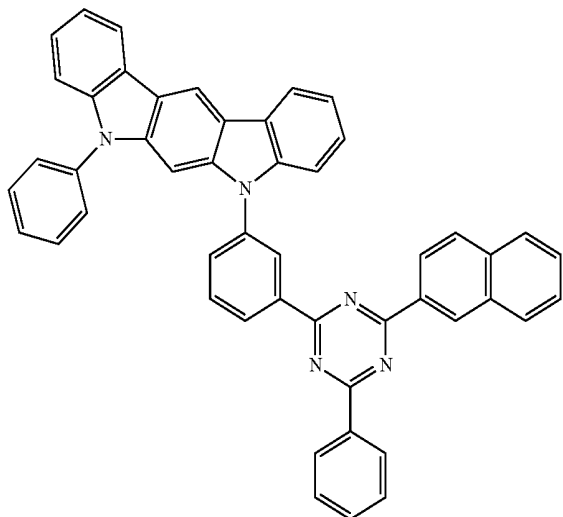


H2-50



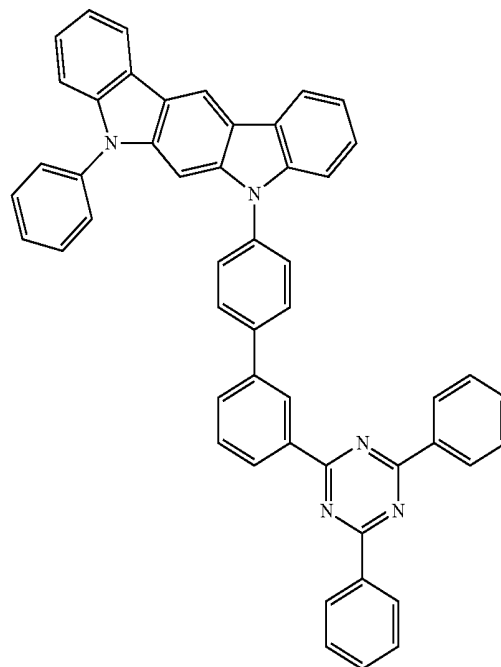
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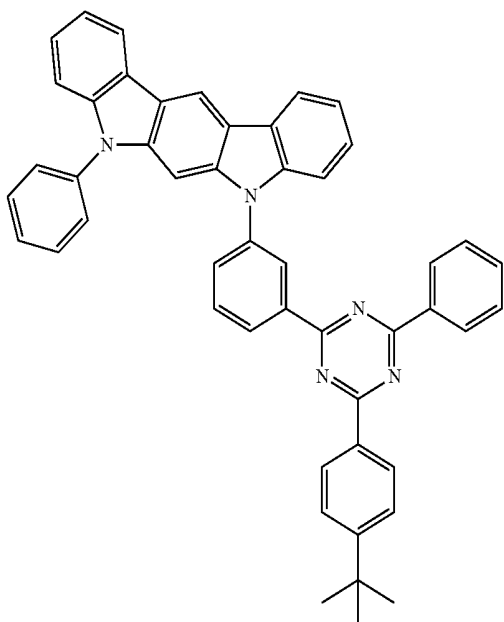


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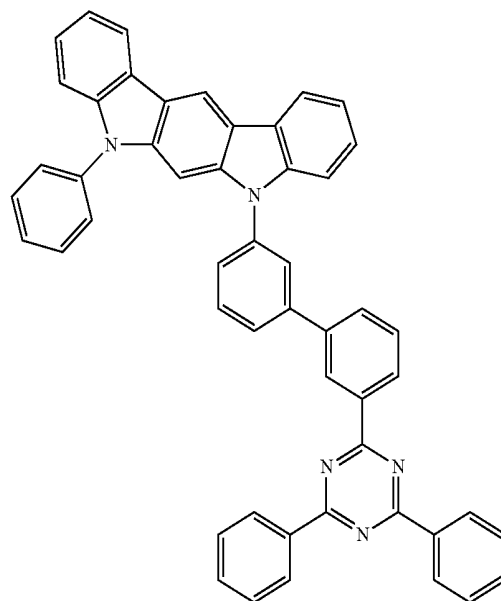
H2-53



H2-52

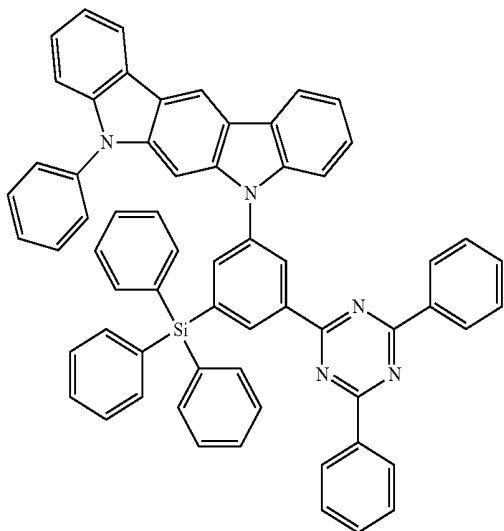


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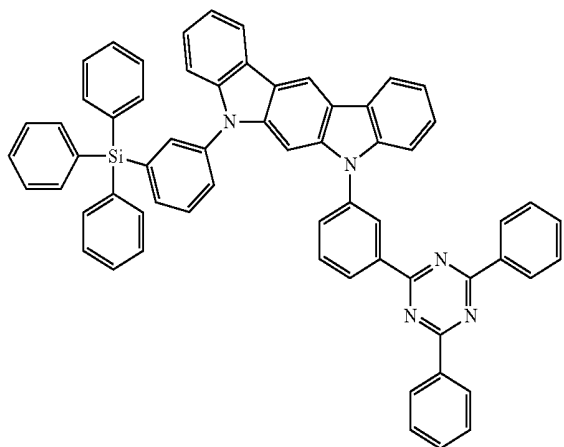


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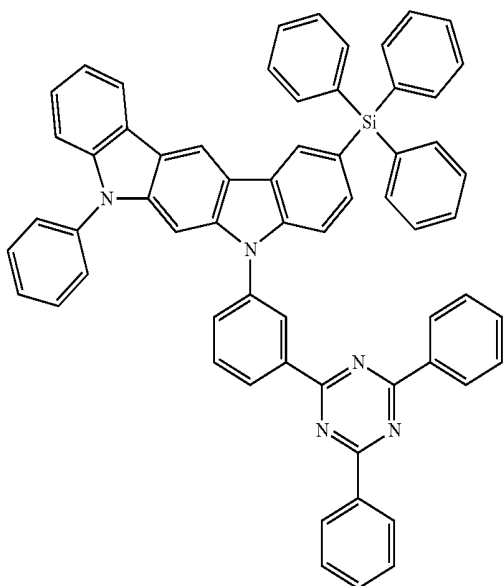
H2-55



H2-56

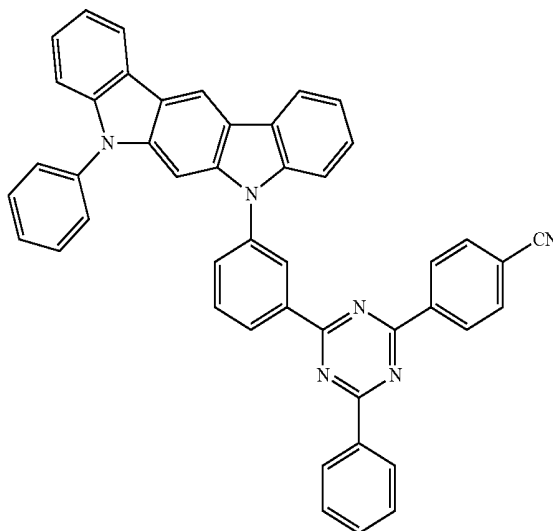


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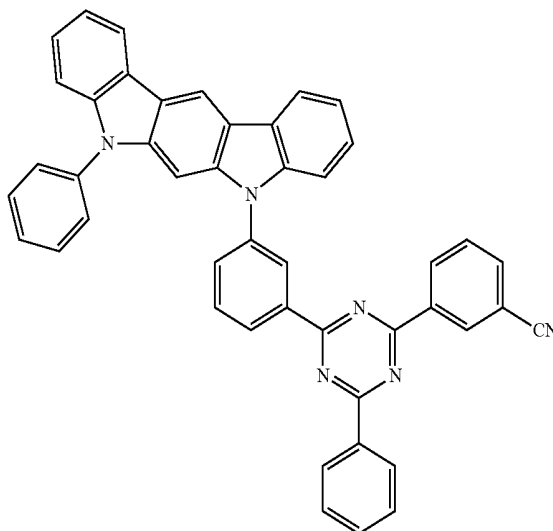


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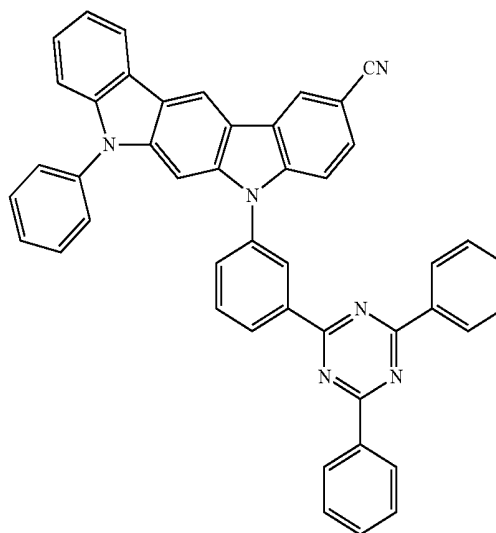
H2-58



H2-59

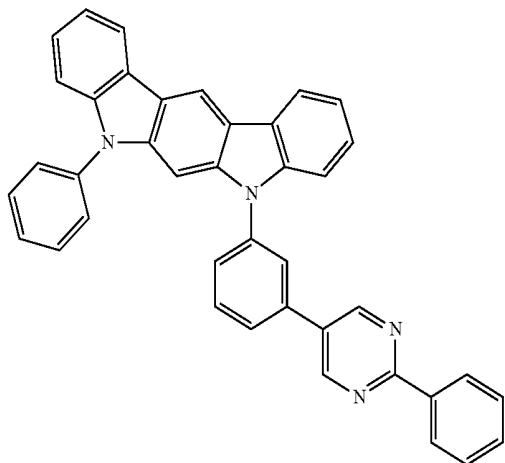


H2-60

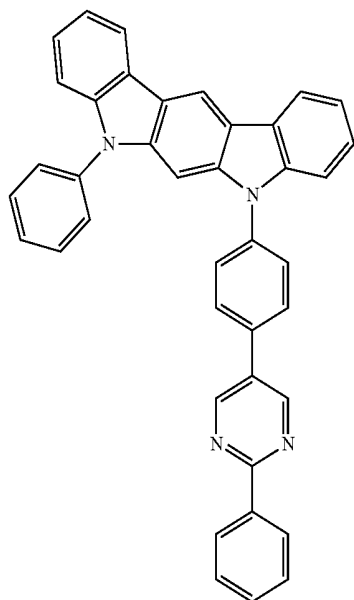


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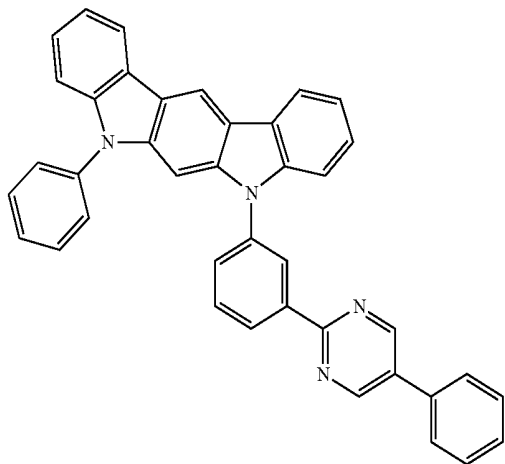
H2-61



H2-62

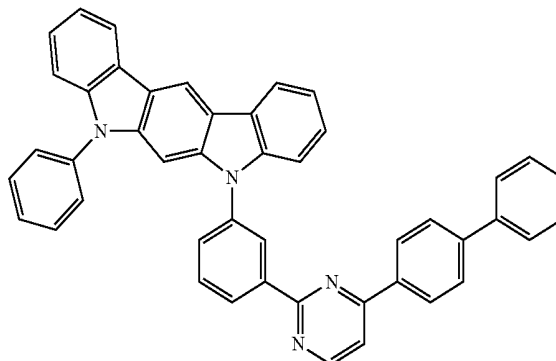


H2-63

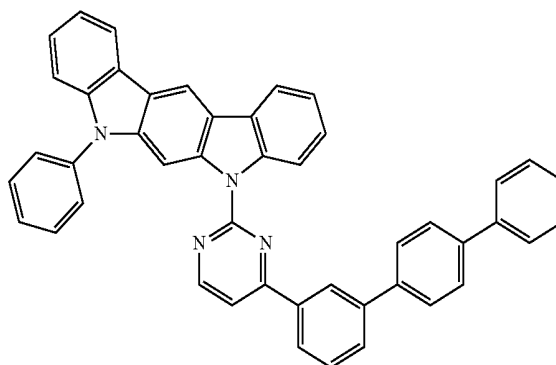


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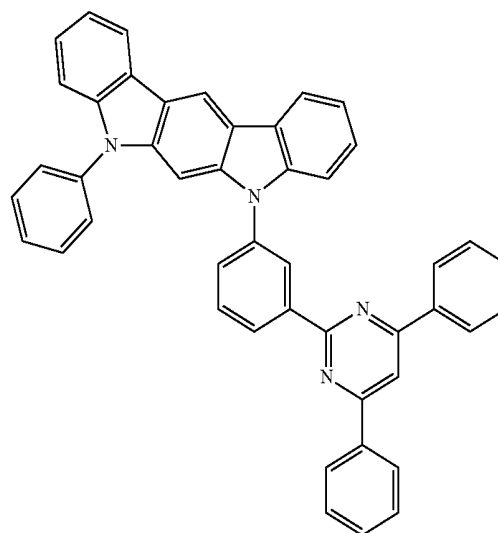
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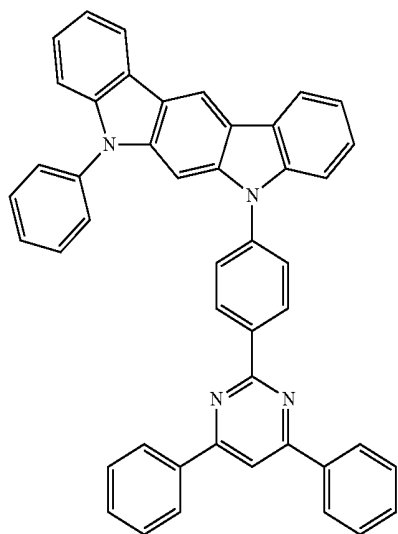
H2-65



H2-66

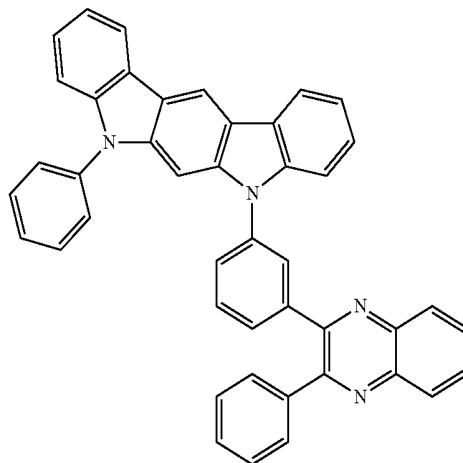


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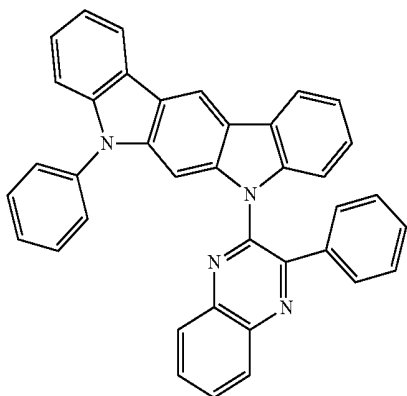


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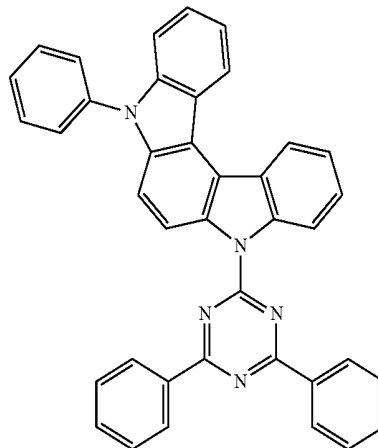
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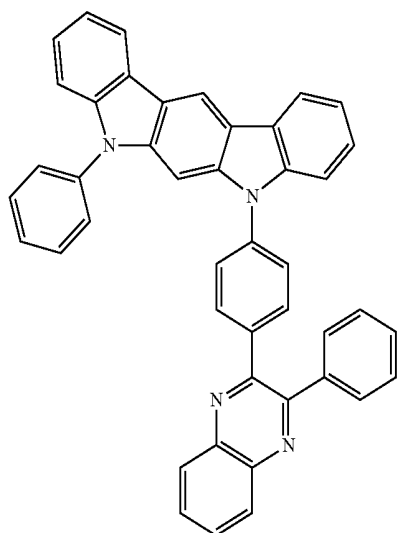
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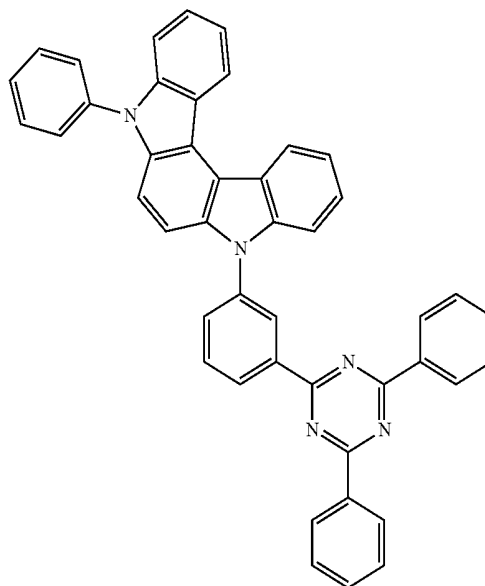
H2-68



H2-71

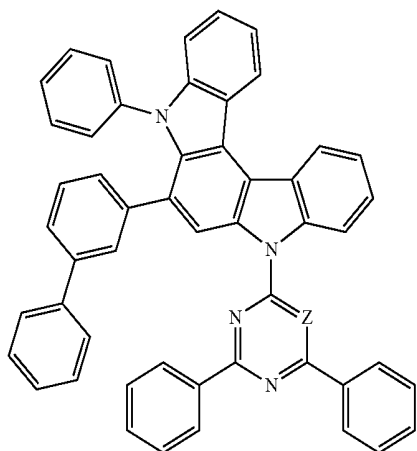


H2-69



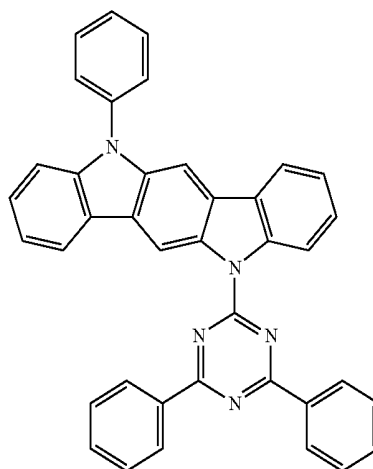
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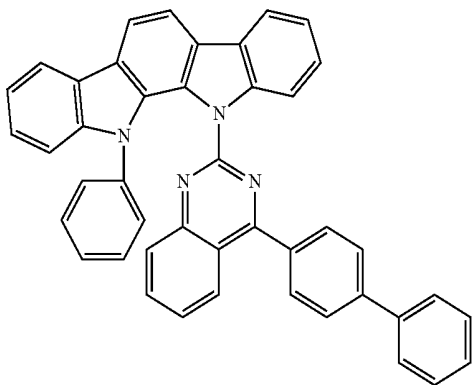


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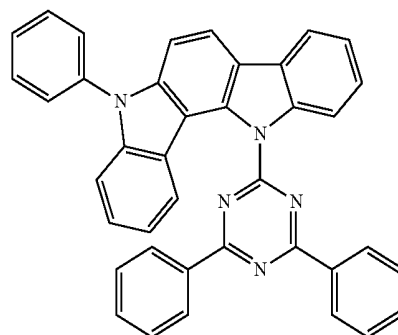
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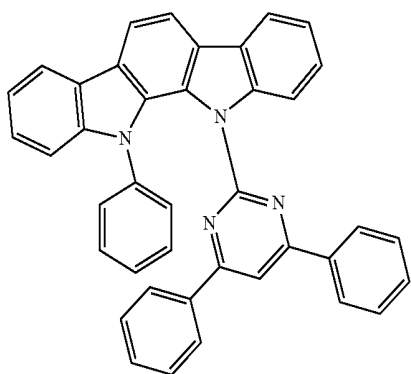
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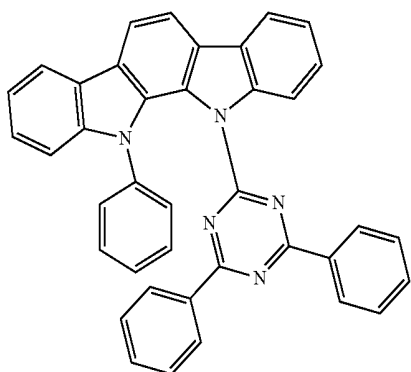
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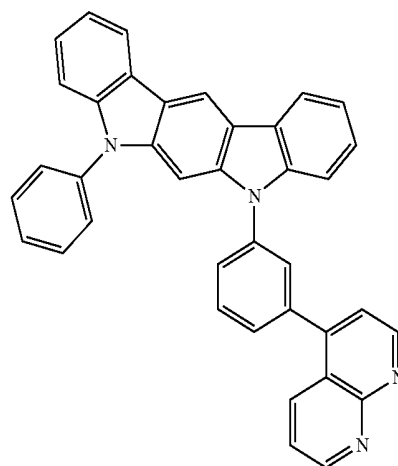
H2-78



H2-75



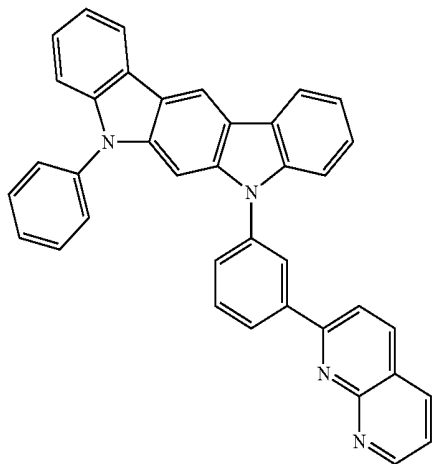
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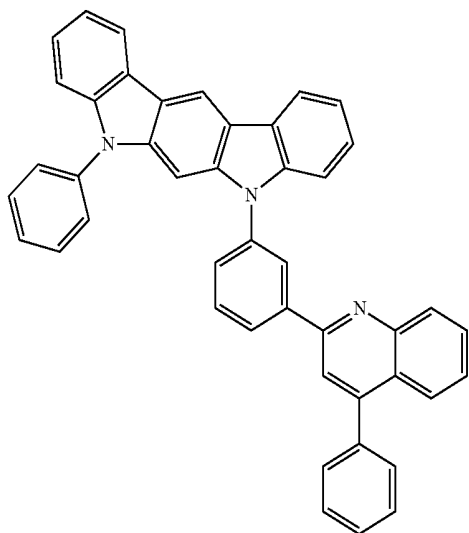
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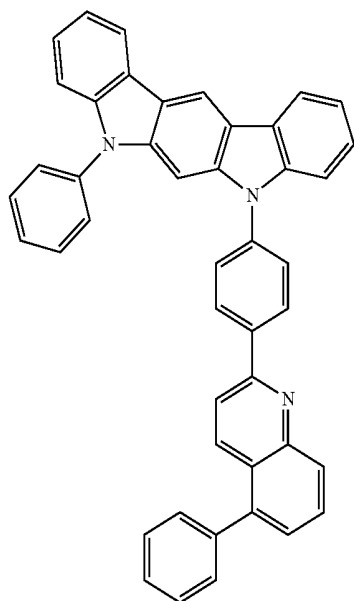
H2-80



H2-81

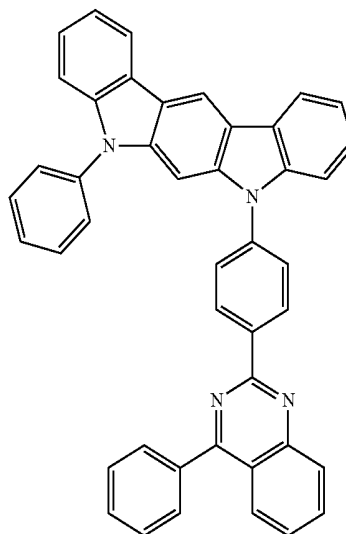


H2-82

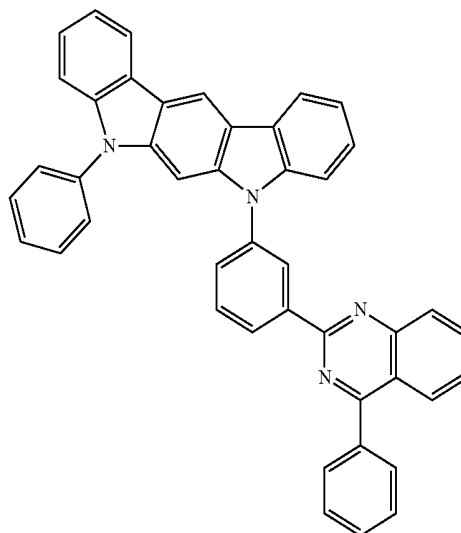


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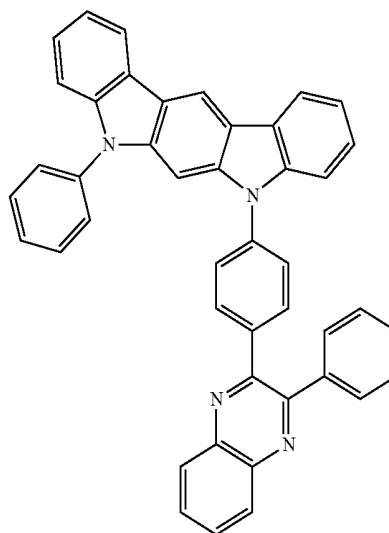
H2-83



H2-84

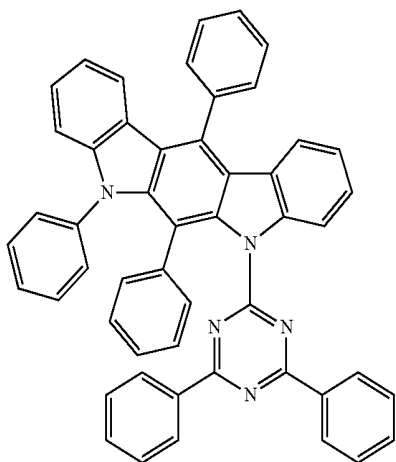


H2-85



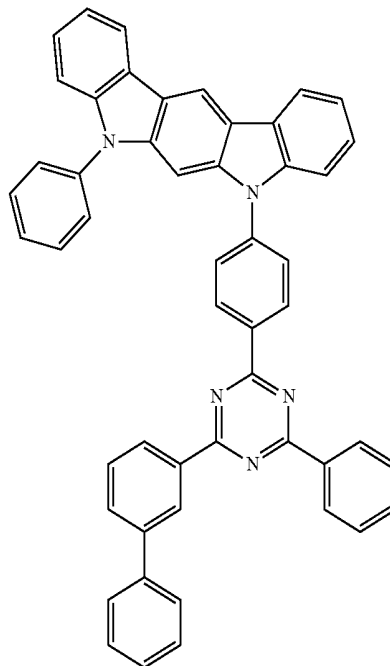
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H2-86

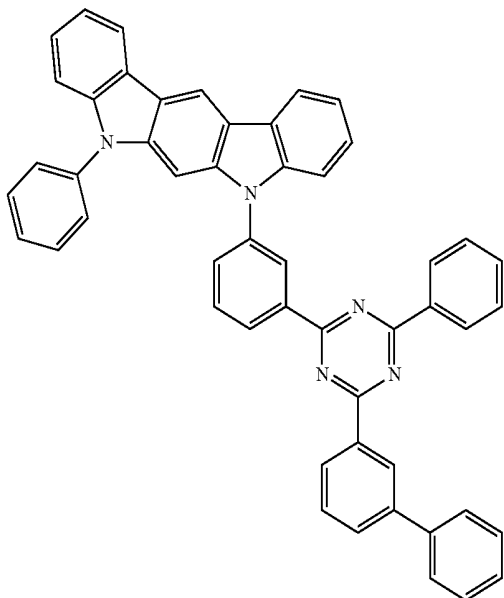


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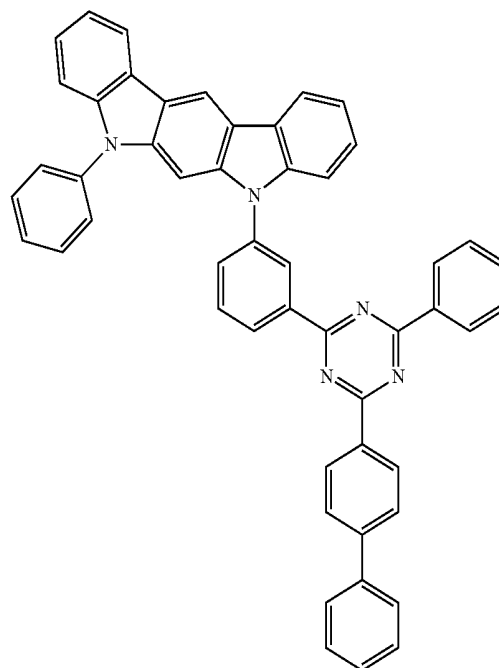
H2-88



H2-87

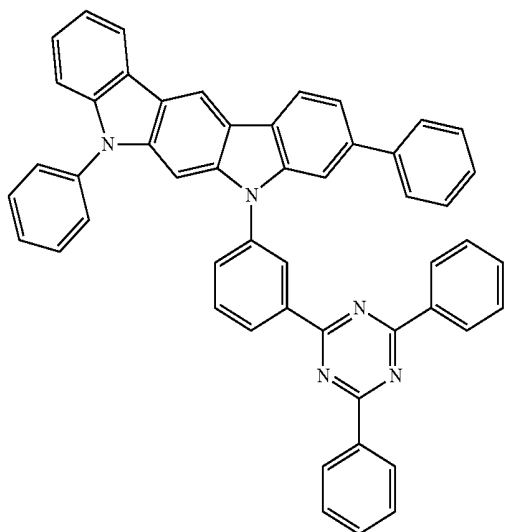


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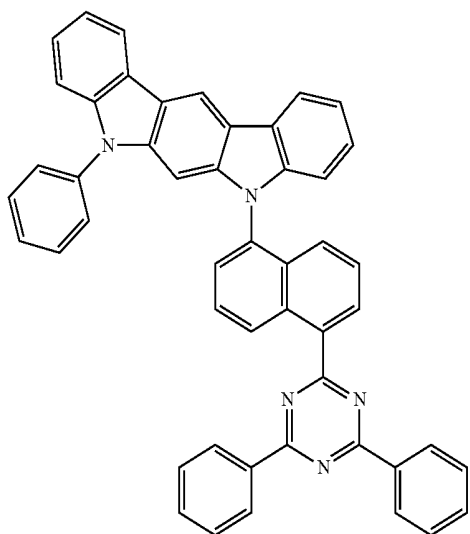


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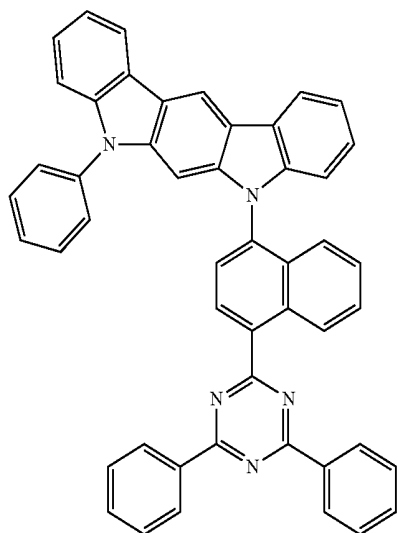
H2-90



H2-91

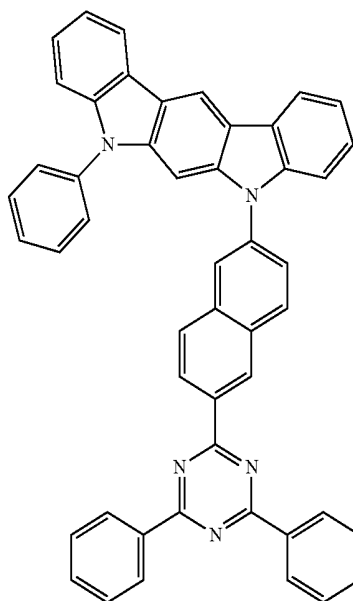


H2-92

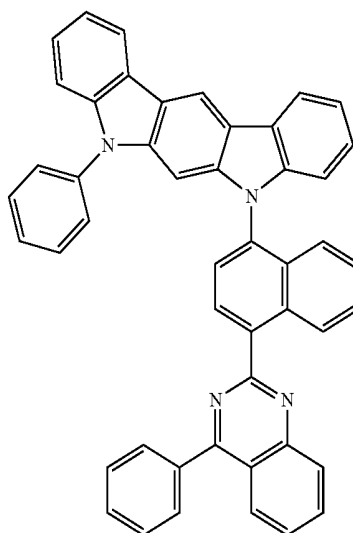


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H2-93

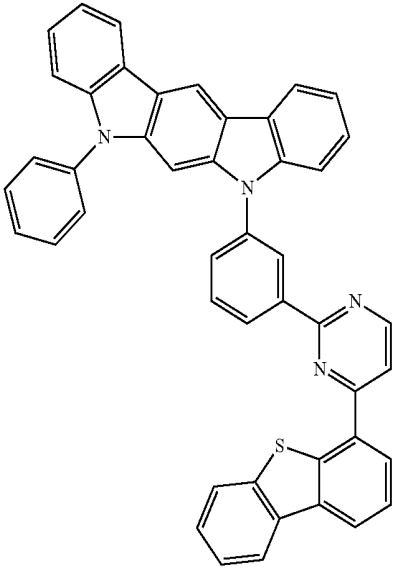


H2-94



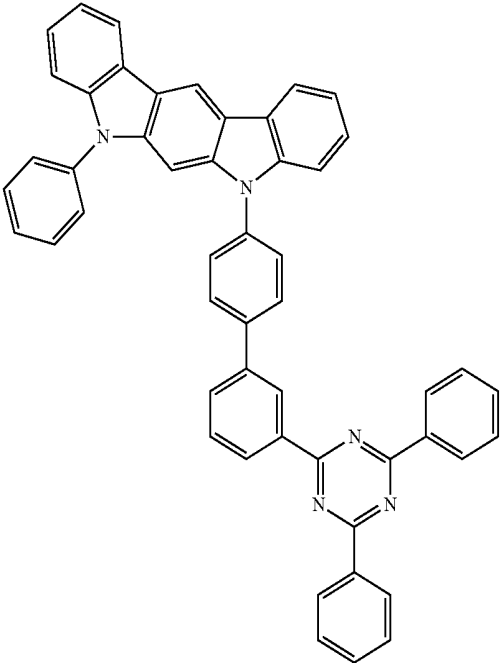
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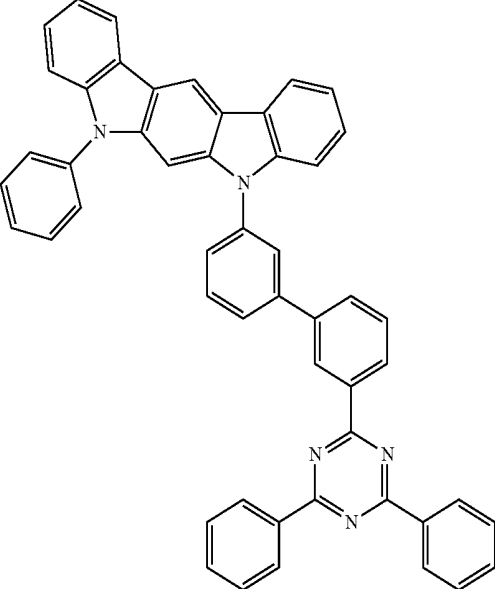


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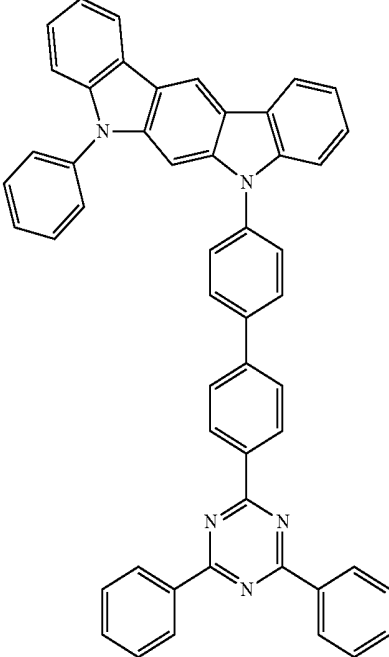
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H2-96

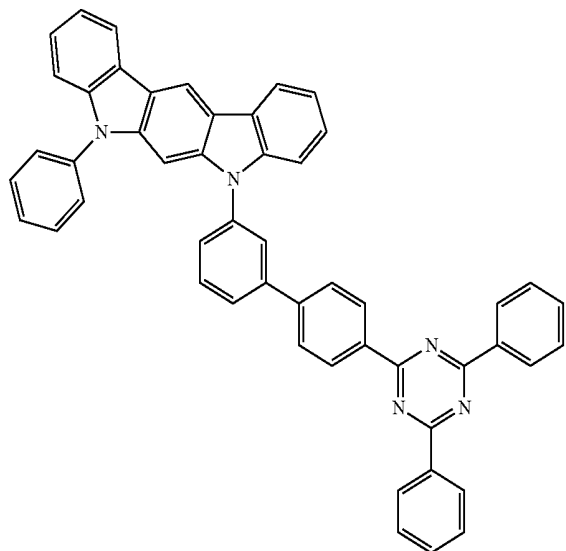


H2-98

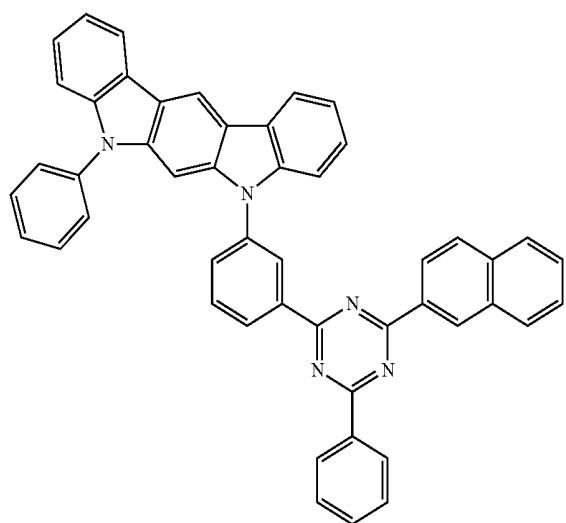


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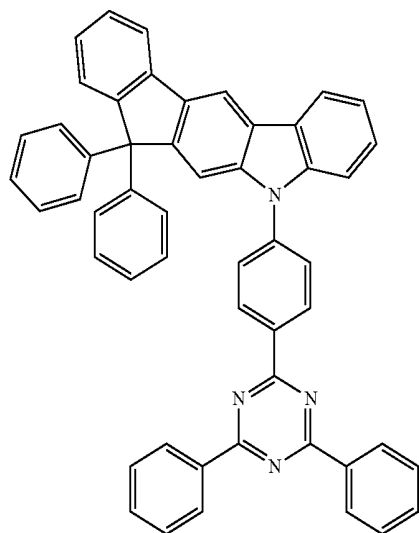
H2-99



H2-100

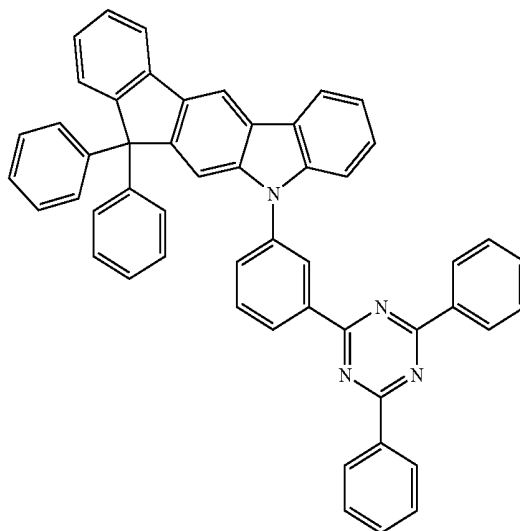


H2-101

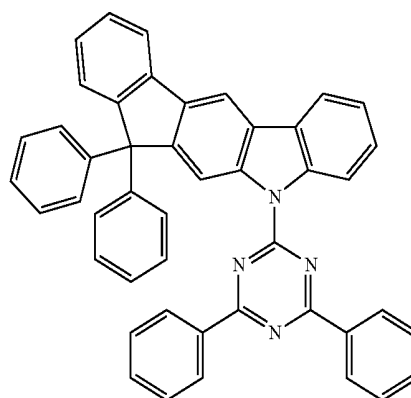


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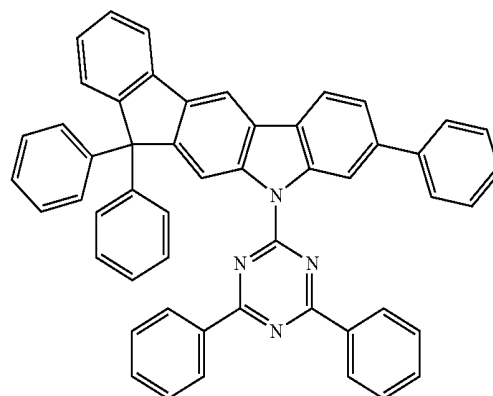
H2-102



H2-103

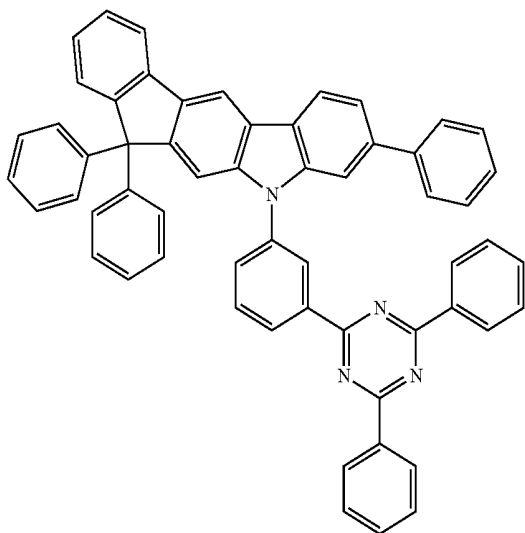


H2-104



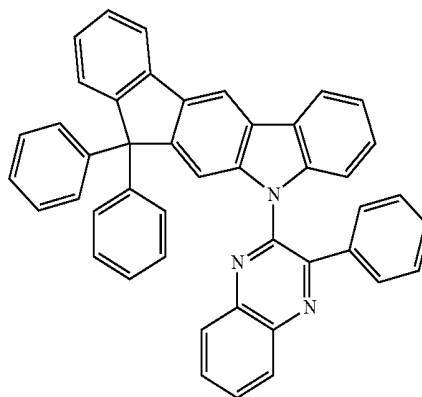
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H2-105

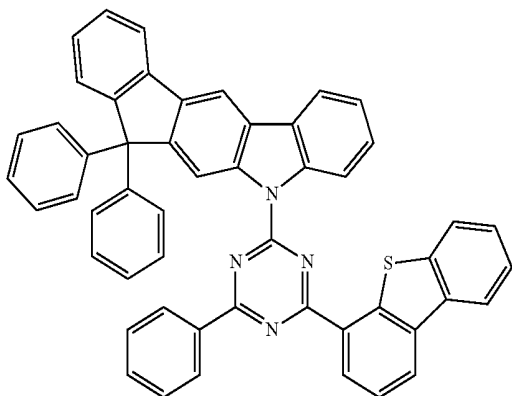


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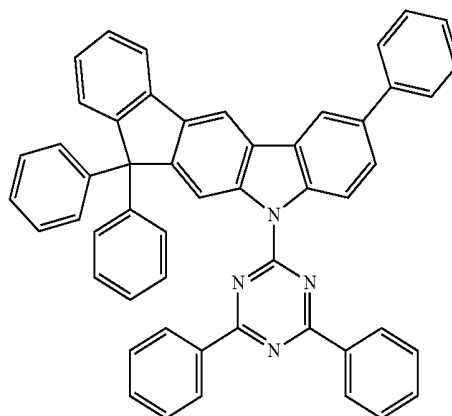
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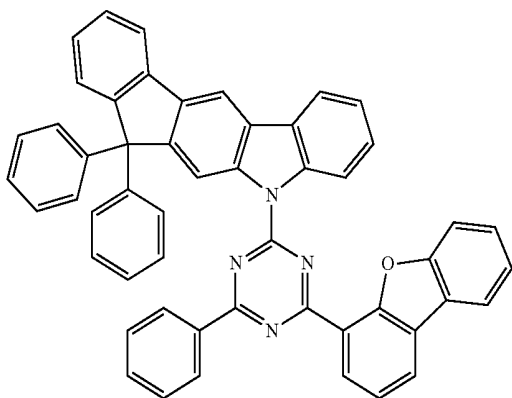
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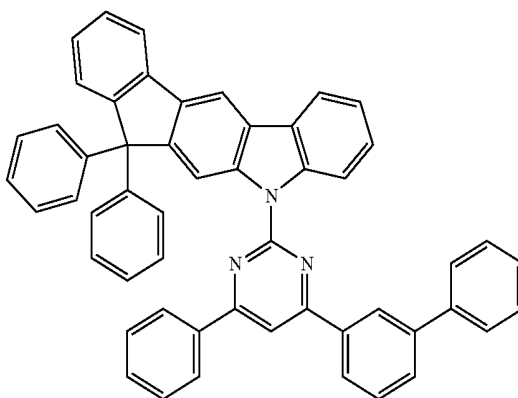
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H2-107

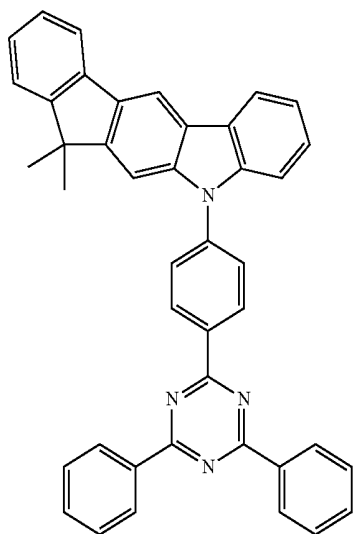


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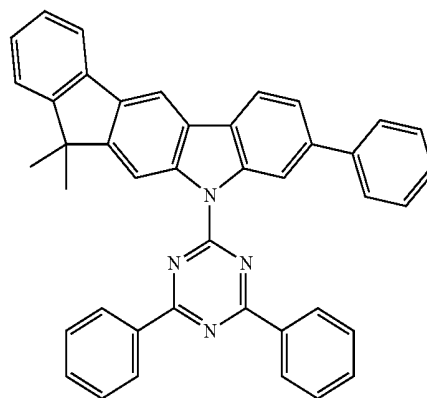
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H2-111



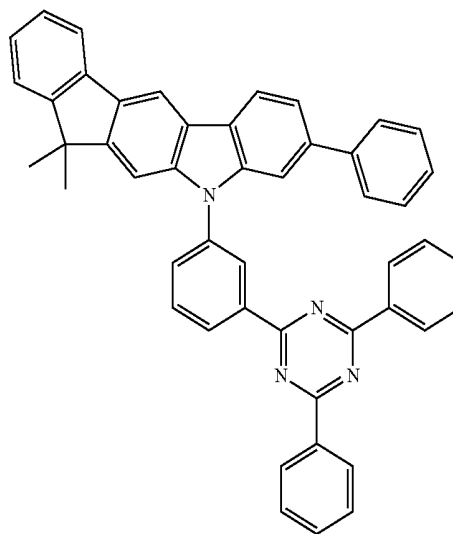
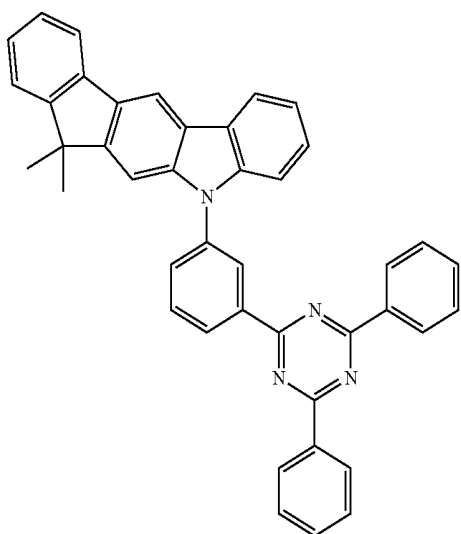
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H2-114

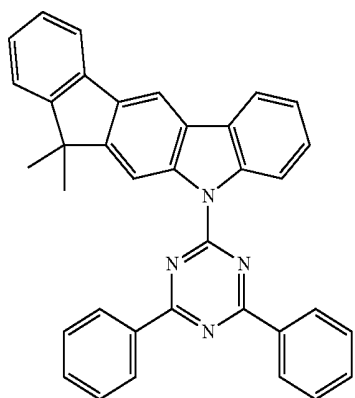


H2-115

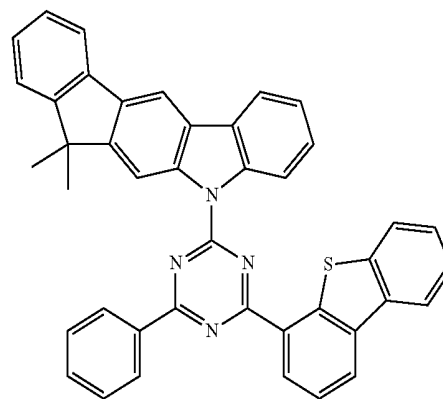
H2-112



H2-113

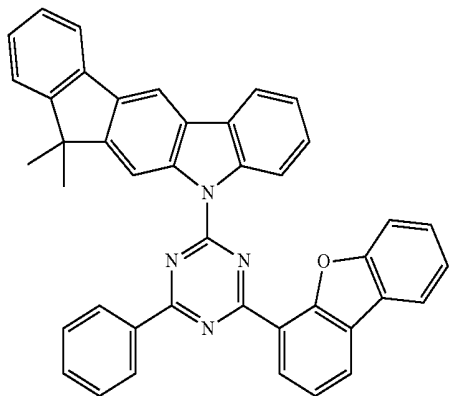


H2-116

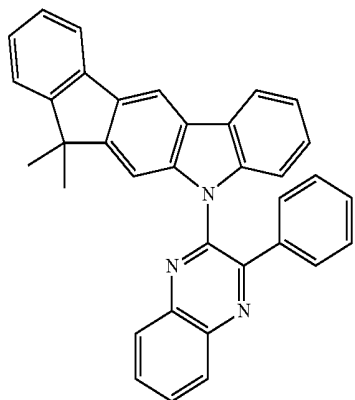


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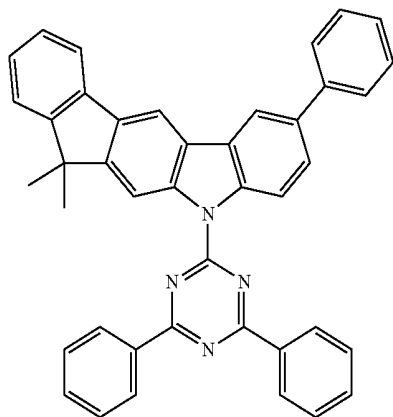
H2-117



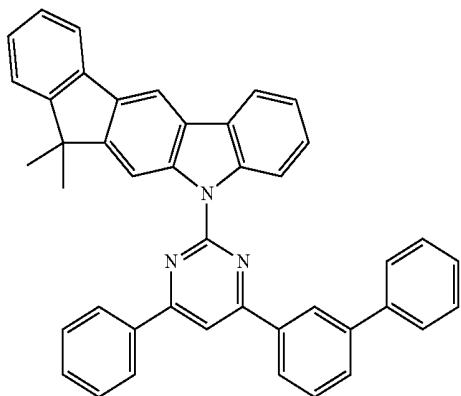
H2-118



H2-119

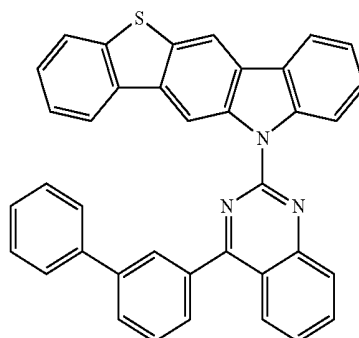


H2-120

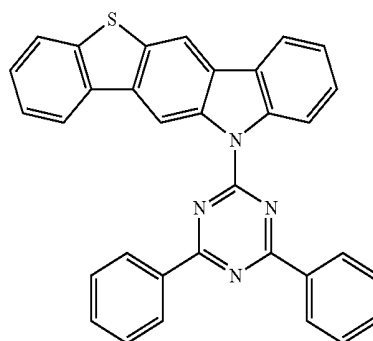


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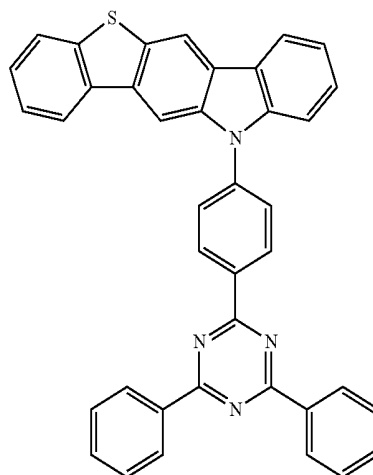
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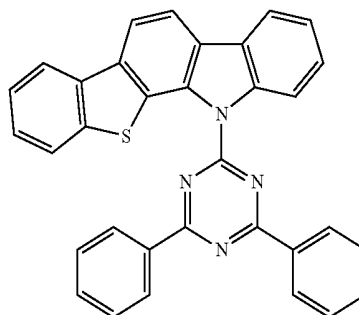
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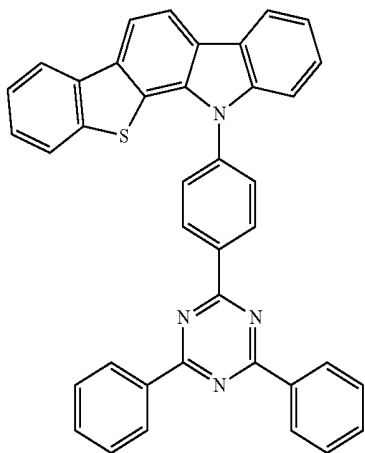
H2-123



H2-124

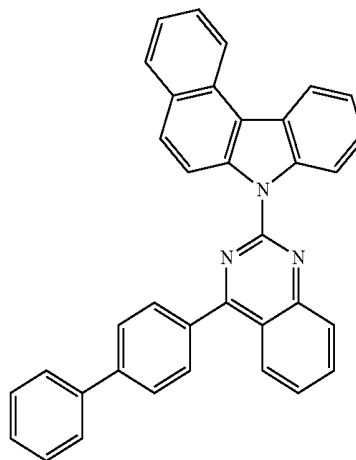


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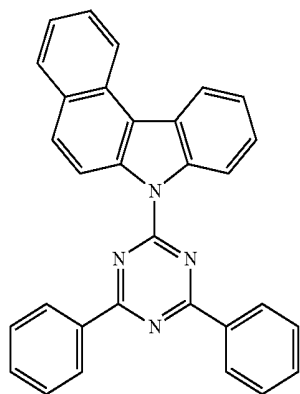


H2-125

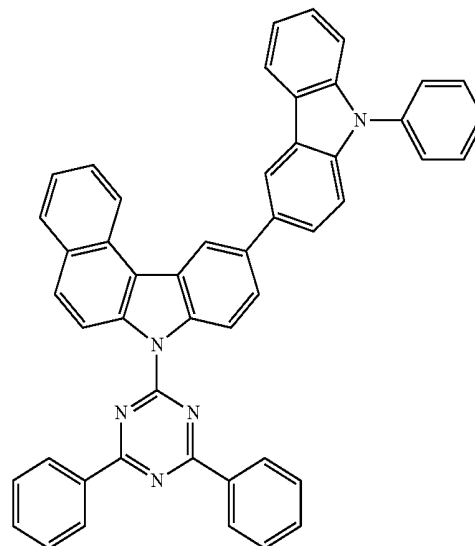
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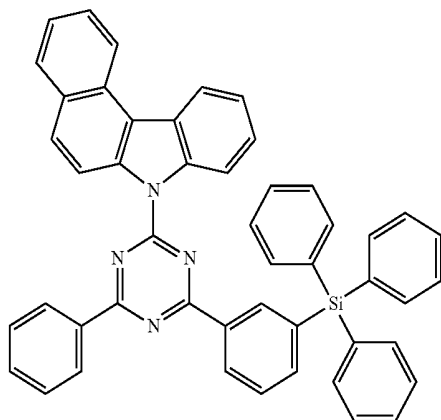
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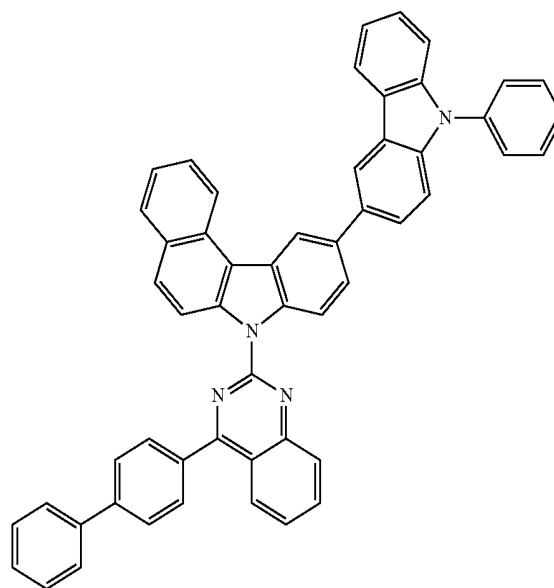
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H2-129



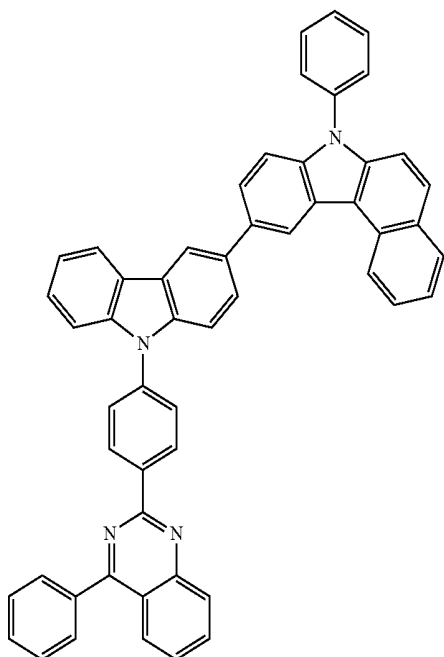
H2-127



H2-130

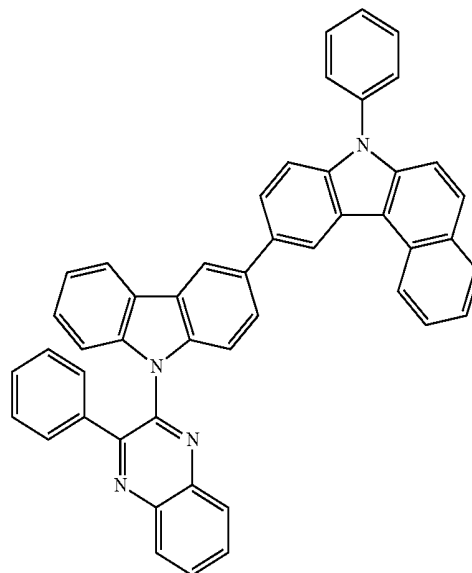
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H2-131

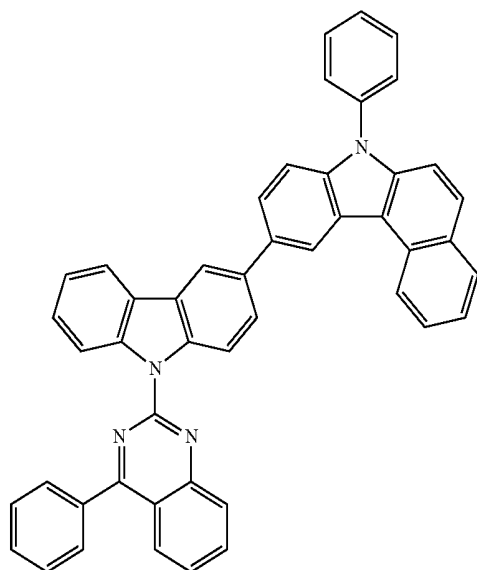


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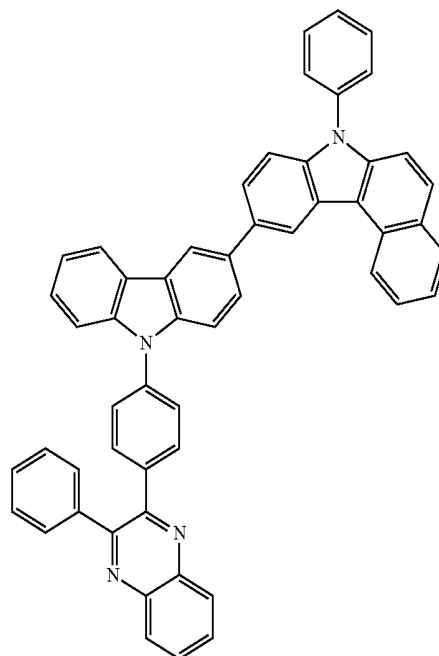
H2-133



H2-132

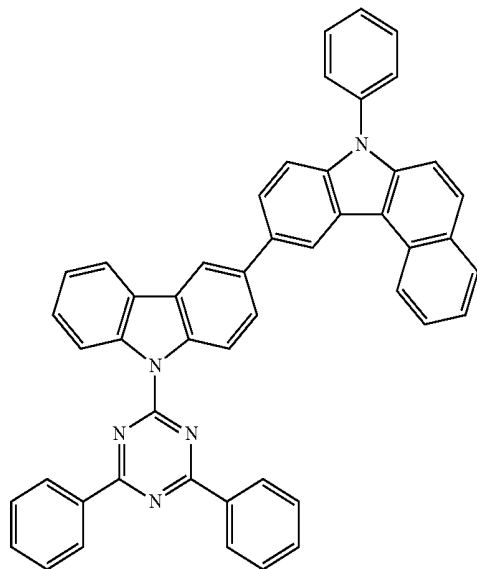


H2-134



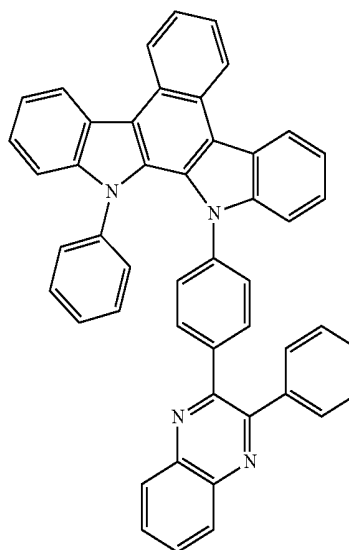
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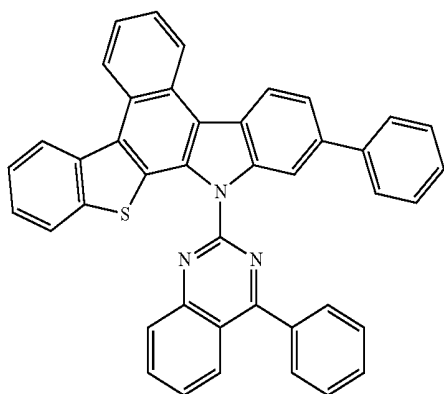


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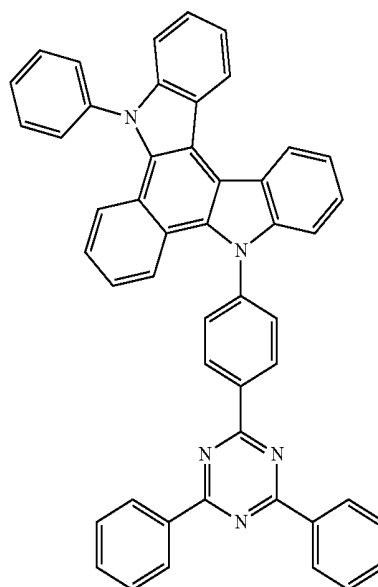
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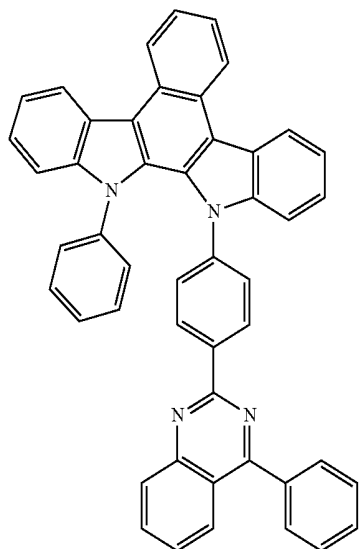
H2-136



H2-139

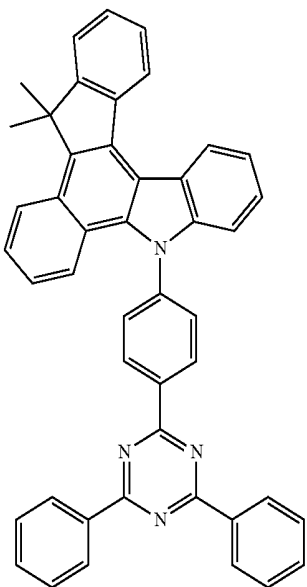


H2-137



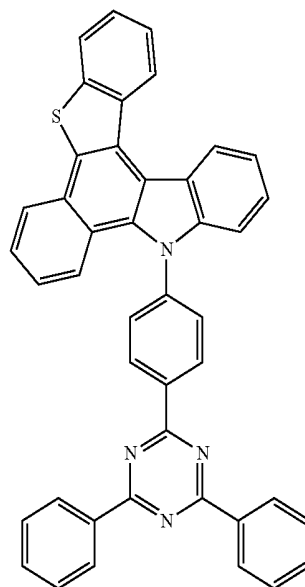
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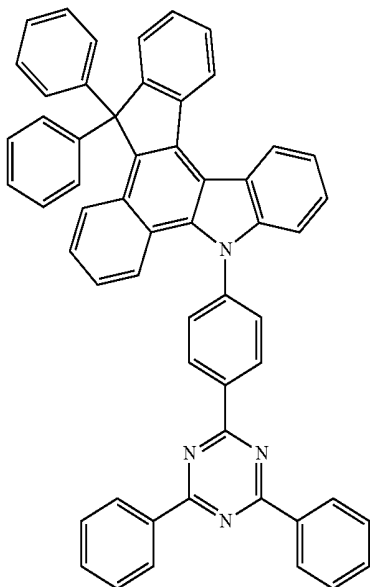


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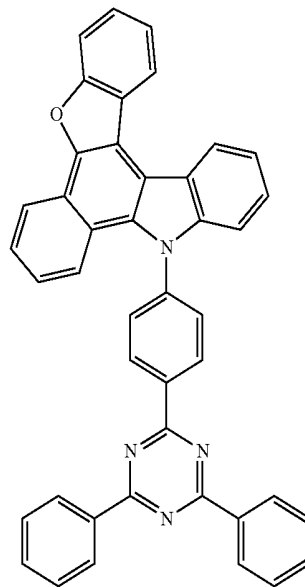
H2-142



H2-141

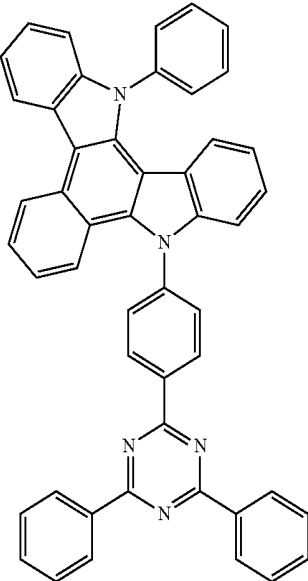


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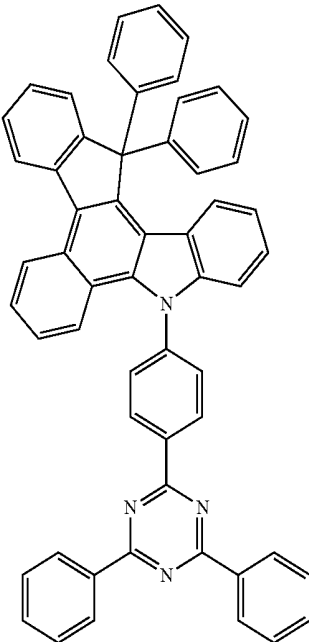
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H2-144

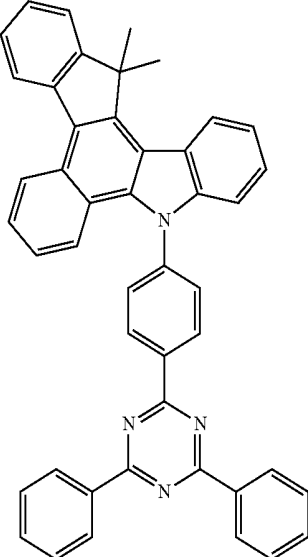


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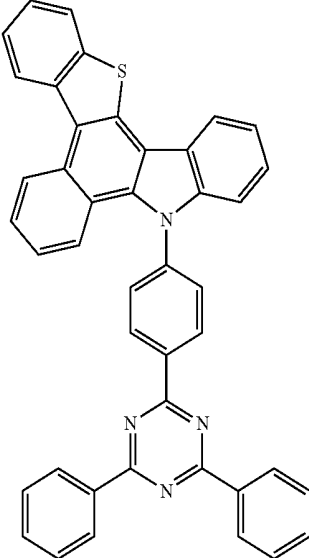
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H2-145

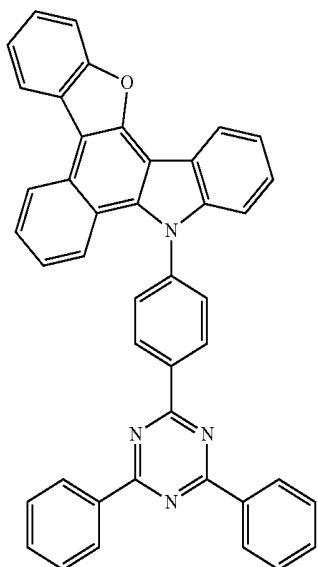


H2-147



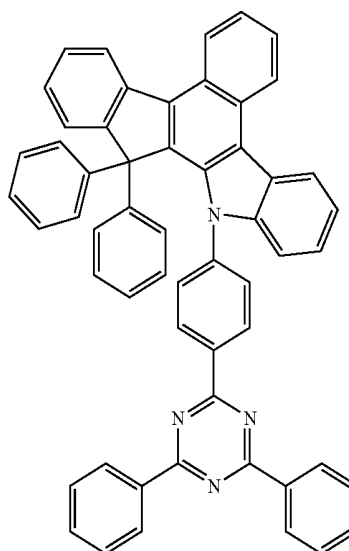
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H2-148

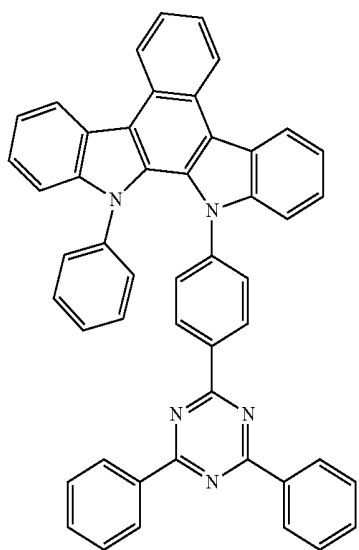


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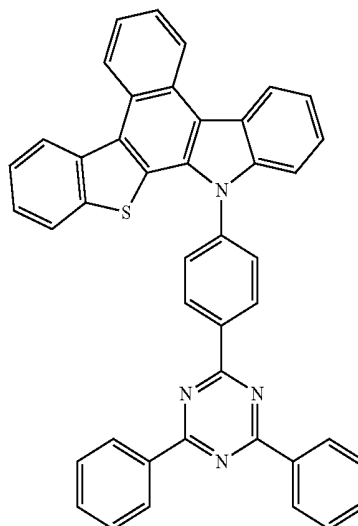
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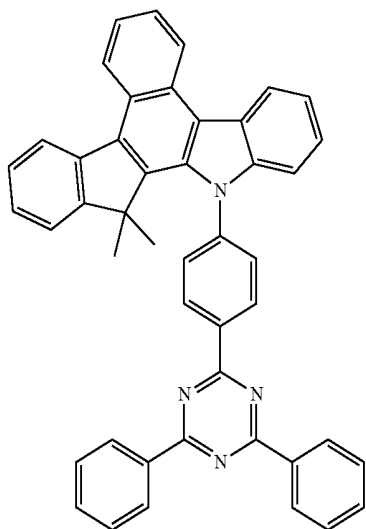
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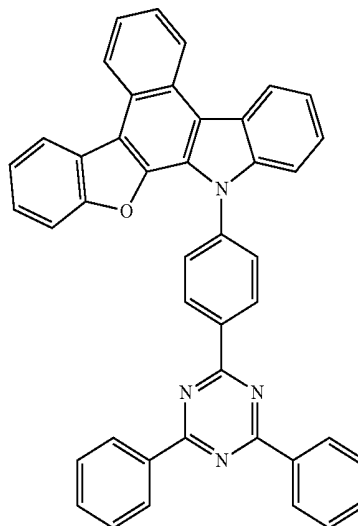
H2-152



H2-150

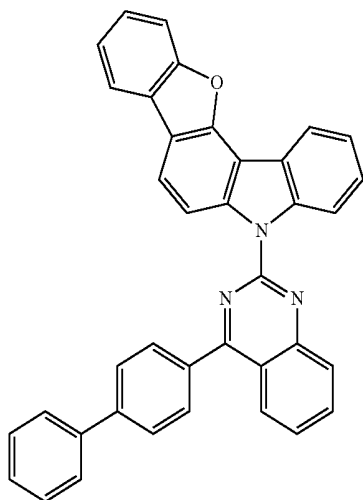


H2-153



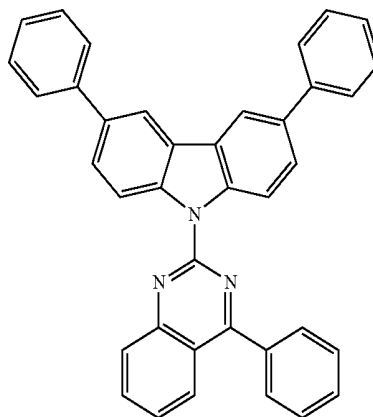
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H2-154



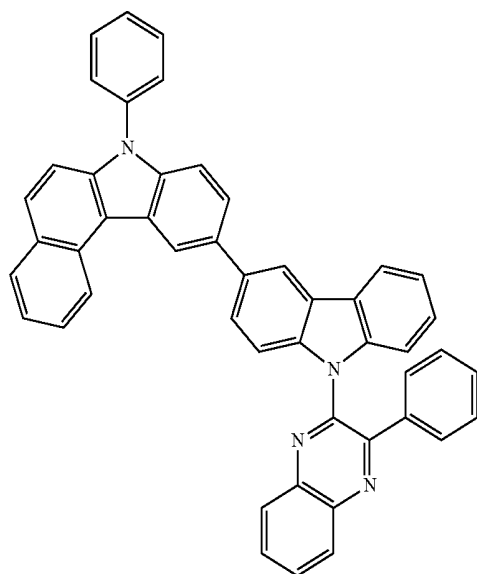
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H2-157

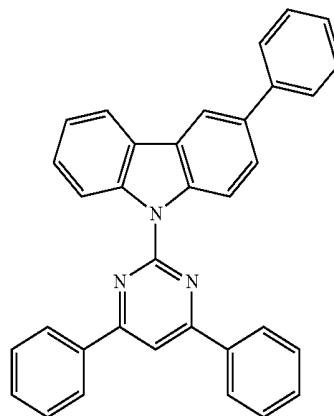


H2-158

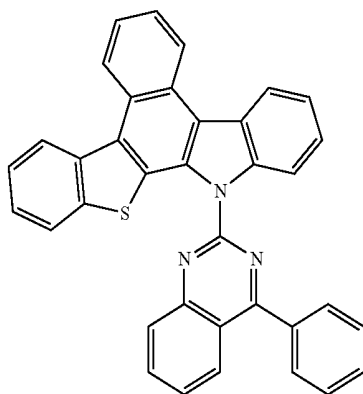
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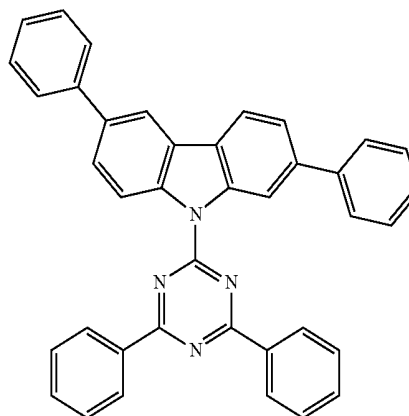
H2-159



H2-156

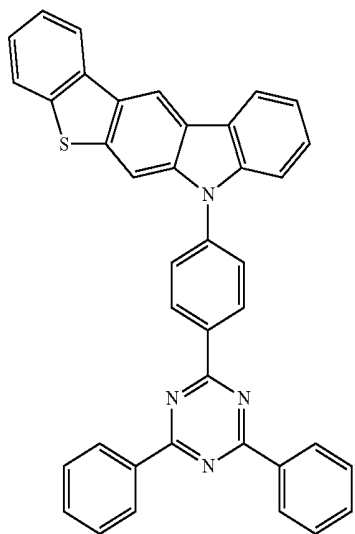


H2-160



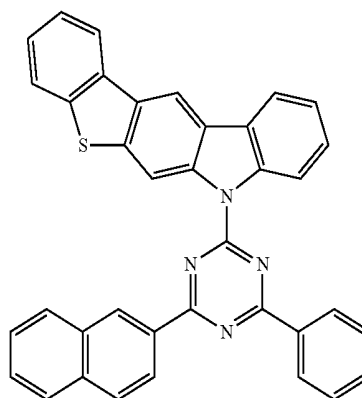
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H2-161

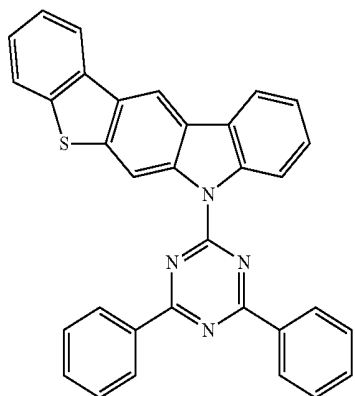


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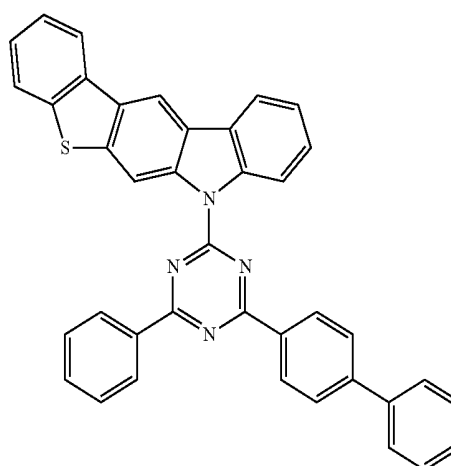
H2-164



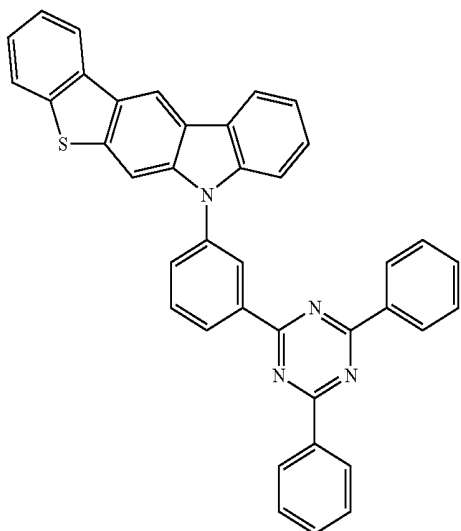
H2-162



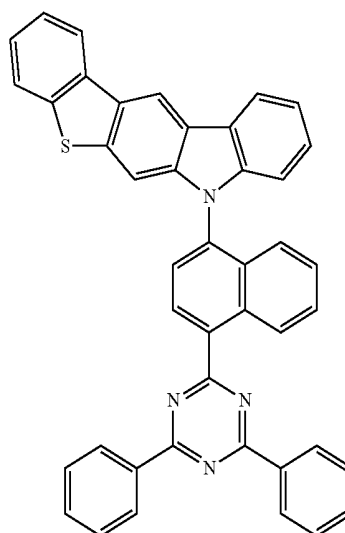
H2-165



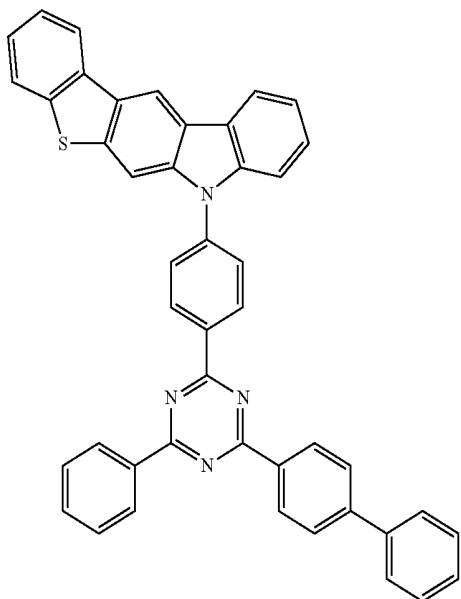
H2-163



H2-166

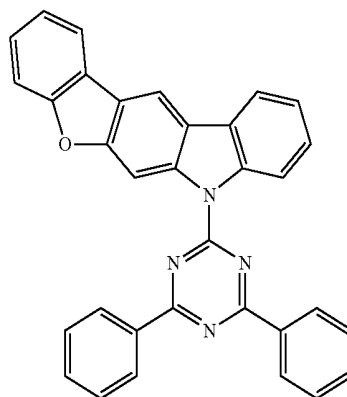


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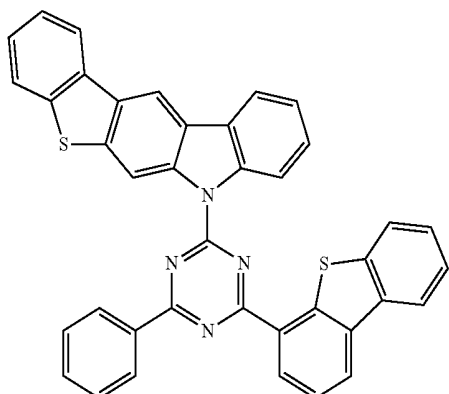


H2-167

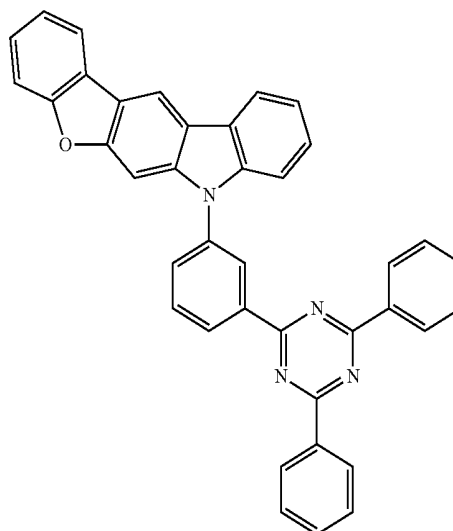
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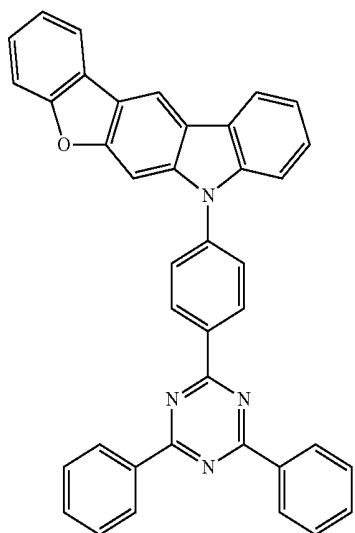
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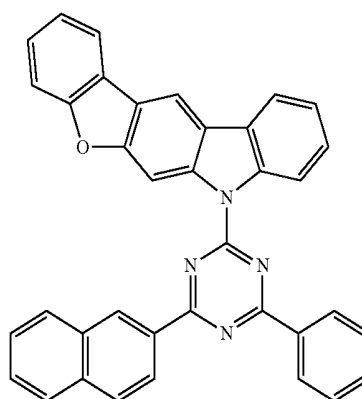
H2-168



H2-171



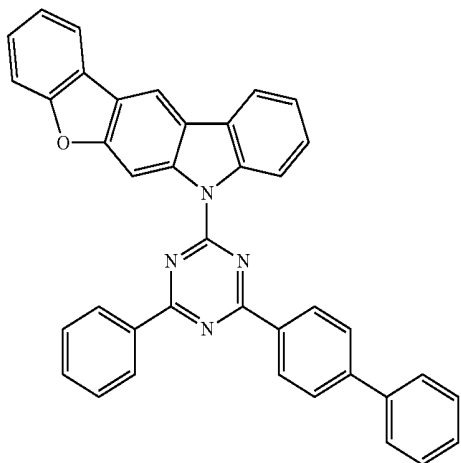
H2-169



H2-172

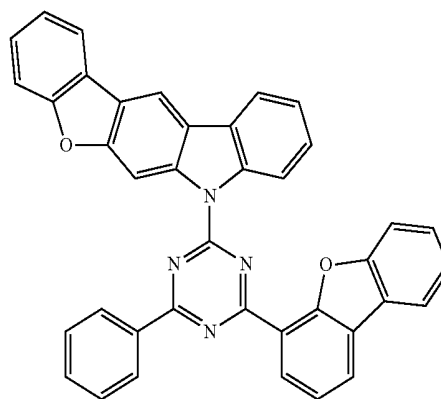
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H2-173



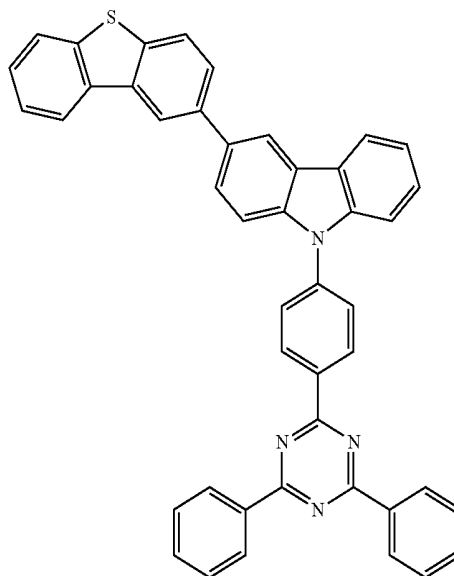
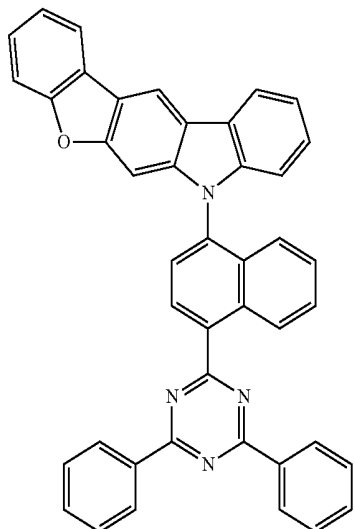
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H2-176



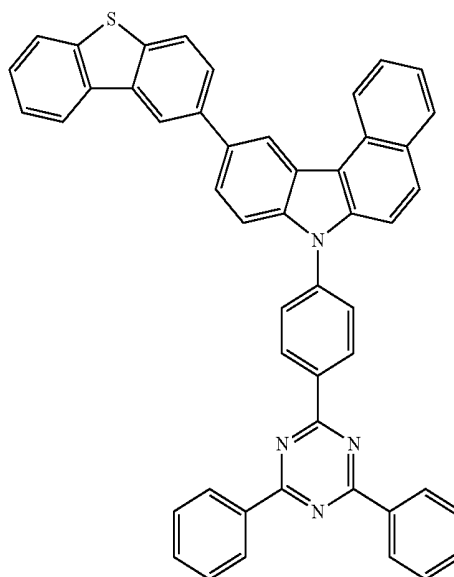
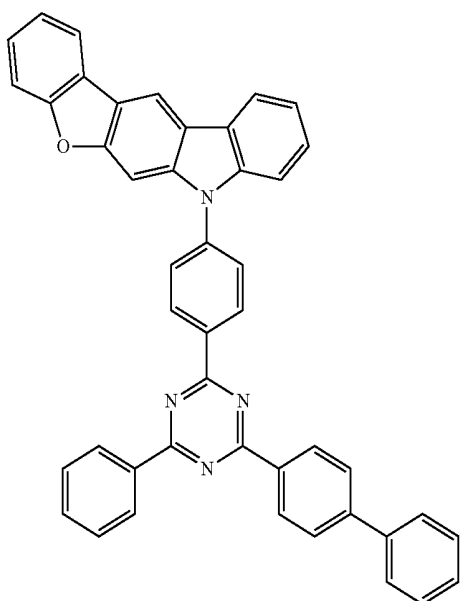
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H2-174



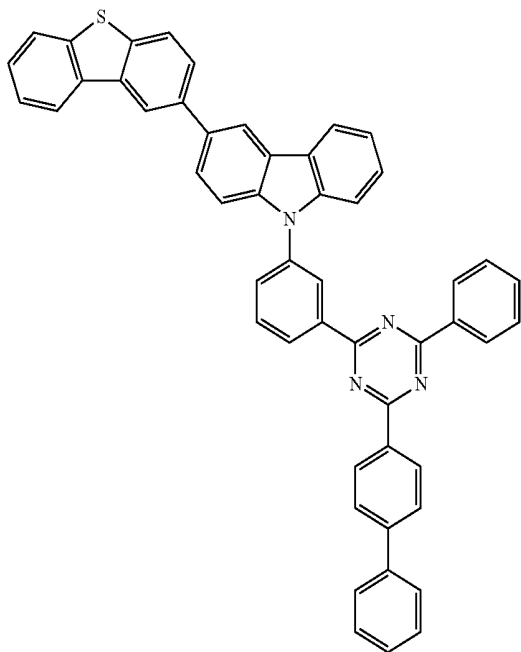
H2-178

H2-175



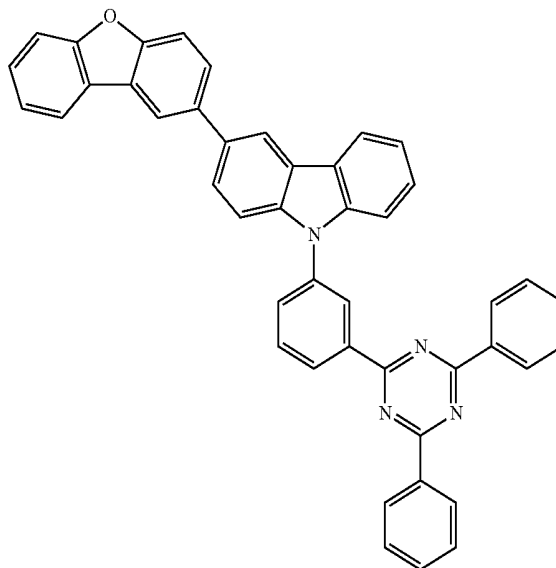
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H2-179



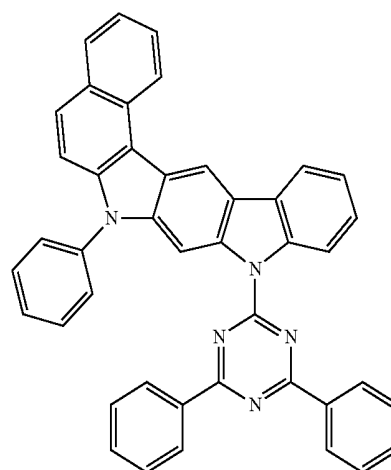
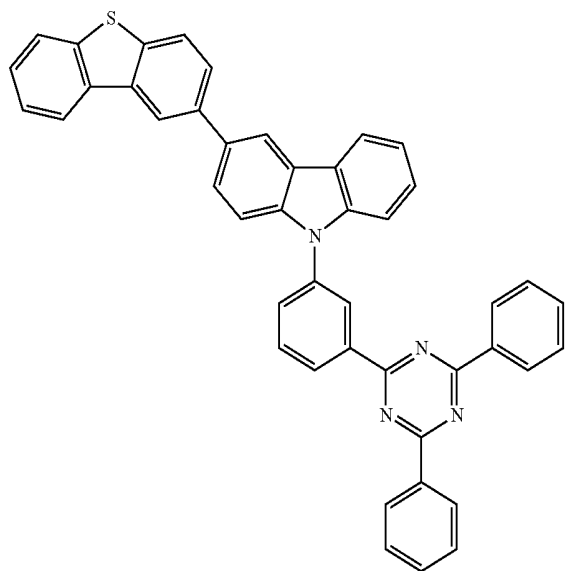
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H2-181

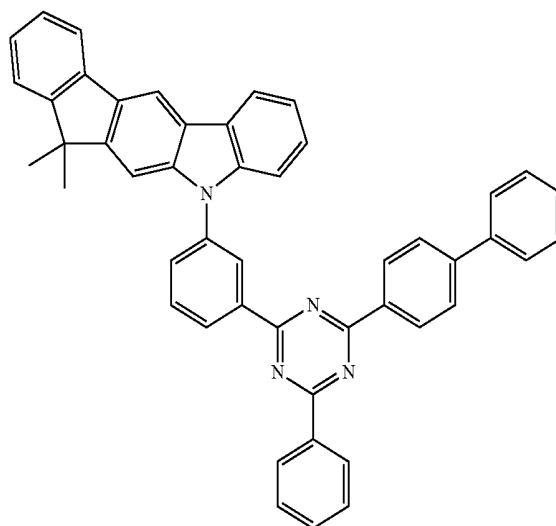


H2-182

H2-180

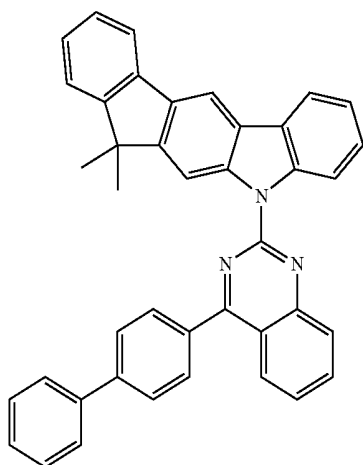


H2-183

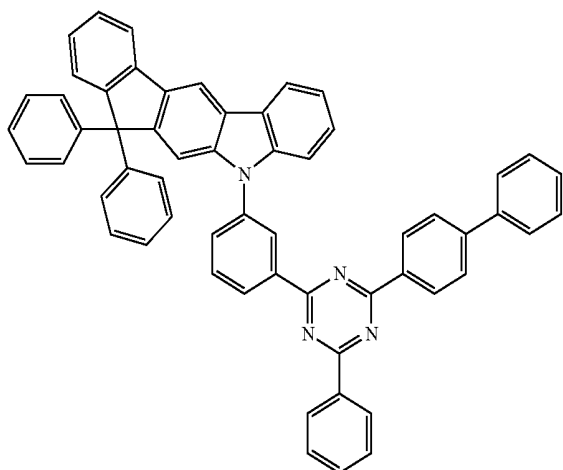


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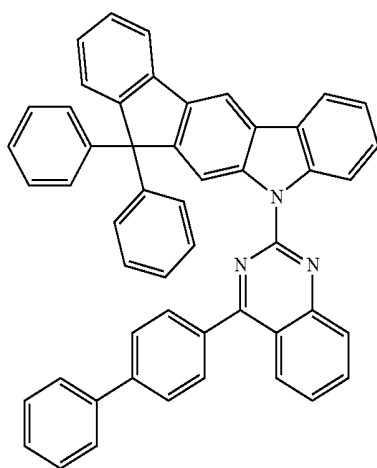
H2-184



H2-185

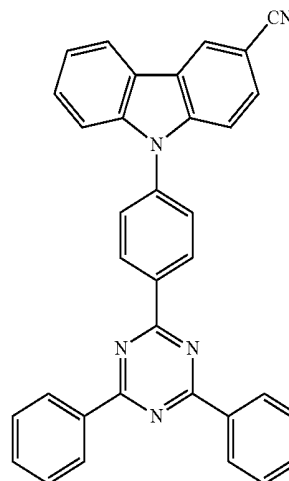


H2-186

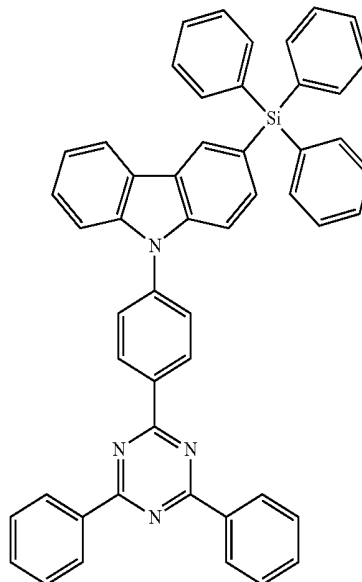


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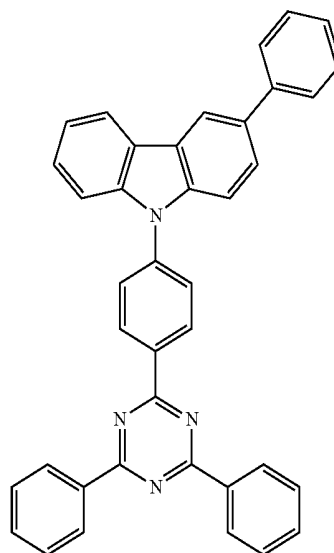
H2-187



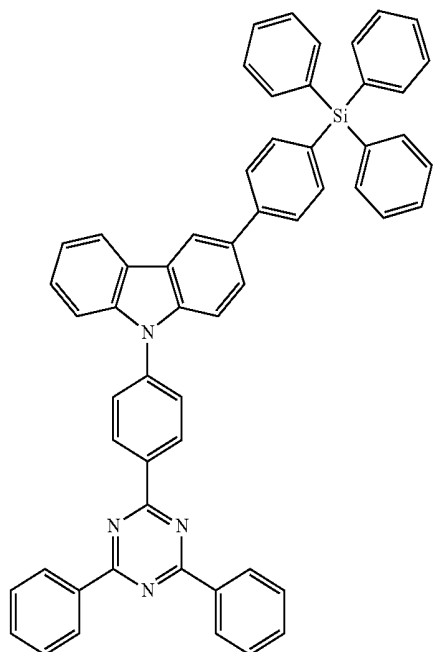
H2-188



H2-189

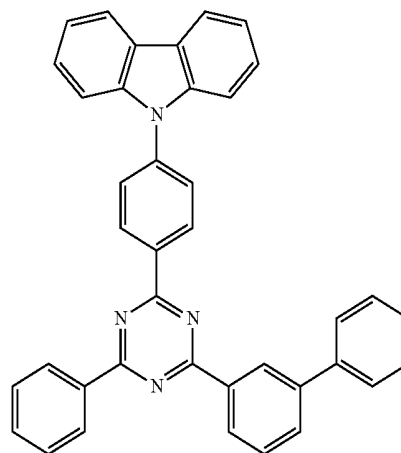


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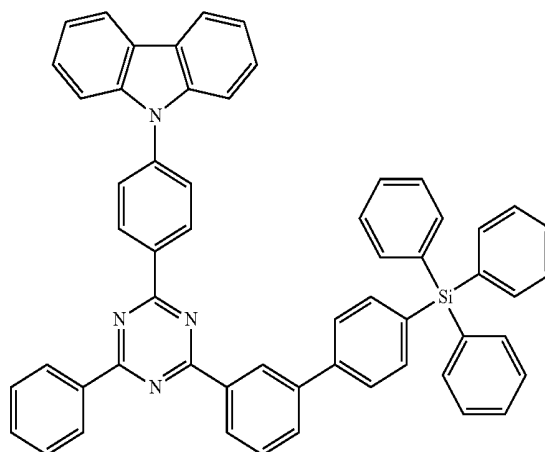
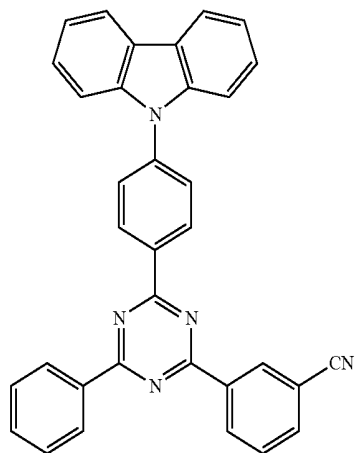
H2-190

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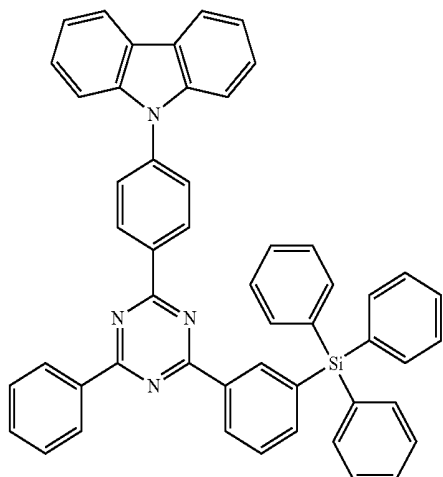
H2-193

H2-191

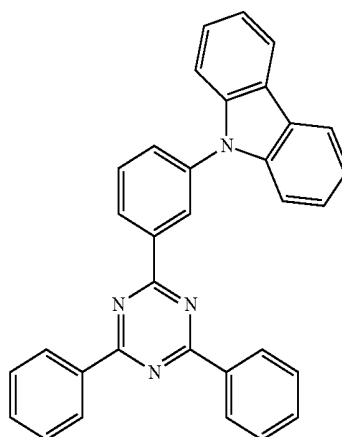


H2-192

H2-194

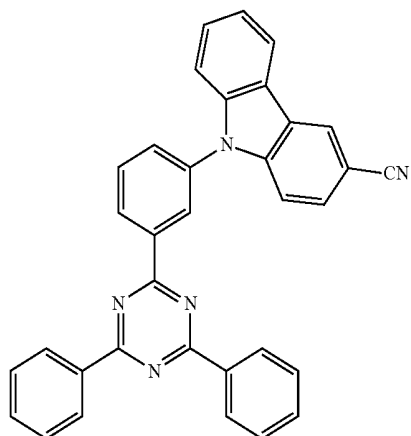


H2-195



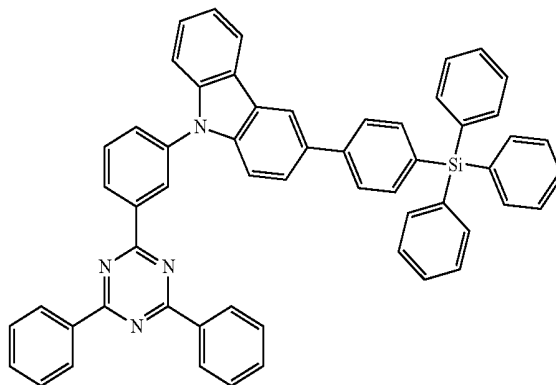
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H2-196

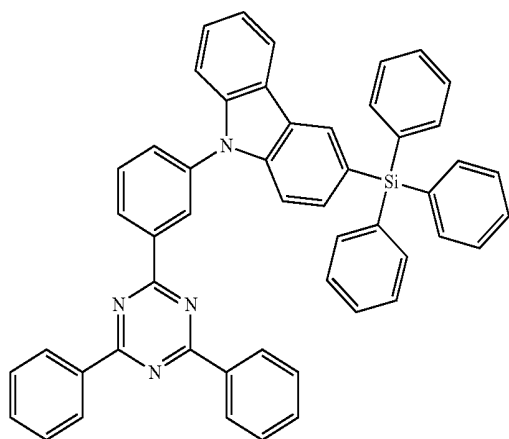


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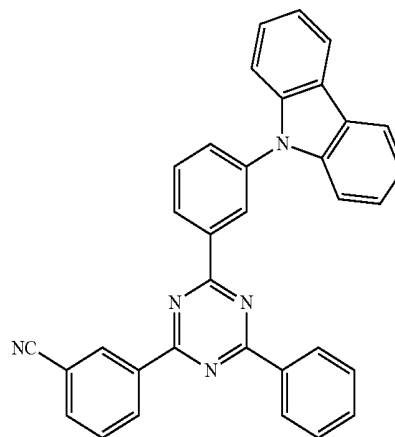
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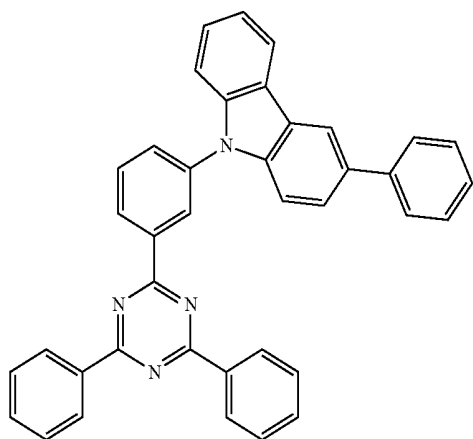
H2-197



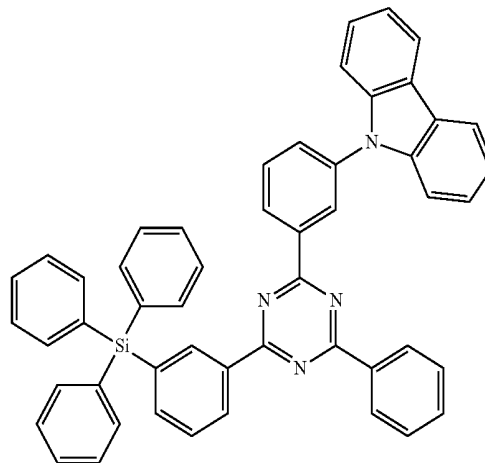
H2-200



H2-198

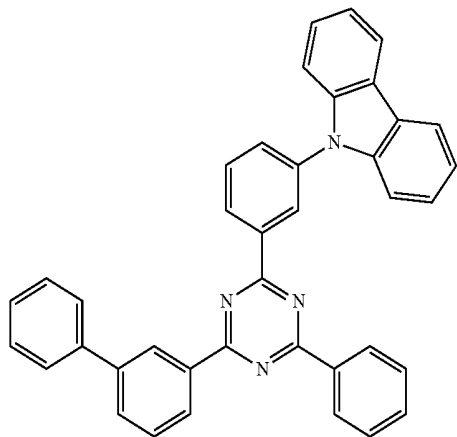


H2-201



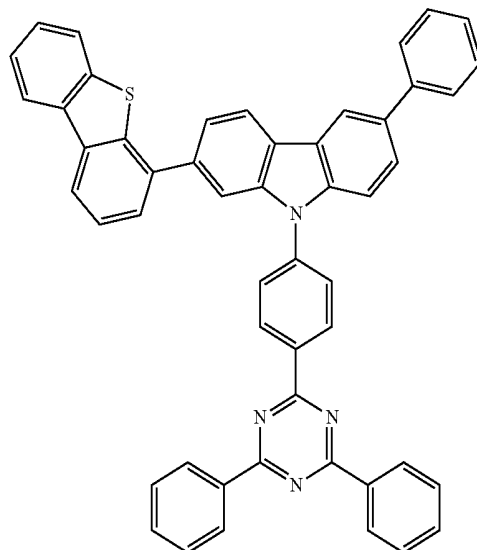
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H2-202

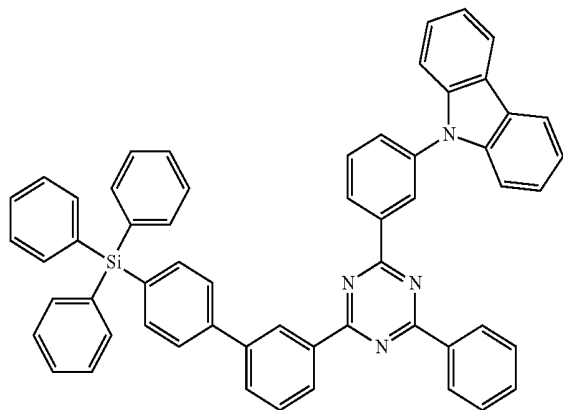


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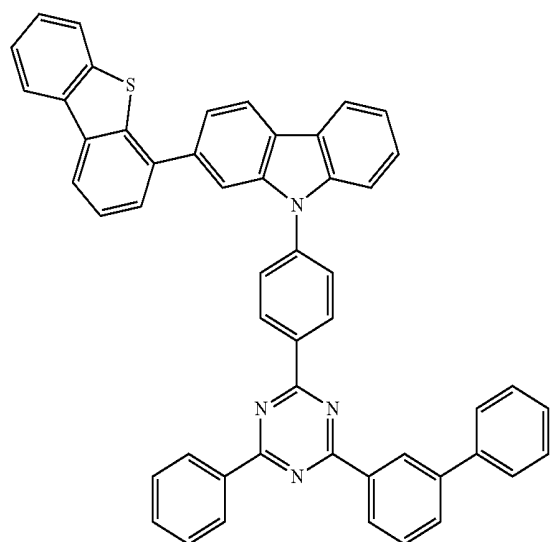
H2-205



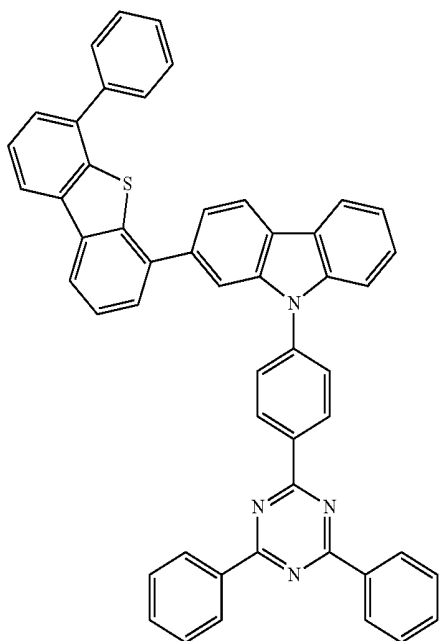
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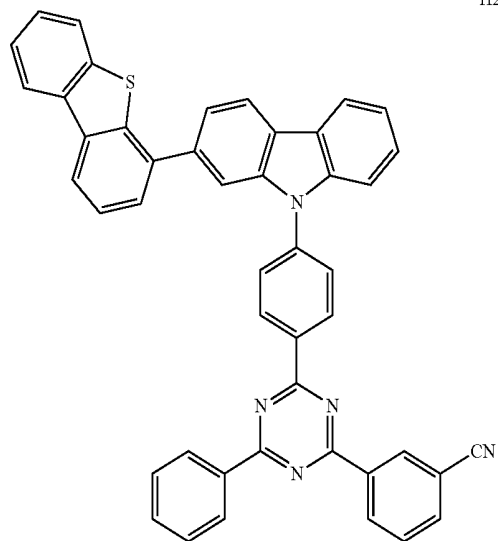
H2-206



H2-204

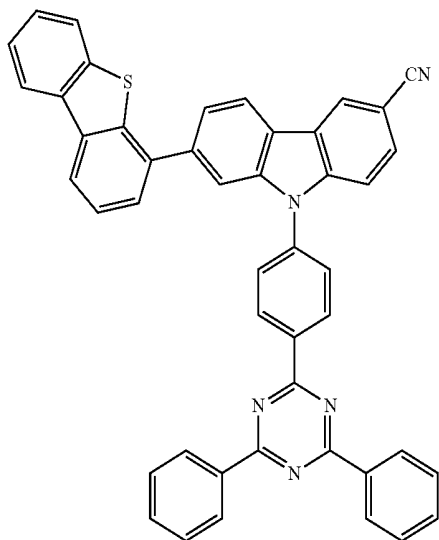


H2-207



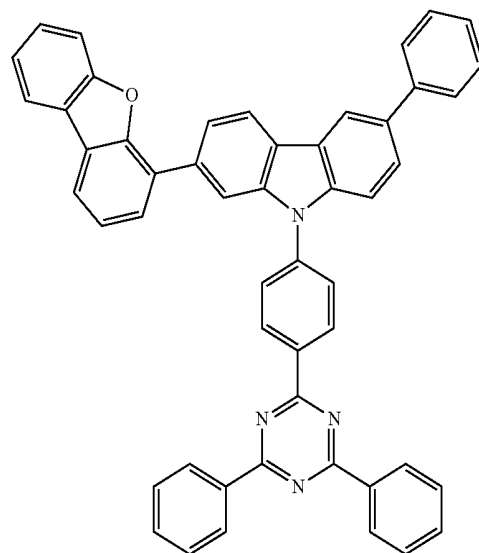
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H2-208



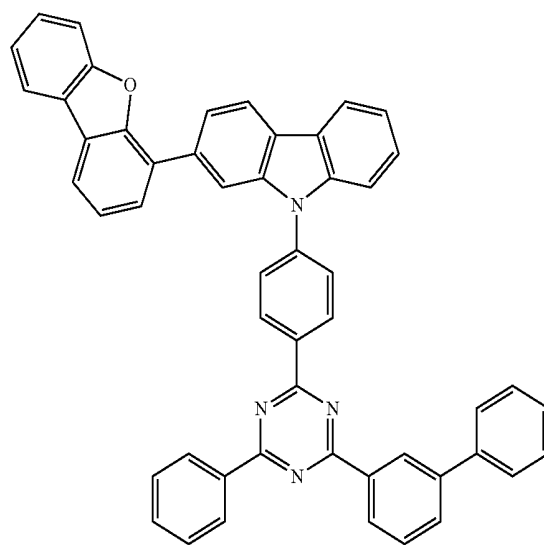
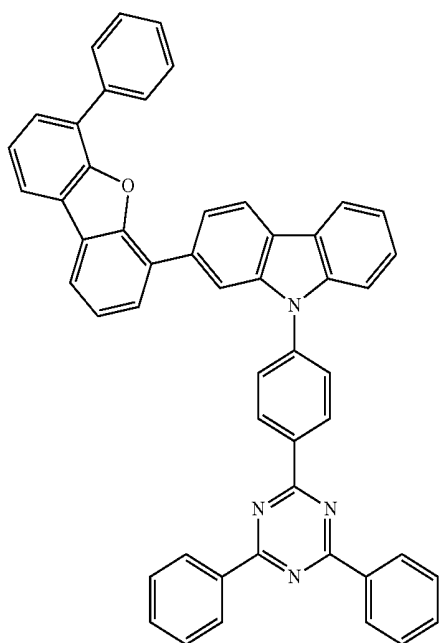
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H2-210

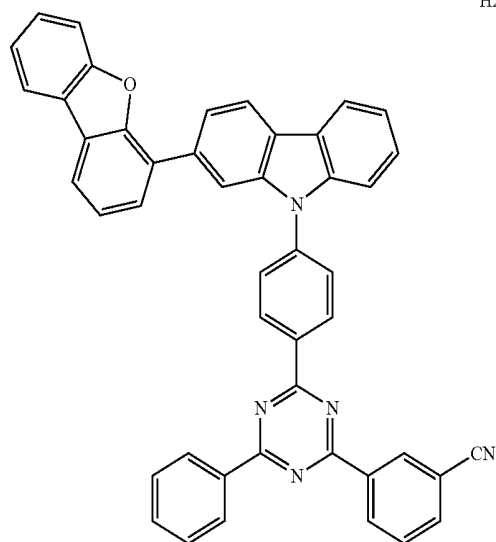


H2-211

H2-209

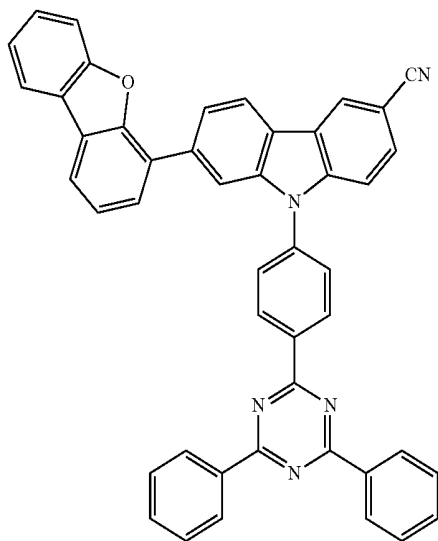


H2-212



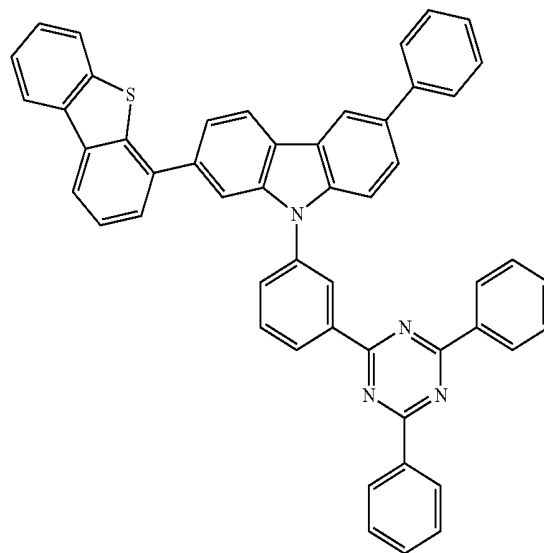
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H2-213



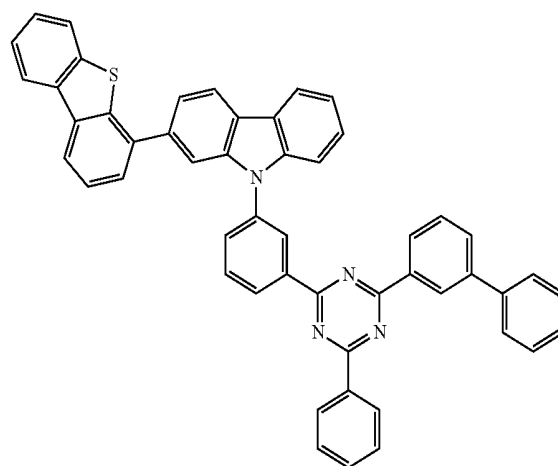
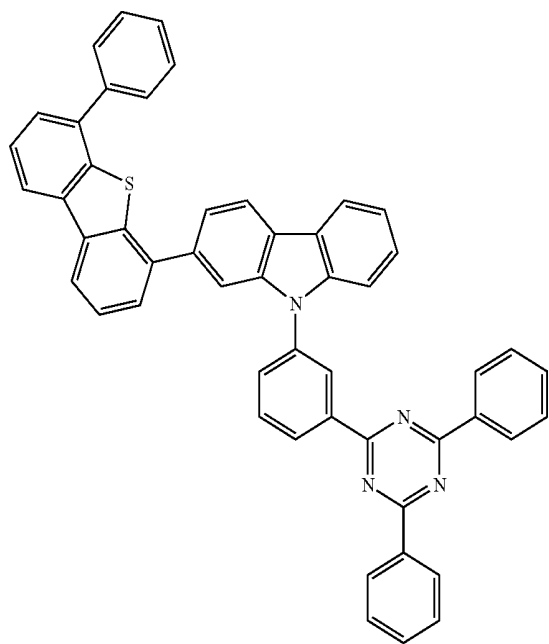
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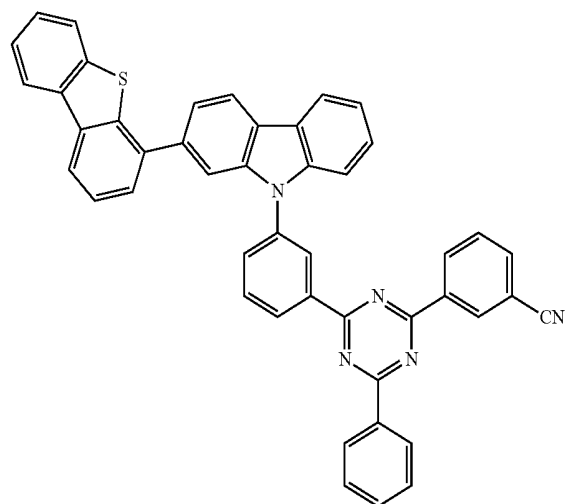


H2-216

H2-214

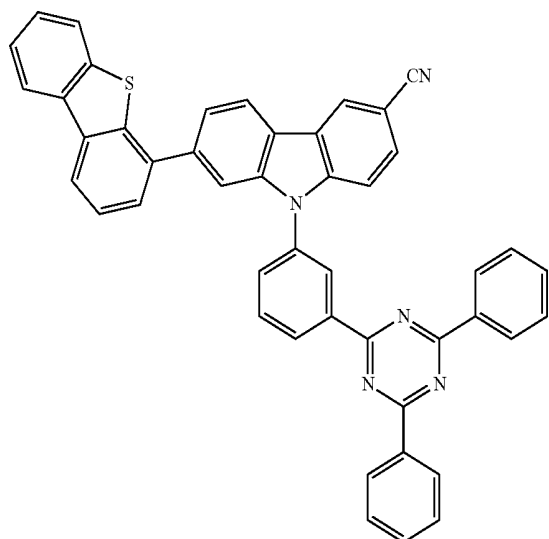


H2-217



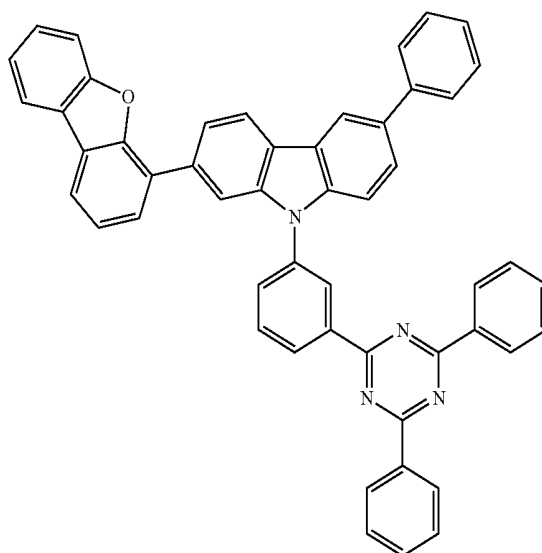
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H2-218



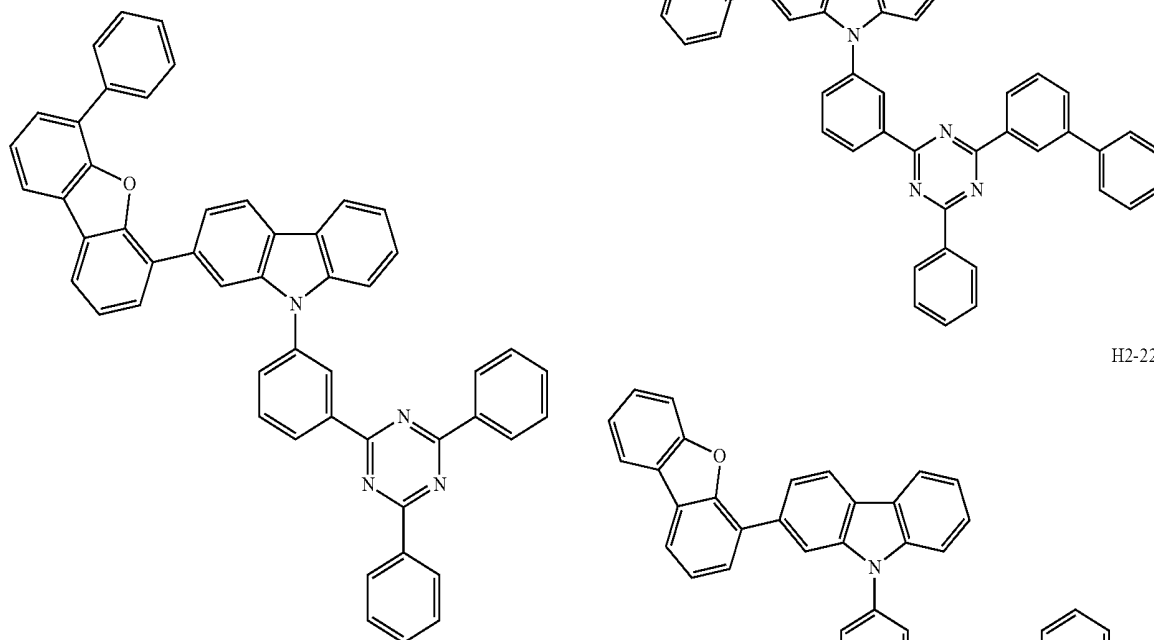
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H2-220

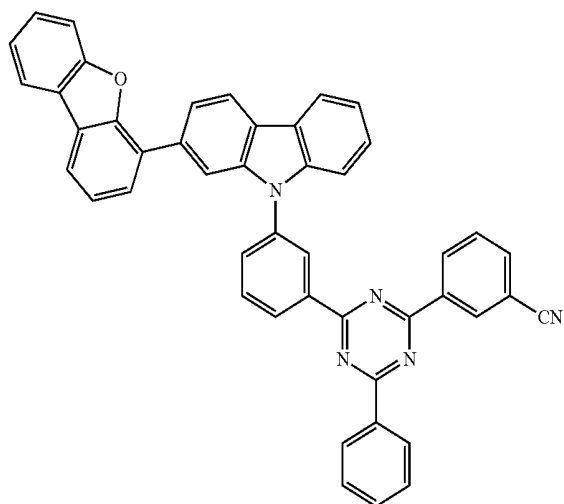


H2-221

H2-219

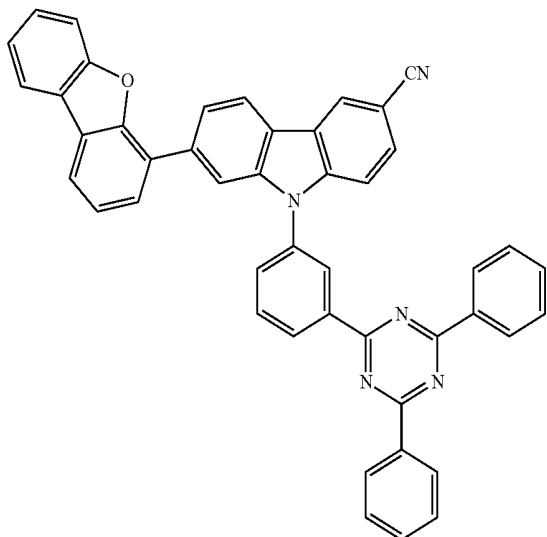


H2-222



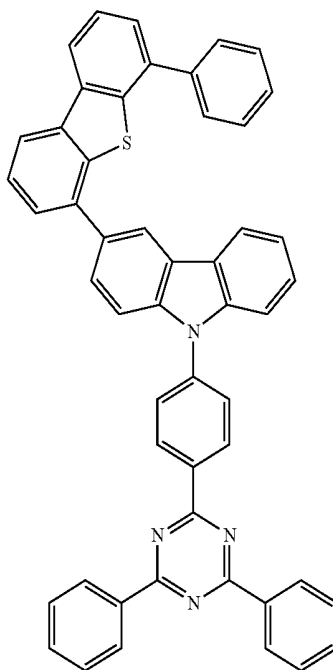
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H2-223

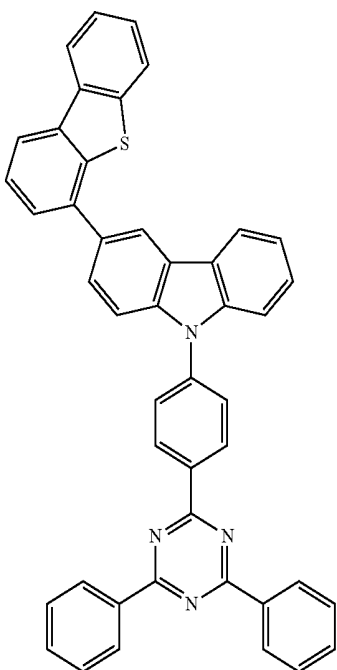


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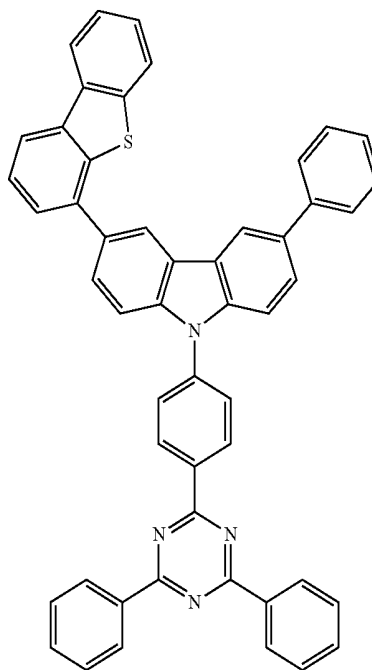
H2-225



H2-224

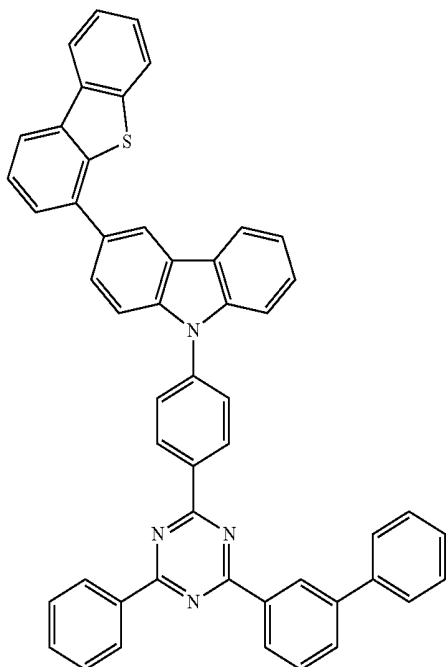


H2-226



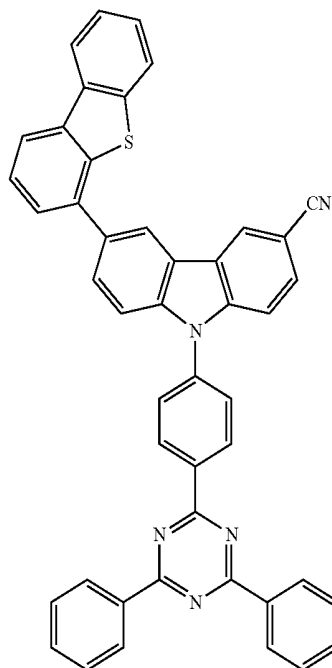
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H2-227

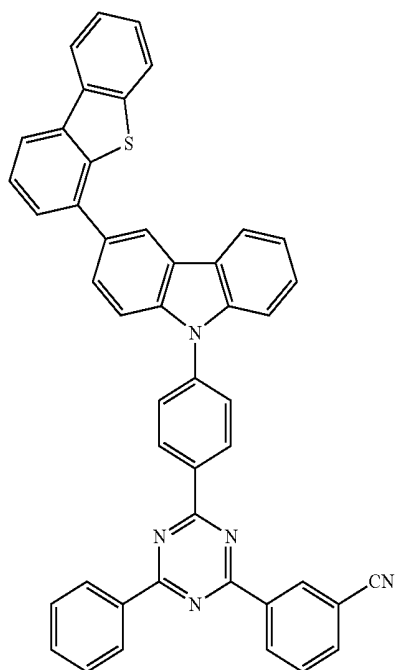


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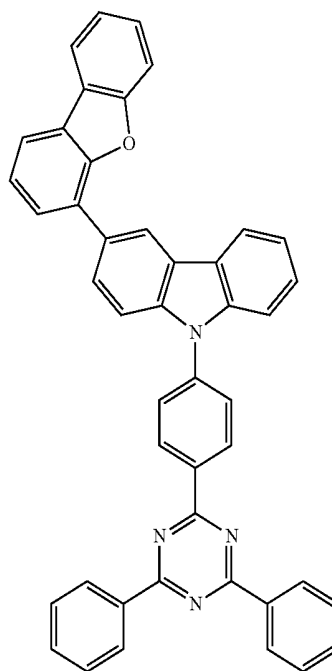
H2-229



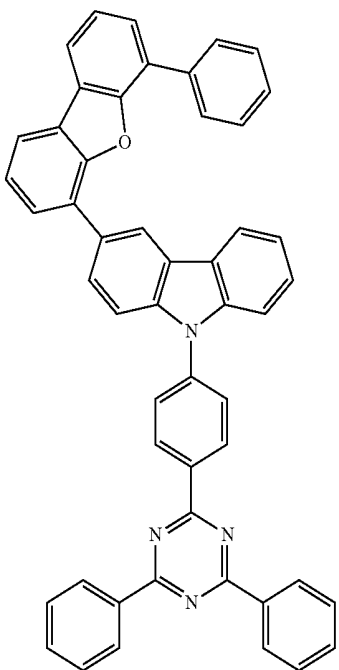
H2-228



H2-230

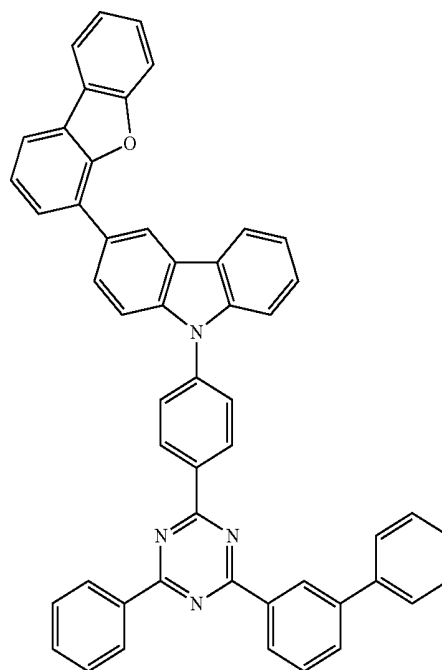


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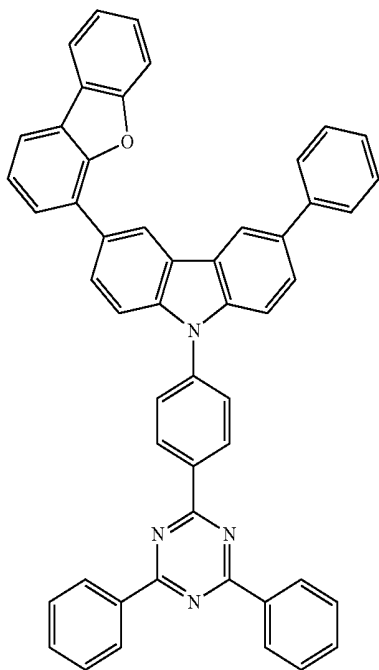
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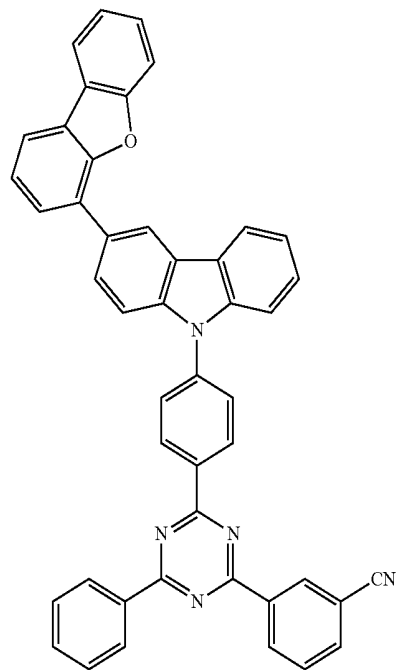


H2-233

H2-232

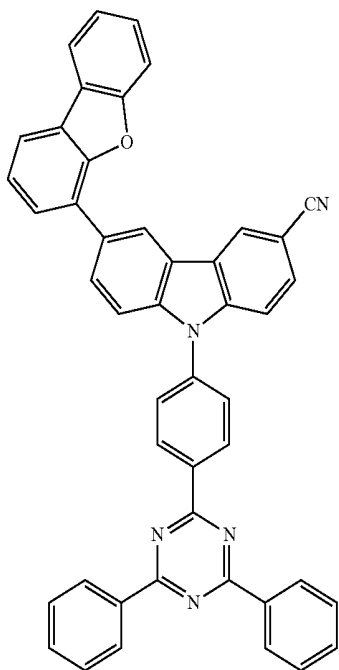


H2-234



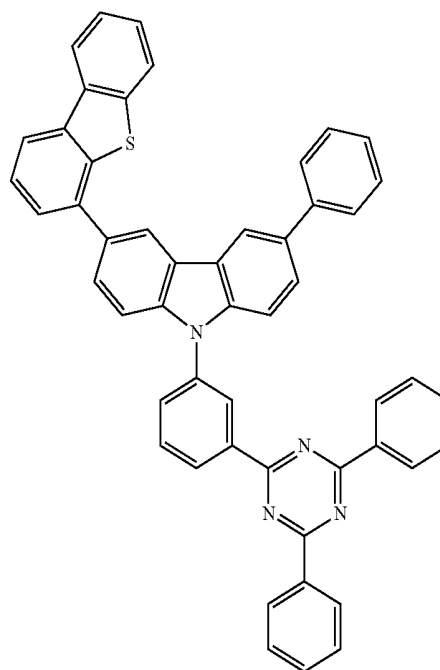
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H2-235

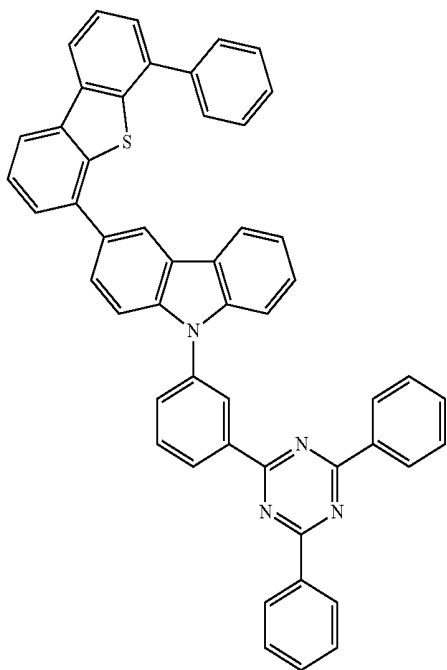


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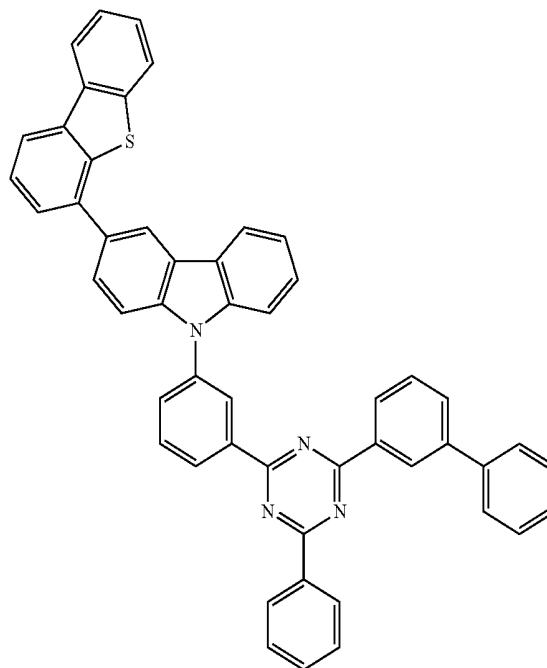
H2-237



H2-236

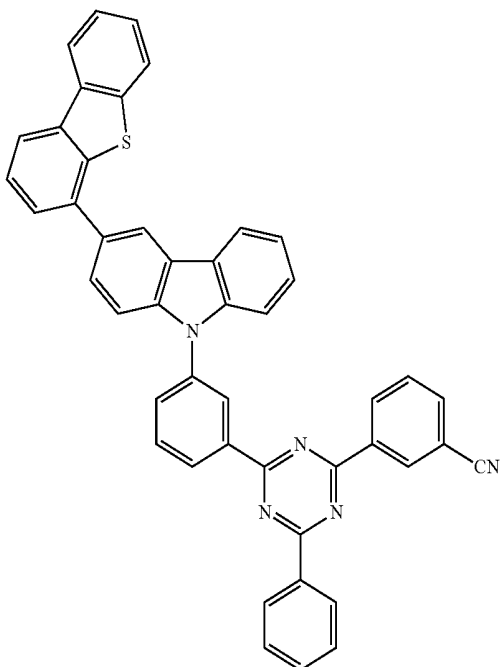


H2-238



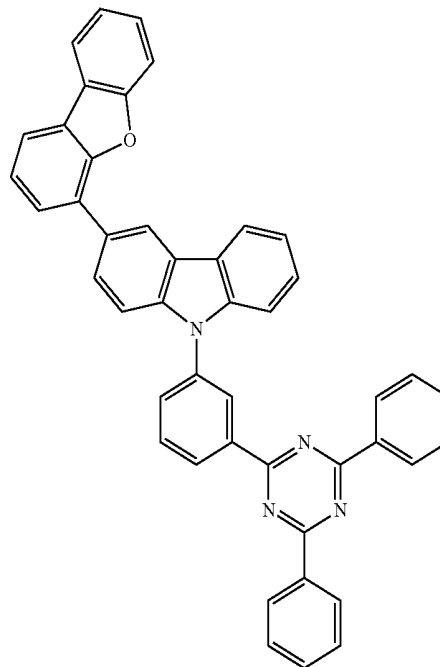
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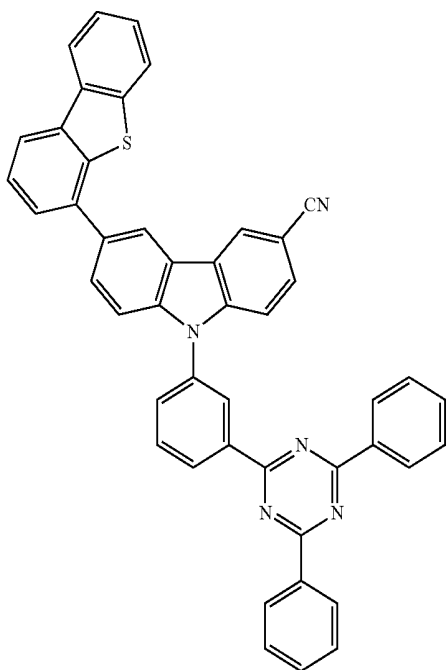


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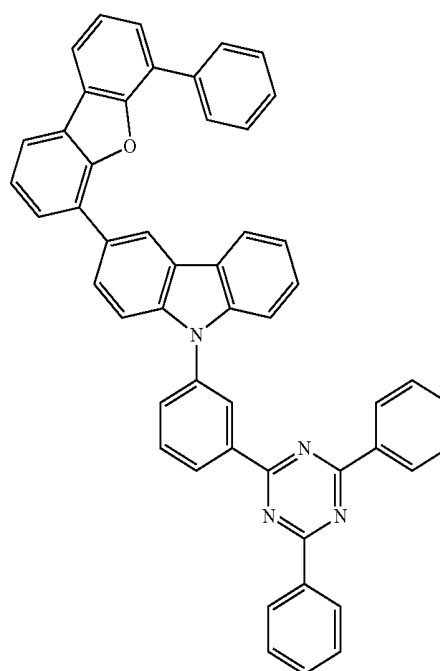
H2-241



H2-240

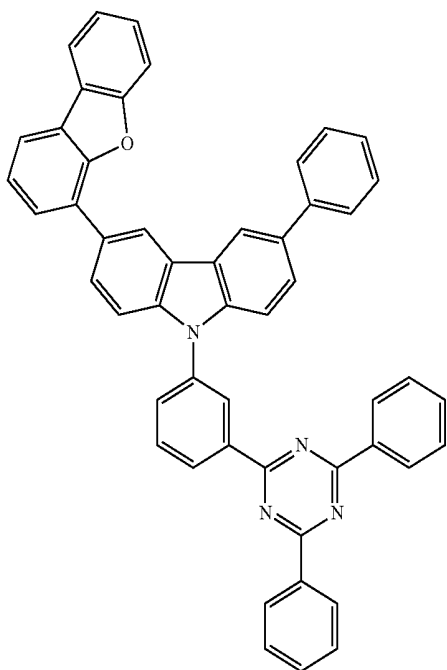


H2-242



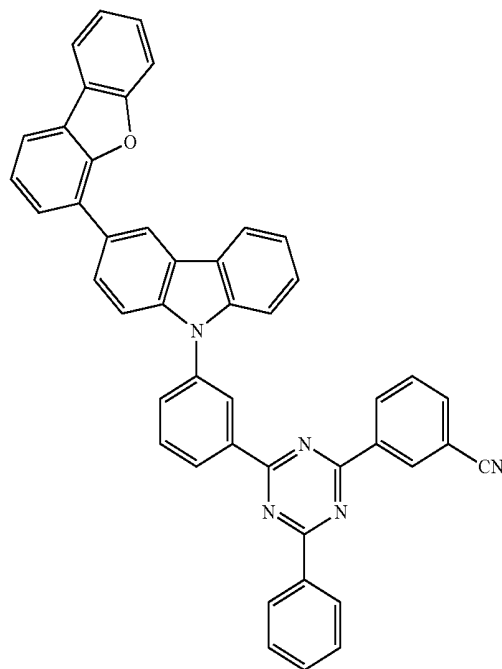
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H2-243

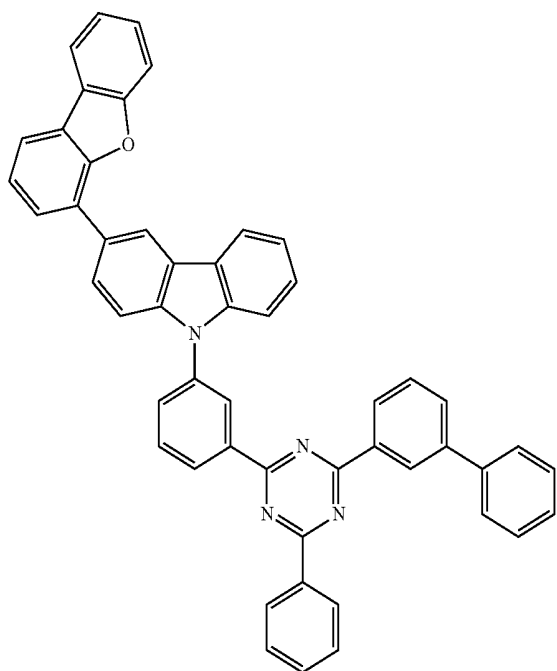


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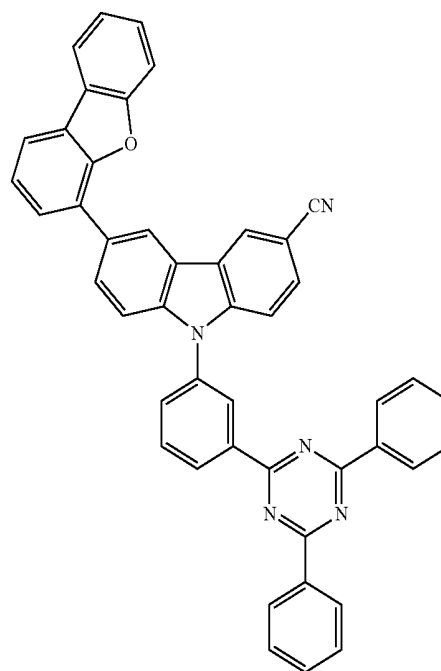
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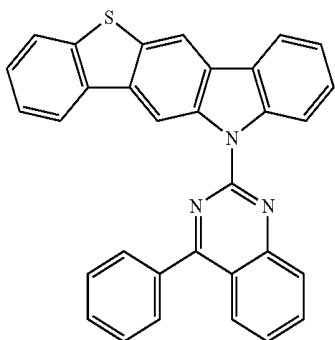
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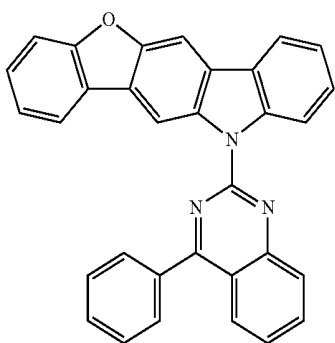
H2-246



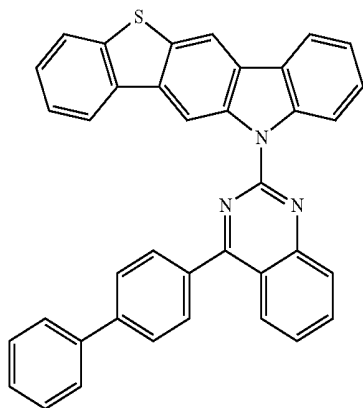
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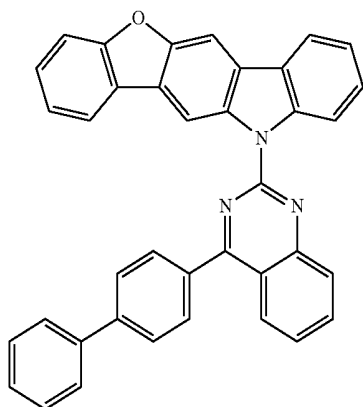
H2-247



H2-248

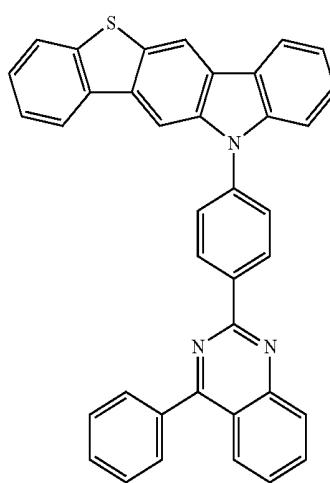


H2-249

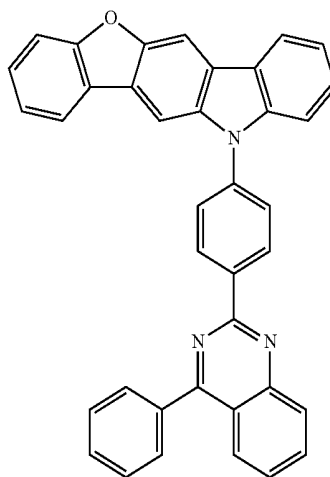


H2-250

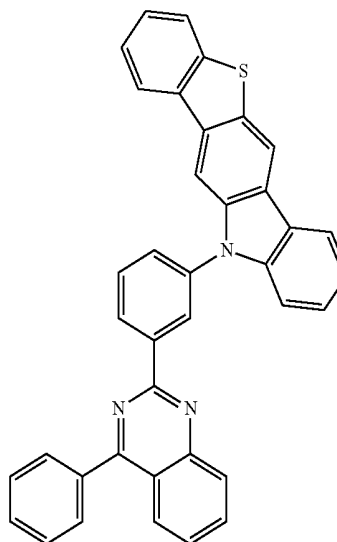
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H2-251



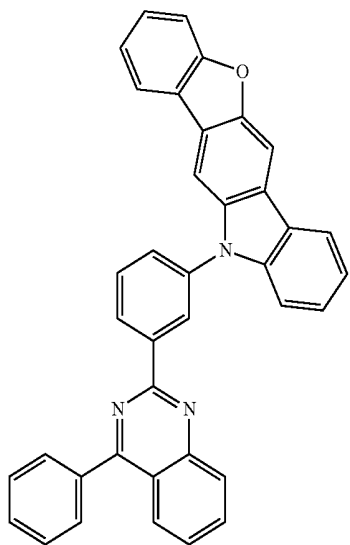
H2-252



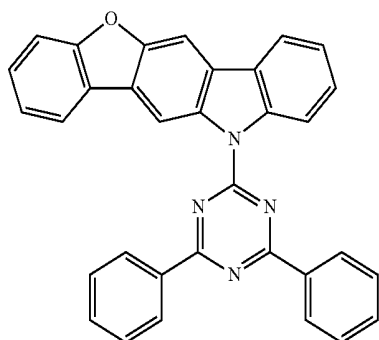
H2-253

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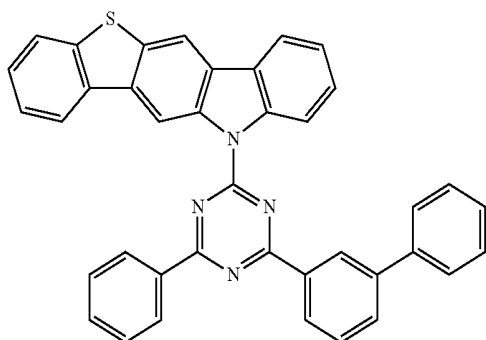
H2-254



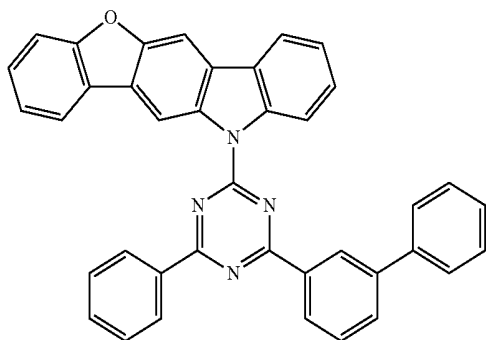
H2-255



H2-256

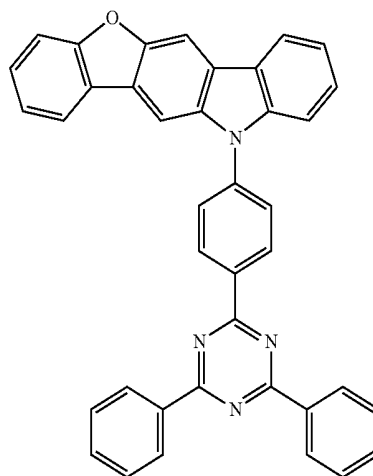


H2-257

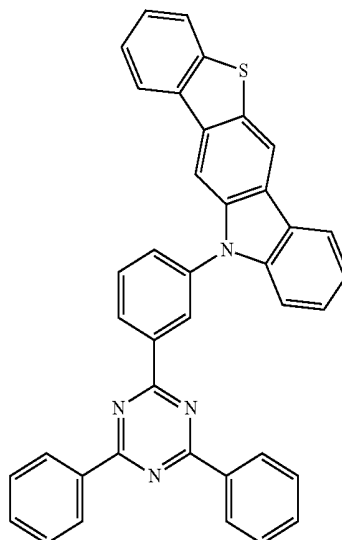


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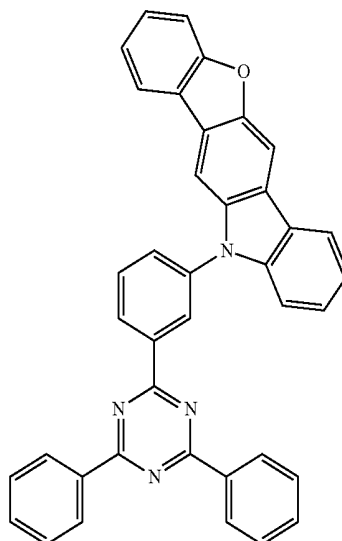
H2-258



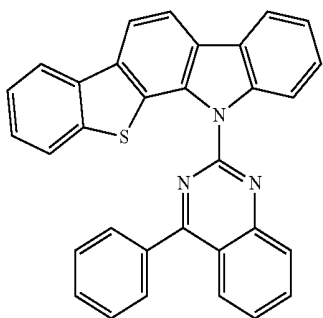
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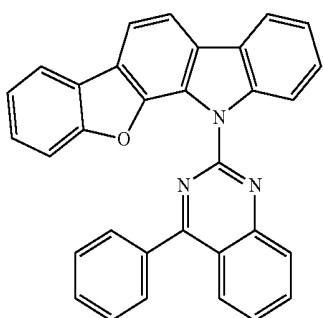
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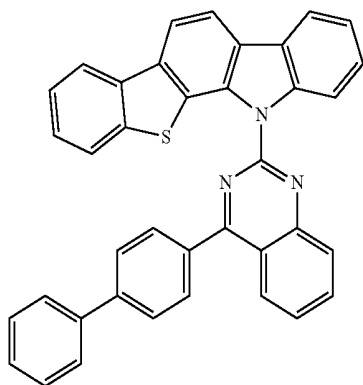
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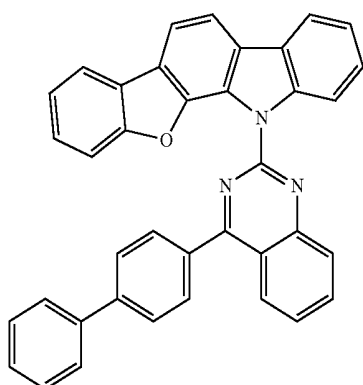
H2-261



H2-262

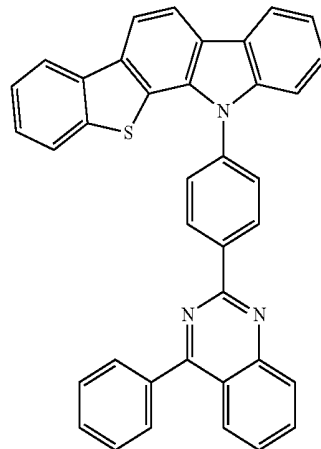


H2-263

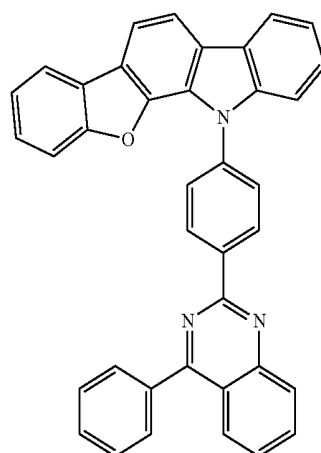


H2-264

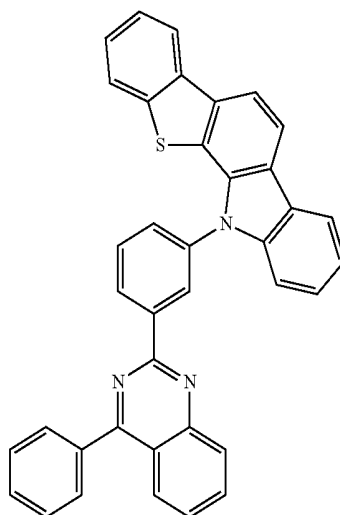
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H2-265



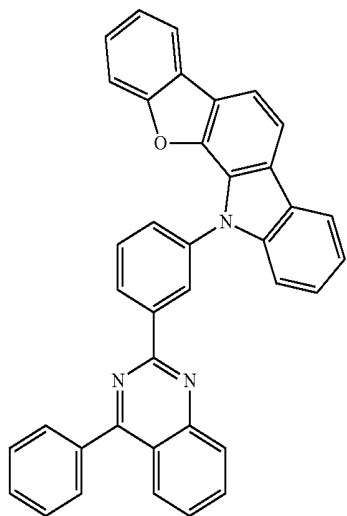
H2-266



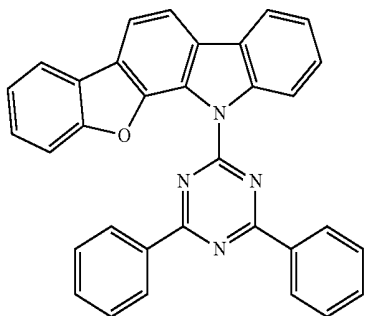
H2-267

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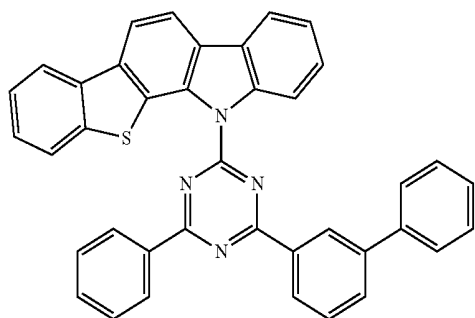
H2-268



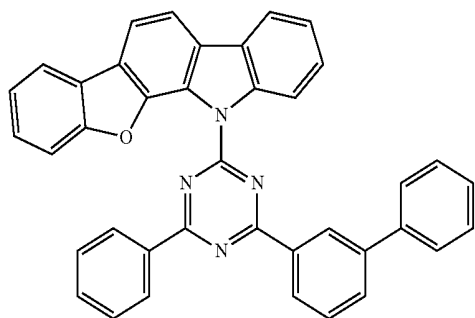
H2-269



H2-270

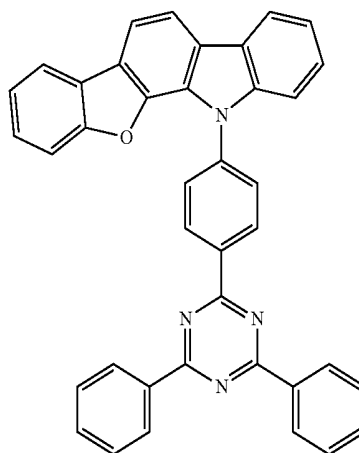


H2-271

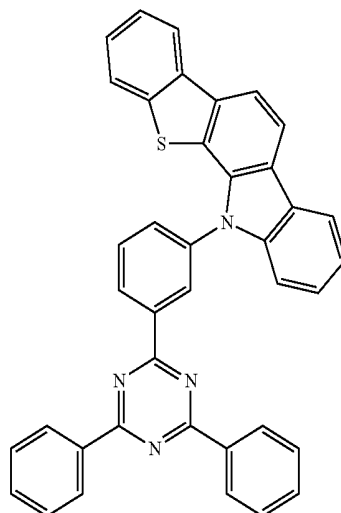


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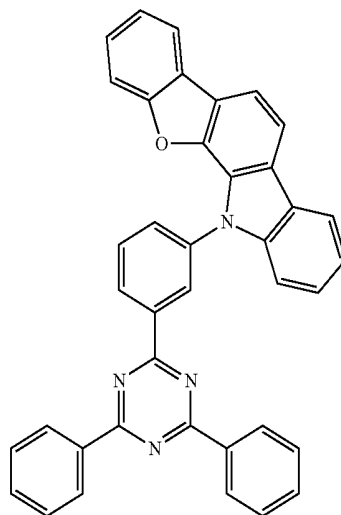
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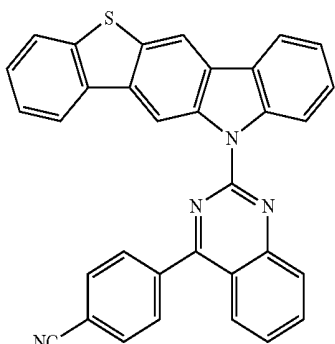
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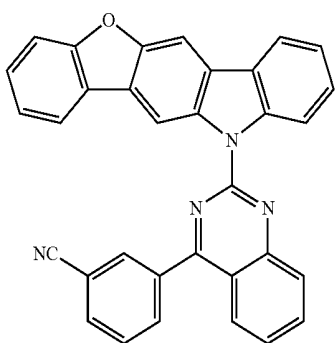
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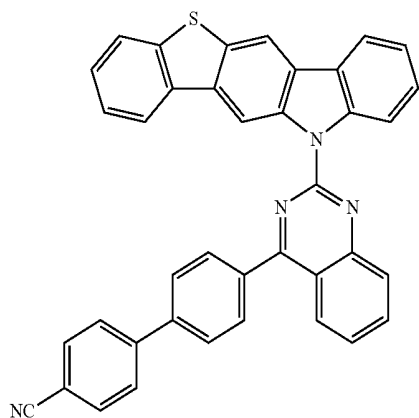
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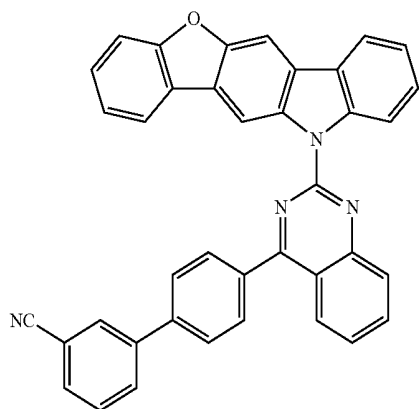
H2-275



H2-276

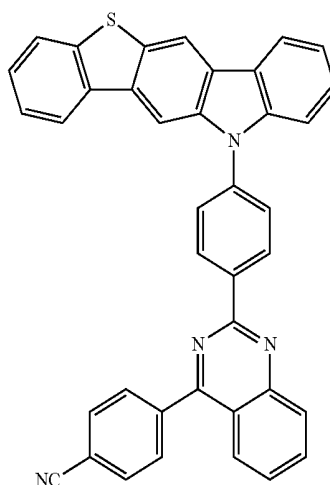


H2-277

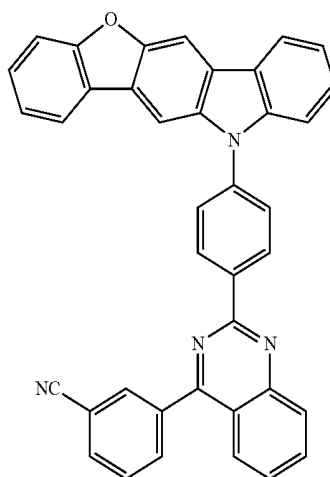


H2-278

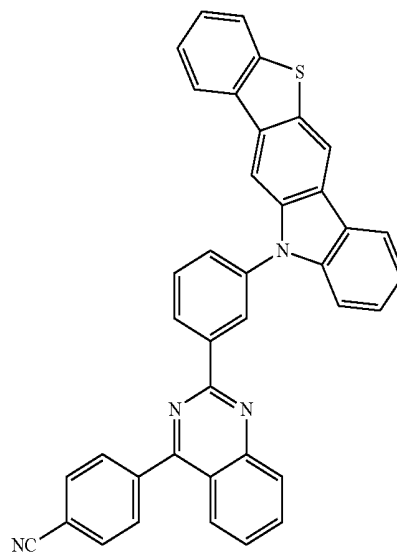
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H2-279



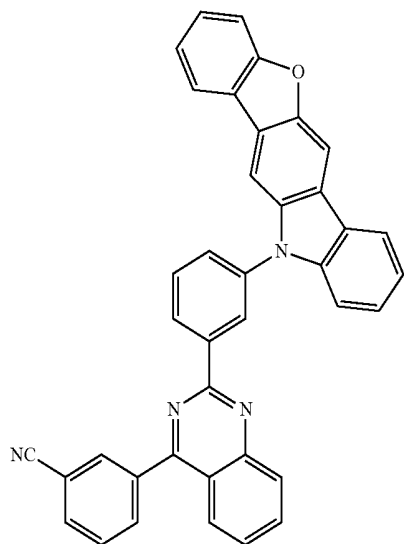
H2-280



H2-281

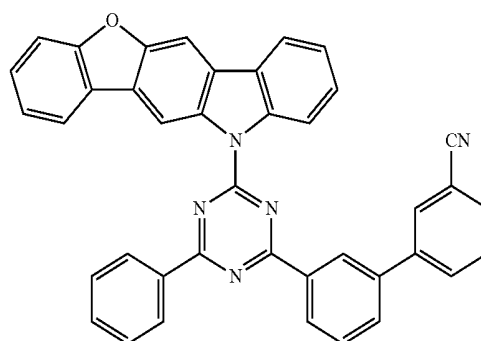
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H2-282

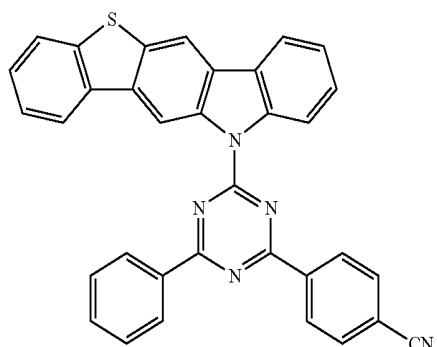


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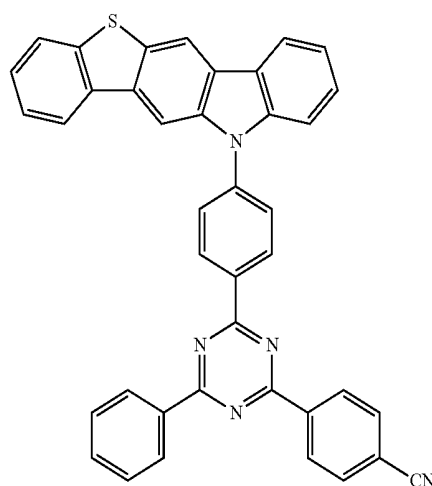
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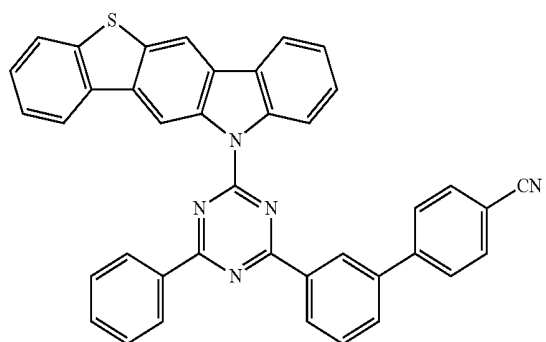
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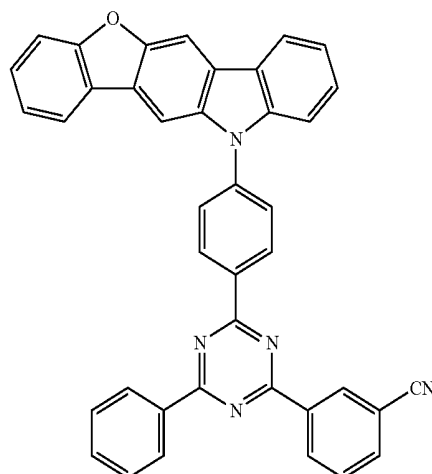
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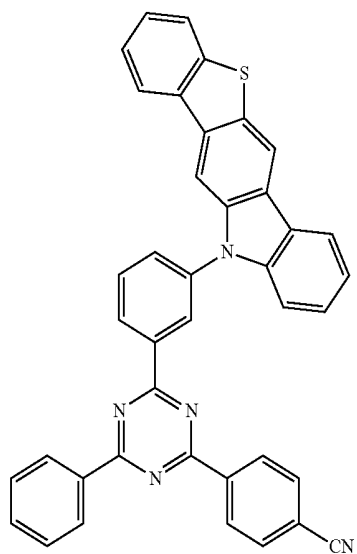
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H2-288

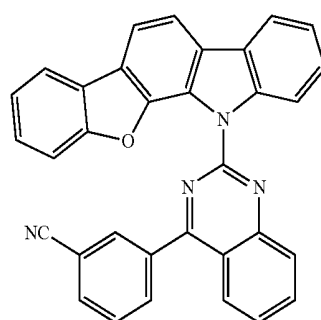


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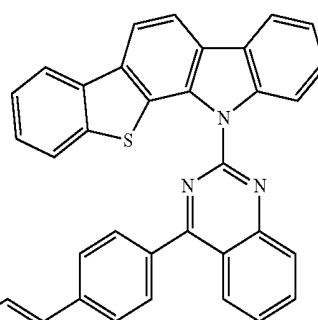


H2-289

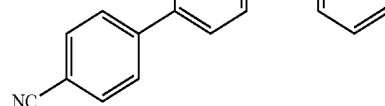
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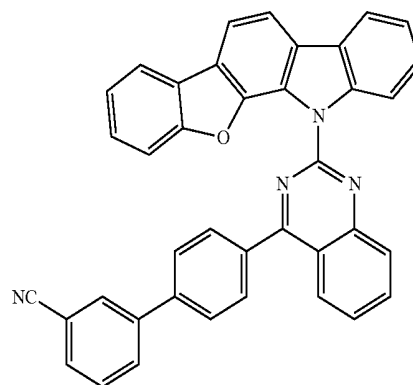
H2-292



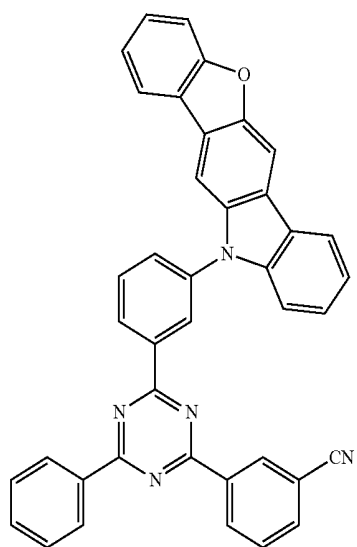
H2-293



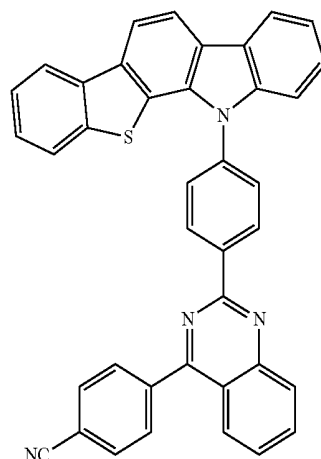
H2-290



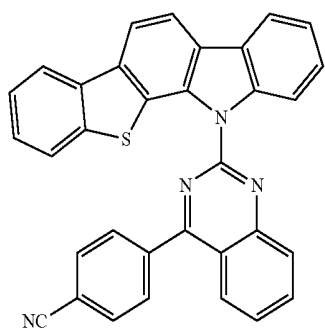
H2-294



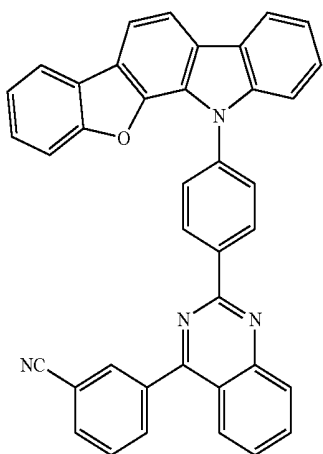
H2-291



H2-295

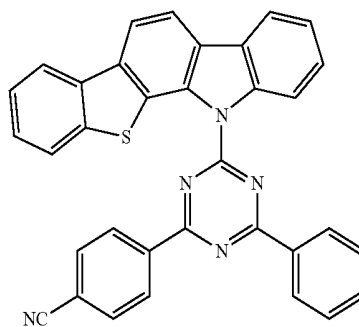


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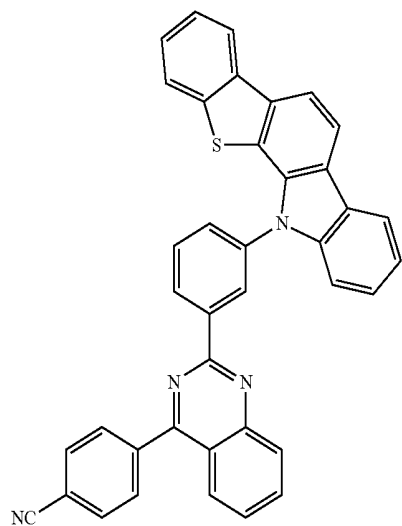


H2-296

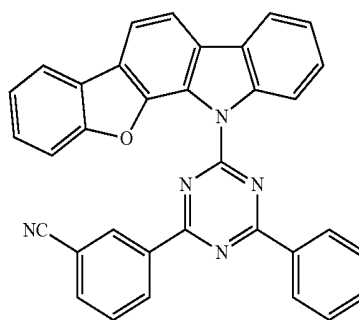
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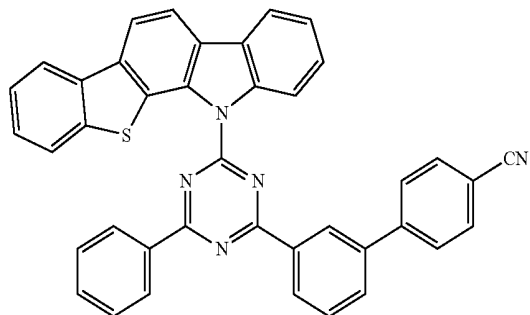
H2-299



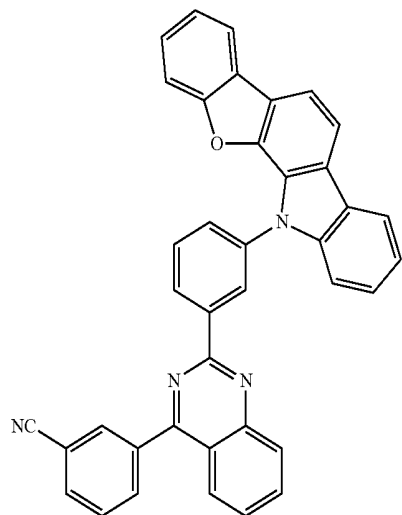
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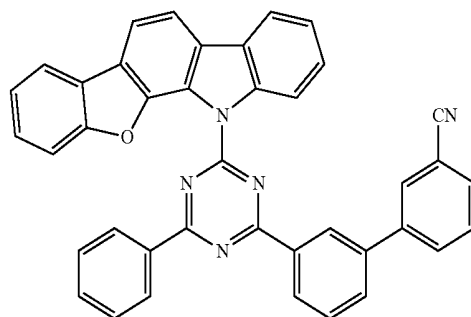
H2-300



H2-301

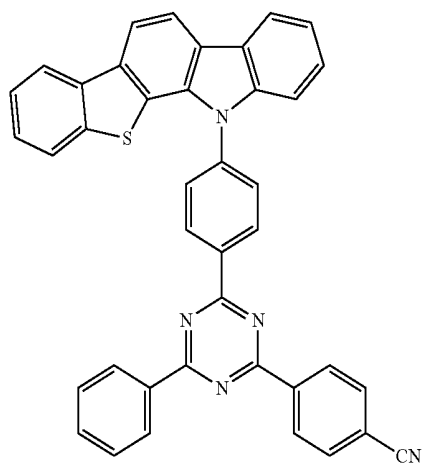


H2-298



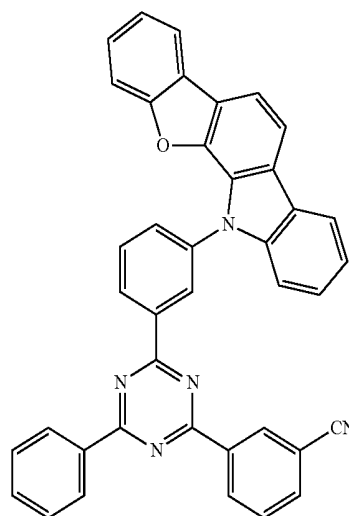
H2-302

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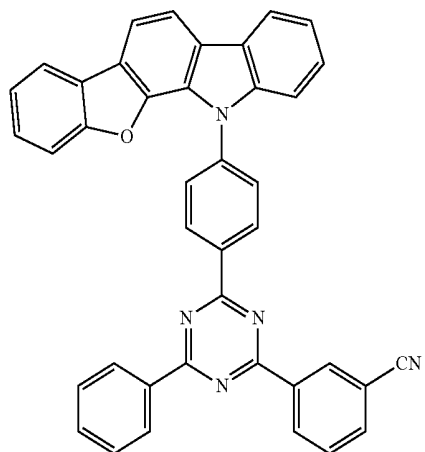


H2-303

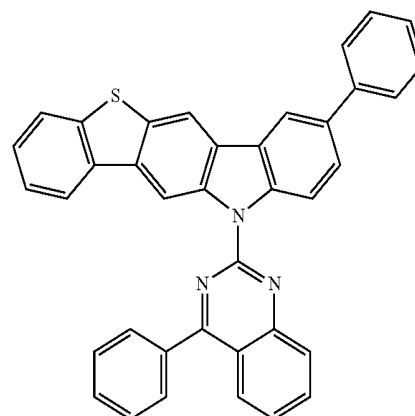
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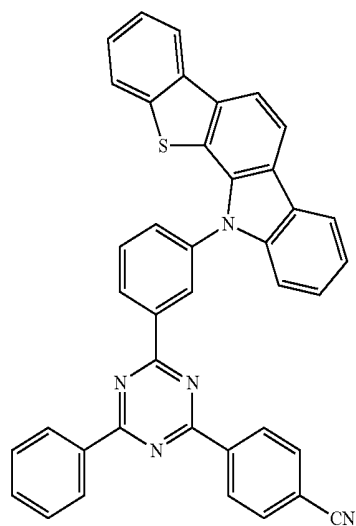
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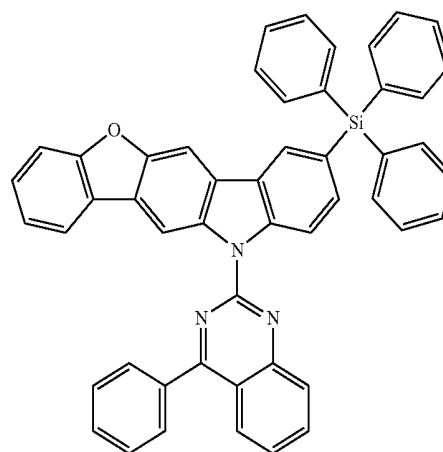
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H2-307



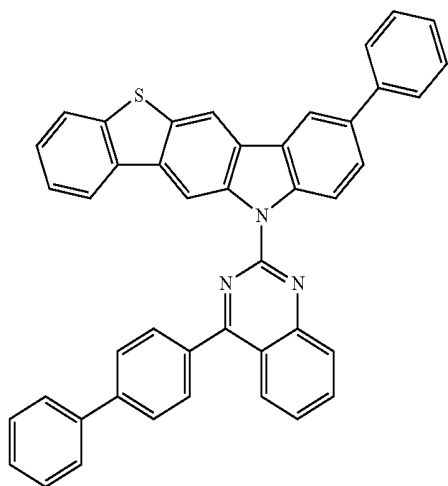
H2-305



H2-308

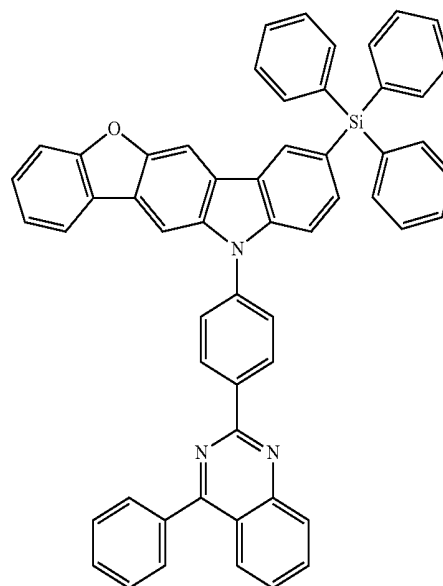
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H2-309

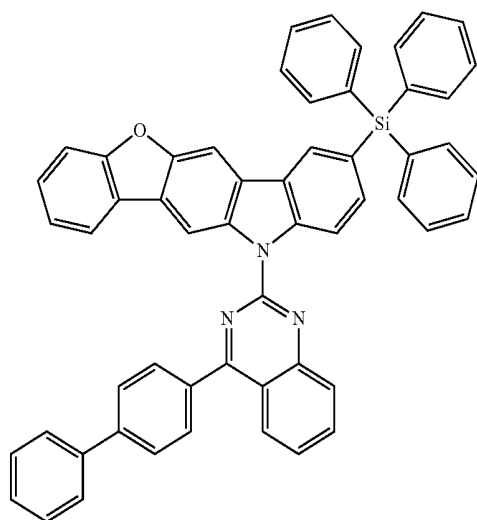


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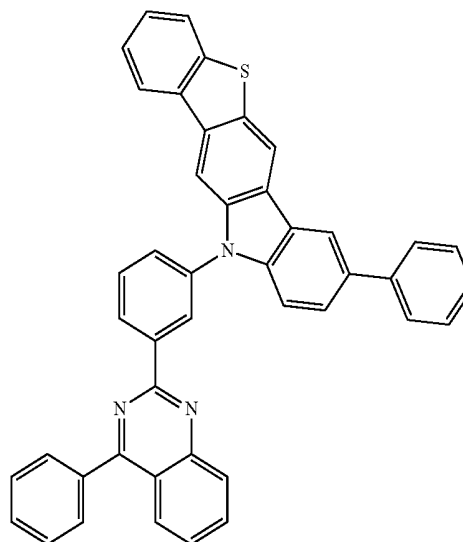
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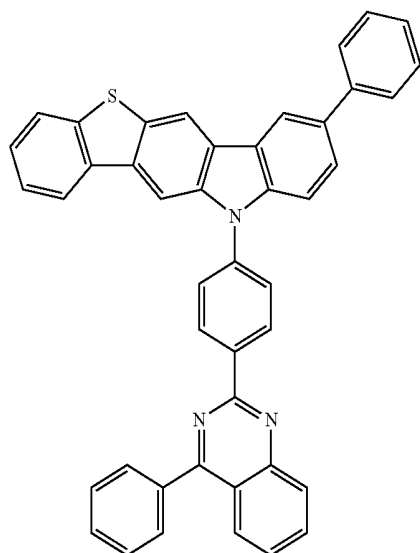
H2-310



H2-313

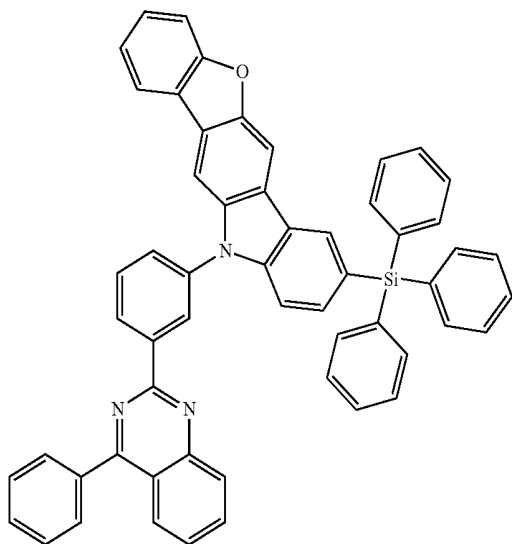


H2-311



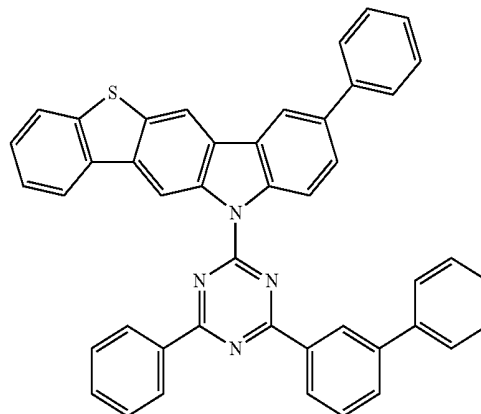
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H2-314



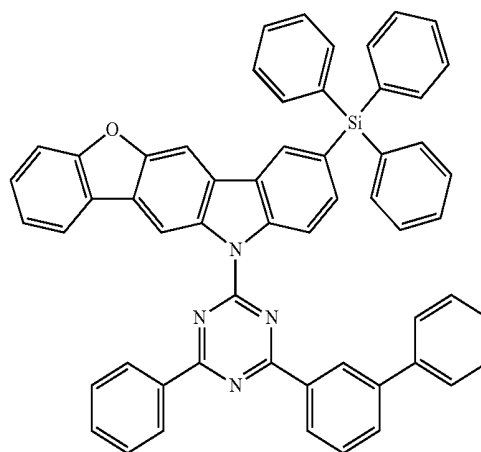
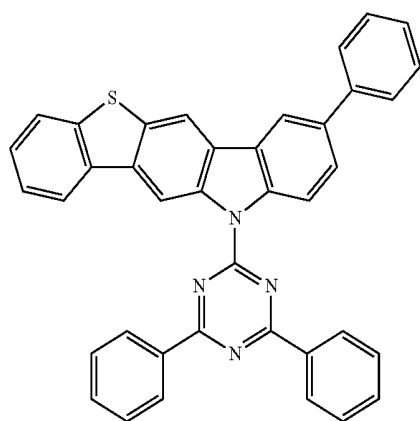
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H2-317

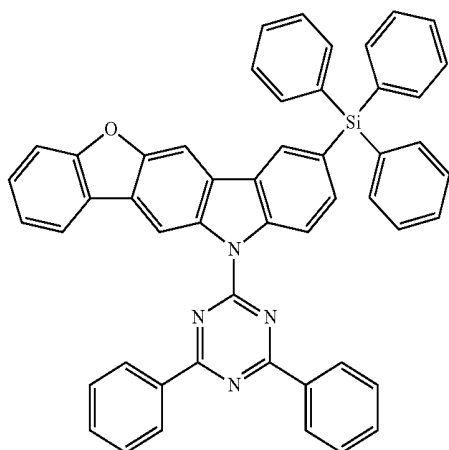


H2-318

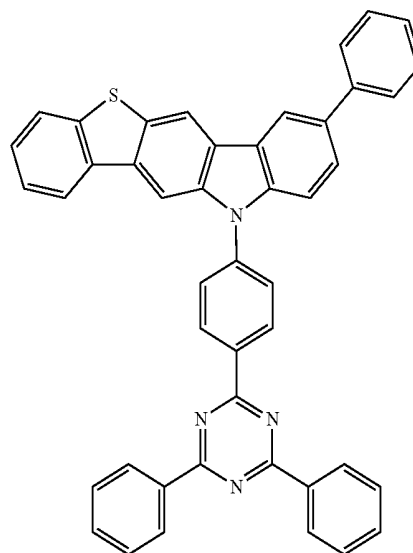
H2-315



H2-316

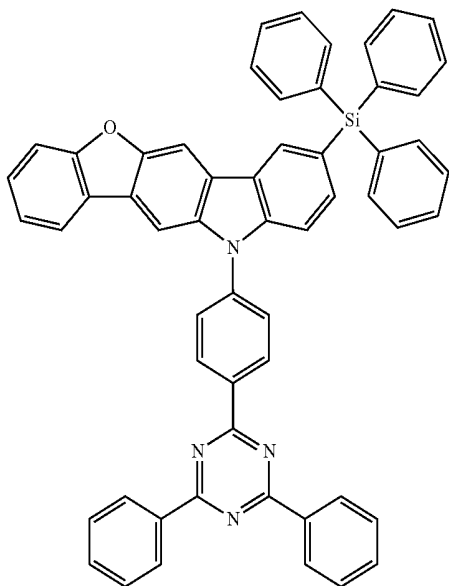


H2-319



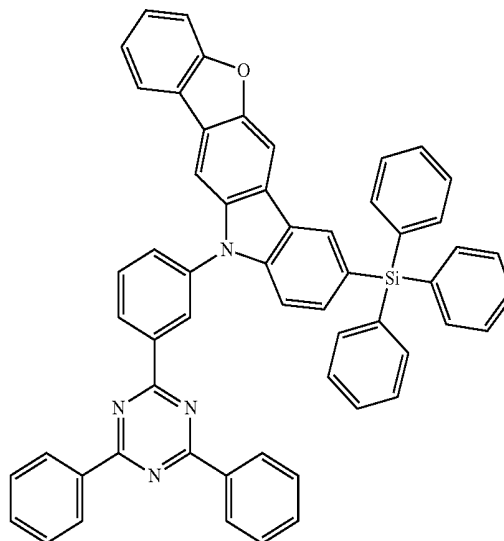
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H2-320

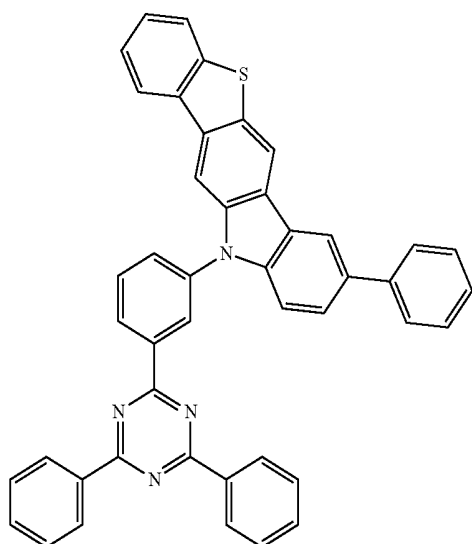


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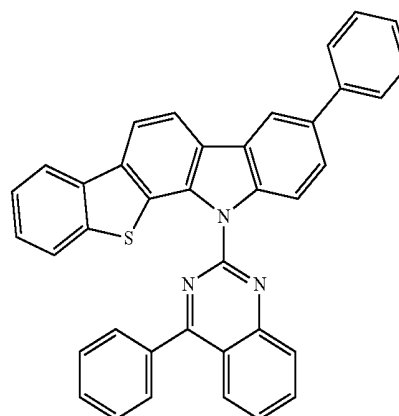
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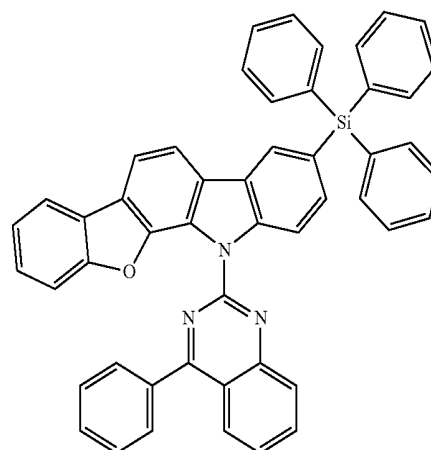
H2-321



H2-323

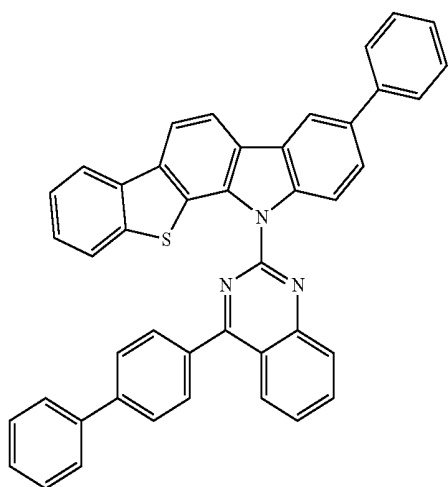


H2-324



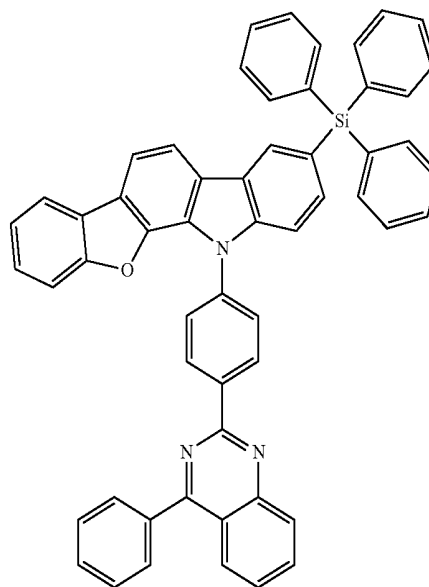
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H2-325

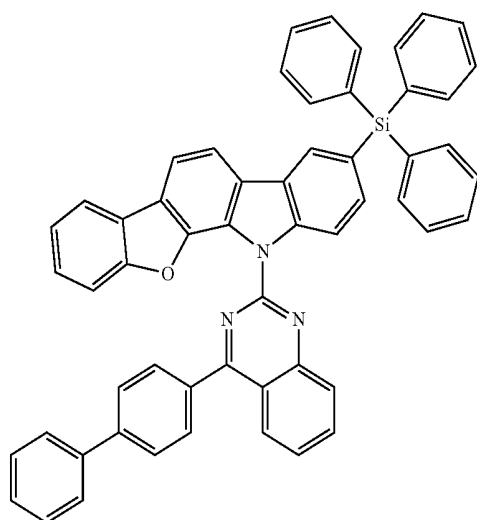


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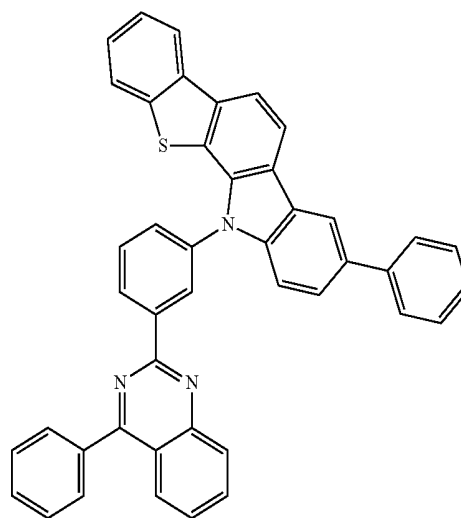
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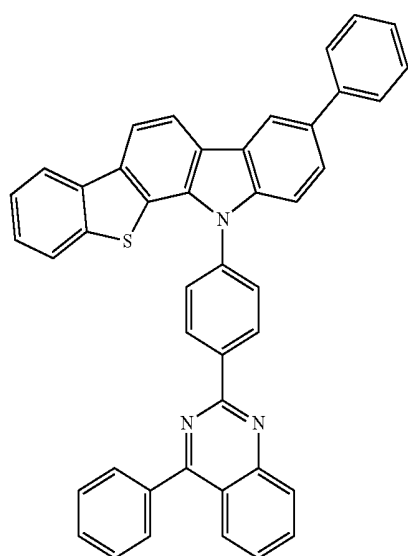
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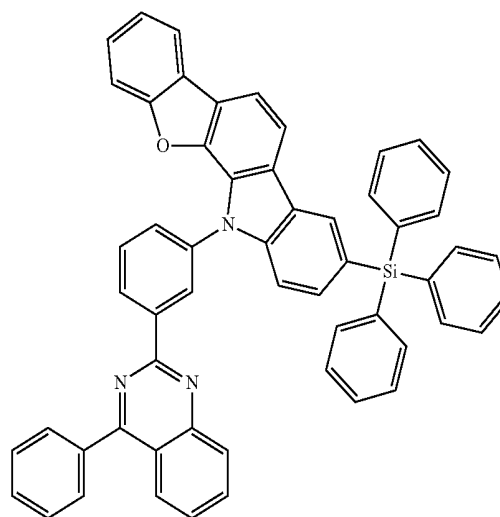
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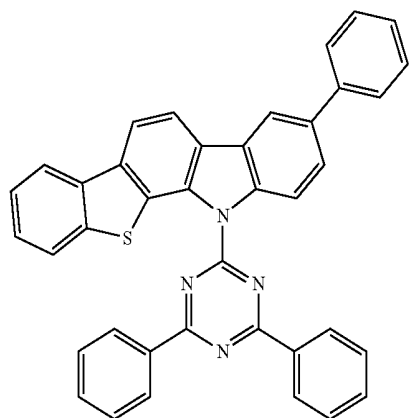
H2-327



H2-330

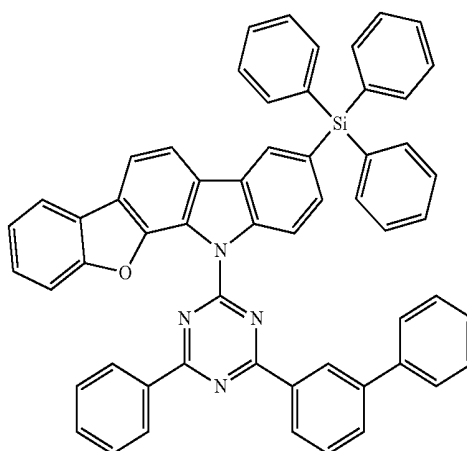


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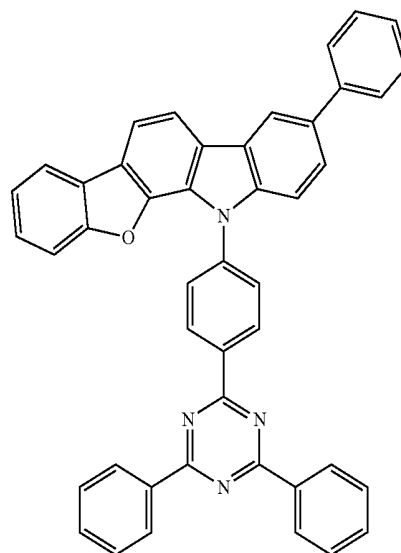
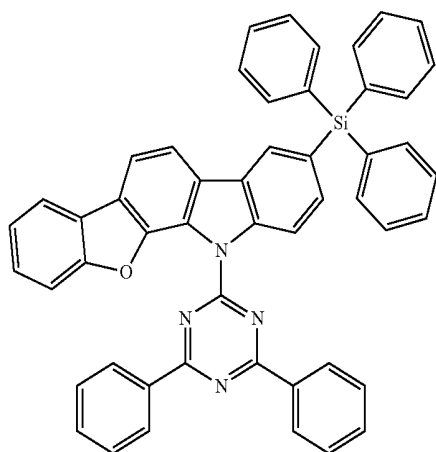
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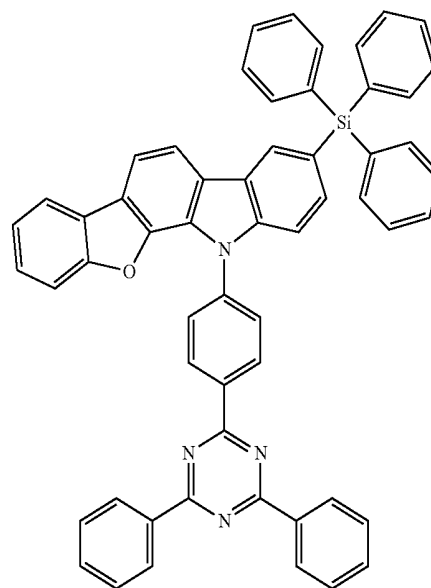
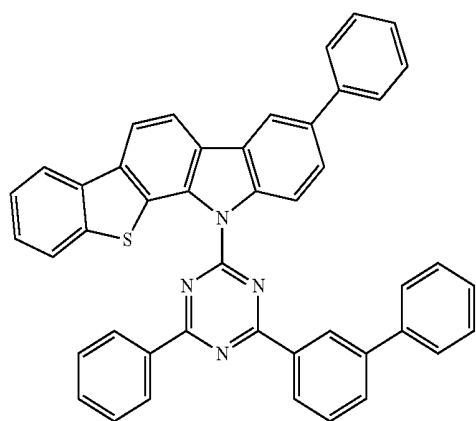
H2-334

H2-332



H2-335

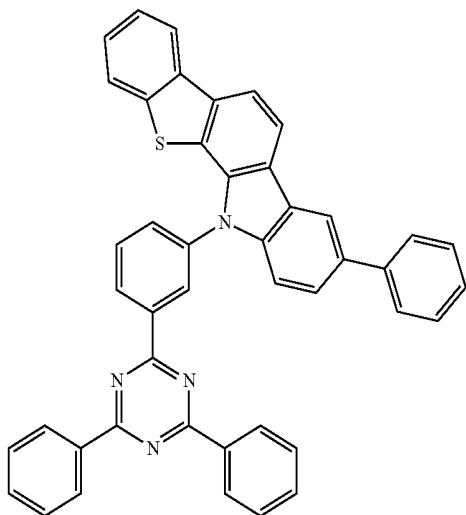
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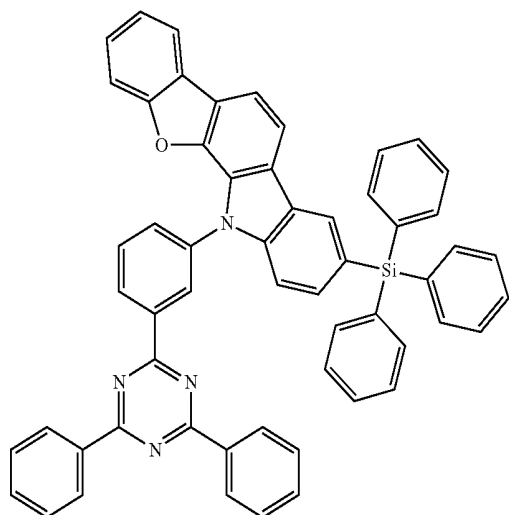
H2-336

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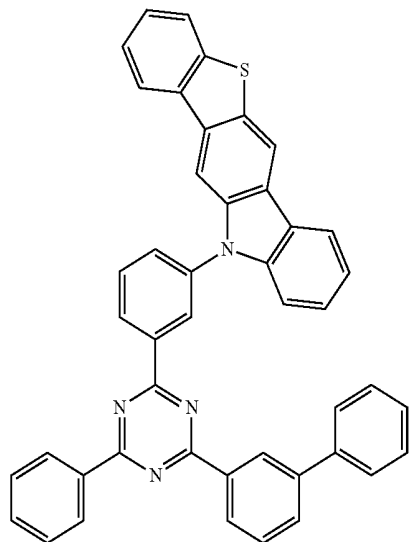
H2-337



H2-338

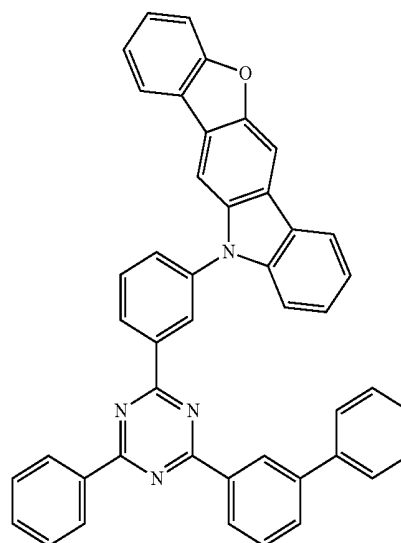


H2-339

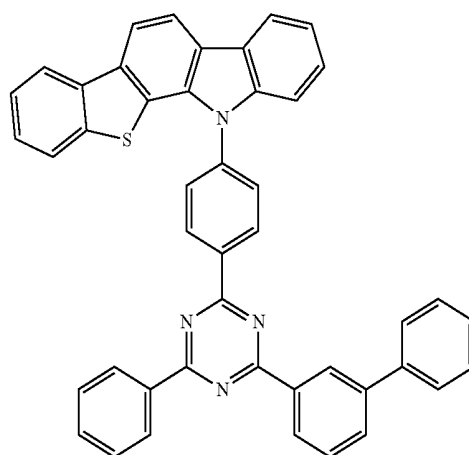


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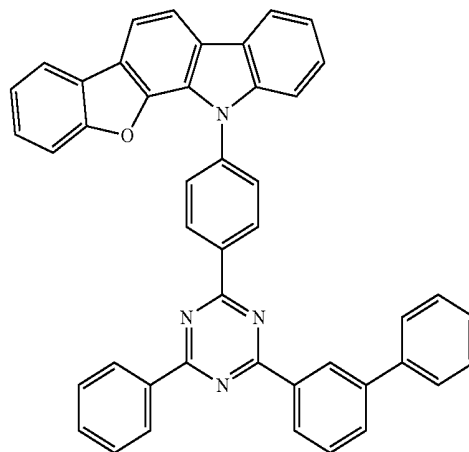
H2-340



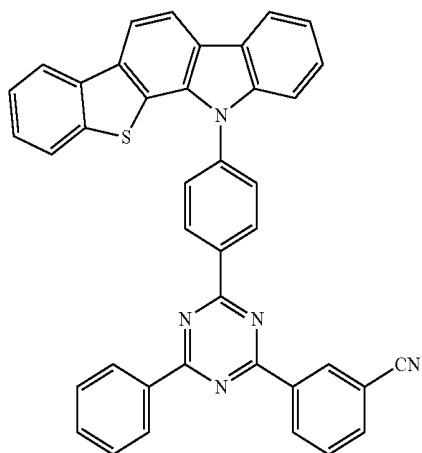
H2-341



H2-342

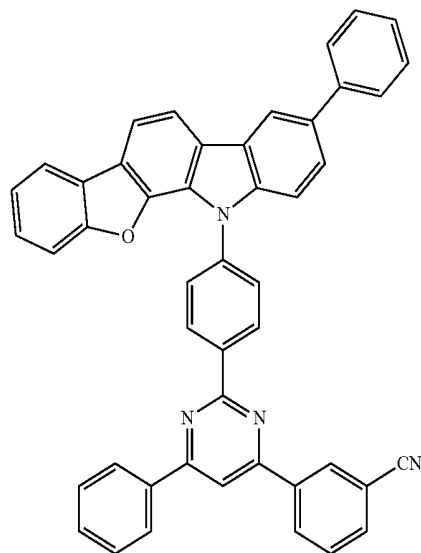


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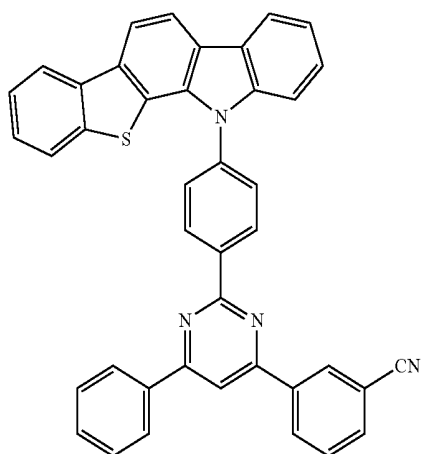


H2-343

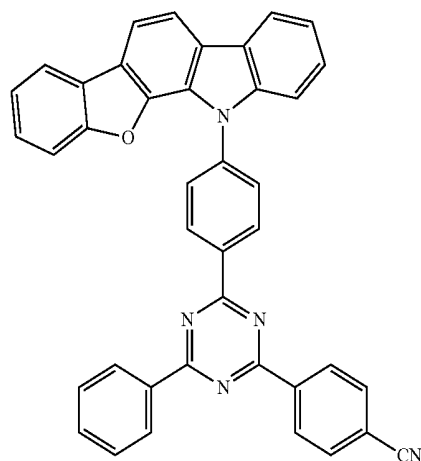
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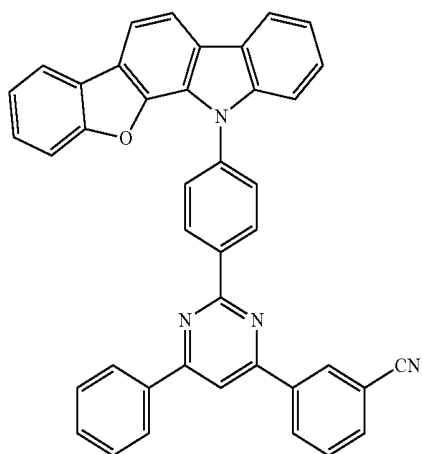
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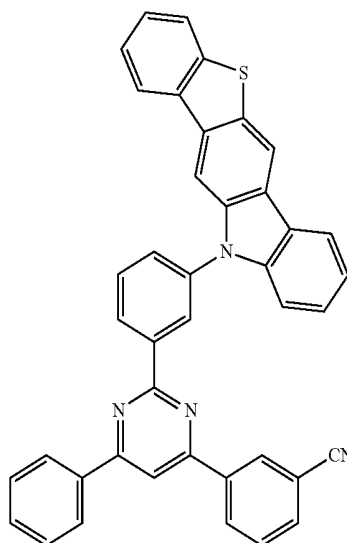
H2-344



H2-347

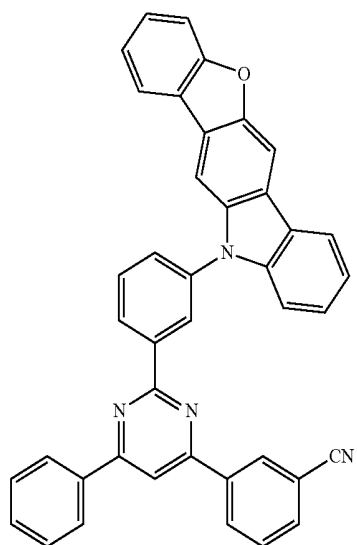


H2-345



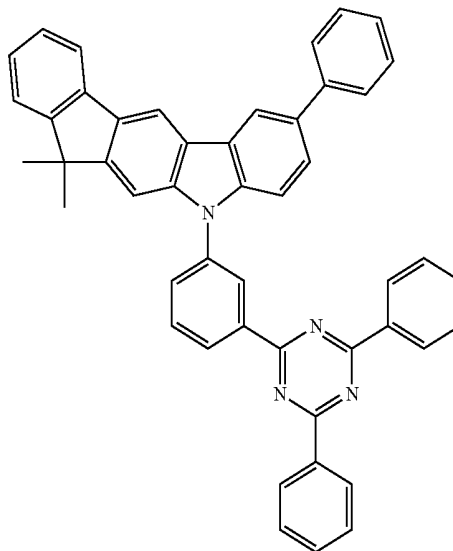
H2-348

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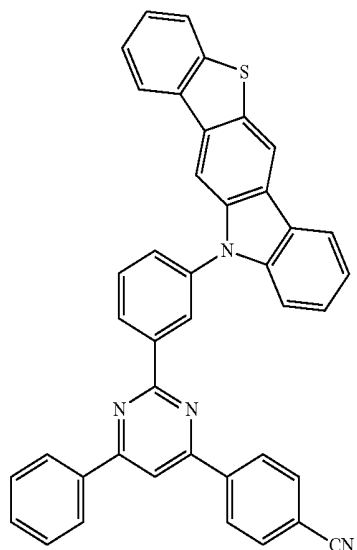
H2-349

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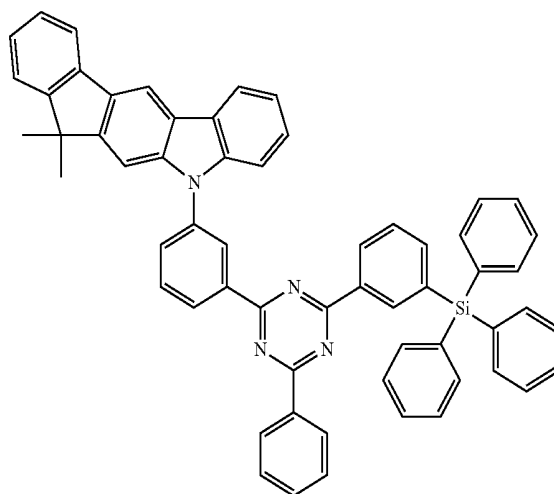


H2-352

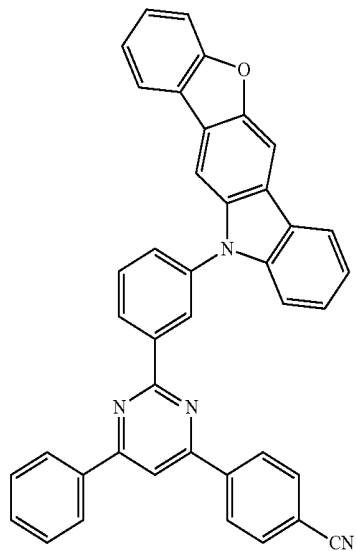
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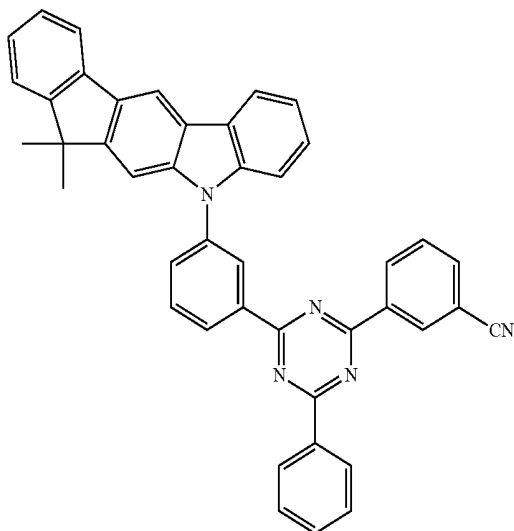
H2-353



H2-351

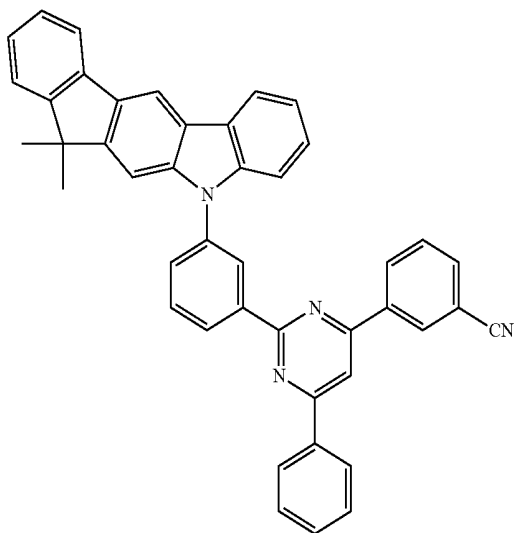


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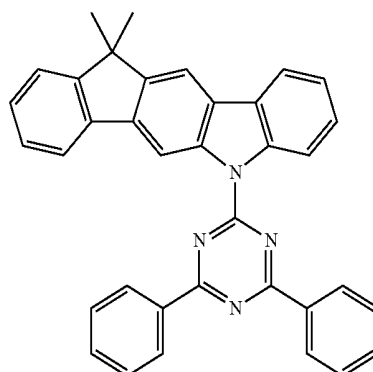
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H2-355

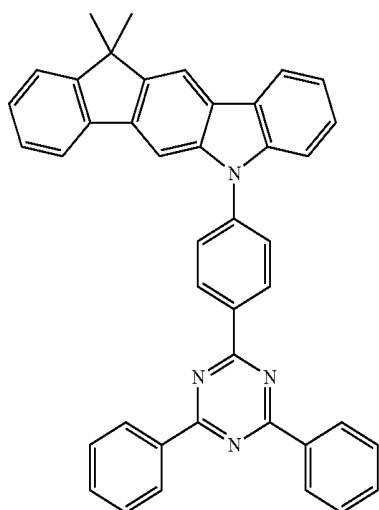


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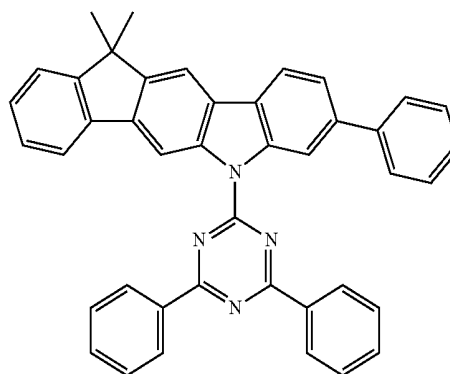
H2-358



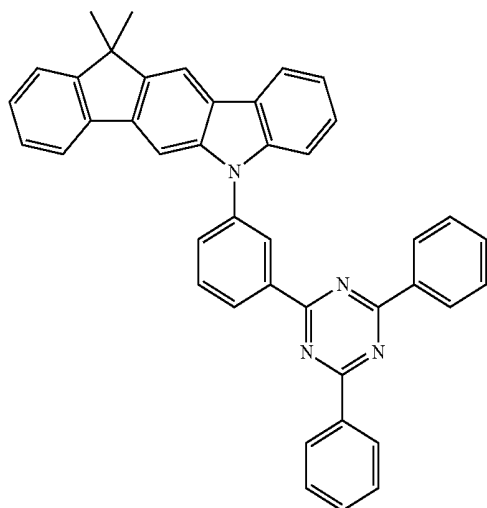
H2-356



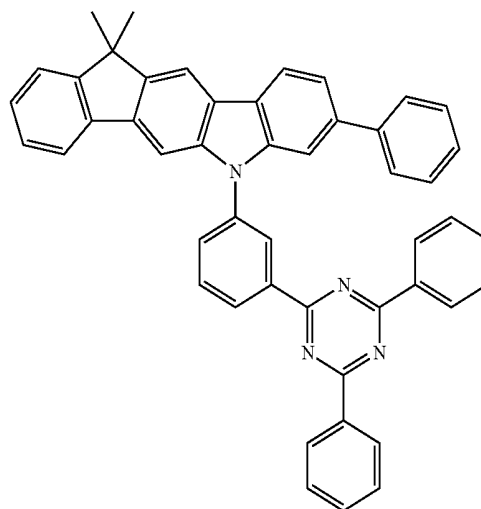
H2-359



H2-357

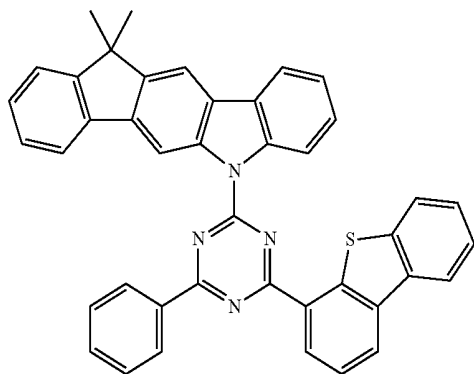


H2-360

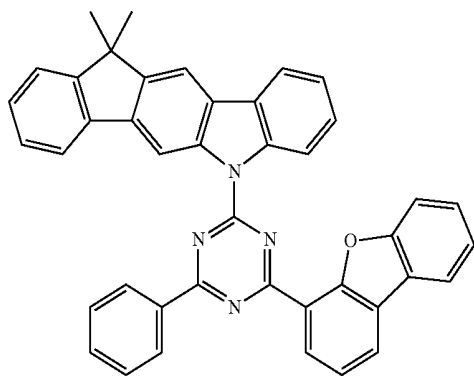


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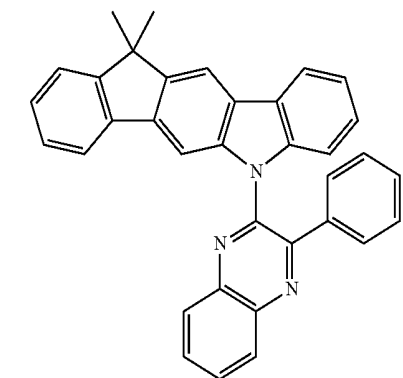
H2-361



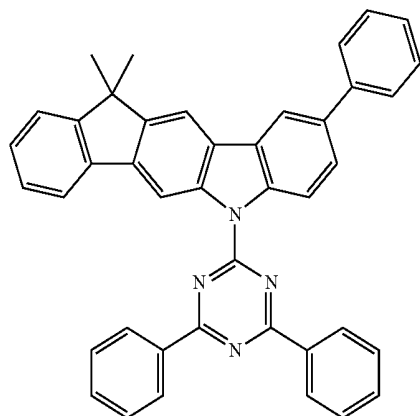
H2-362



H2-363

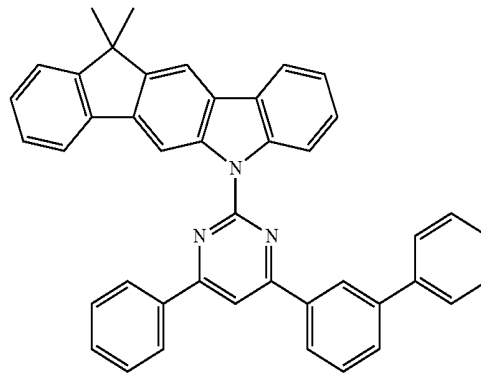


H2-364

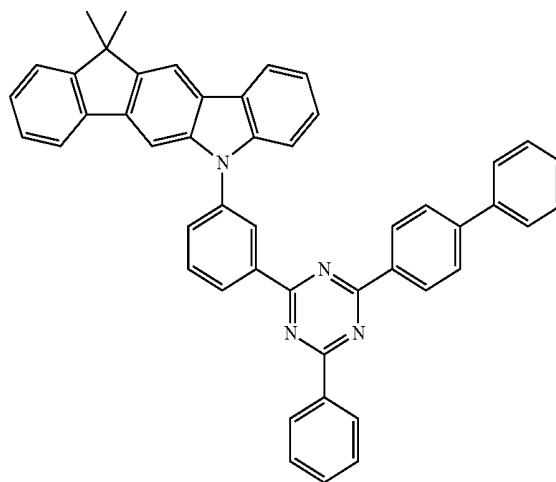


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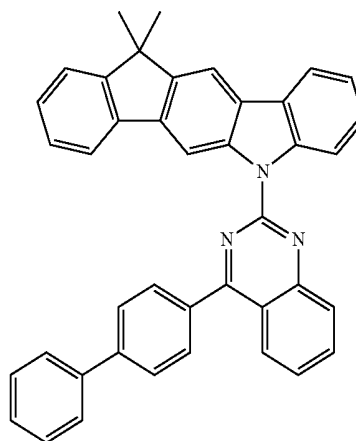
H2-365



H2-366

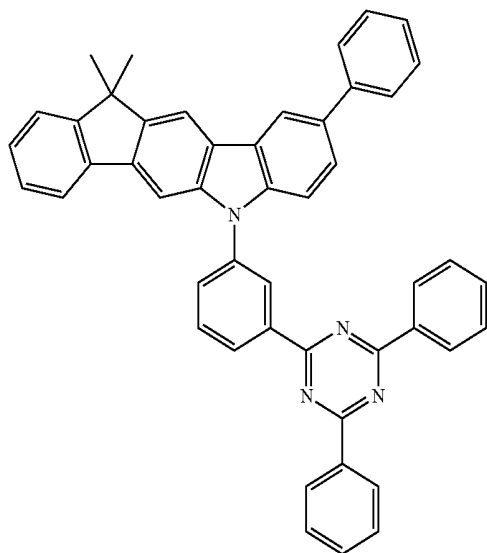


H2-367



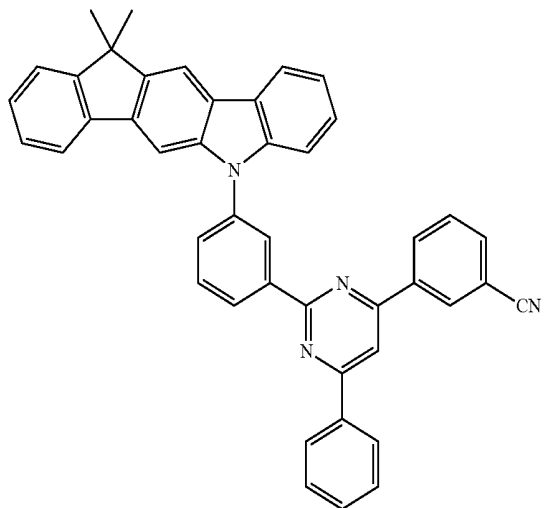
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H2-368

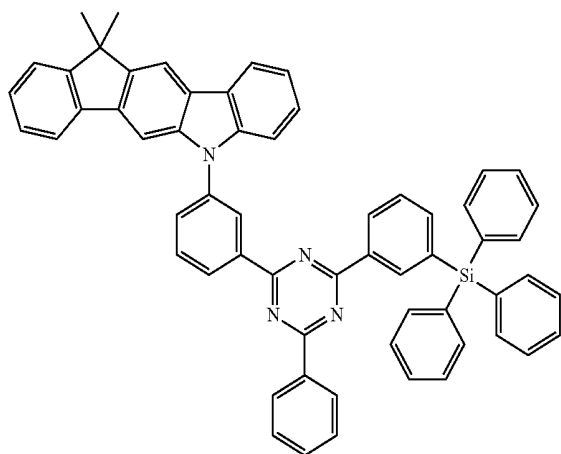


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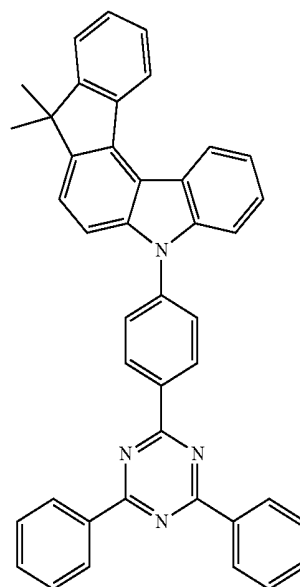
H2-371



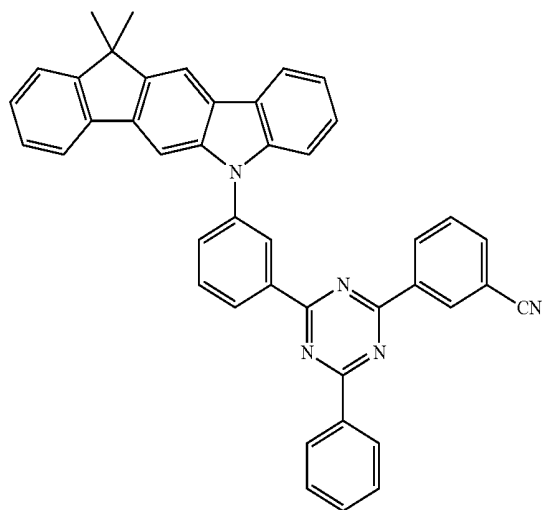
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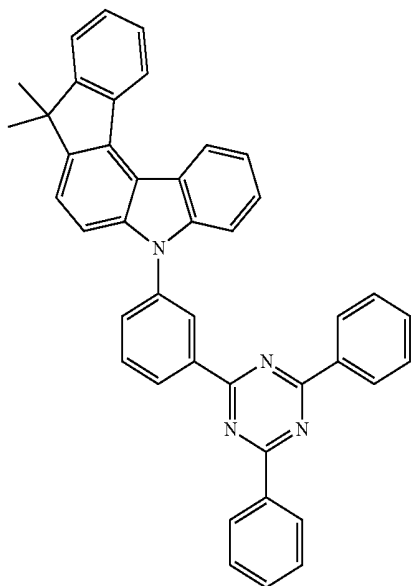
H2-372



H2-370

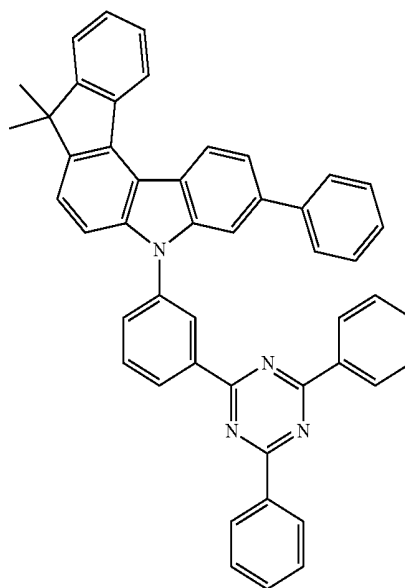


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H2-373

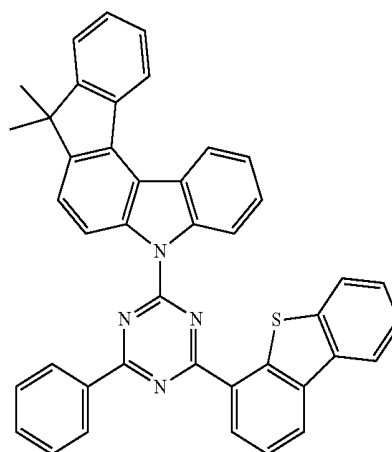
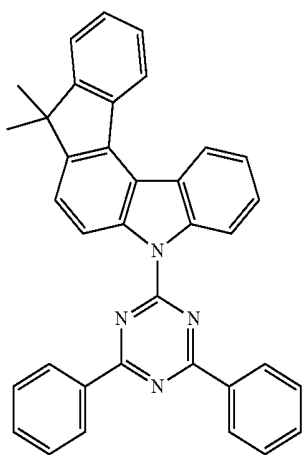
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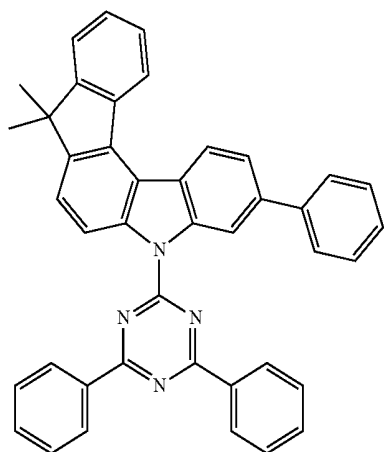
H2-376

H2-377

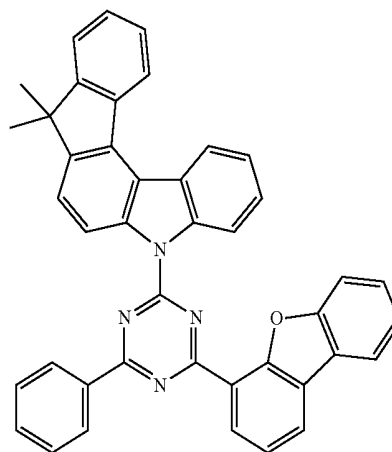
H2-374



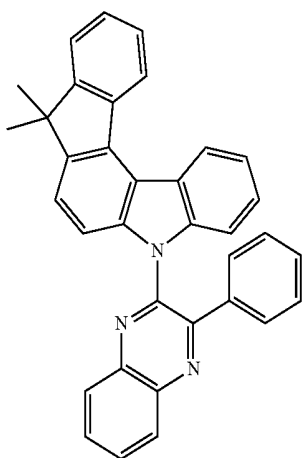
H2-375



H2-378

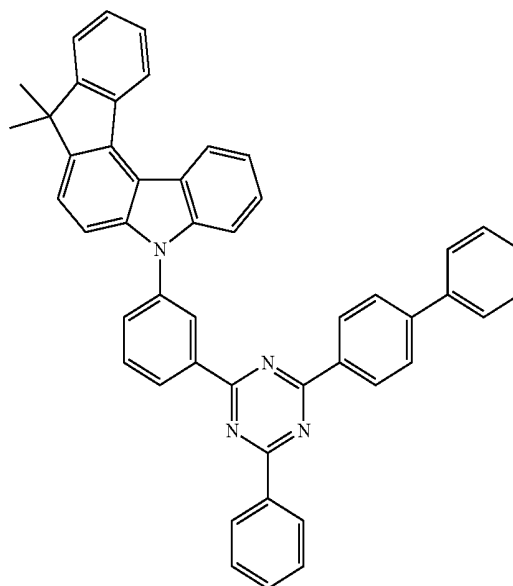


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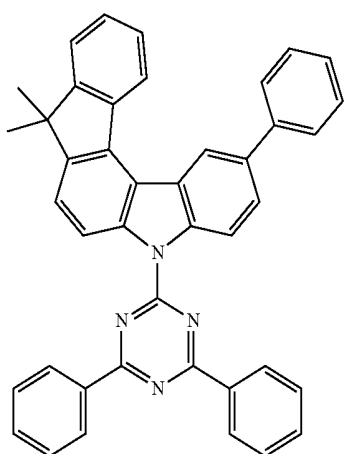


H2-379

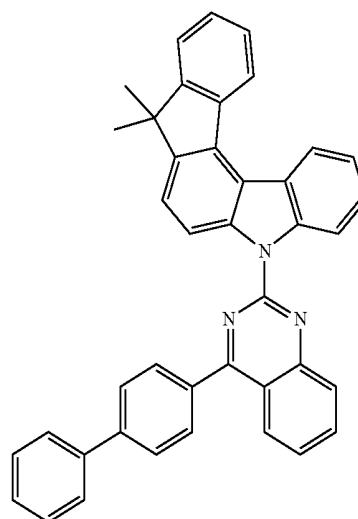
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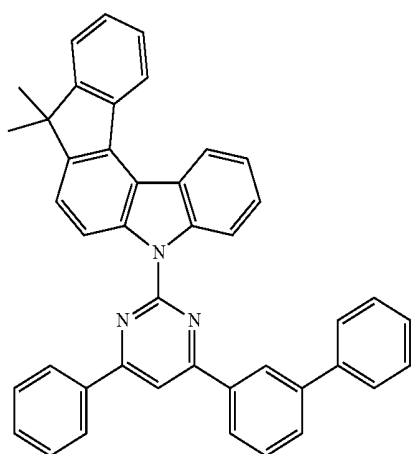
H2-382



H2-380



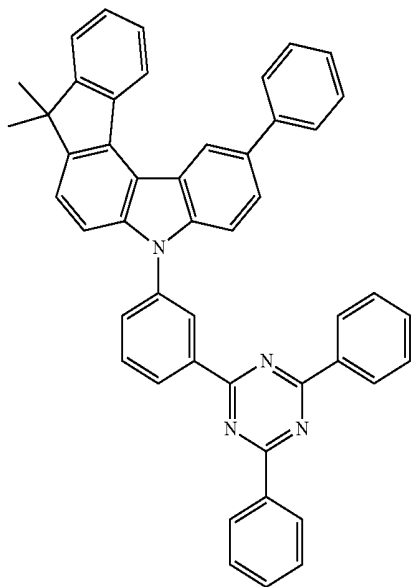
H2-383



H2-381

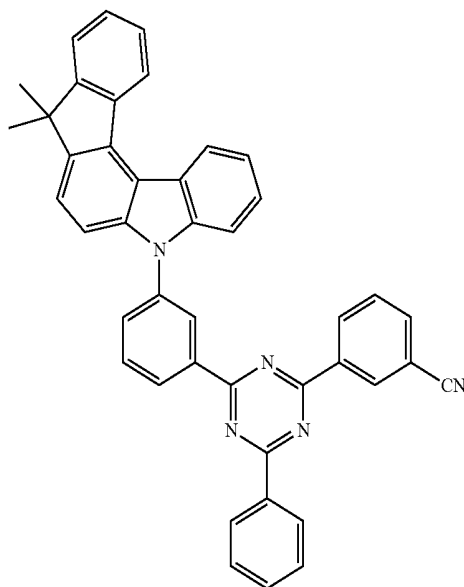
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H2-384



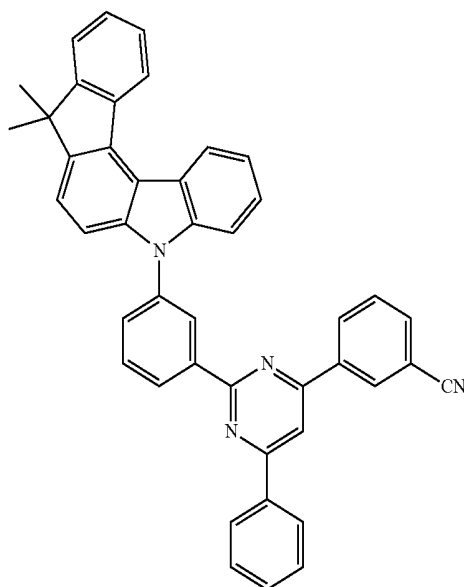
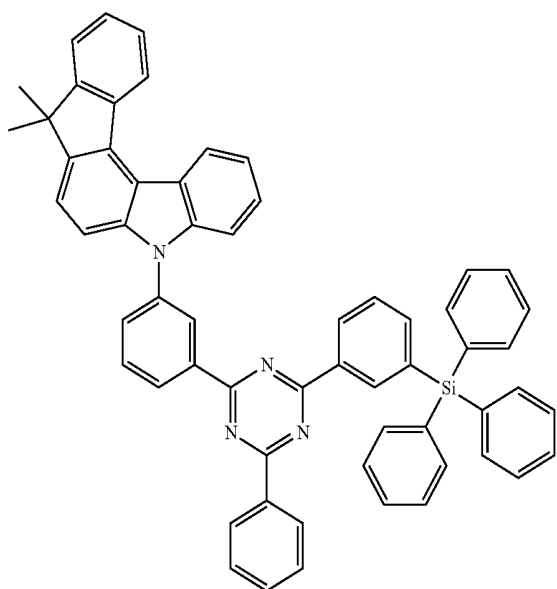
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H2-386

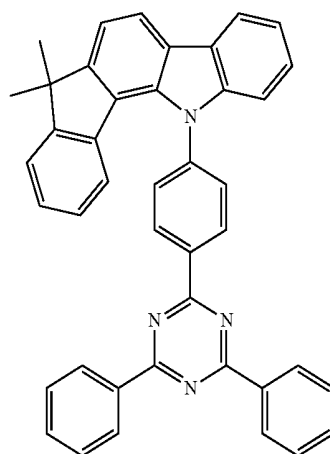


H2-387

H2-385

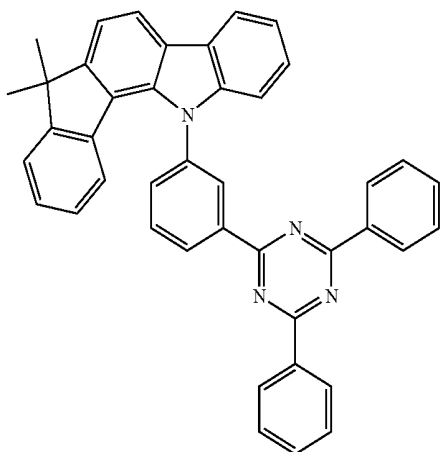


H2-388

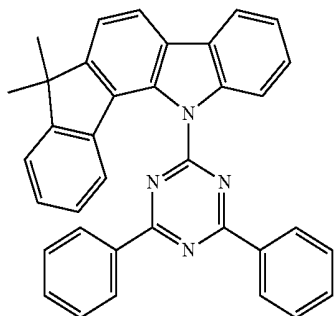


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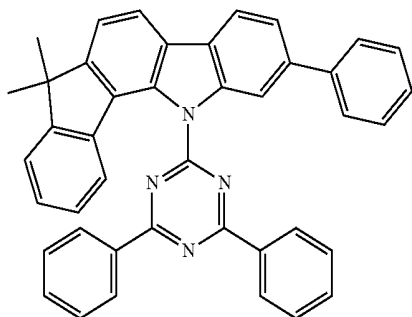
H2-389



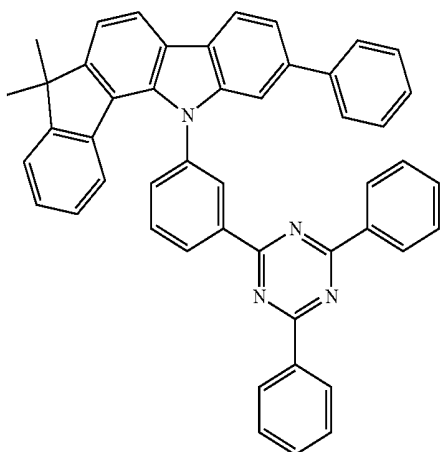
H2-390



H2-391

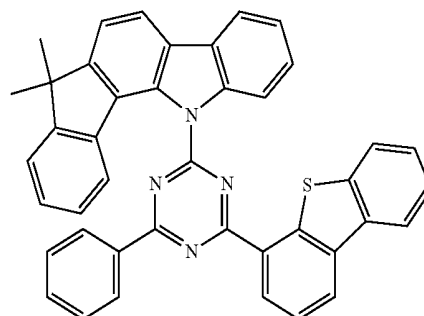


H2-392

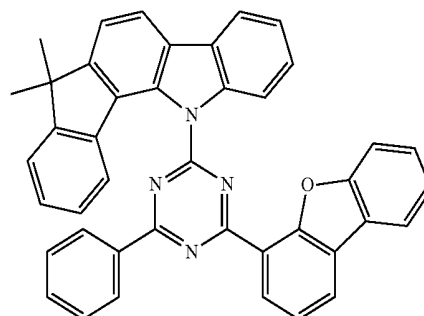


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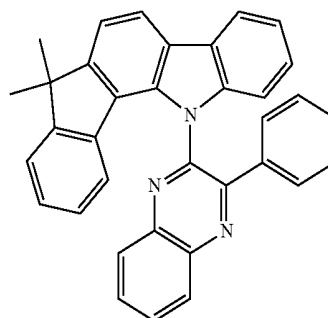
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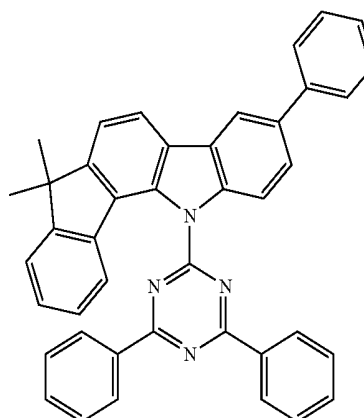
H2-394



H2-395

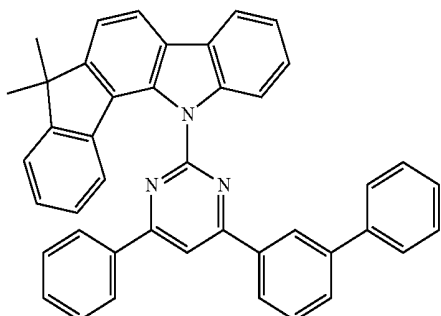


H2-396



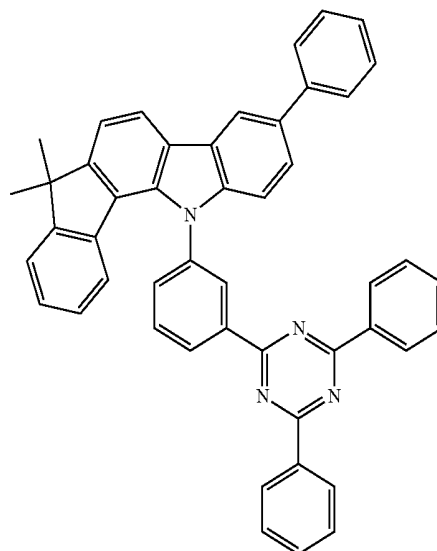
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H2-397

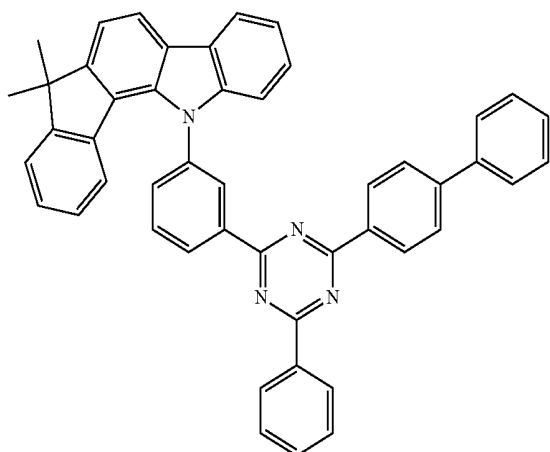


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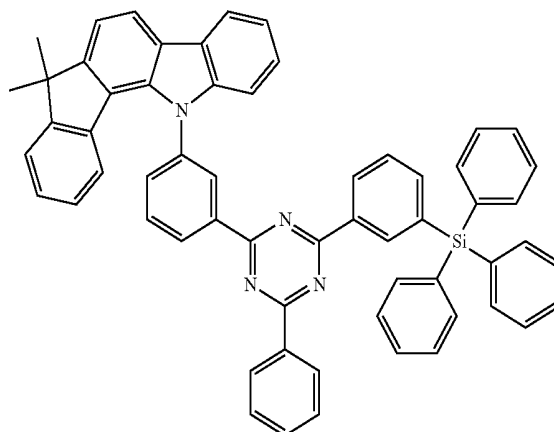
H2-400



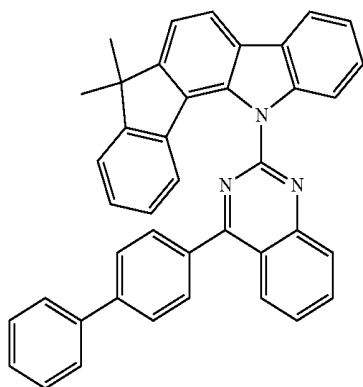
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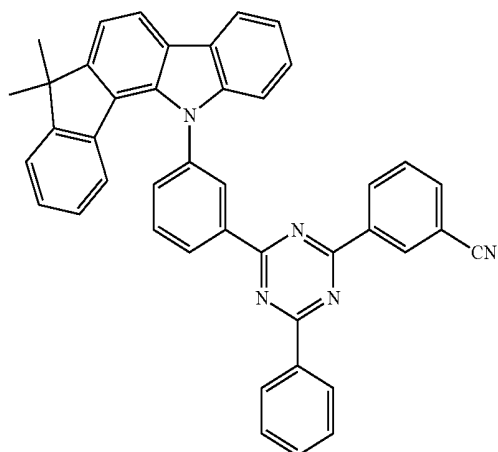
H2-401



H2-399

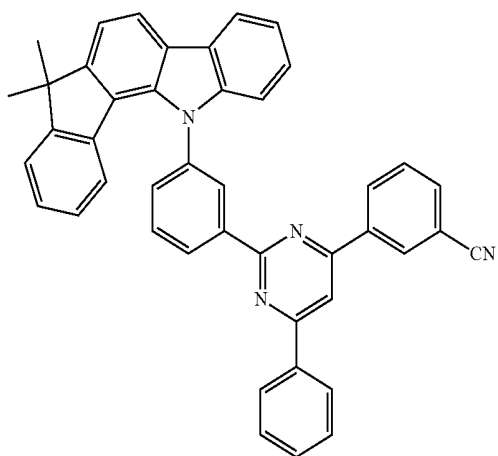


H2-402



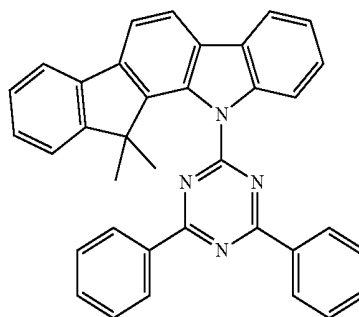
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H2-403

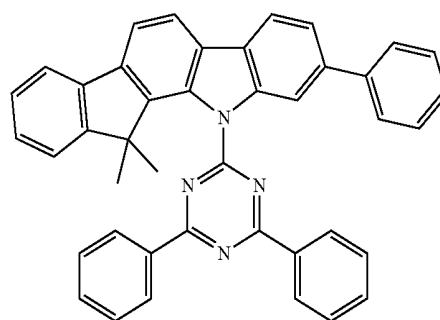


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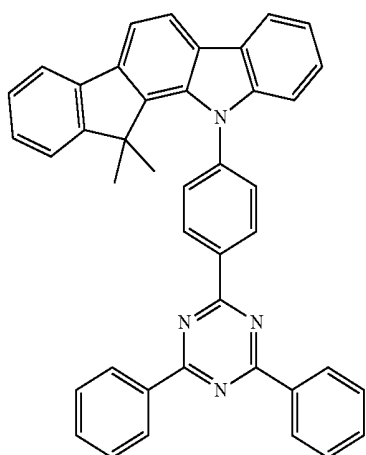
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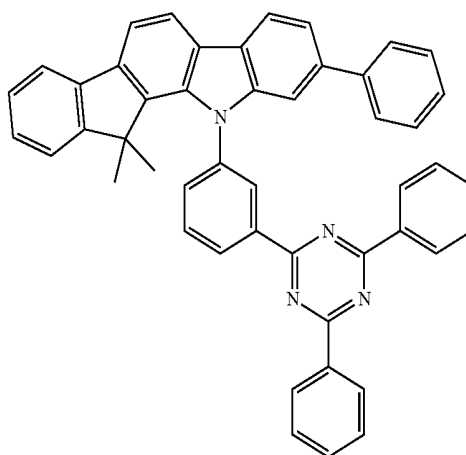
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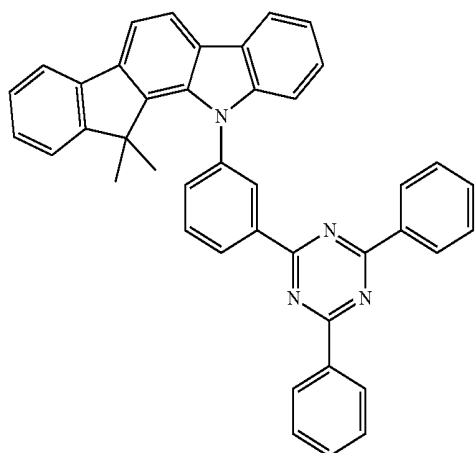
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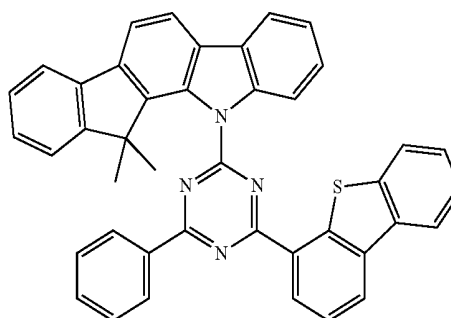
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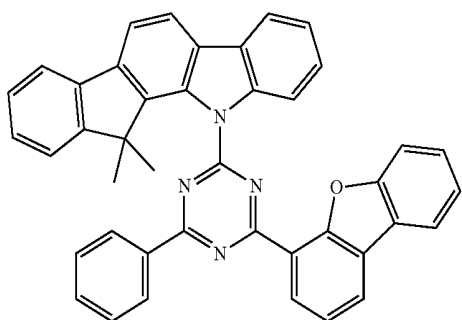
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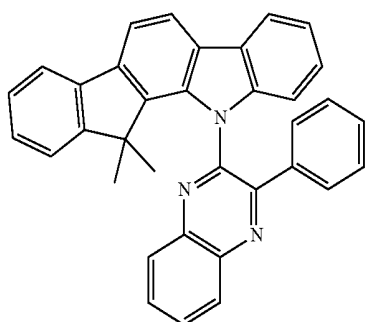
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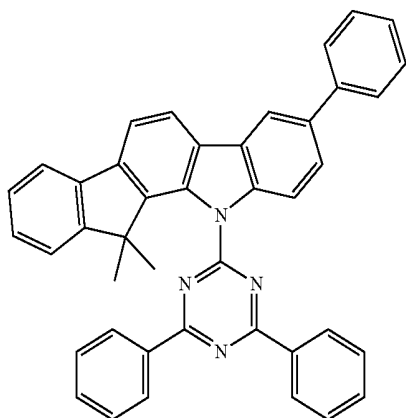
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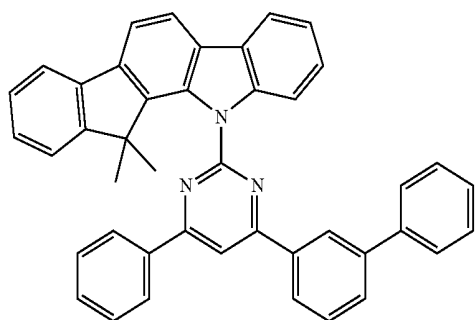
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H2-411

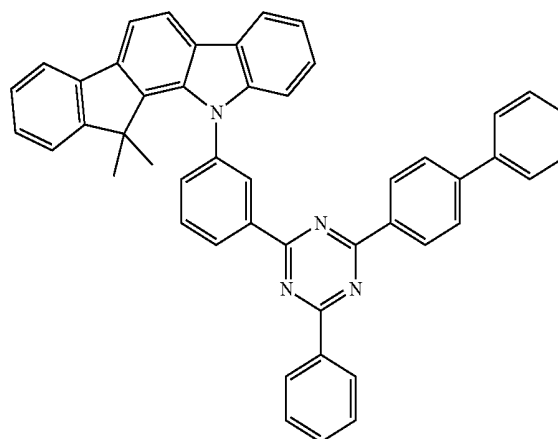


H2-412

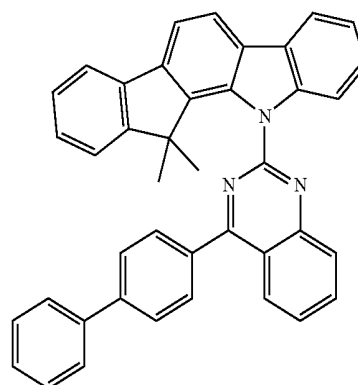


H2-413

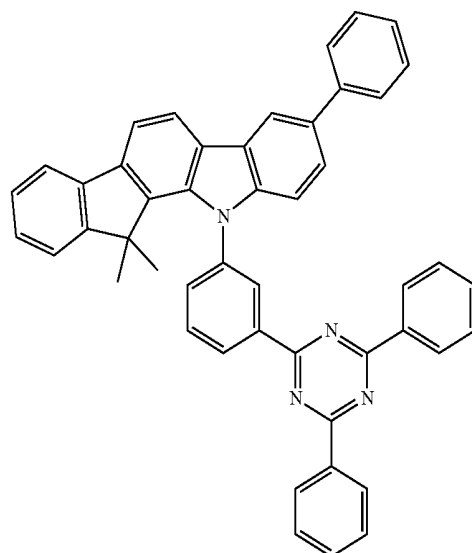
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H2-414



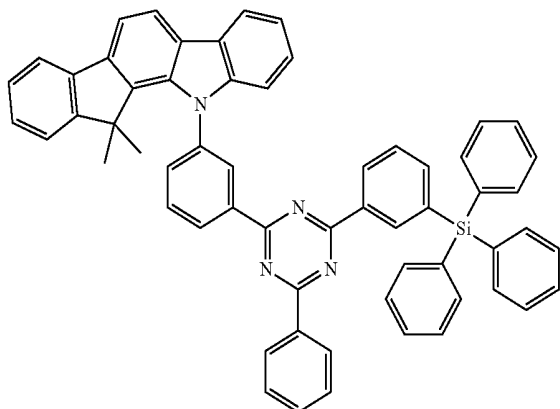
H2-415



H2-416

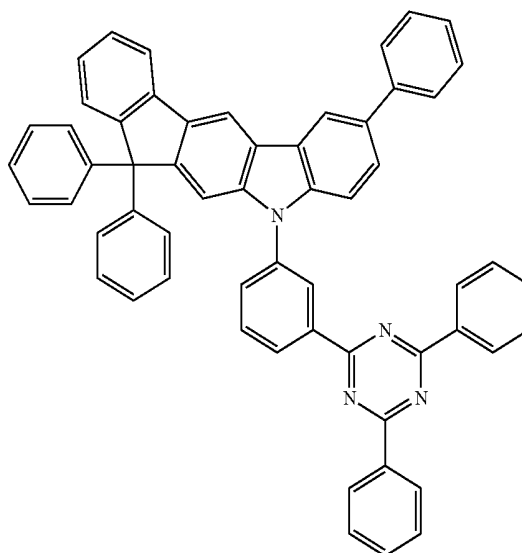
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H2-417



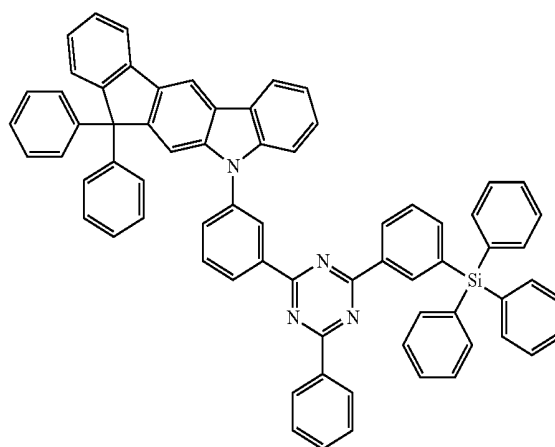
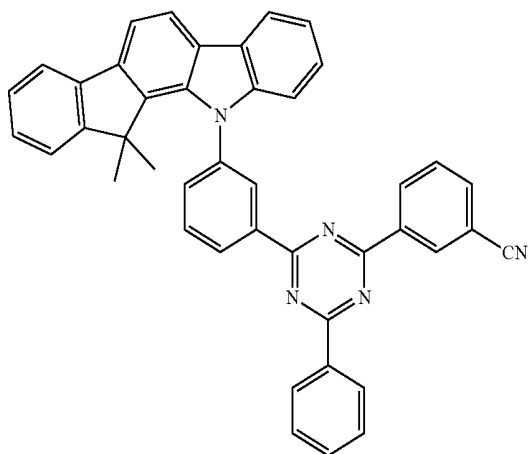
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H2-420



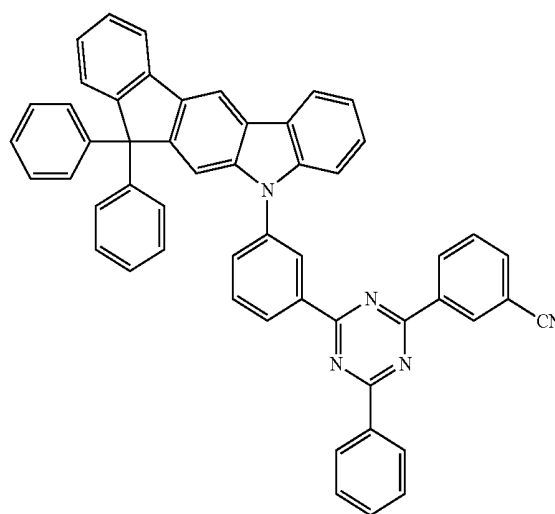
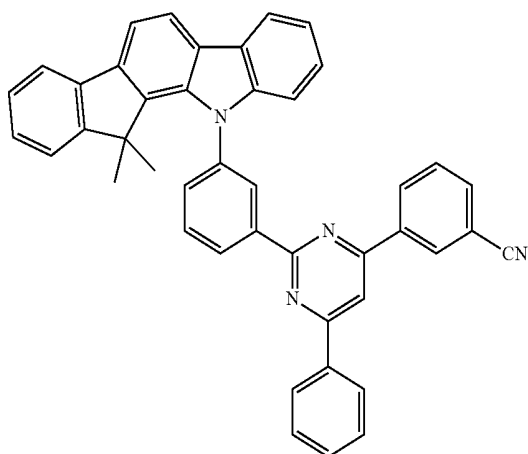
H2-418

H2-421



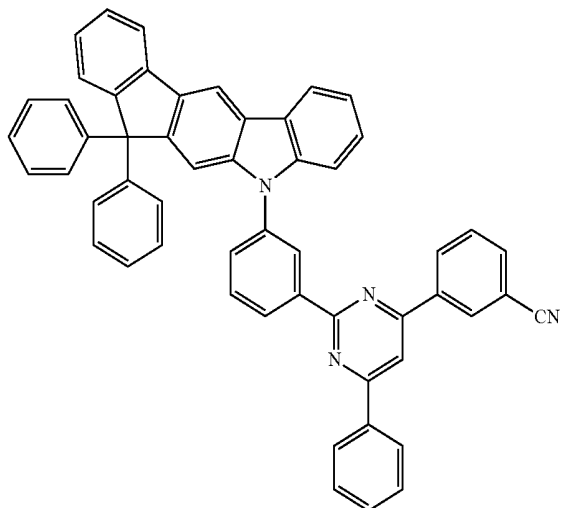
H2-422

H2-419



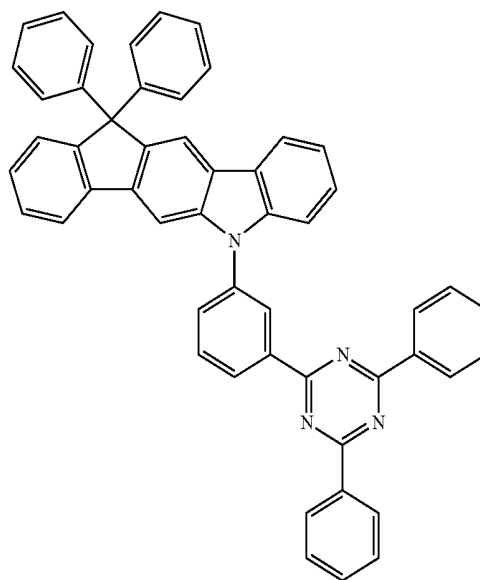
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H2-423

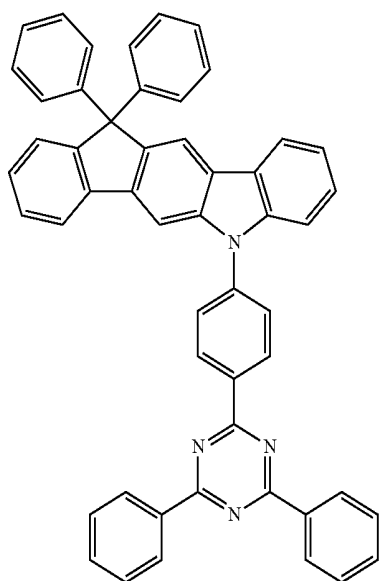


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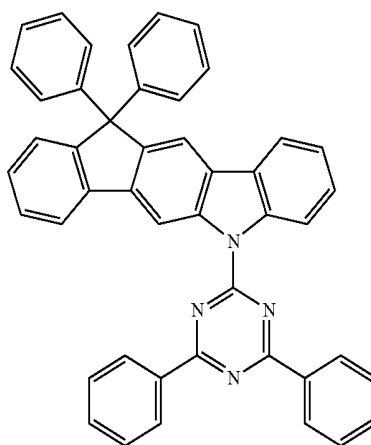
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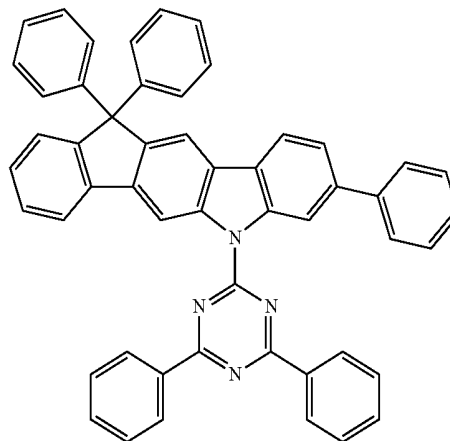
H2-424



H2-426

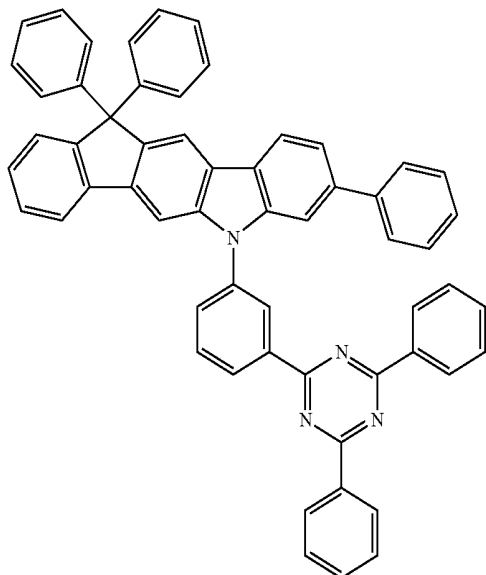


H2-427



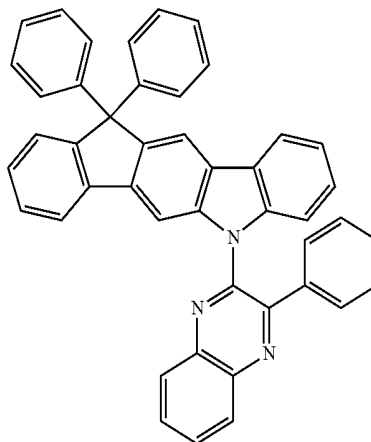
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H2-428

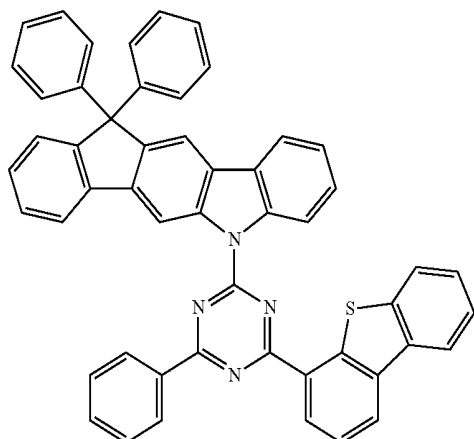


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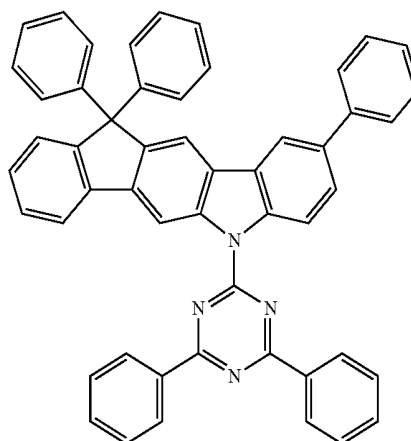
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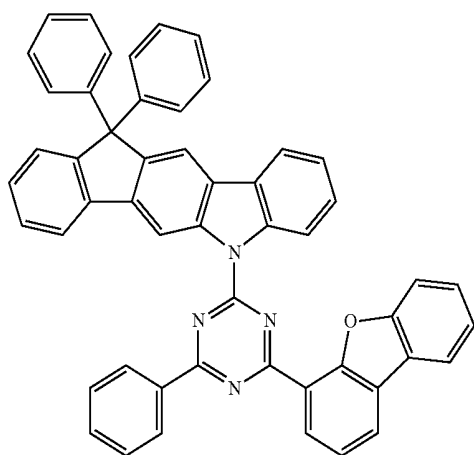
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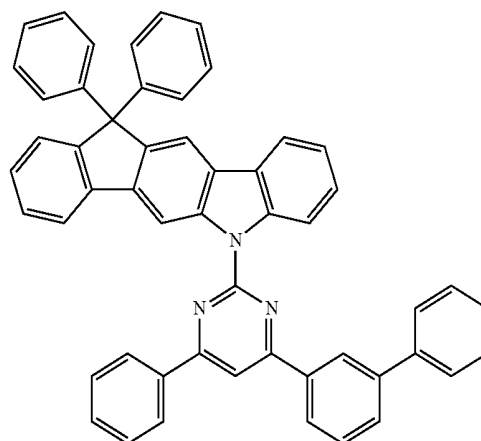
H2-432



H2-430

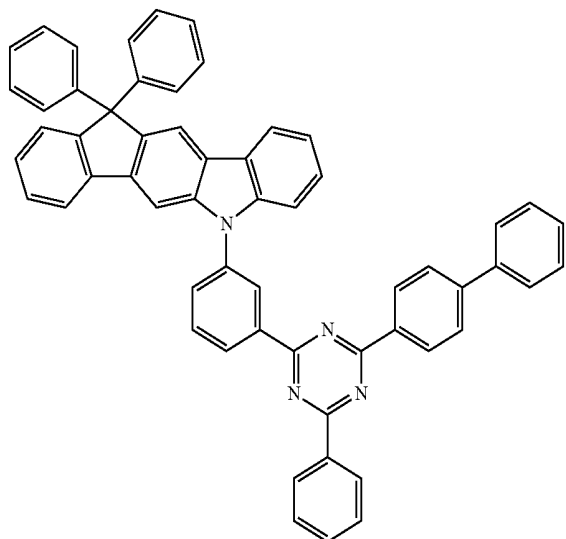


H2-433



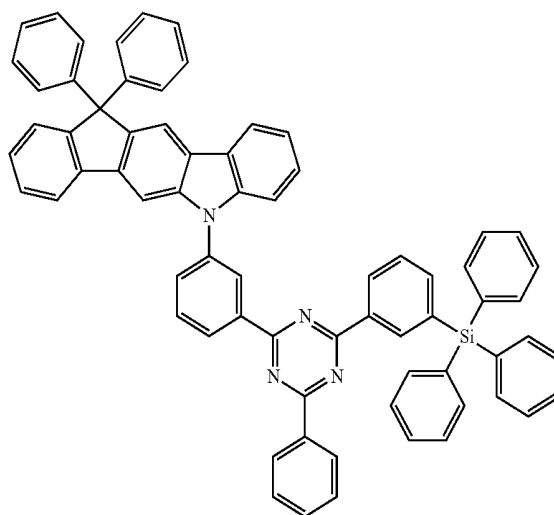
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H2-434

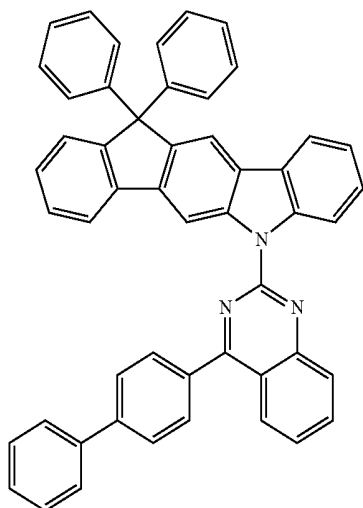


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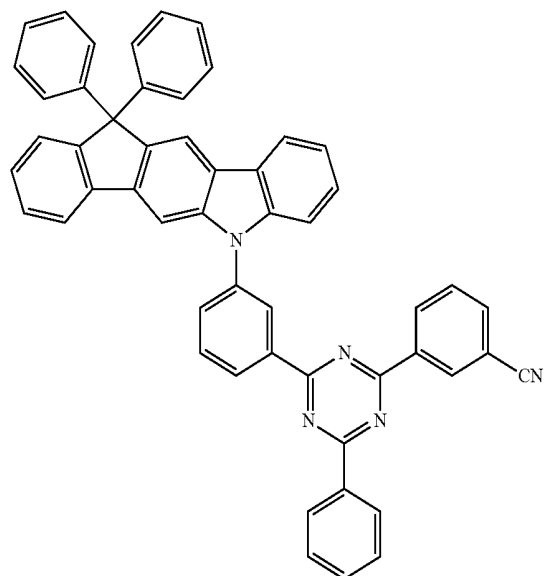
H2-437



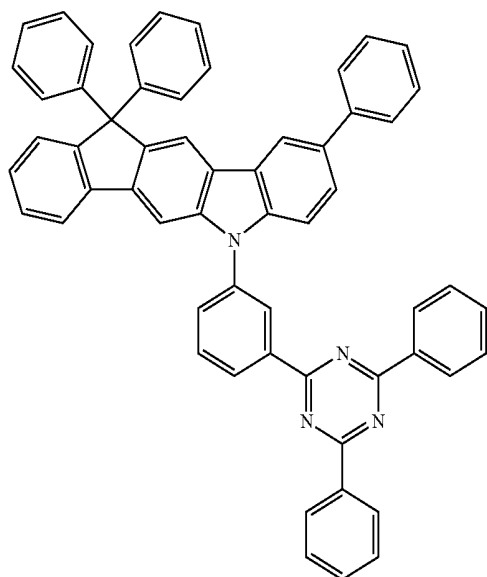
H2-435



H2-438

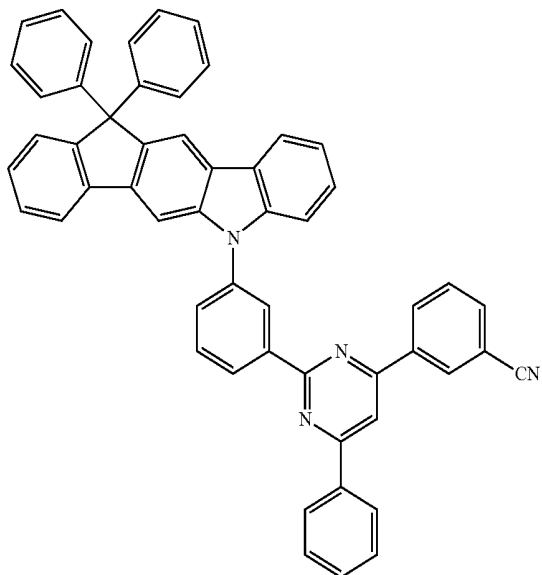


H2-436



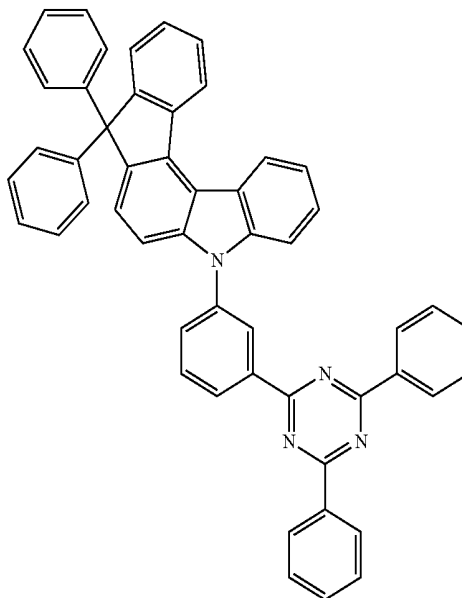
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H2-439

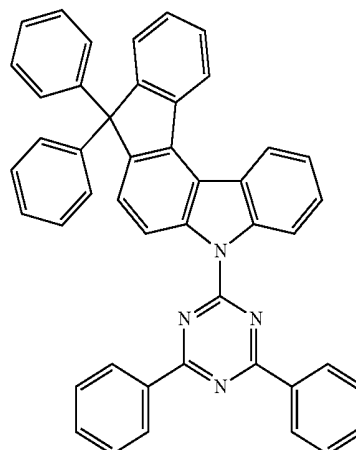


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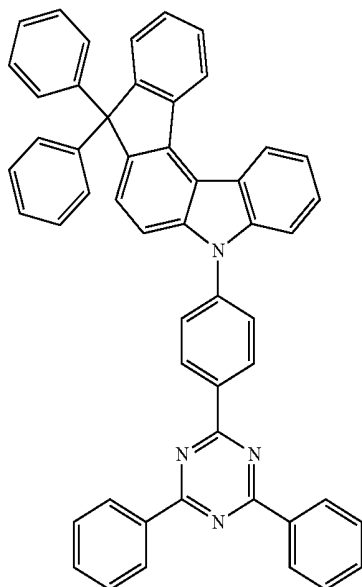
H2-441



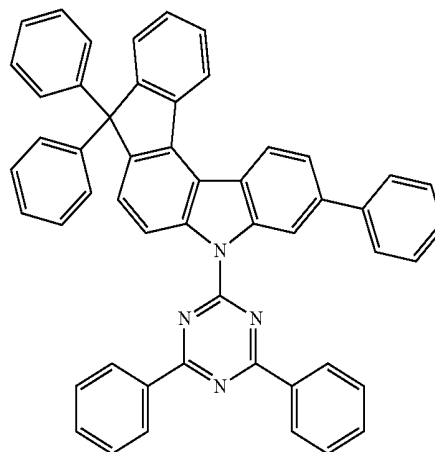
H2-442



H2-440

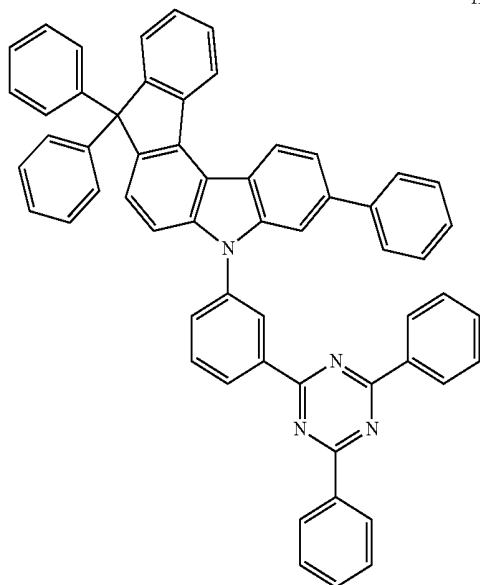


H2-443



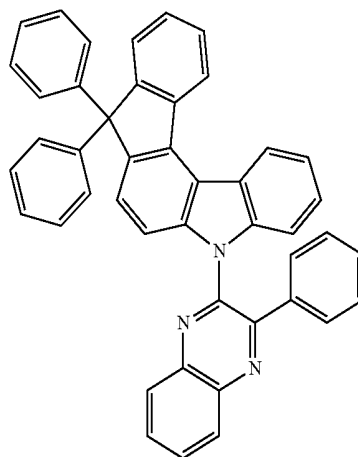
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H2-444

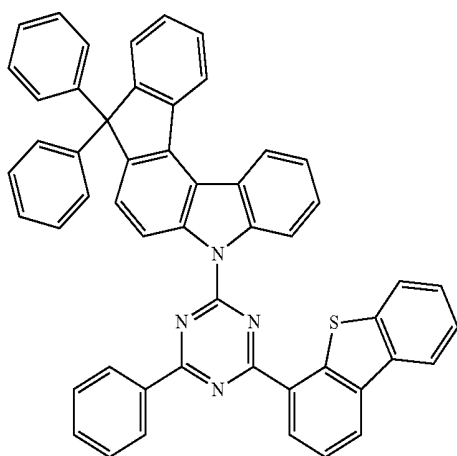


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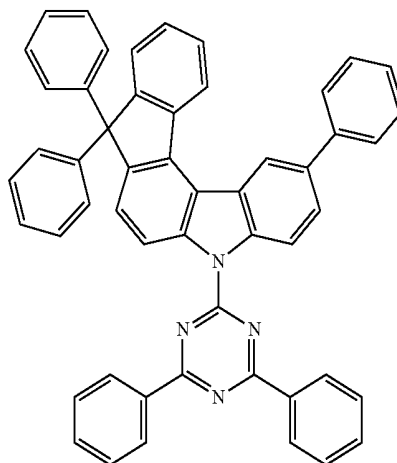
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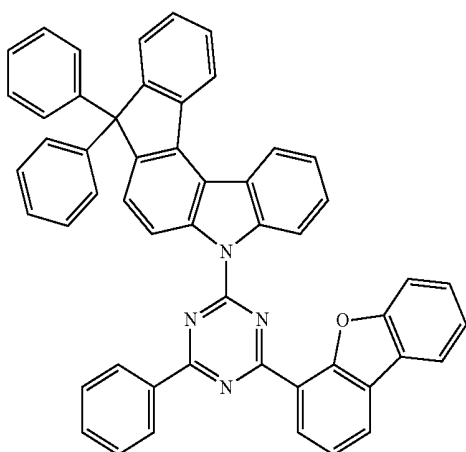
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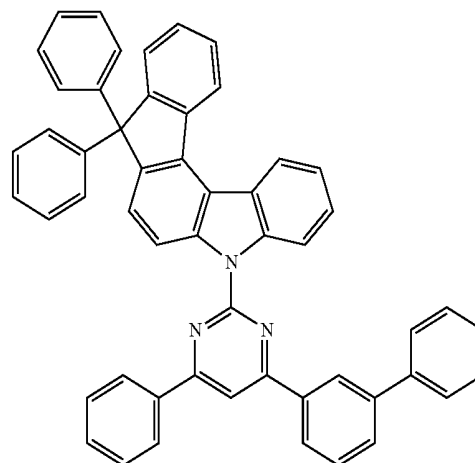
H2-448



H2-446

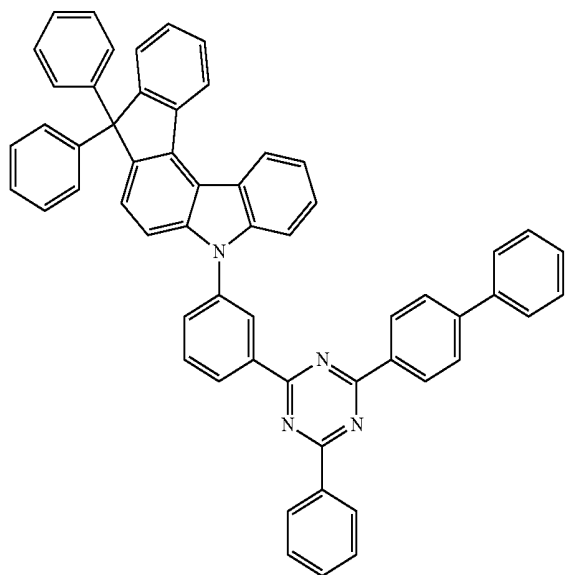


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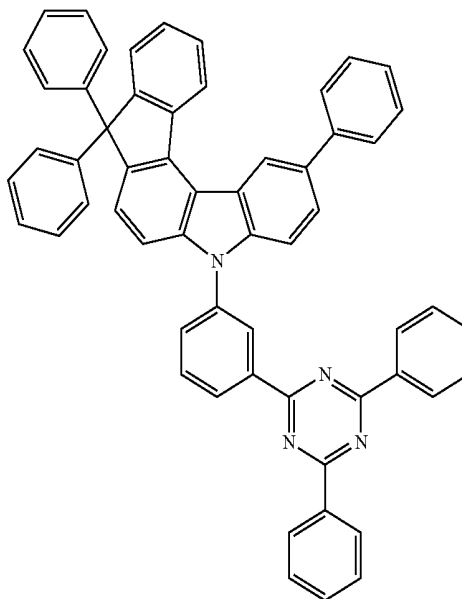
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H2-450

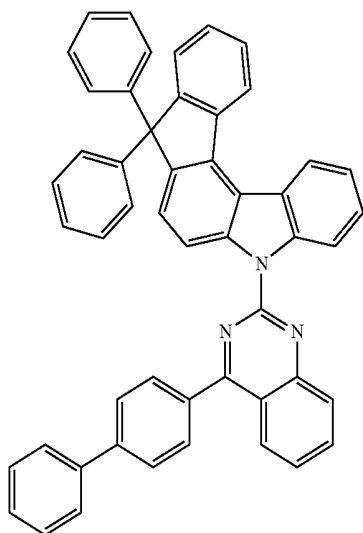


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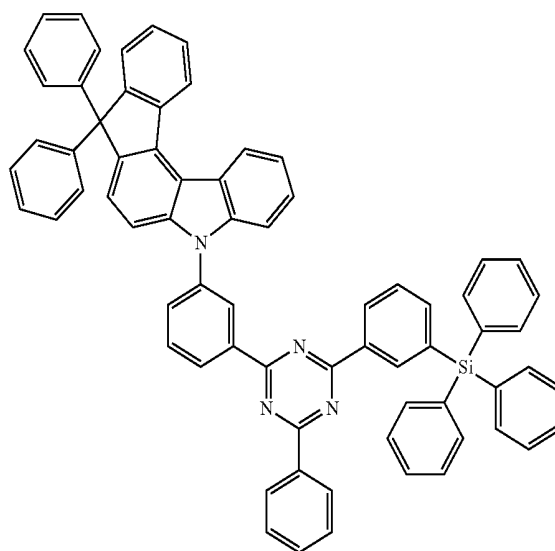
H2-452



H2-451

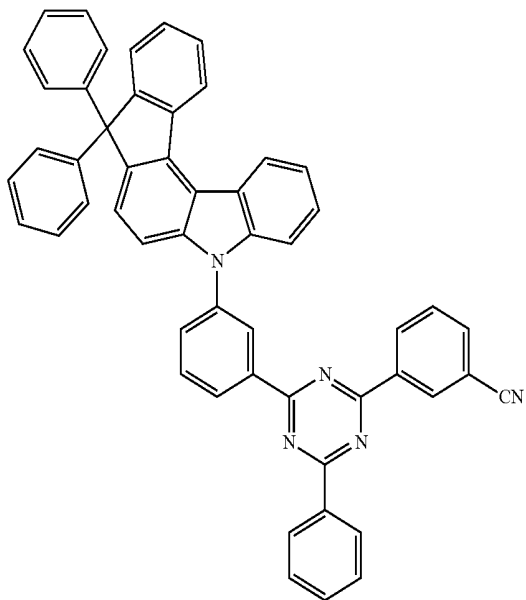


H2-453



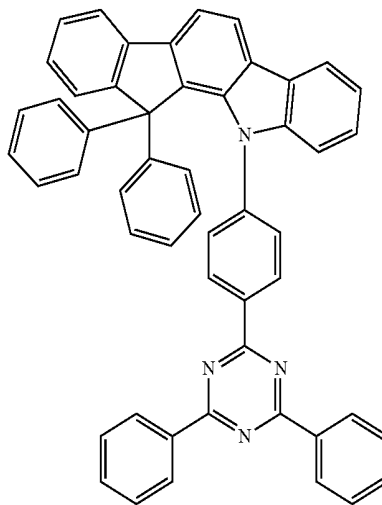
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H2-454



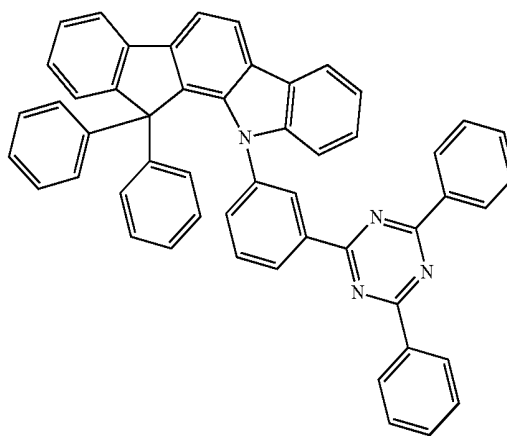
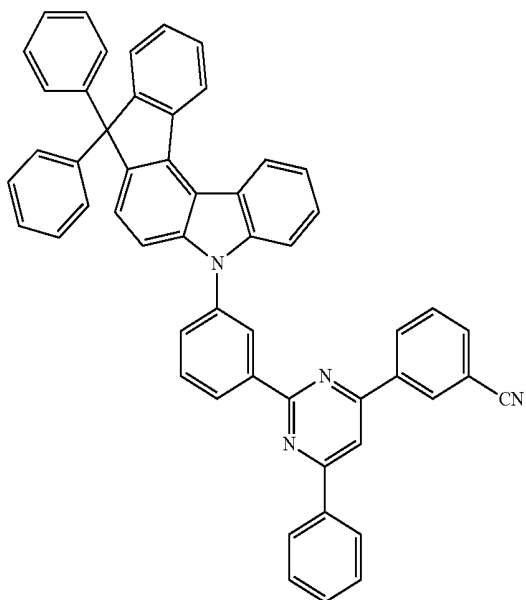
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H2-456

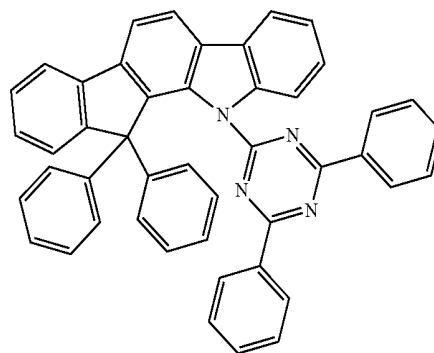


H2-457

H2-455

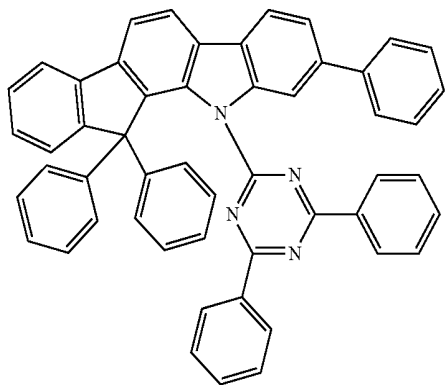


H2-458



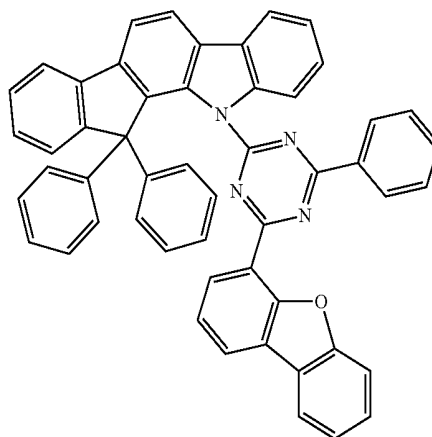
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H2-459

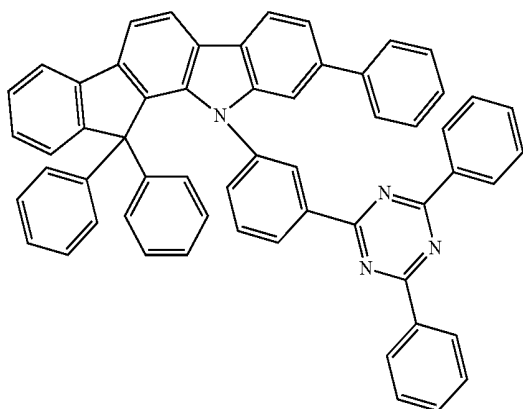


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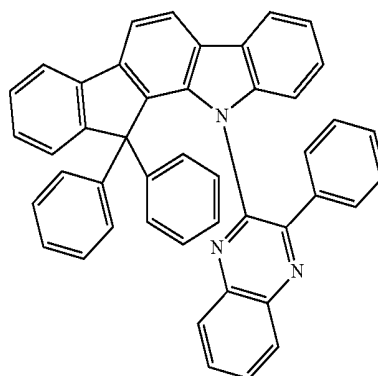
H2-262



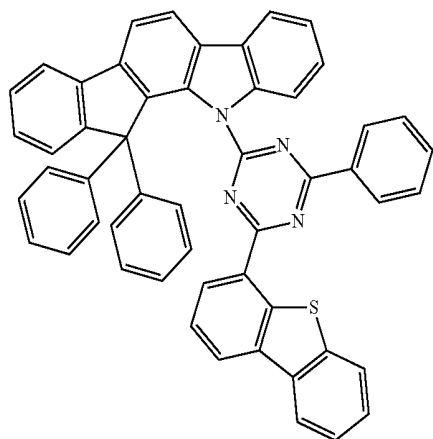
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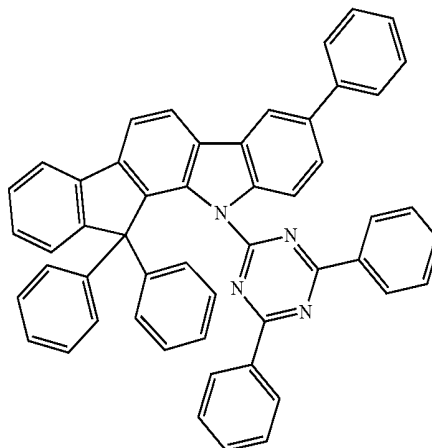
H2-263



H2-461

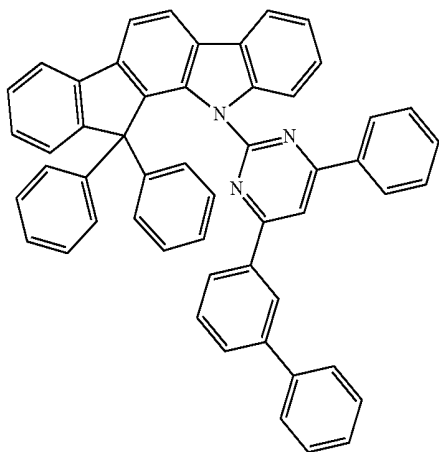


H2-264



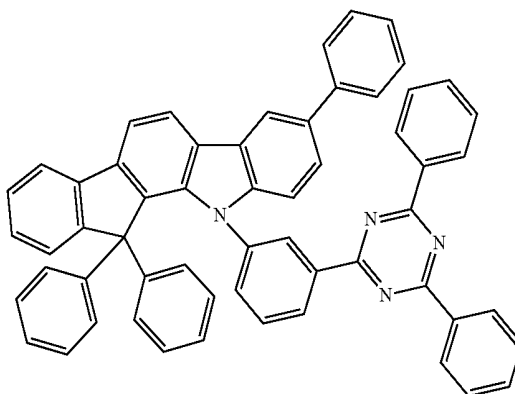
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H2-465

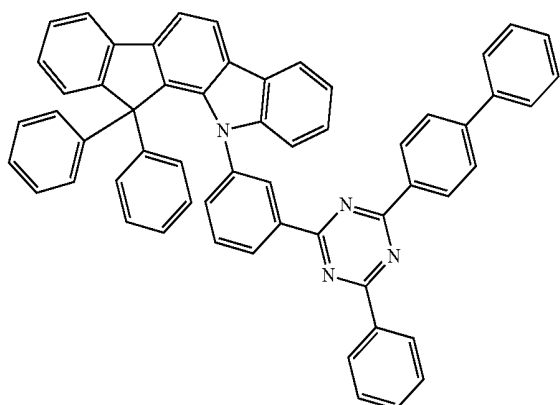


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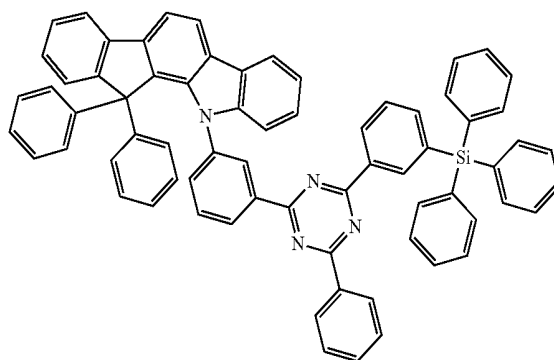
H2-468



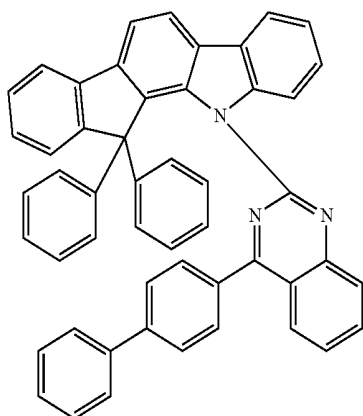
H2-466



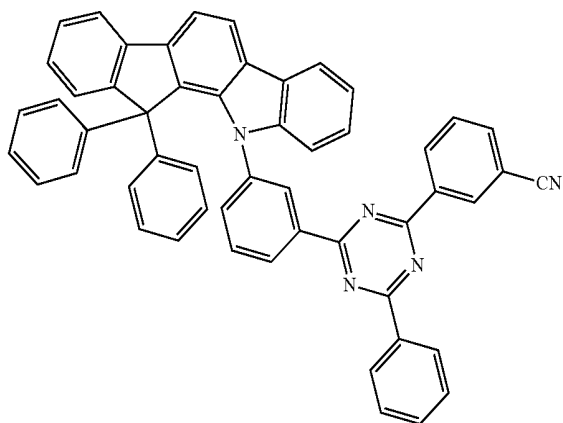
H2-469



H2-467

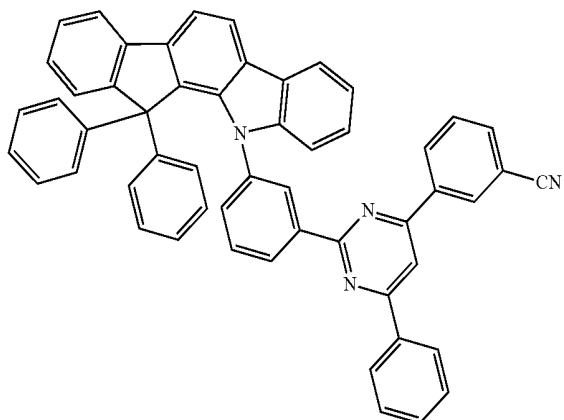


H2-470



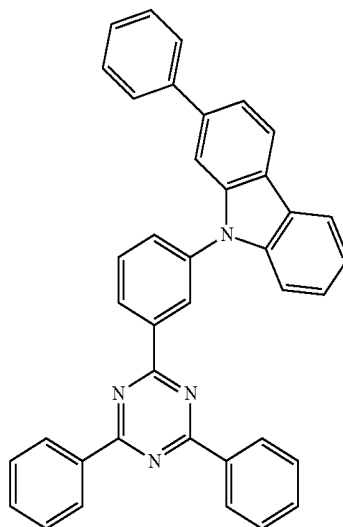
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H2-471



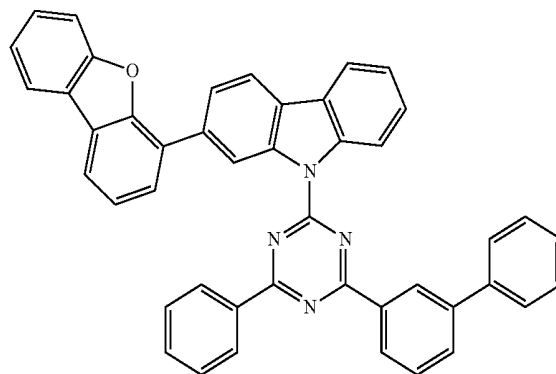
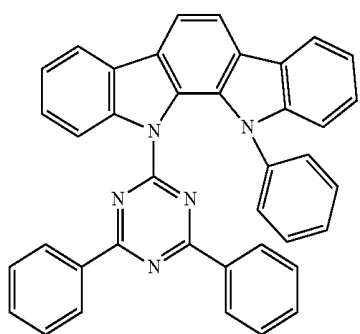
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H2-474



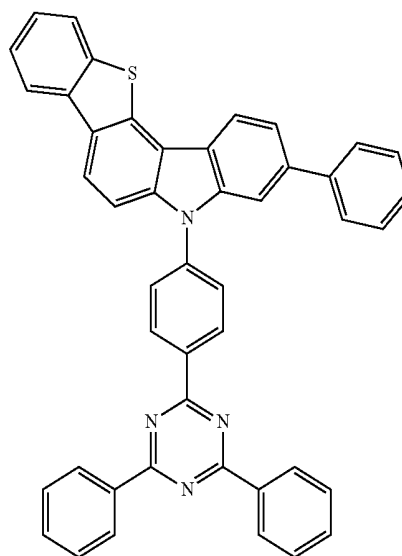
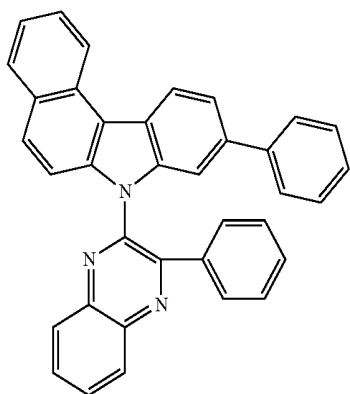
H2-475

H2-472



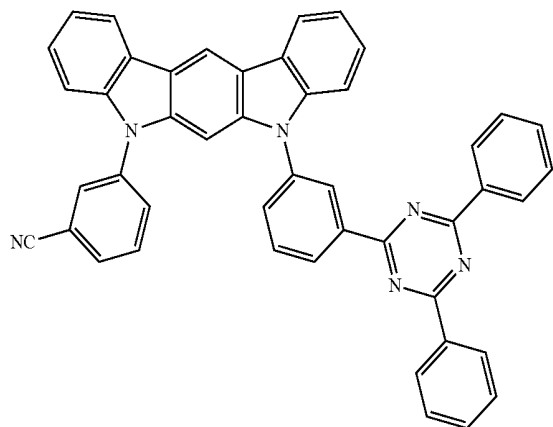
H2-473

H2-476



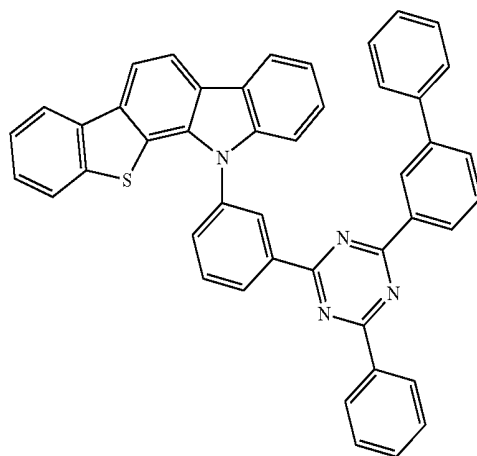
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H2-477

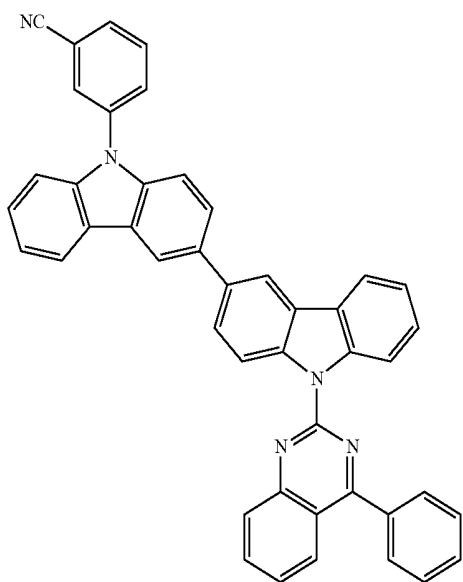


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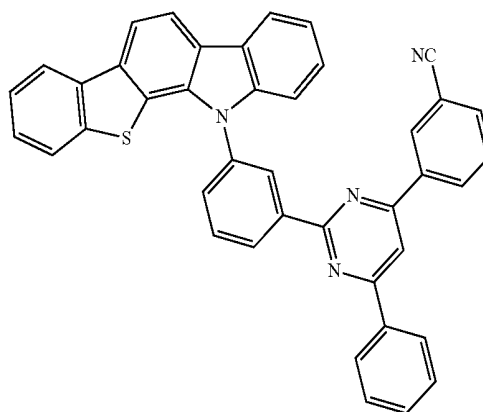
H2-480



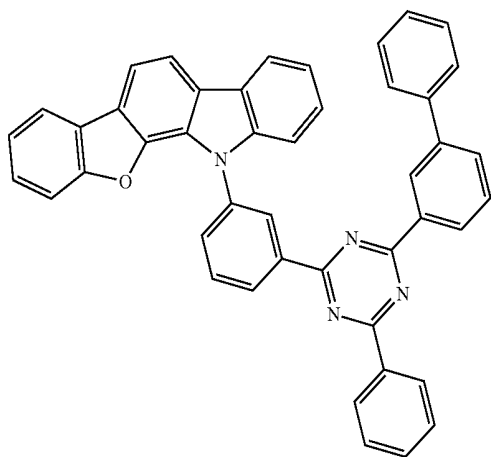
H2-478



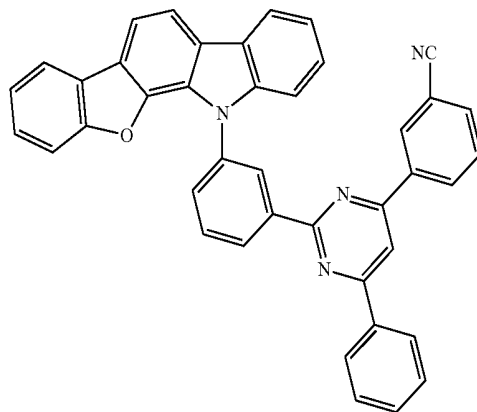
H2-481



H2-479

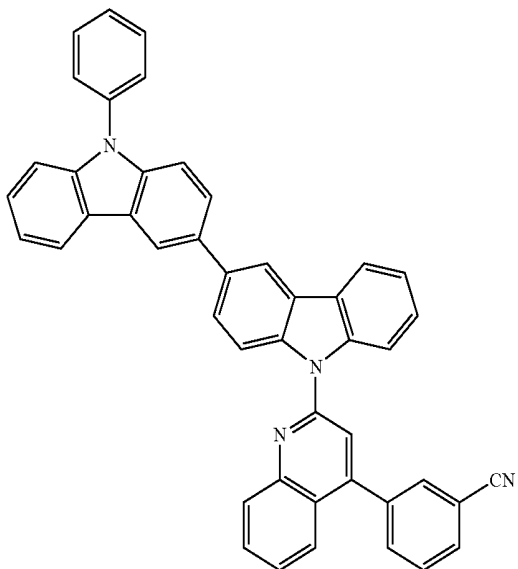


H2-482

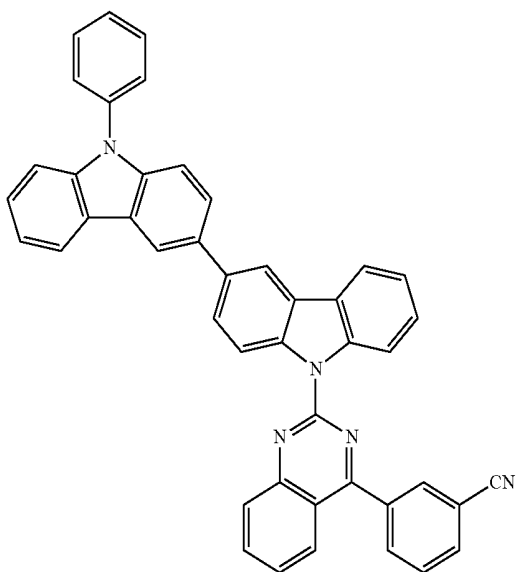


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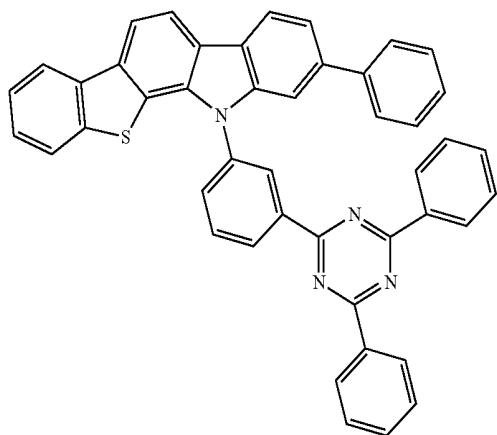
H2-483



H2-484

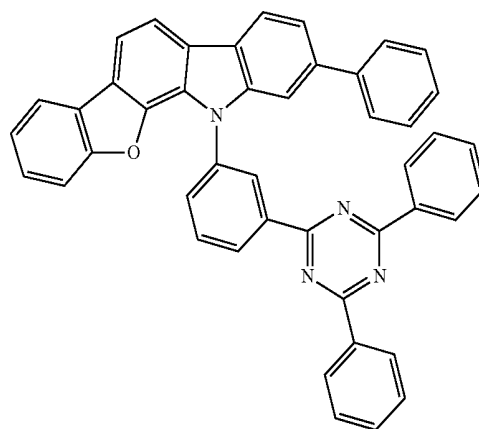


H2-485

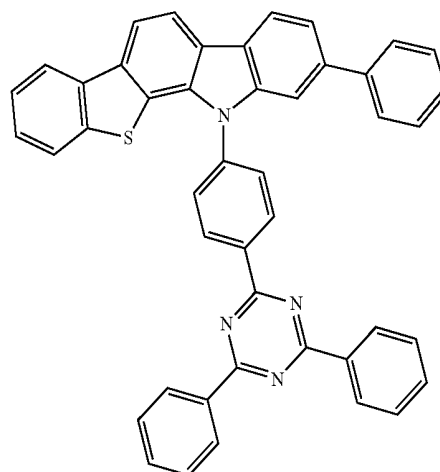


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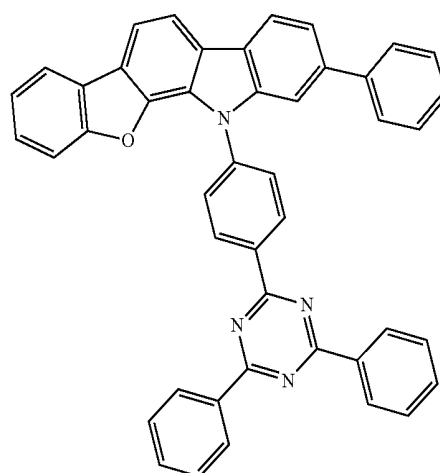
H2-486



H2-487

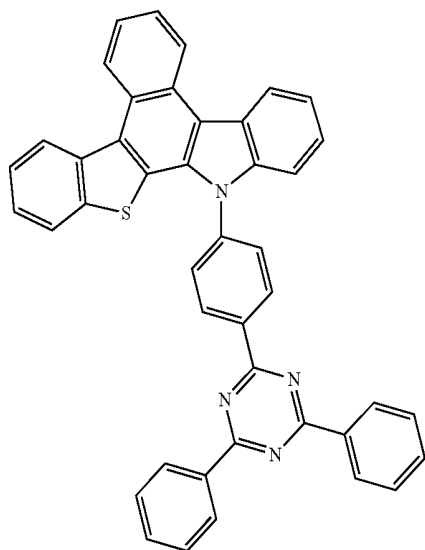


H2-488



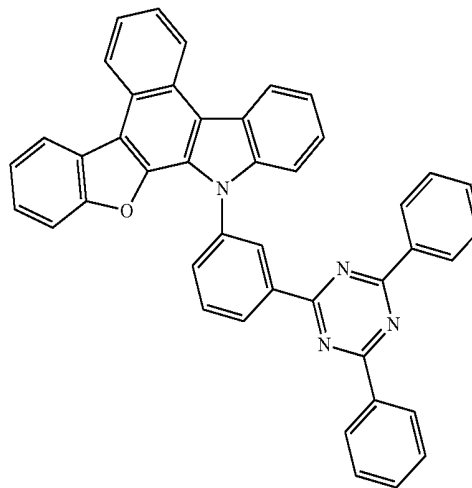
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H2-489

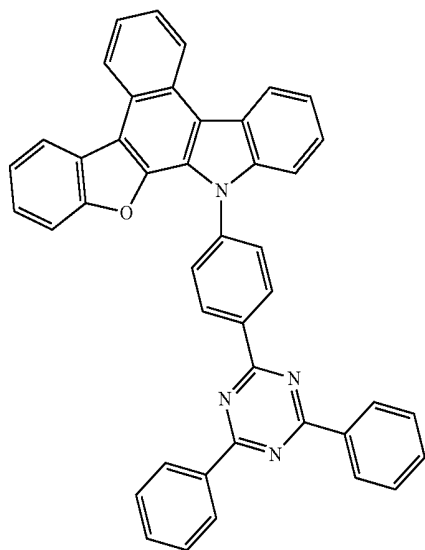


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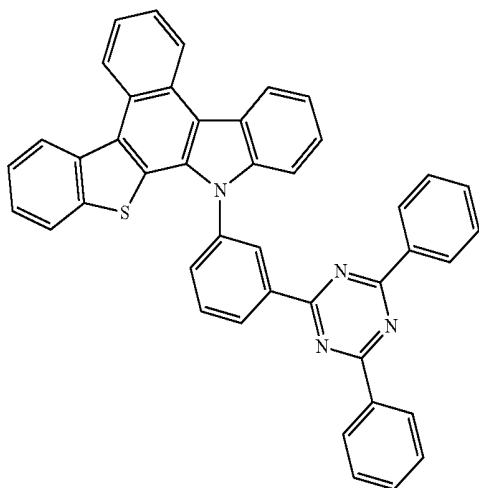
H2-492



H2-490



H2-491



[0039] The organic electroluminescent device according to the present invention comprises an anode; a cathode; and at least one organic layer between the anode and the cathode. The organic layer comprises a light-emitting layer, and the light-emitting layer comprises a host and a phosphorescent dopant. The host consists of multi-component host compounds, at least a first host compound of the multi-component host compounds is represented by formula 1, and a second host compound is represented by formula 2.

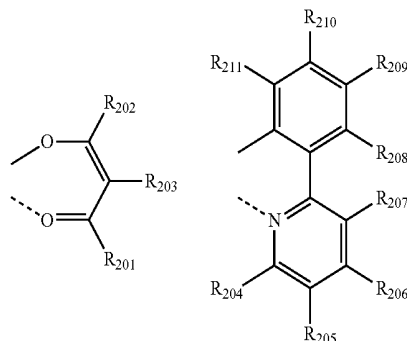
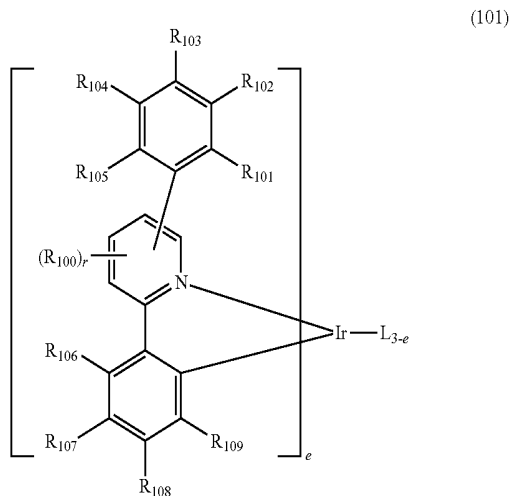
[0040] The light-emitting layer is a layer from which light is emitted, and can be a single layer or a multi layer of which two or more layers are stacked. In the light-emitting layer, it is preferable that the doping concentration of the dopant compound based on the host compound is less than 20 wt %.

[0041] The organic layer comprises a light-emitting layer, and may further comprise at least one layer selected from the group consisting of a hole injection layer, a hole transport layer, an electron transport layer, an electron injection layer, an interlayer, a hole blocking layer, and an electron blocking layer.

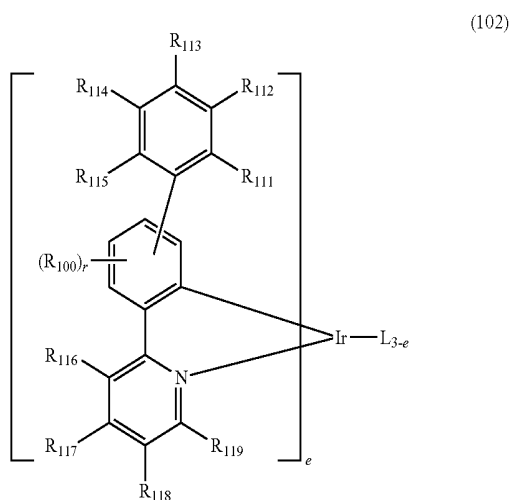
[0042] According to the organic electroluminescent device of the present invention, the weight ratio of the first host material to the second host material is in the range of 1:99 to 99:1. The dopant is preferably at least one phosphorescent dopant. The dopant materials applied to the organic electroluminescent device according to the present invention are not limited, but may be preferably selected from metalated complex compounds of iridium, osmium, copper and platinum, more preferably selected from ortho-metallated complex compounds of iridium, osmium, copper and platinum, and even more preferably ortho-metallated iridium complex compounds.

[0043] The phosphorescent dopant is preferably selected from compounds represented by the following formulae 101 to 103.

[0044] wherein L is selected from the following structures:

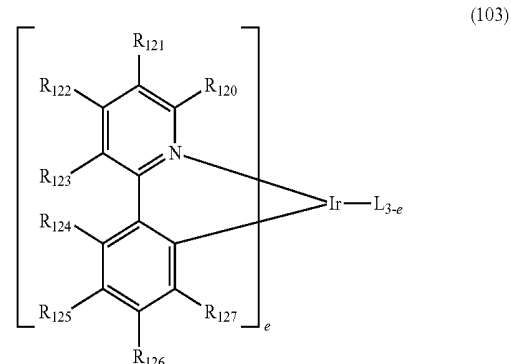


[0045]  $R_{100}$  represents hydrogen, a substituted or unsubstituted (C1-C30)alkyl, or a substituted or unsubstituted (C3-C30)cycloalkyl;



[0046]  $R_{101}$  to  $R_{109}$ , and  $R_{111}$  to  $R_{123}$  each independently represent hydrogen, deuterium, a halogen, a (C1-C30)alkyl unsubstituted or substituted with deuterium or a halogen(s), a cyano, a substituted or unsubstituted (C1-C30)alkoxy, a substituted or unsubstituted (C6-C30)aryl, or a substituted or unsubstituted (C3-C30)cycloalkyl; adjacent substituents of  $R_{106}$  to  $R_{109}$  may be linked to each other to form a substituted or unsubstituted fused ring, e.g., fluorene unsubstituted or substituted with alkyl, dibenzothiophene unsubstituted or substituted with alkyl, or dibenzofuran unsubstituted or substituted with alkyl; and adjacent substituents of  $R_{120}$  to  $R_{123}$  may be linked to each other to form a substituted or unsubstituted fused ring, e.g., quinoline unsubstituted or substituted with halogen, alkyl, or aryl;

[0047]  $R_{124}$  to  $R_{127}$  each independently represent hydrogen, deuterium, a halogen, a substituted or unsubstituted (C1-C30)alkyl, or a substituted or unsubstituted (C6-C30)aryl; and adjacent substituents of  $R_{124}$  to  $R_{127}$  may be linked to each other to form a substituted or unsubstituted fused ring, e.g., fluorene unsubstituted or substituted with alkyl, dibenzothiophene unsubstituted or substituted with alkyl, or dibenzofuran unsubstituted or substituted with alkyl;



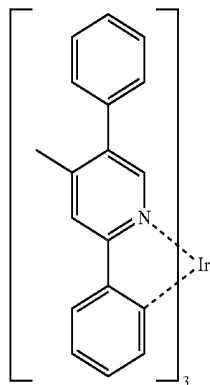
[0048]  $R_{201}$  to  $R_{211}$  each independently represent hydrogen, deuterium, a halogen, a (C1-C30)alkyl unsubstituted or substituted with deuterium or a halogen(s), a substituted or unsubstituted (C3-C30)cycloalkyl, or a substituted or unsubstituted (C6-C30)aryl; and adjacent substituents of  $R_{205}$  to  $R_{211}$  may be linked to each other to form a substituted or unsubstituted fused ring, e.g., fluorene unsubstituted or substituted with alkyl, dibenzothiophene unsubstituted or substituted with alkyl, or dibenzofuran unsubstituted or substituted with alkyl;

[0049]  $r$  and  $s$  each independently represent an integer of 1 to 3; where  $r$  or  $s$  is an integer of 2 or more, each of  $R_{100}$  may be the same or different; and

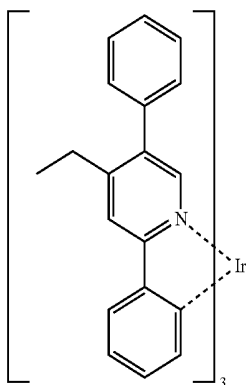
[0050]  $e$  represents an integer of 1 to 3.

[0051] Specifically, the phosphorescent dopant materials include the following:

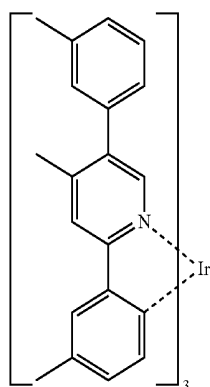
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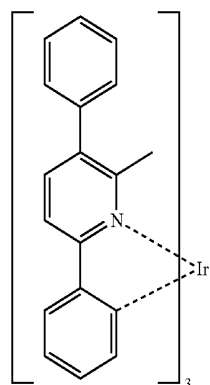
D-1



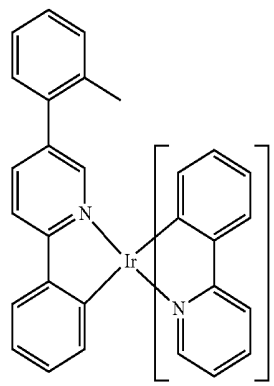
D-2



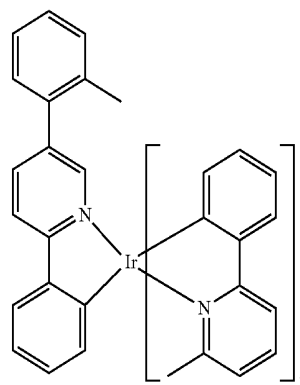
D-3



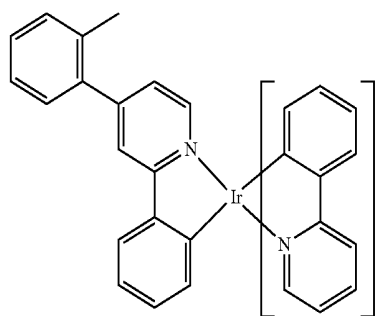
D-4



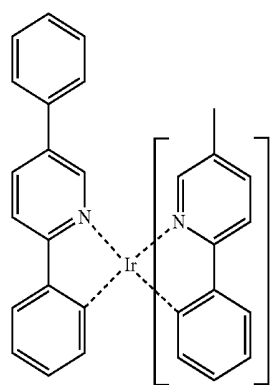
D-5



D-6

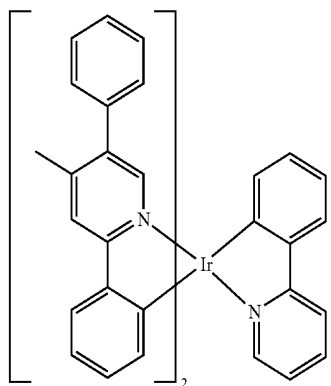


D-7



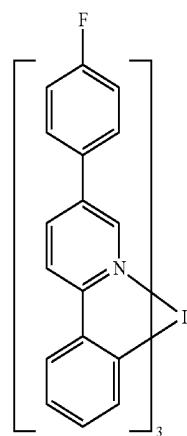
D-8

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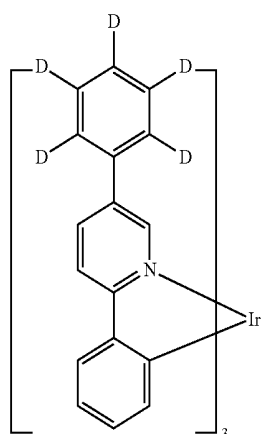


D-9

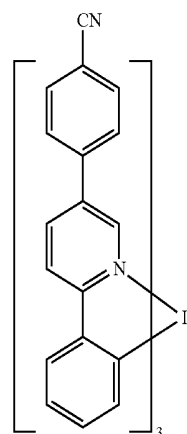
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D-12

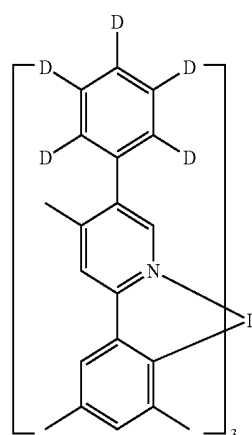


D-10

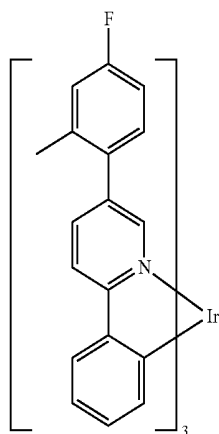


D-13

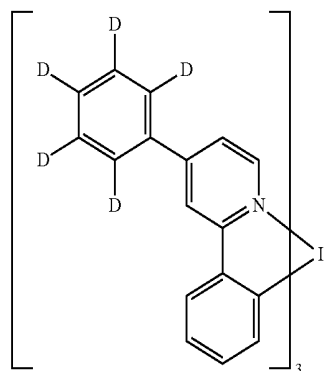
D-11



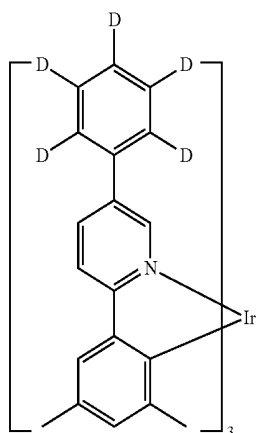
D-14



D-15

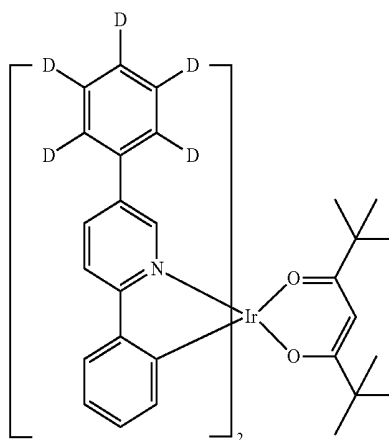


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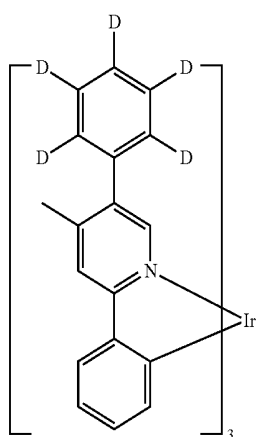


D-16

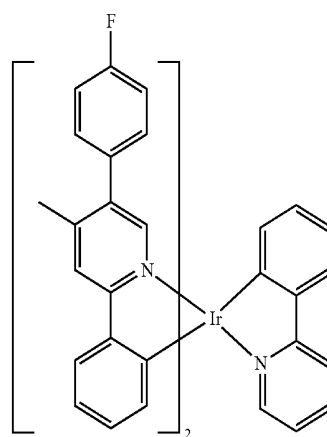
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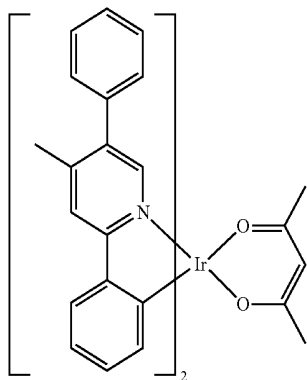
D-19



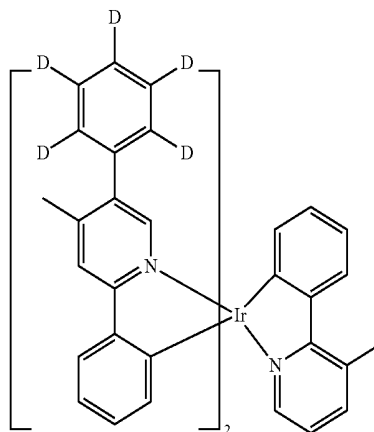
D-17



D-20

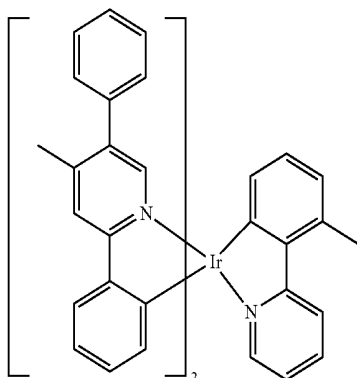


D-18



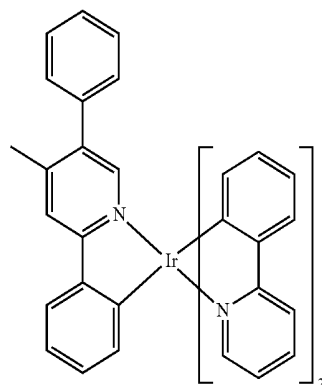
D-21

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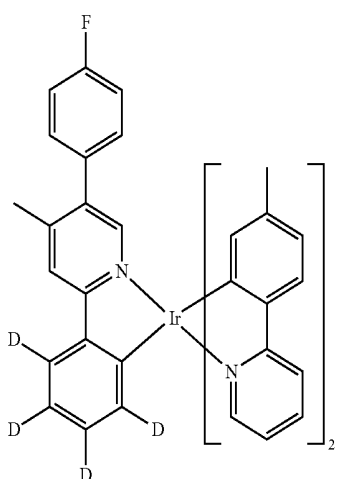


D-22

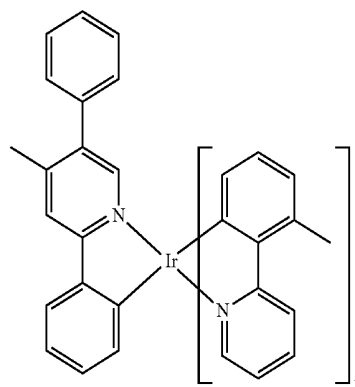
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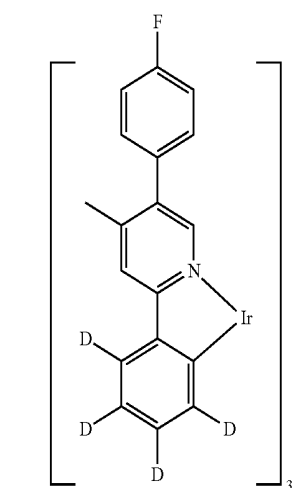
D-25



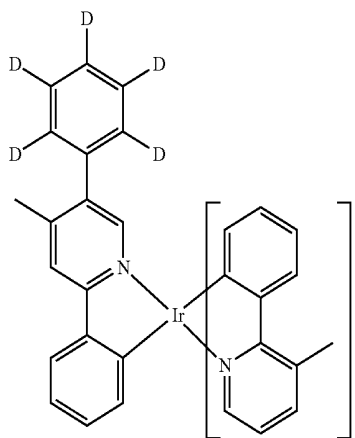
D-23



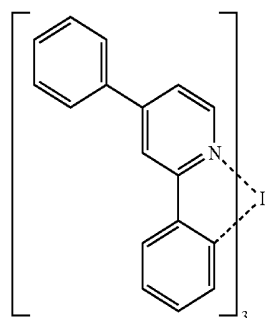
D-26



D-24

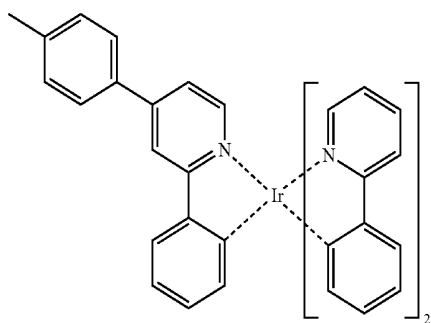


D-27



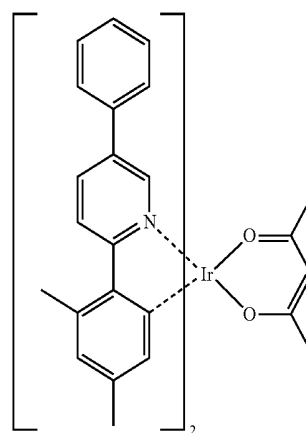
D-28

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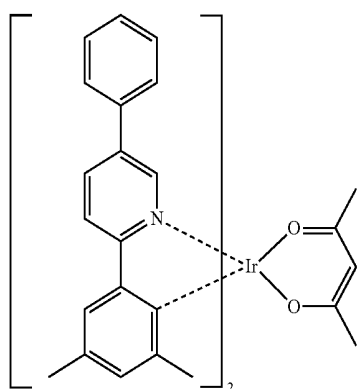
D-29

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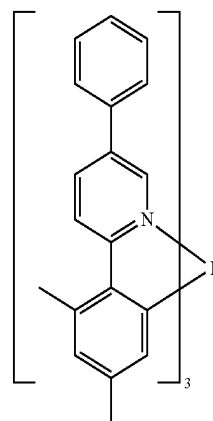


D-30

D-33

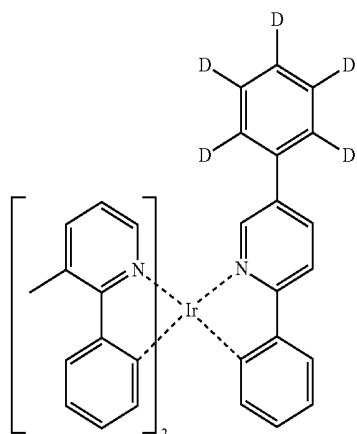


D-31

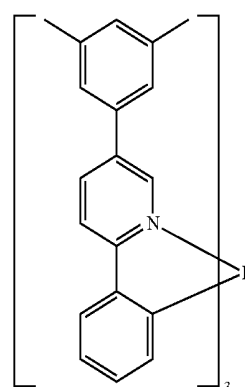


D-32

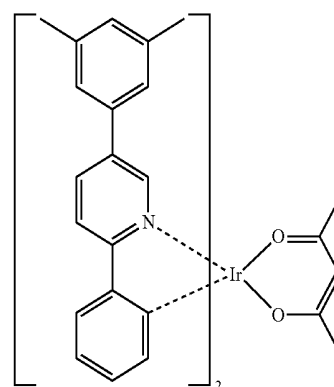
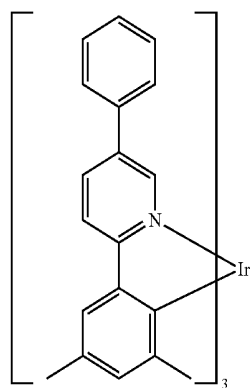
D-34



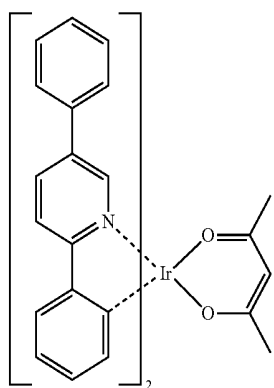
D-35



D-36

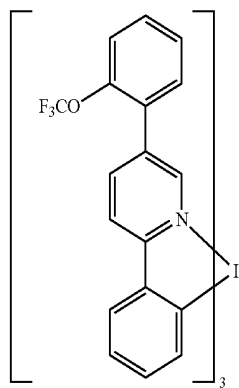


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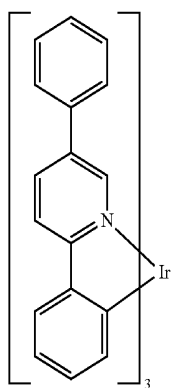


D-37

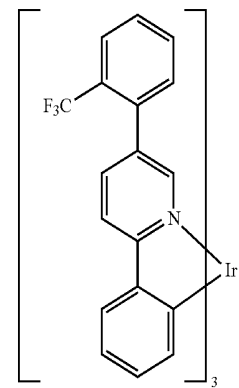
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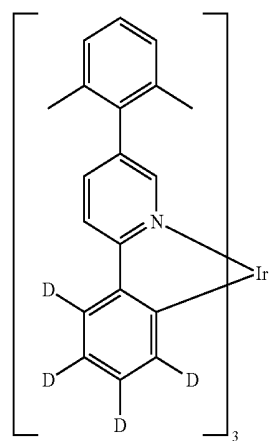
D-41



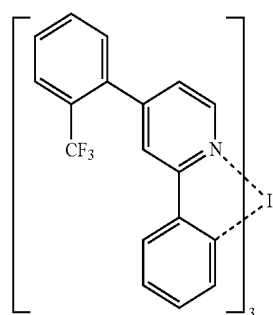
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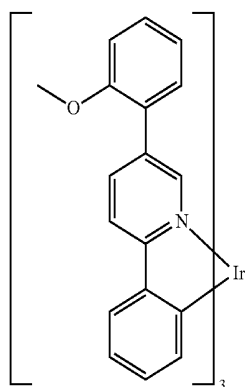
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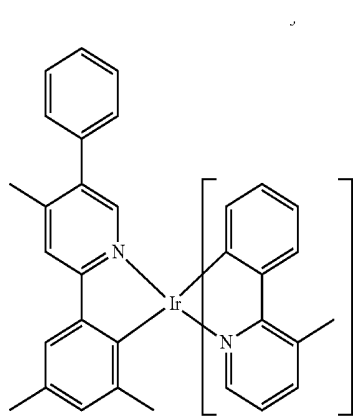
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D-43

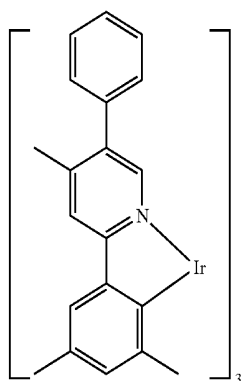


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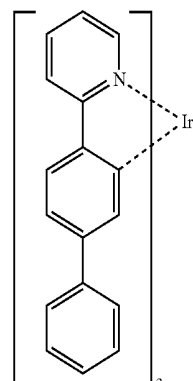
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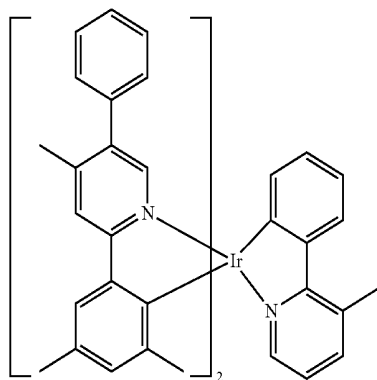


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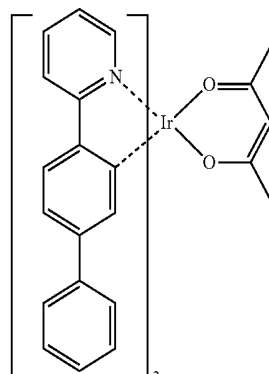
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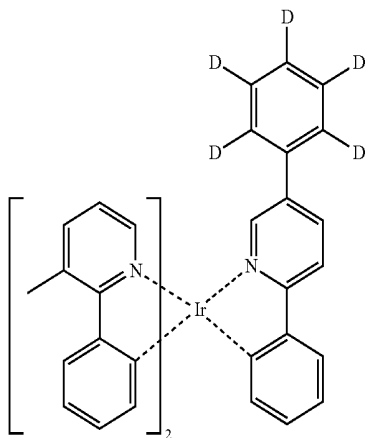
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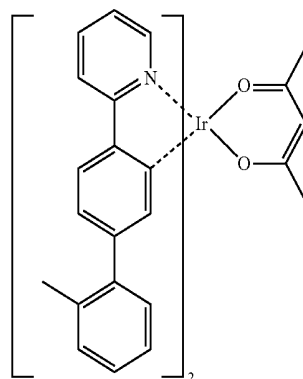
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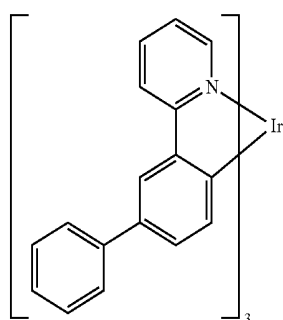
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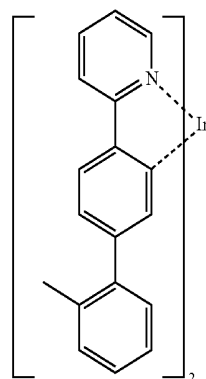
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D-51

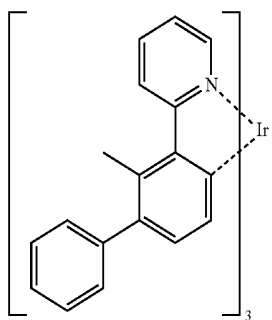


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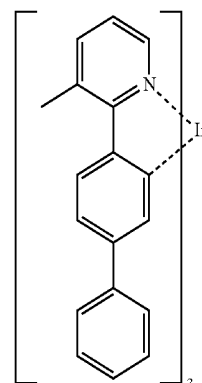
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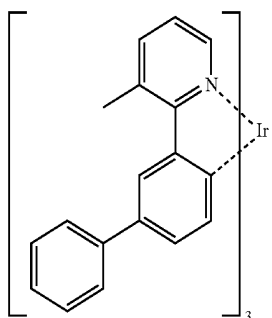


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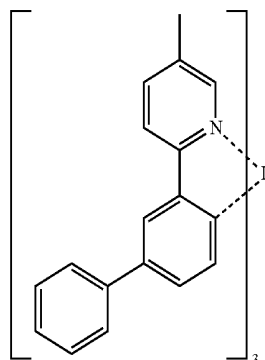
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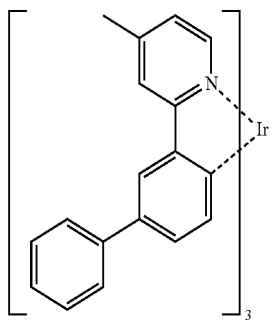
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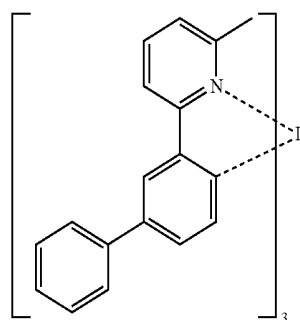
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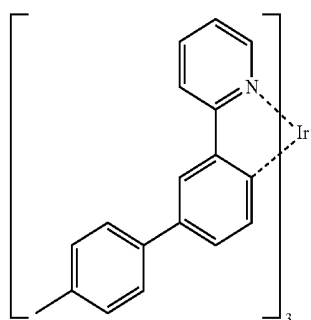
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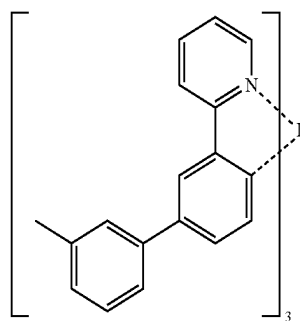
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D-59

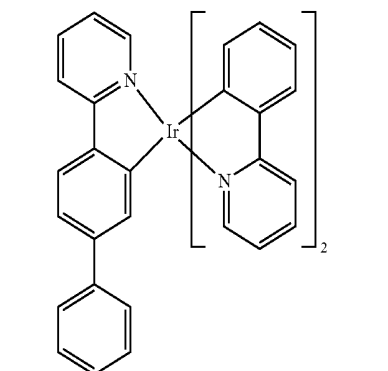


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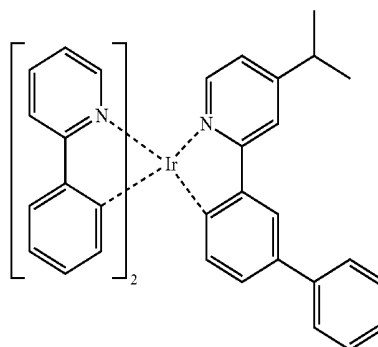
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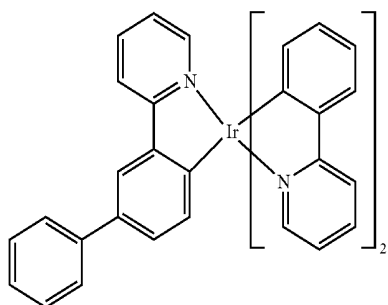


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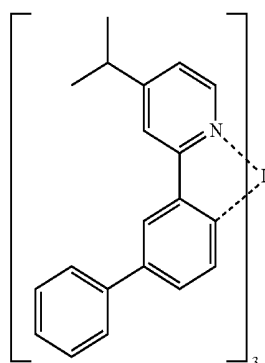
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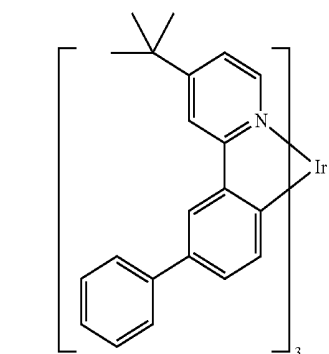
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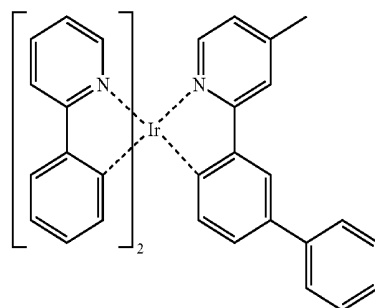
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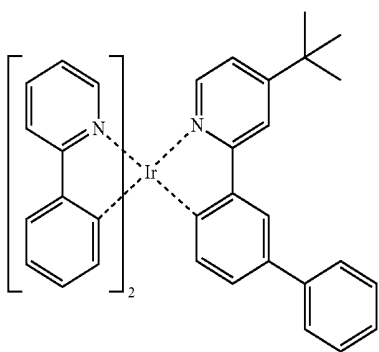
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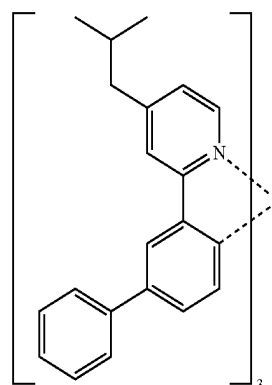
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D-67

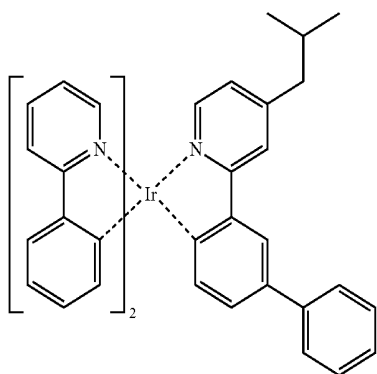


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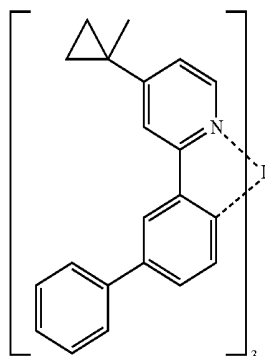
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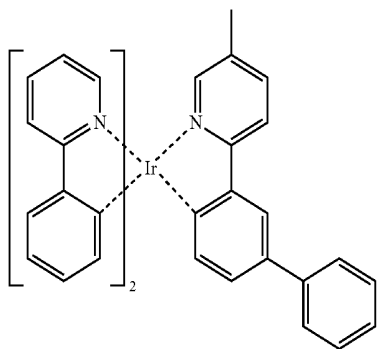


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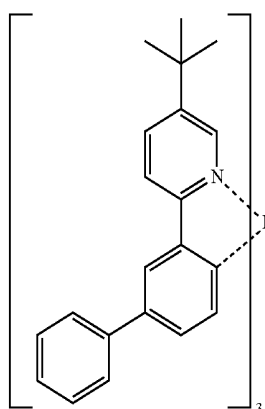
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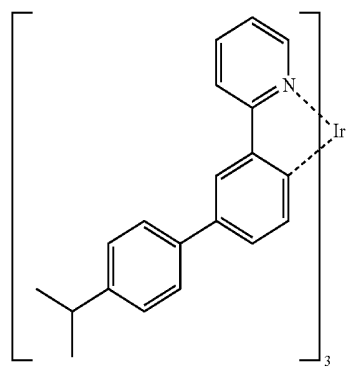
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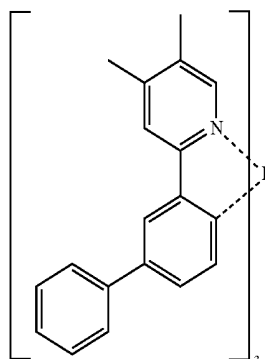
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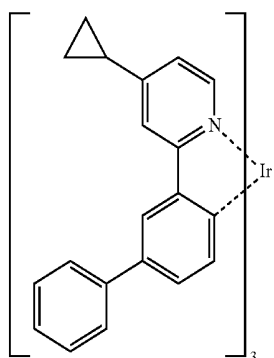
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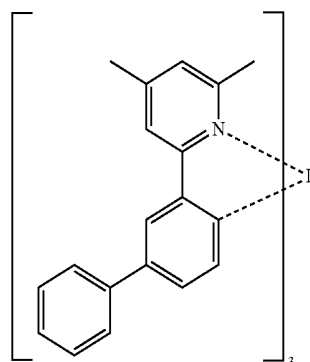
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D-75

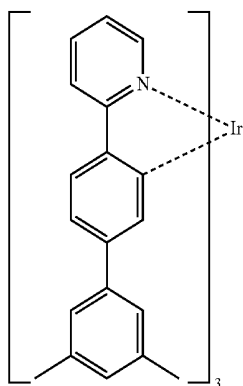


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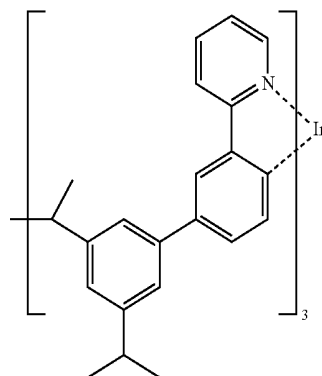
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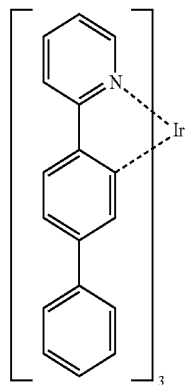


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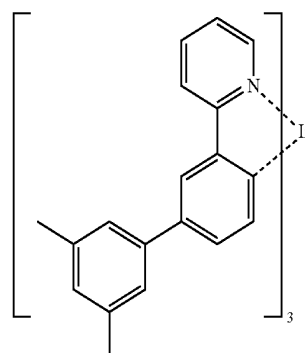
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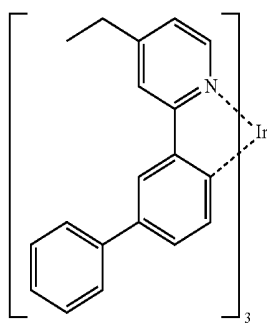
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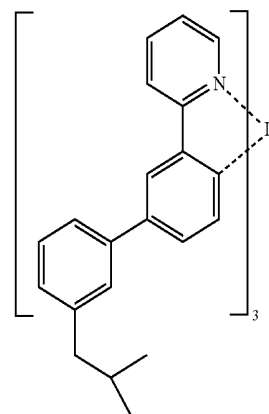
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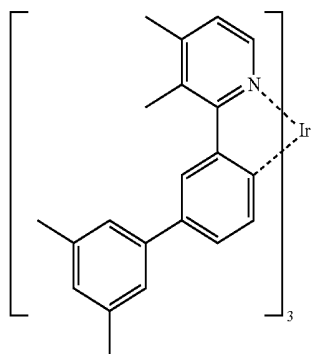
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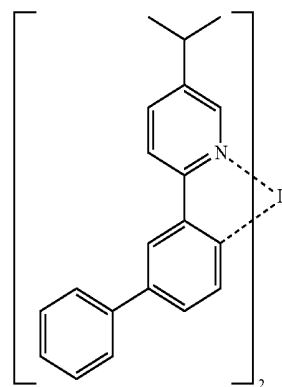
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D-83

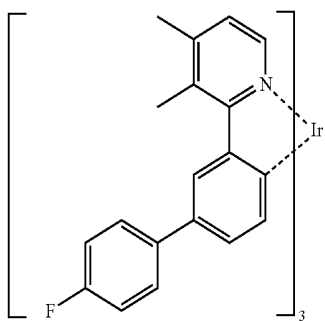


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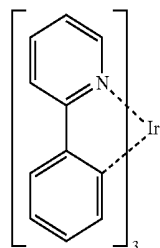


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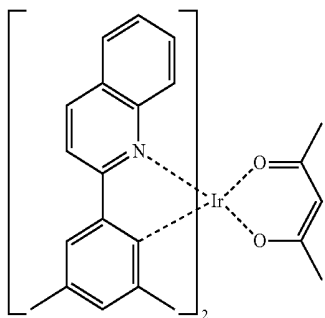
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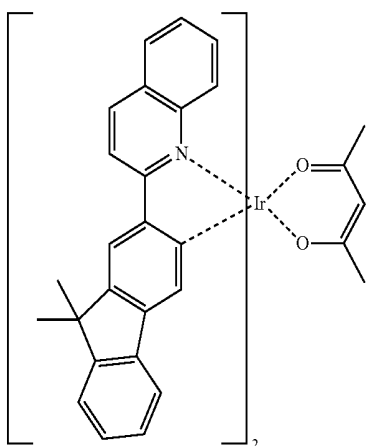
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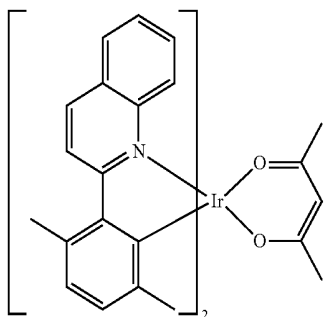
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D-87

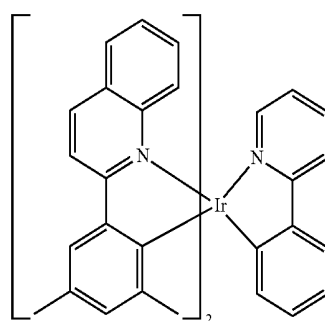


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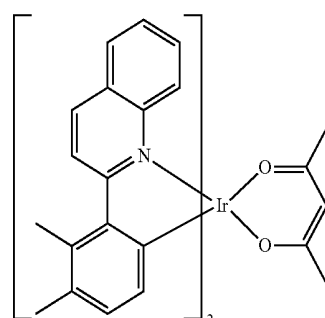


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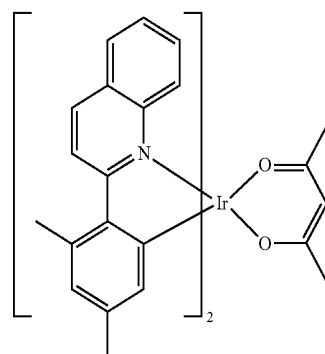
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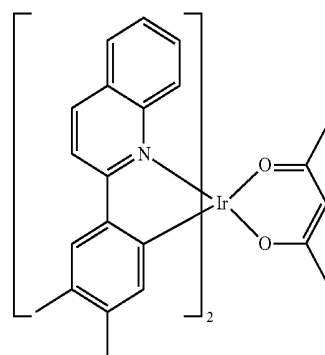
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D-91

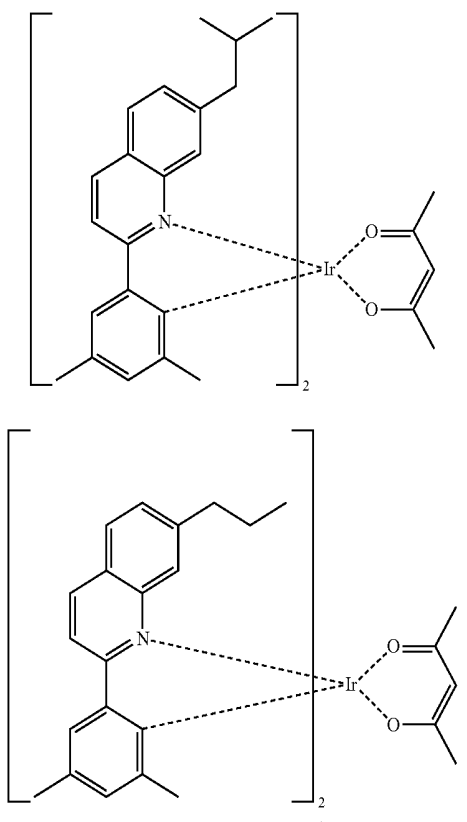


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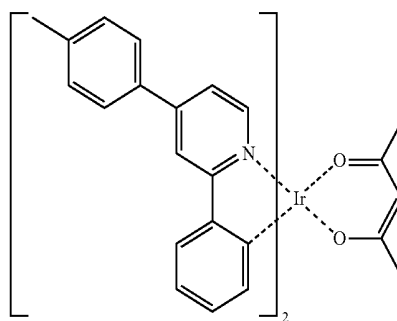
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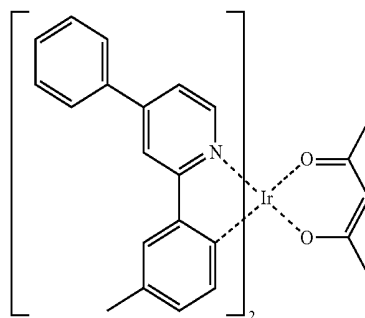
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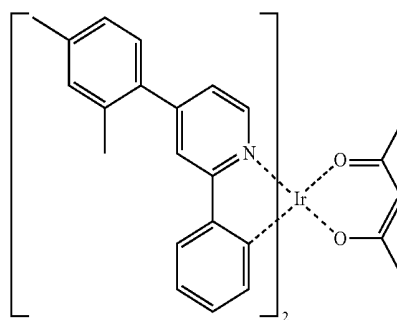
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D-95



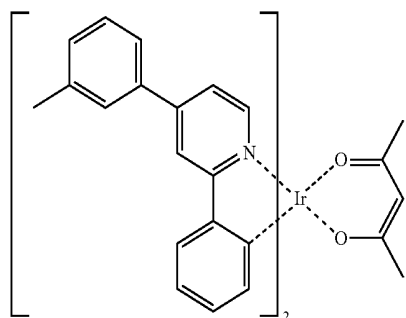
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D-96

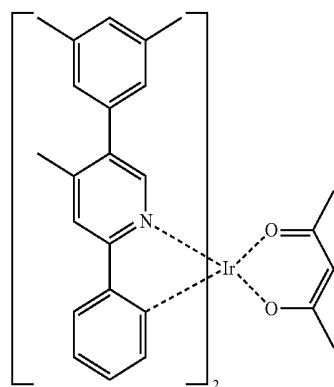


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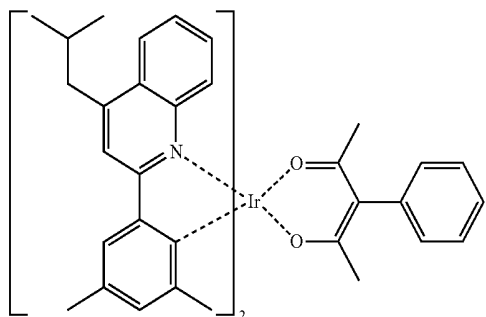
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D-101

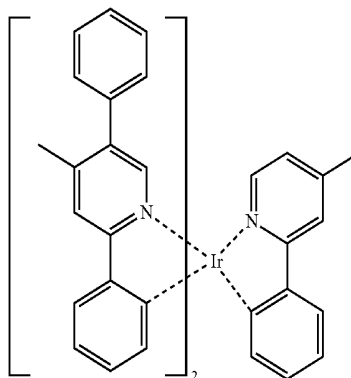


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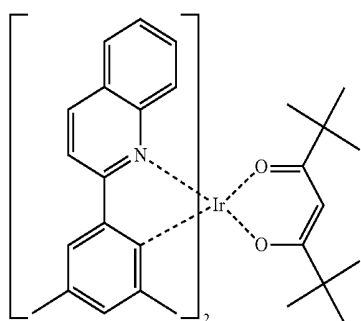


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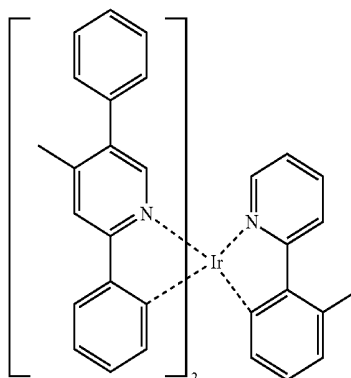
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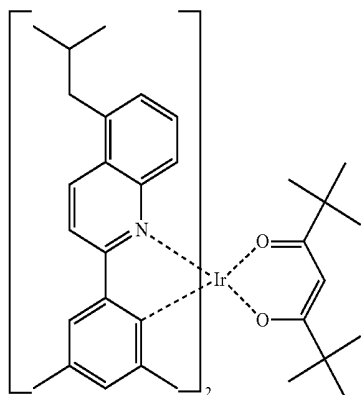
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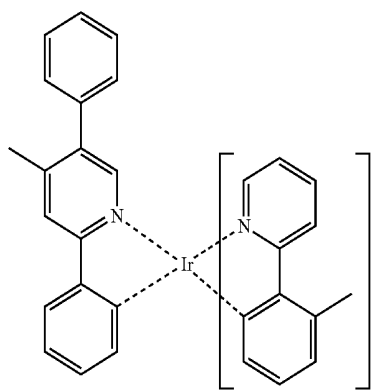
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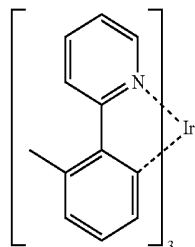
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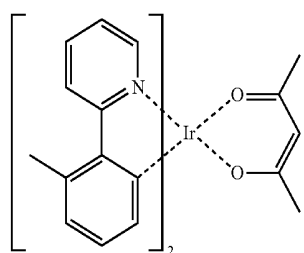
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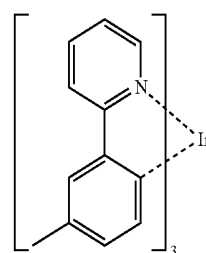
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D-105

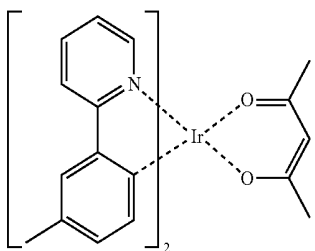


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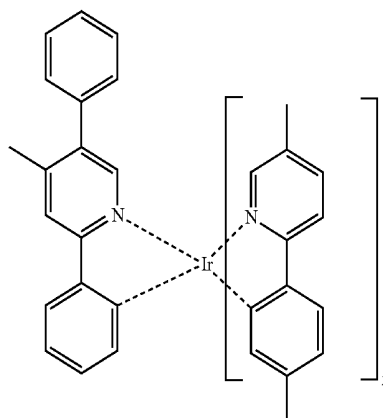
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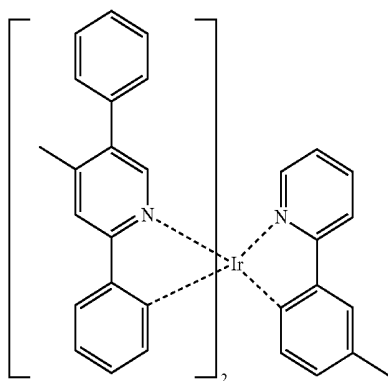
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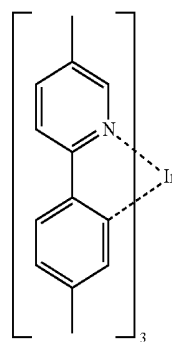


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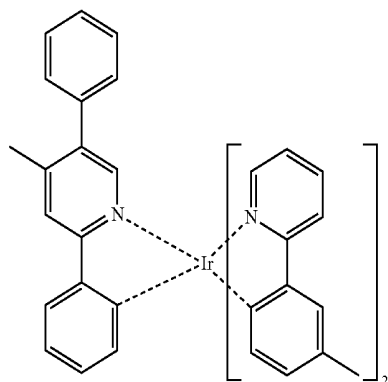
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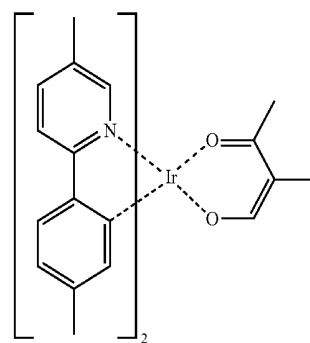
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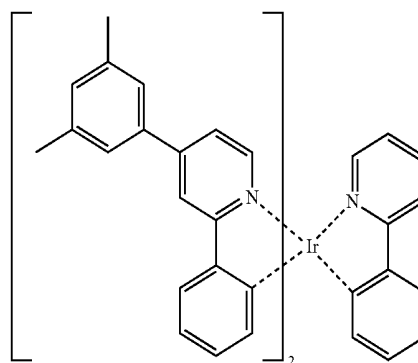
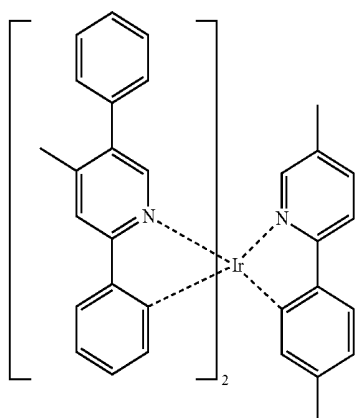
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D-114

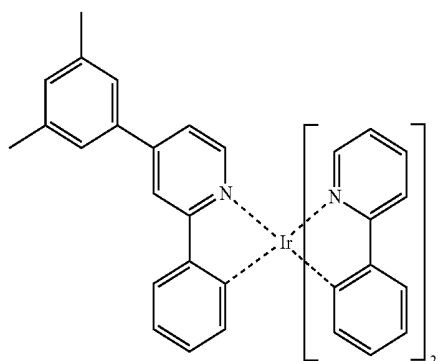


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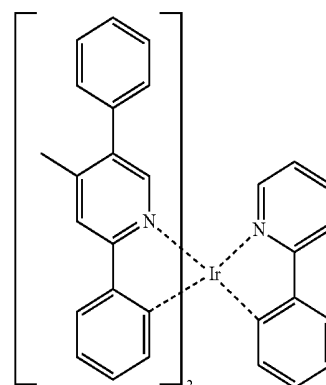


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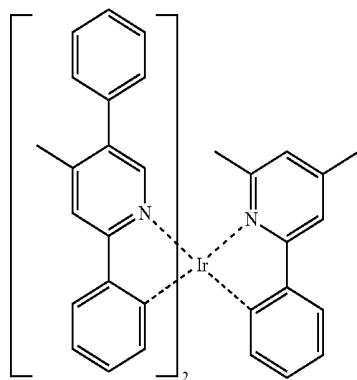
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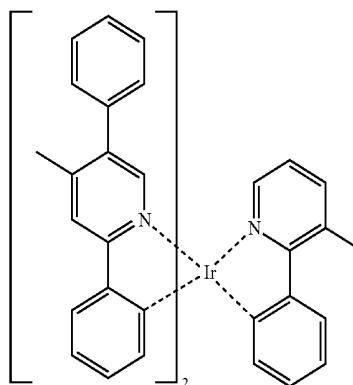
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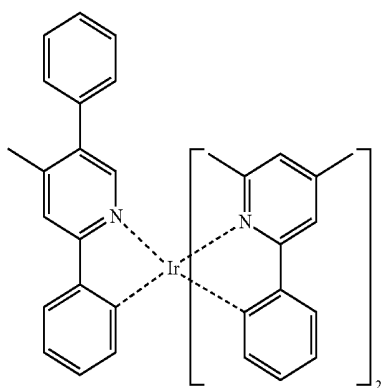
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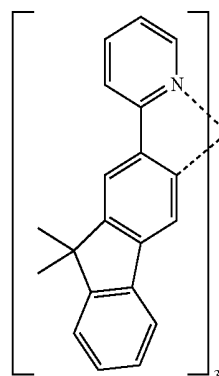
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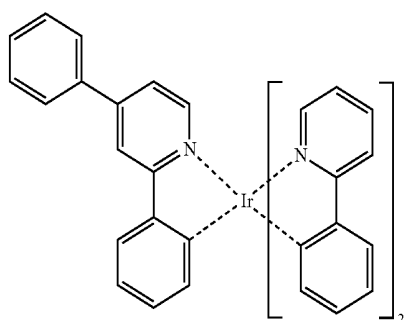
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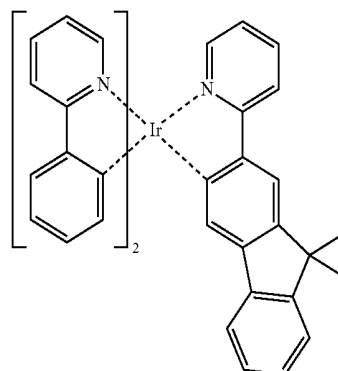
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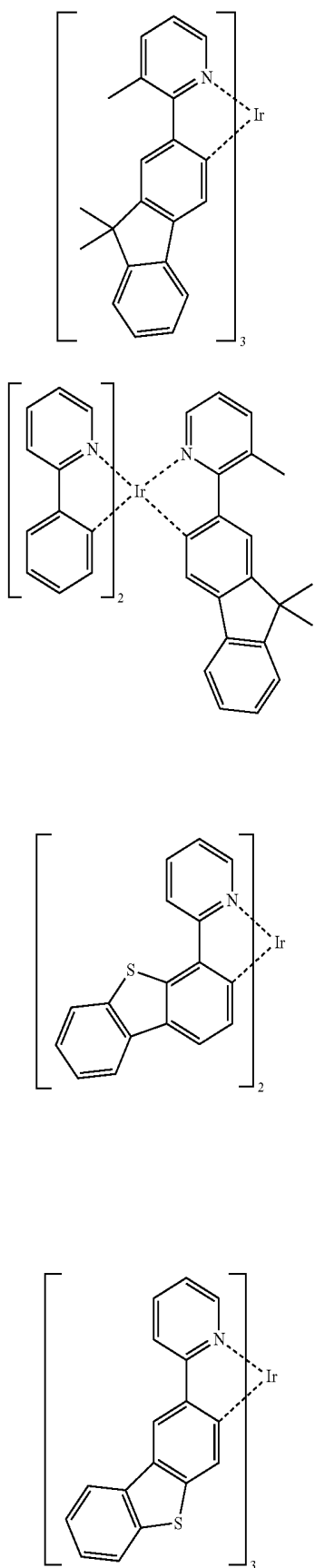
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D-126

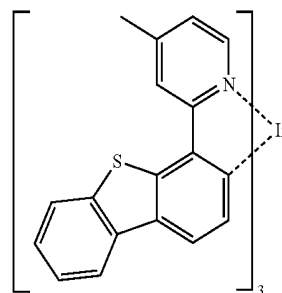


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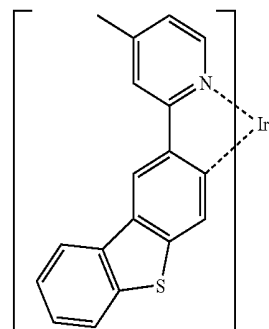
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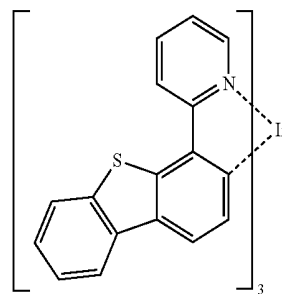
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D-128



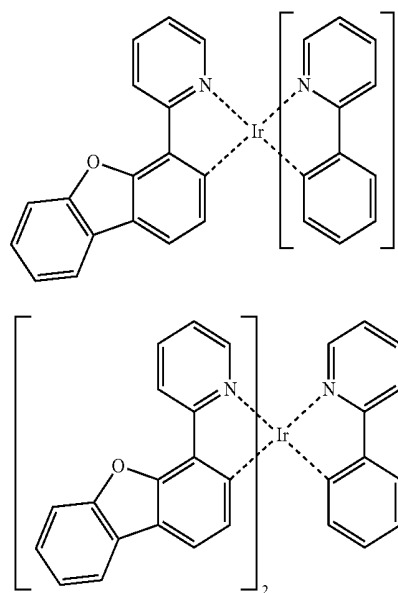
D-132

D-129



D-133

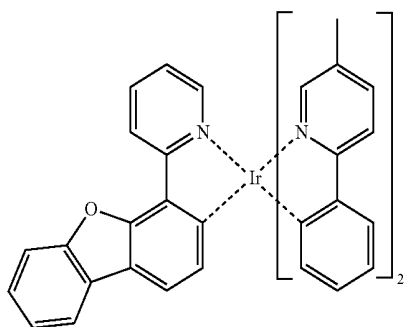
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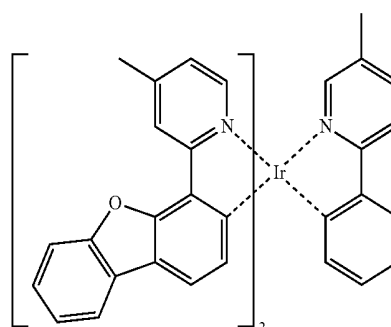
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D-135

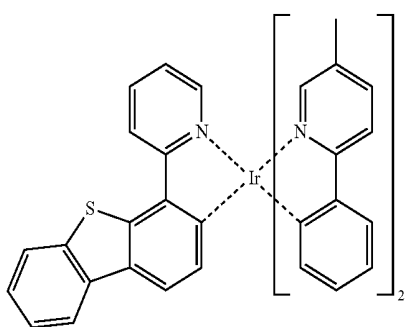
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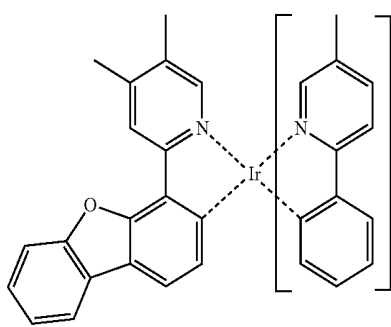
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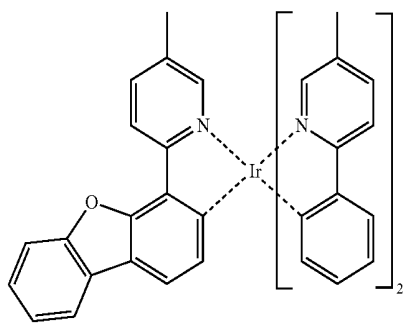
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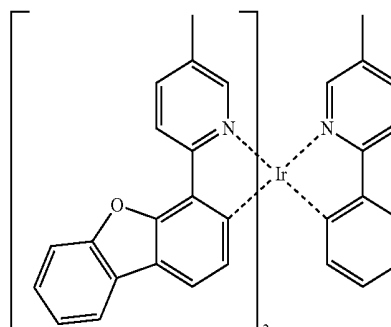
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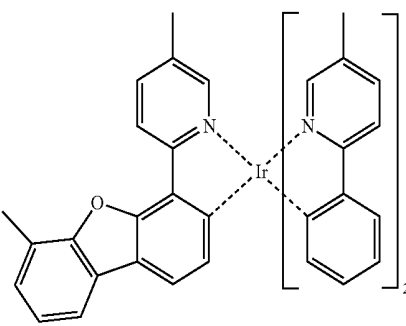
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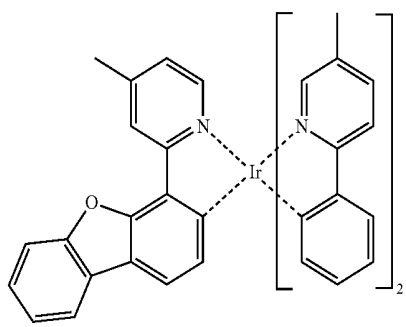
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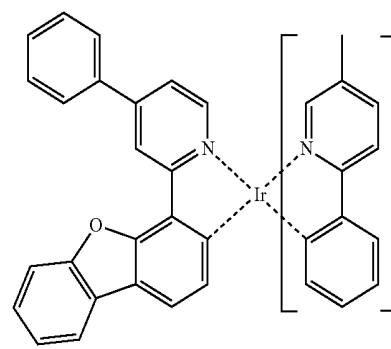
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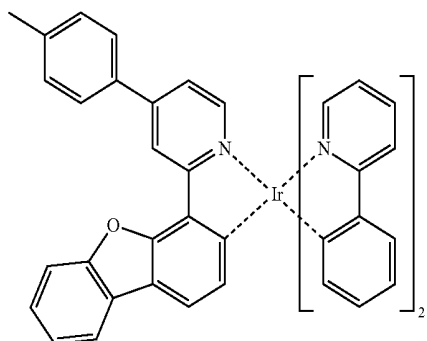
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D-144

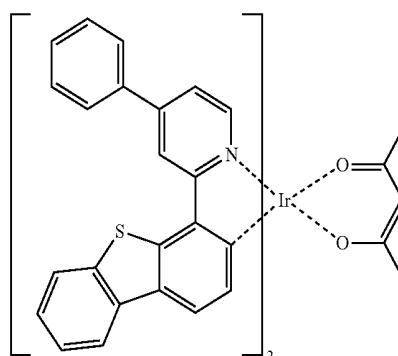


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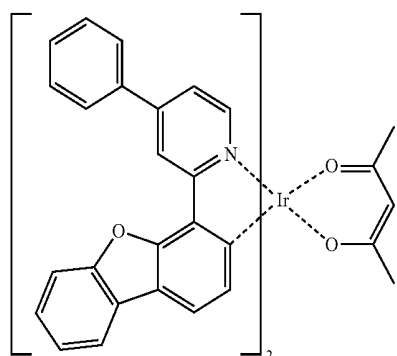


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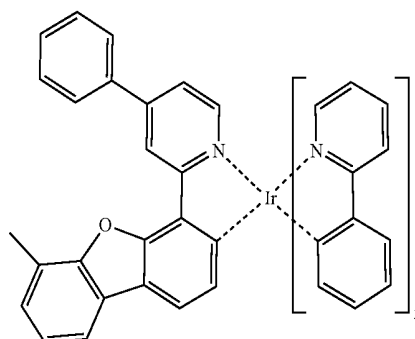


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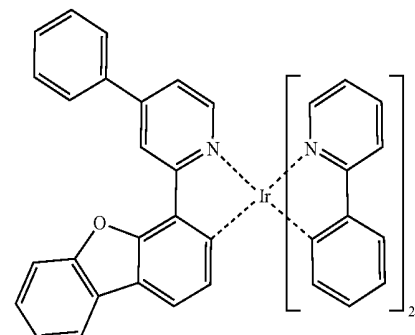
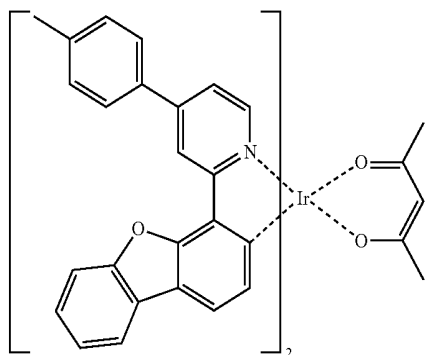
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D-150



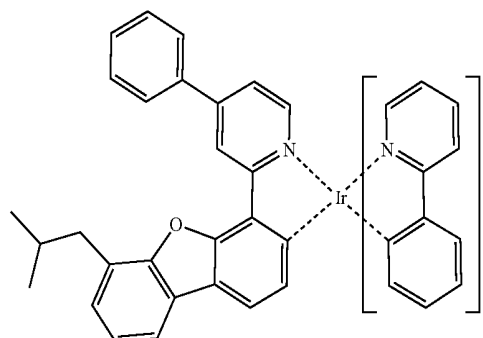
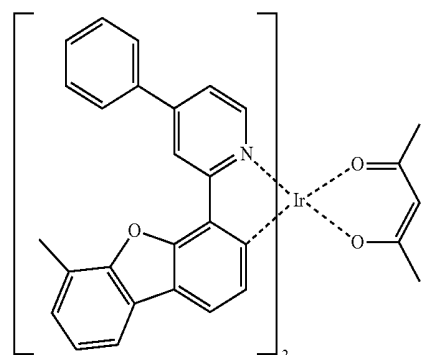
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D-151

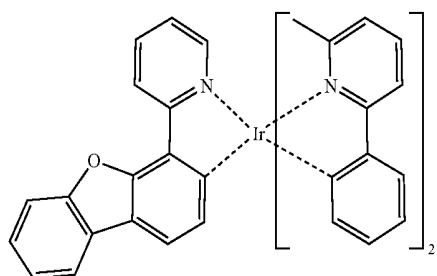


D-148

D-152

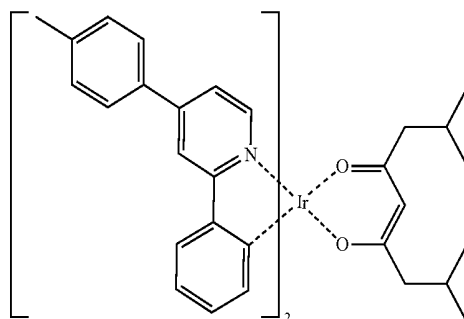


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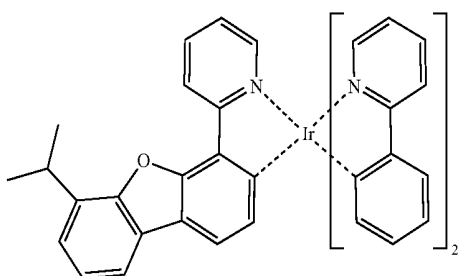
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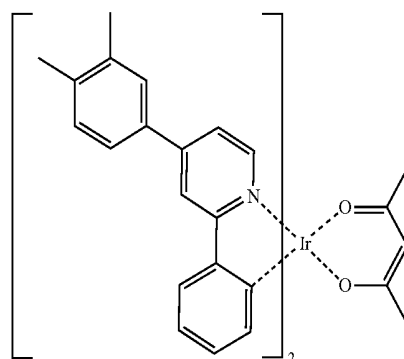


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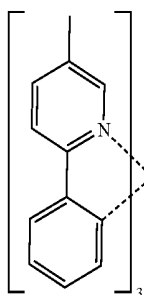
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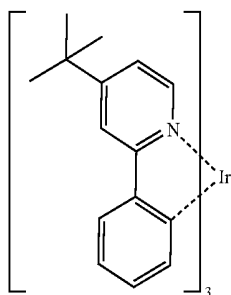
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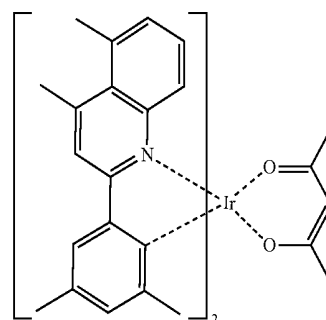
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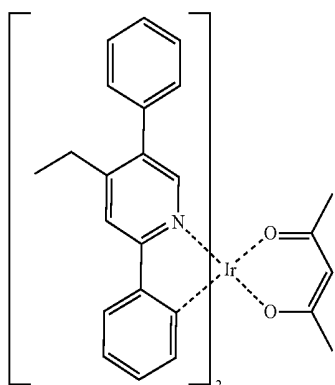
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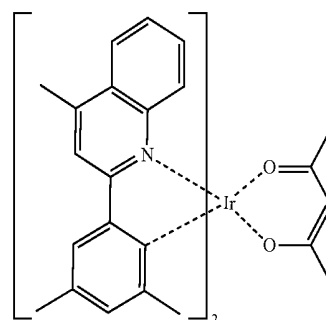
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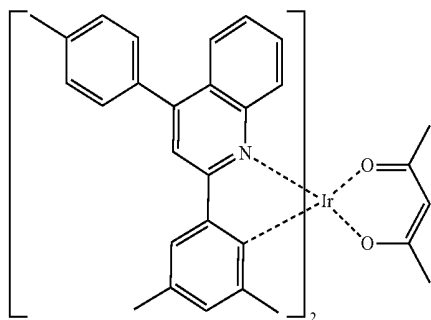
D-157



D-161

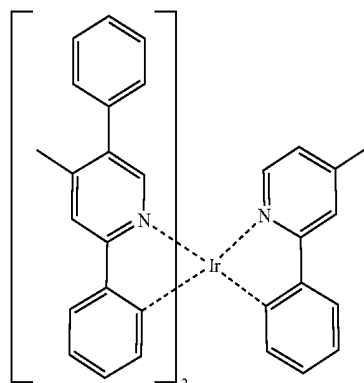


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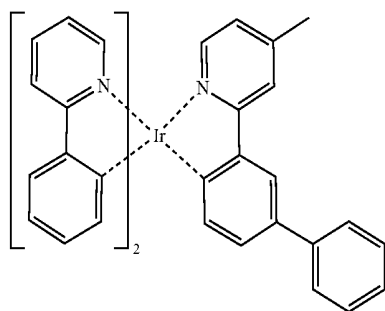


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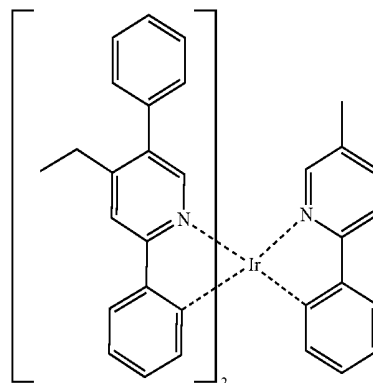
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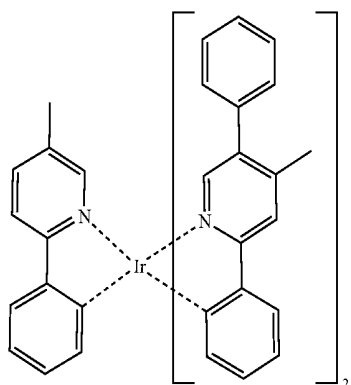
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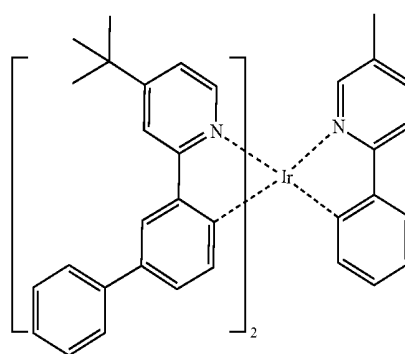
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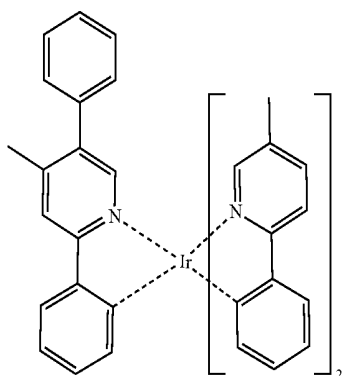
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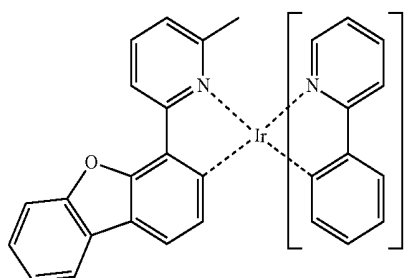
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D-168

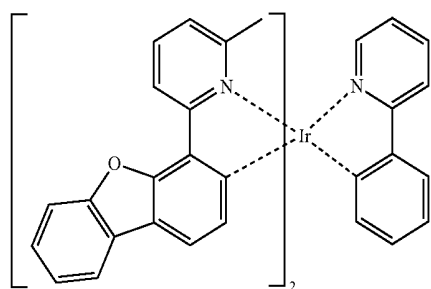


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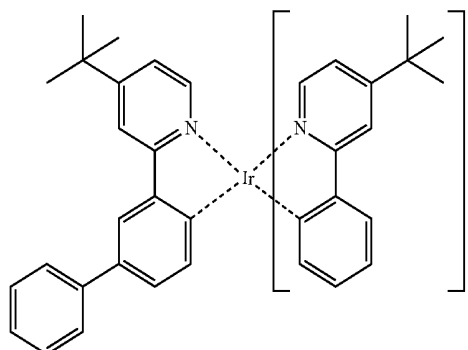
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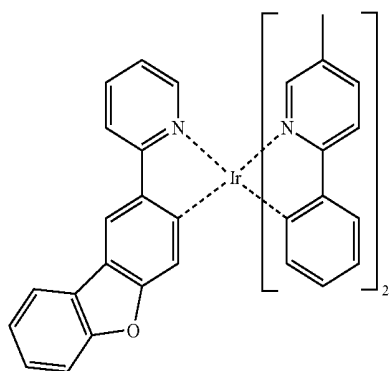


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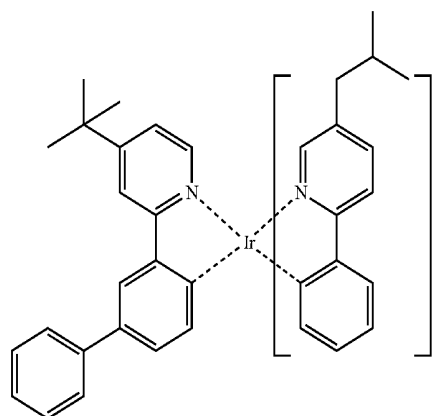
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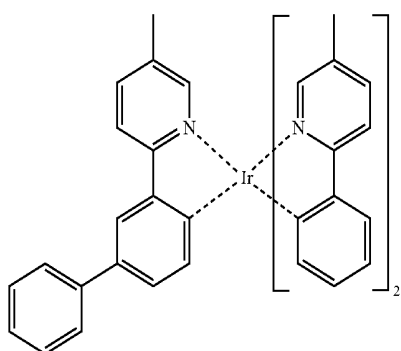
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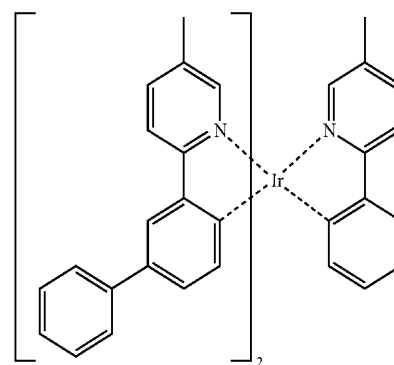
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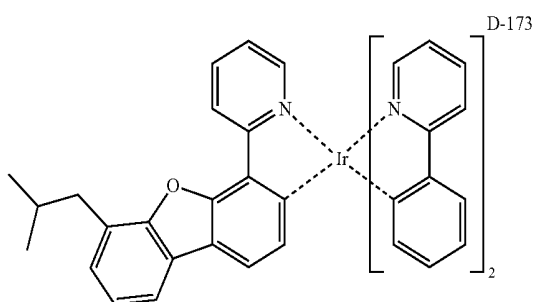
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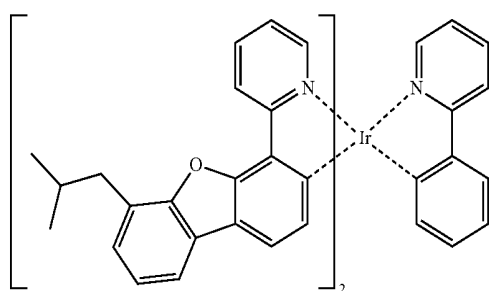
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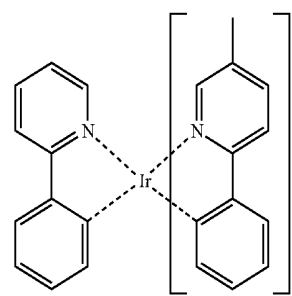
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D-173

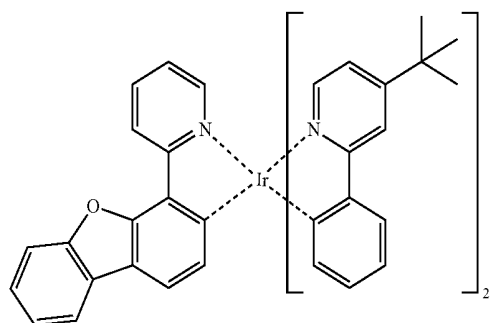


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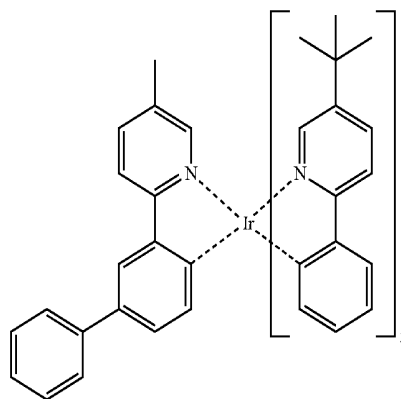
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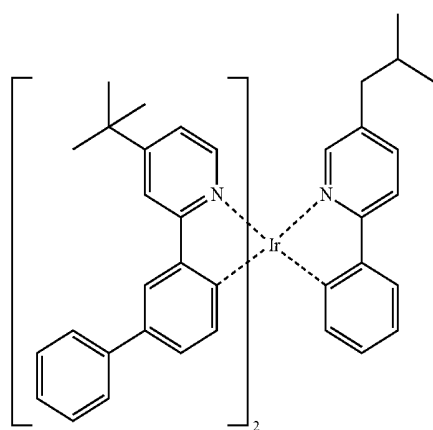
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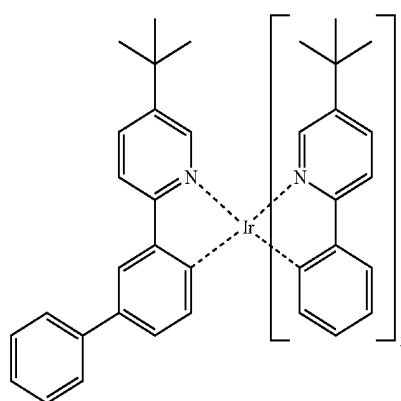


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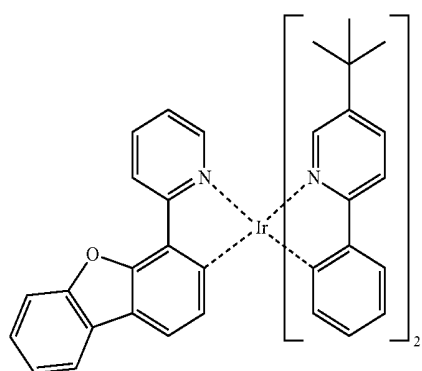
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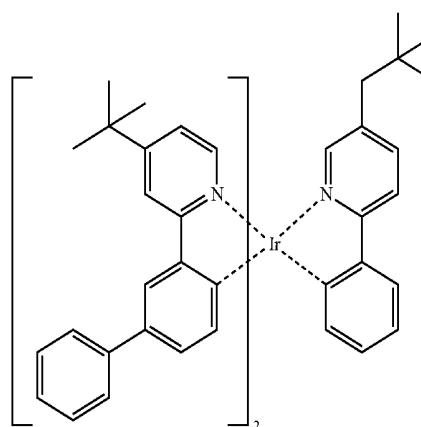
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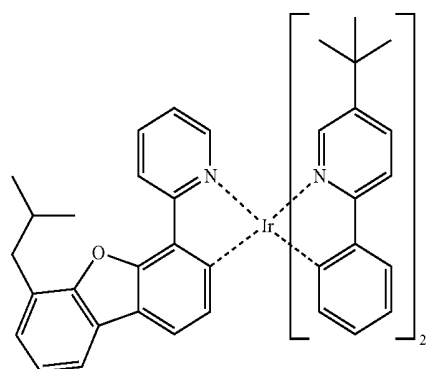
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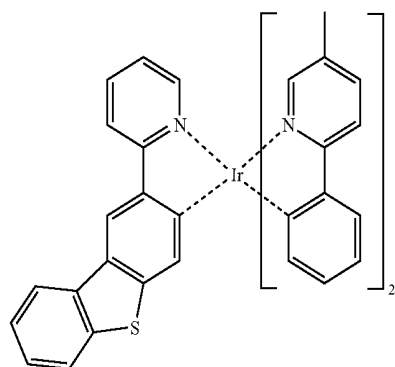
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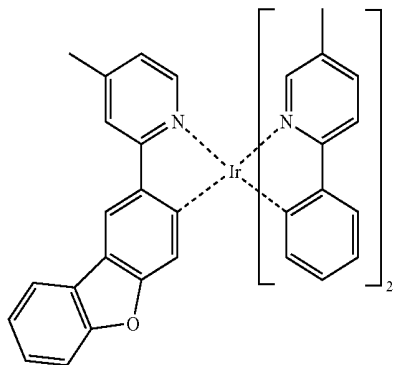
D-182



D-186

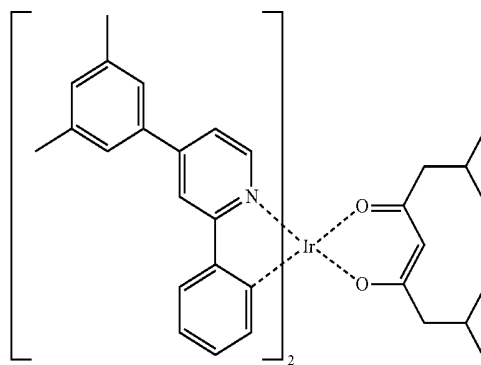


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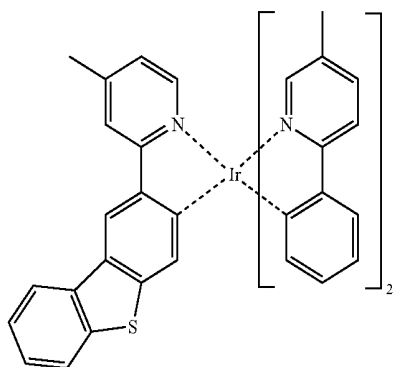


D-187

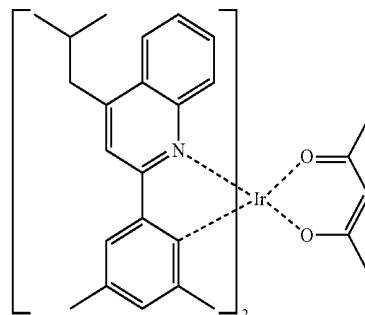
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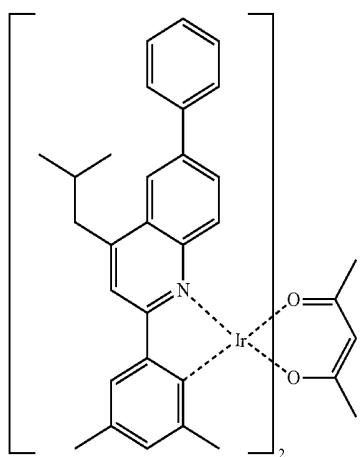
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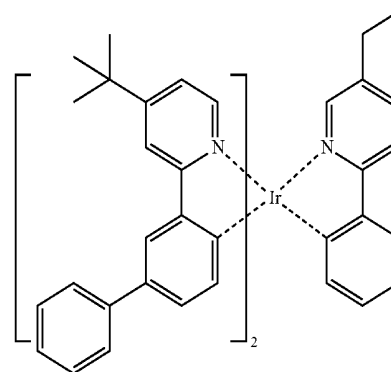
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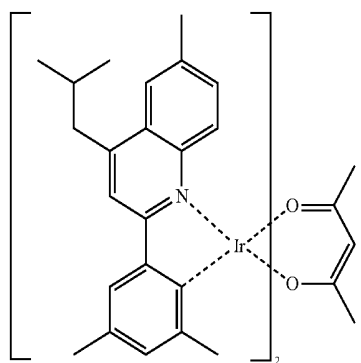
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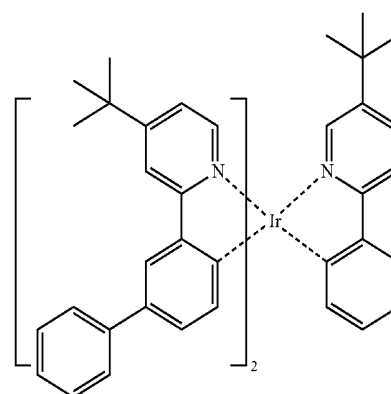
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D-193

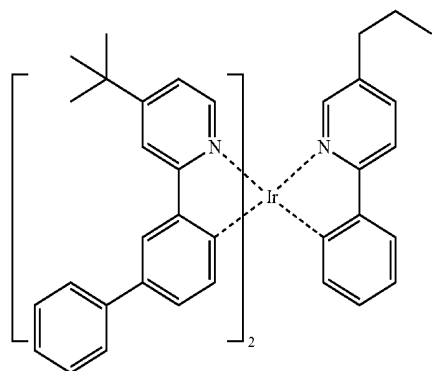


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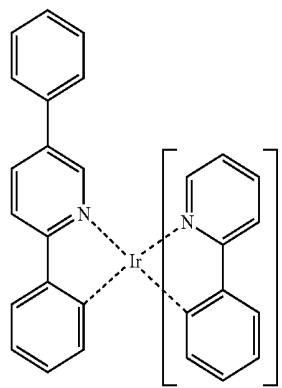
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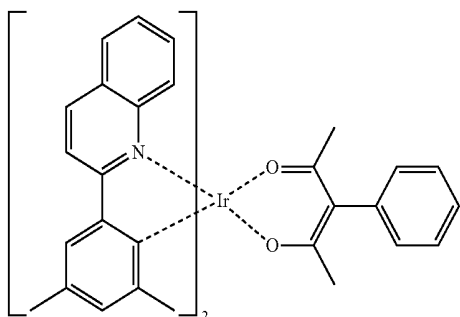


D-195

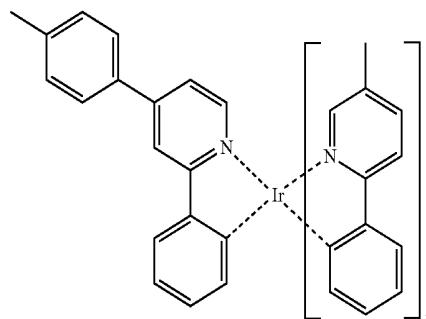
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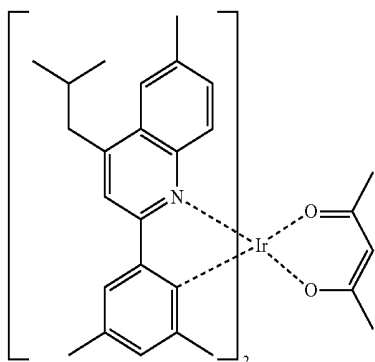
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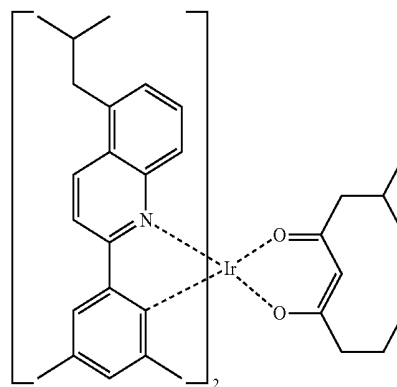
D-196



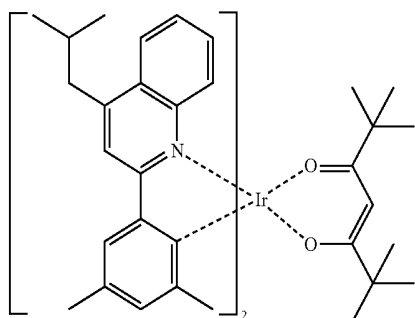
D-200



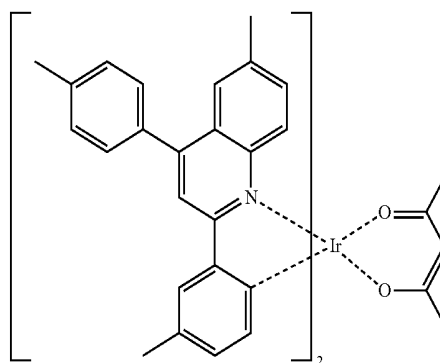
D-197



D-201

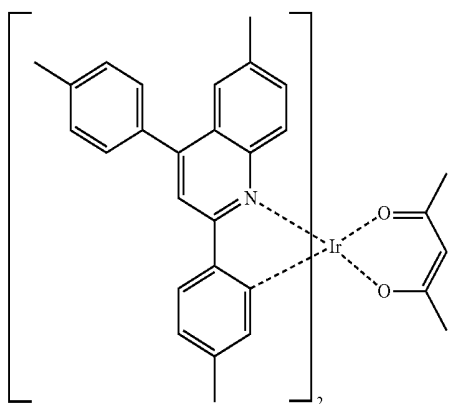


D-198

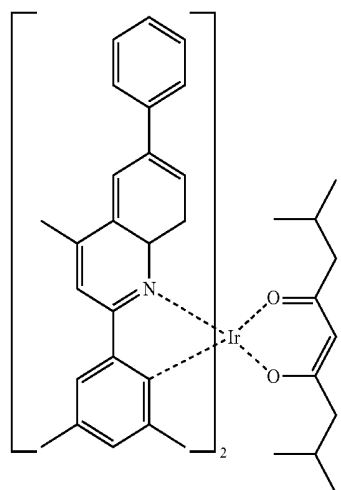
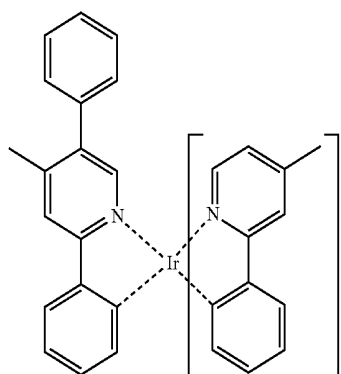
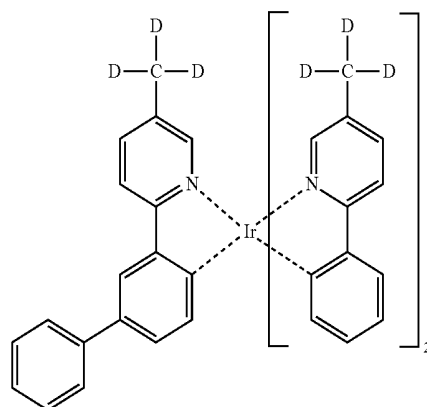
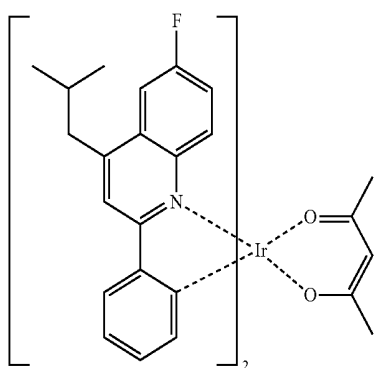
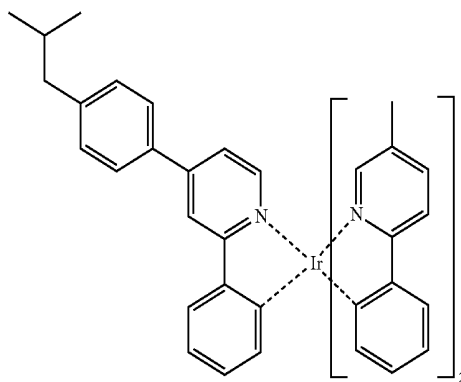


D-202

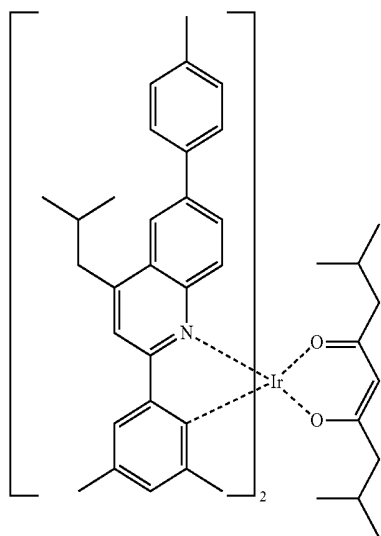
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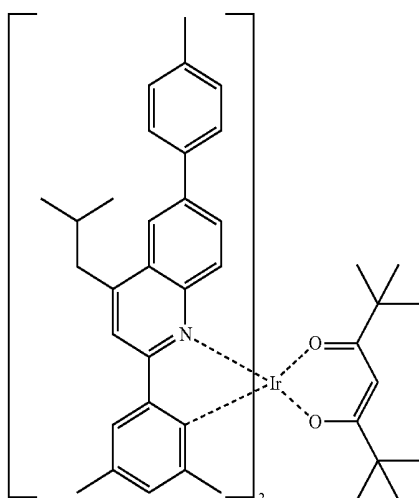


D-210

may further comprise at least one metal selected from the group consisting of metals of Group 1, metals of Group 2, transition metals of the 4<sup>th</sup> period, transition metals of the 5<sup>th</sup> period, lanthanides and organic metals of d-transition elements of the Periodic Table, or at least one complex compound comprising said metal.

**[0054]** According to the present invention, at least one layer (hereinafter, "a surface layer") is preferably placed on an inner surface(s) of one or both electrode(s); selected from a chalcogenide layer, a metal halide layer and a metal oxide layer. Specifically, a chalcogenide (including oxides) layer of silicon or aluminum is preferably placed on an anode surface of an electroluminescent medium layer, and a metal halide layer or a metal oxide layer is preferably placed on a cathode surface of an electroluminescent medium layer. Such a surface layer provides operation stability for the organic electroluminescent device. Preferably, said chalcogenide includes  $\text{SiO}_x$  ( $1 \leq x \leq 2$ ),  $\text{AlO}_x$  ( $1 \leq x \leq 1.5$ ),  $\text{SiON}$ ,  $\text{SiAlON}$ , etc.; said metal halide includes  $\text{LiF}$ ,  $\text{MgF}_2$ ,  $\text{CaF}_2$ , a rare earth metal fluoride, etc.; and said metal oxide includes  $\text{Cs}_2\text{O}$ ,  $\text{Li}_2\text{O}$ ,  $\text{MgO}$ ,  $\text{SrO}$ ,  $\text{BaO}$ ,  $\text{CaO}$ , etc.

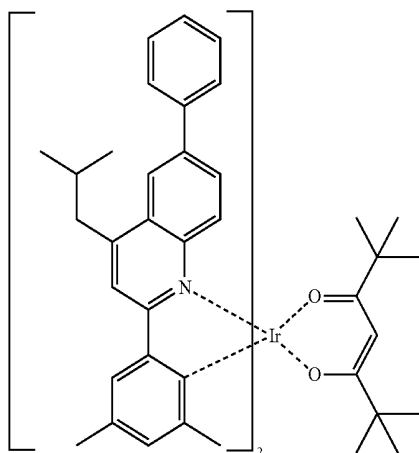
D-211



**[0055]** Between the anode and the light-emitting layer, a layer selected from a hole injection layer, a hole transport layer, or an electron blocking layer, or formed by a combination thereof can be used. Multi layers can be used for the hole injection layer in order to lower the hole injection barrier (or hole injection voltage) from the anode to the hole transport layer or the electron blocking layer. Two compounds can be simultaneously used in each layer. The hole transport layer and the electron blocking layer can also be formed of multi layers.

**[0056]** Between the light-emitting layer and the cathode, a layer selected from an electron buffer layer, a hole blocking layer, an electron transport layer, or an electron injection layer, or formed by a combination thereof can be used. Multi layers can be used for the electron buffer layer in order to control the injection of the electrons and enhance the interfacial characteristics between the light-emitting layer and the electron injection layer. Two compounds can be simultaneously used in each layer. The hole blocking layer and the electron transport layer can also be formed of multi layers, and each layer can comprise two or more compounds.

D-212



**[0052]** The organic electroluminescent device according to the present invention may further comprise at least one compound selected from the group consisting of arylamine-based compounds and styrylarylamine-based compounds in the organic layer.

**[0053]** In addition, in the organic electroluminescent device according to the present invention, the organic layer

**[0057]** In the organic electroluminescent device according to the present invention, a mixed region of an electron transport compound and a reductive dopant, or a mixed region of a hole transport compound and an oxidative dopant is preferably placed on at least one surface of a pair of electrodes. In this case, the electron transport compound is reduced to an anion, and thus it becomes easier to inject and transport electrons from the mixed region to an electroluminescent medium. Further, the hole transport compound is oxidized to a cation, and thus it becomes easier to inject and transport holes from the mixed region to the electroluminescent medium. Preferably, the oxidative dopant includes various Lewis acids and acceptor compounds; and the reductive dopant includes alkali metals, alkali metal compounds, alkaline earth metals, rare-earth metals, and mixtures thereof. A reductive dopant layer may be employed as a charge generating layer to prepare an electroluminescent device having two or more electroluminescent layers and emitting white light.

**[0058]** In order to form each layer of the organic electroluminescent device of the present invention, dry film-forming methods such as vacuum evaporation, sputtering,

plasma and ion plating methods, or wet film-forming methods such as ink jet printing, nozzle printing, slot coating, spin coating, dip coating, and flow coating methods can be used. The first and second host compounds of the present invention may be co-evaporated or mixture-evaporated.

**[0059]** When using a wet film-forming method, a thin film can be formed by dissolving or diffusing materials forming each layer into any suitable solvent such as ethanol, chloroform, tetrahydrofuran, dioxane, etc. The solvent can be any solvent where the materials forming each layer can be dissolved or diffused, and where there are no problems in film-formation capability.

**[0060]** Herein, a co-evaporation indicates a process for two or more materials to be deposited as a mixture, by introducing each of the two or more materials into respective crucible cells, and applying an electric current to the cells for each of the materials to be evaporated. Herein, a mixture-evaporation indicates a process for two or more materials to be deposited as a mixture, by mixing the two or more materials in one crucible cell before the deposition, and applying an electric current to the cell for the mixture to be evaporated.

**[0061]** By using the organic electroluminescent device of the present invention, a display system or a lighting system can be produced.

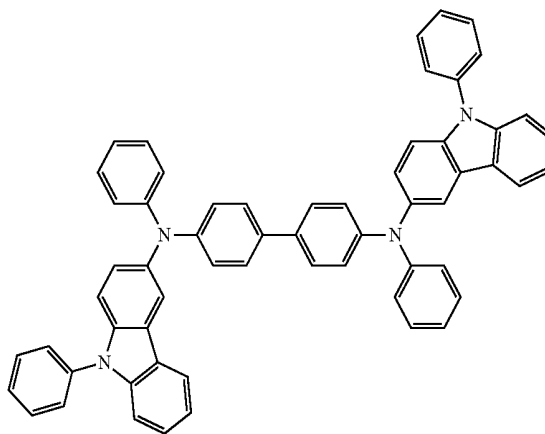
**[0062]** Hereinafter, the luminescent properties of the device comprising the host compound of the present invention will be explained in detail with reference to the following examples.

Device Examples 1-1 to 1-6: Preparation of an OLED Device by Co-Evaporating the First Host Compound and the Second Host Compound of the Present Invention

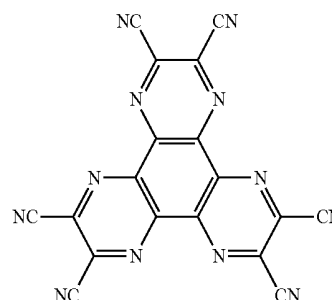
**[0063]** An OLED device was produced using the organic electroluminescent compound according to the present invention. A transparent electrode indium tin oxide (ITO) thin film (10  $\Omega$ /sq) on a glass substrate for an organic light-emitting diode (OLED) device (Geomatec) was subjected to an ultrasonic washing with trichloroethylene, acetone, ethanol, and distilled water, sequentially, and then was stored in isopropanol. The ITO substrate was then mounted on a substrate holder of a vacuum vapor depositing apparatus.  $N^+$ , $N^+$ -diphenyl- $N^+$ , $N^+$ -bis(9-phenyl-9H-carbazol-3-yl)-[1,1'-biphenyl]-4,4'-diamine (compound HI-1) was introduced into a cell of said vacuum vapor depositing apparatus, and then the pressure in the chamber of said apparatus was controlled to  $10^{-6}$  torr. Thereafter, an electric current was applied to the cell to evaporate the above introduced material, thereby forming a first hole injection layer having a thickness of 80 nm on the ITO substrate. Next, 1,4,5,8,9,12-hexaazatriphenylene-hexacarbonitrile (compound HI-2) was introduced into another cell of said vacuum vapor depositing apparatus, and was evaporated by applying an electric current to the cell, thereby forming a second hole injection layer having a thickness of 5 nm on the first hole injection layer.  $N$ -([1,1'-biphenyl]-4-yl)-9,9-dimethyl- $N$ -(4-(9-phenyl-9H-carbazol-3-yl)phenyl)-9H-fluorene-2-amine (compound HT-1) was then introduced into another cell of said vacuum vapor depositing apparatus, and was evaporated by applying an electric current to the cell, thereby forming a first hole transport layer having a thickness of 10 nm on the second hole injection layer. Afterwards,  $N,N$ -di([1,1'-biphenyl]-4-yl)-4'-(9H-carbazol-9-yl)-[1,1'-bi-

phenyl]-4-amine (compound HT-2) was introduced into another cell of said vacuum vapor depositing apparatus, and was evaporated by applying an electric current to the cell, thereby forming a second hole transport layer having a thickness of 60 nm on the first hole transport layer. As a host material, a first host compound and a second host compound were introduced into two cells of the vacuum vapor depositing apparatus, respectively. A dopant compound D-96 was introduced into another cell. The two host materials were evaporated at 1:1 rate, while the dopant was evaporated at a different rate from the host materials, so that the dopant was deposited in a doping amount of 3 wt % based on the total amount of the host and dopant to form a light-emitting layer having a thickness of 40 nm on the hole transport layer. 2,4-bis(9,9-dimethyl-9H-fluorene-2-yl)-6-(naphthalen-2-yl)-1,3,5-triazine (compound ET-1) and lithium quinolate (compound EI-1) were then introduced into two cells of the vacuum vapor depositing apparatus, respectively, and evaporated at 1:1 rate to form an electron transport layer having a thickness of 30 nm on the light-emitting layer. After depositing lithium quinolate (compound EI-1) as an electron injection layer having a thickness of 2 nm on the electron transport layer, an Al cathode having a thickness of 80 nm was deposited by another vacuum vapor deposition apparatus. Thus, an OLED device was produced.

HI-1

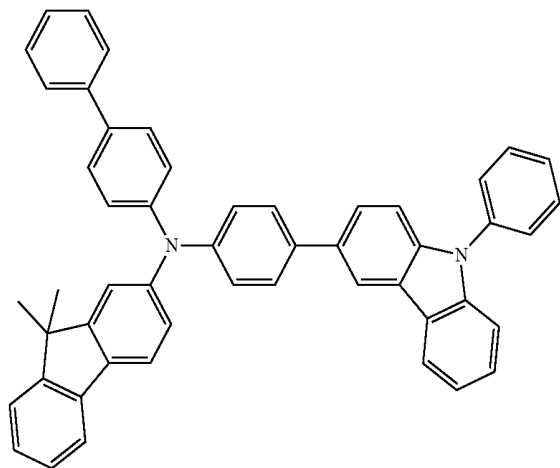


HI-2



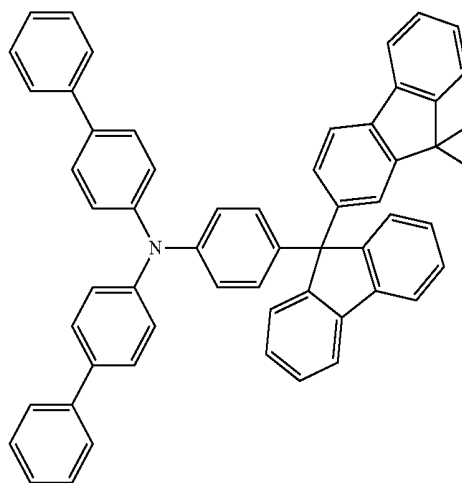
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HT-1

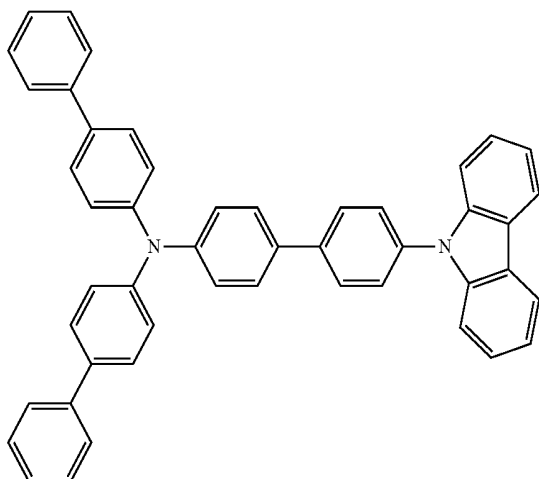


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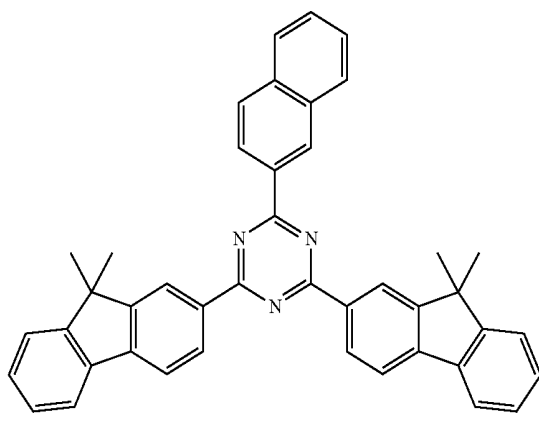
HT-4



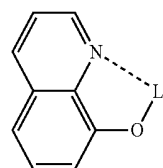
HT-2



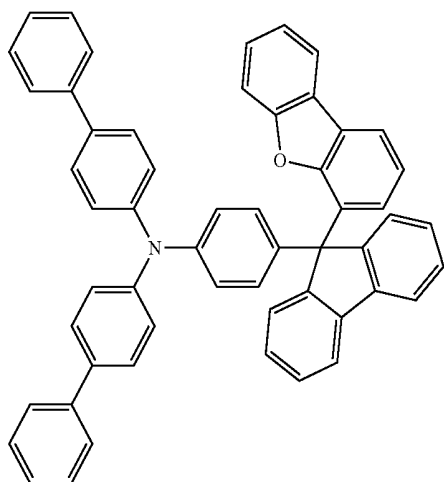
ET-1



EI-1



HT-3



Comparative Examples 1-1 to 1-3: Preparation of  
an OLED Device Using Only the Second Host  
Compound as a Host

**[0064]** An OLED device was produced in the same manner as in Device Examples 1-1 to 1-6, except for using only the second host compound as a host of the light-emitting layer.

**[0065]** The driving voltage at 1,000 nit, luminous efficiency, CIE color coordinate, and the time taken for the luminance at 5,000 nit to be reduced from 100% to 80% at a constant current of the OLEDs produced as above were measured.

**[0066]** Table 1 below shows the luminous characteristics of the organic electroluminescent devices produced as in the examples above.

TABLE 1

Device No.	HTL	Host	Dopant	Voltage [V]	Efficiency [cd/A]	Color Coordinate (x, y)	Lifespan [hr]
Example 1-1	HT-1/HT-2	H1-1:H2-2	D-96	4.4	27.5	0.664, 0.335	1,280
Example 1-2	HT-1/HT-2	H1-7:H2-29	D-96	3.9	27.7	0.665, 0.332	550
Example 1-3	HT-1/HT-2	H1-19:H2-29	D-96	4.1	24.6	0.664, 0.332	470
Example 1-4	HT-1/HT-2	H1-36:H2-154	D-96	4.6	27.8	0.663, 0.335	1,530
Example 1-5	HT-1/HT-2	H1-36:H2-29	D-96	3.7	28.2	0.666, 0.331	780
Example 1-6	HT-1/HT-2	H1-36:H2-155	D-96	4.6	26.9	0.664, 0.335	970
Comp. Ex. 1-1	HT-1/HT-2	H2-2	D-96	4.1	28.2	0.662, 0.337	300
Comp. Ex. 1-2	HT-1/HT-2	H2-154	D-96	4.5	27.1	0.662, 0.337	420
Comp. Ex. 1-3	HT-1/HT-2	H2-29	D-96	3.6	27.5	0.668, 0.331	310

Device Examples 2-1 to 2-7: Preparation of an OLED Device by Co-Evaporating the First Host Compound and the Second Host Compound of the Present Invention

**[0067]** An OLED device was produced in the same manner as in Device Examples 1-1 to 1-6, except for forming the second hole injection layer of 3 nm; forming the first hole transport layer of 40 nm; not forming the second hole transport layer; doping compound D-25 as the dopant of the light-emitting layer in a doping amount of 15 wt % based on the total amount of the host and dopant; forming the electron transport layer of 35 nm by evaporating 2,4-bis(9,9-dimethyl-9H-fluoren-2-yl)-6-(naphthalen-2-yl)-1,3,5-triazine and lithium quinolate at a rate of 4:6; and using other combinations for the first host compound and the second host compound used in the host of the light-emitting layer.

Device Examples 2-8 to 2-9: Preparation of an OLED Device by Co-Evaporating the First Host Compound and the Second Host Compound of the Present Invention

**[0068]** An OLED device was produced in the same manner as in Device Examples 1-1 to 1-6, except for forming the second hole injection layer of 3 nm; forming the first hole transport layer of 40 nm; not forming the second hole transport layer; doping compound D-1 as the dopant of the light-emitting layer in a doping amount of 15 wt % based on the total amount of the host and dopant; forming the electron transport layer of 35 nm by evaporating 2,4-bis(9,9-dimethyl-9H-fluoren-2-yl)-6-(naphthalen-2-yl)-1,3,5-triazine and lithium quinolate at a rate of 4:6; and using other combinations for the first host compound and the second host compound used in the host of the light-emitting layer.

Device Example 2-10: Preparation of an OLED Device by Co-Evaporating the First Host Compound and the Second Host Compound of the Present Invention

**[0069]** An OLED device was produced in the same manner as in Device Examples 1-1 to 1-6, except for forming the second hole injection layer of 3 nm; forming the first hole transport layer of 40 nm; not forming the second hole

transport layer; doping compound D-136 as the dopant of the light-emitting layer in a doping amount of 15 wt % based on the total amount of the host and dopant; forming the electron transport layer of 35 nm by evaporating 2,4-bis(9,9-dimethyl-9H-fluoren-2-yl)-6-(naphthalen-2-yl)-1,3,5-triazine and lithium quinolate at a rate of 4:6; and using other combinations for the first host compound and the second host compound used in the host of the light-emitting layer.

Device Examples 3-1 to 3-3: Preparation of an OLED Device by Co-Evaporating the First Host Compound and the Second Host Compound of the Present Invention

**[0070]** An OLED device was produced in the same manner as in Device Examples 2-1 to 2-7, except for forming the first hole injection layer of 10 nm; forming the second hole transport layer of 30 nm using compound HT-3; using compound D-136 as the dopant of the light-emitting layer; and using other combinations for the first host compound and the second host compound used in the host of the light-emitting layer.

Device Example 3-4: Preparation of an OLED Device by Co-Evaporating the First Host Compound and the Second Host Compound of the Present Invention

**[0071]** An OLED device was produced in the same manner as in Device Examples 2-1 to 2-7, except for forming the first hole injection layer of 10 nm; forming the second hole transport layer of 30 nm using compound HT-3; using compound D-168 as the dopant of the light-emitting layer; and using other combinations for the first host compound and the second host compound used in the host of the light-emitting layer.

Comparative Examples 2-1 to 2-3: Preparation of an OLED Device Using Only the First Host Compound as a Host

**[0072]** An OLED device was produced in the same manner as in Device Examples 2-1 to 2-7, except for using only the first host compound as a host of the light-emitting layer.

Comparative Examples 3-1 to 3-3: Preparation of an OLED Device Using Only the Second Host Compound as a Host

**[0073]** An OLED device was produced in the same manner as in Device Examples 2-1 to 2-7, except for using only the second host compound as a host of the light-emitting layer.

Comparative Examples 3-4 to 3-6: Preparation of an OLED Device Using Only the Second Host Compound as a Host

**[0074]** An OLED device was produced in the same manner as in Device Examples 2-8 to 2-9, except for using only the second host compound as a host of the light-emitting layer.

Comparative Examples 4-1 to 4-3: Preparation of an OLED Device Using Only the Second Host Compound as a Host

**[0075]** An OLED device was produced in the same manner as in Device Examples 3-1 to 3-3, except for using only the second host compound as a host of the light-emitting layer.

**[0076]** The driving voltage at 1,000 nit, luminous efficiency, CIE color coordinate, and the time taken for the luminance at 15,000 nit to be reduced from 100% to 80% at a constant current of the OLEDs produced as above were measured.

**[0077]** Table 2 below shows the luminous characteristics of the organic electroluminescent devices produced as in the examples above.

TABLE 2

Device No.	HTL	Host	Dopant	Voltage [V]	Efficiency [cd/A]	Color Coordinate (x, y)	Lifespan [hr]
Example 2-1	HT-1	H1-1:H2-25	D-25	3.2	49.8	0.301, 0.658	350
Example 2-2	HT-1	H1-1:H2-31	D-25	3	57.1	0.308, 0.655	380
Example 2-3	HT-1	H1-1:H2-48	D-25	2.9	56.8	0.305, 0.656	400
Example 2-4	HT-1	H1-1:H2-101	D-25	3	55.5	0.303, 0.657	230
Example 2-5	HT-1	H1-1:H2-34	D-25	3.1	58.1	0.306, 0.655	440
Example 2-6	HT-1	H1-4:H2-31	D-25	3	53.3	0.304, 0.656	120
Example 2-7	HT-1	H1-37:H2-31	D-25	3	53.7	0.306, 0.655	300
Example 2-8	HT-1	H1-1:H2-31	D-1	2.9	53	0.321, 0.656	560
Example 2-9	HT-1	H1-1:H2-48	D-1	2.8	55.3	0.319, 0.657	550
Example 2-10	HT-1	H1-113:H2-31	D-136	2.8	59.4	0.331, 0.655	600
Example 3-1	HT-1/HT-3	H1-1:H2-48	D-136	3.1	67.5	0.326, 0.658	590
Example 3-2	HT-1/HT-3	H1-1:H2-273	D-136	3.1	66.2	0.328, 0.657	700
Example 3-3	HT-1/HT-3	H1-113:H2-125	D-136	3.1	65.8	0.329, 0.657	700
Example 3-4	HT-1/HT-3	H1-1:H2-273	D-168	3.0	57.2	0.288, 0.665	450
Comp. Ex. 2-1	HT-1	H1-1	D-25	6.8	3.1	0.301, 0.653	x
Comp. Ex. 2-2	HT-1	H1-4	D-25	7.2	3.6	0.295, 0.658	x
Comp. Ex. 2-3	HT-1	H1-37	D-25	7.0	3.0	0.302, 0.653	x
Comp. Ex. 3-1	HT-1	H2-31	D-25	2.9	42.8	0.314, 0.652	100
Comp. Ex. 3-2	HT-1	H2-101	D-25	2.8	50.3	0.315, 0.651	60
Comp. Ex. 3-3	HT-1	H2-34	D-25	2.7	49.2	0.312, 0.652	100
Comp. Ex. 3-4	HT-1	H2-31	D-1	2.9	33.5	0.323, 0.653	390
Comp. Ex. 3-5	HT-1	H2-48	D-1	2.6	41.2	0.325, 0.653	380
Comp. Ex. 3-6	HT-1	H2-87	D-1	2.8	37.9	0.323, 0.653	420

TABLE 2-continued

Device No.	HTL	Host	Dopant	Voltage [V]	Efficiency [cd/A]	Color Coordinate (x, y)	Lifespan [hr]
Comp. Ex. 4-1	HT-1/HT-3	H2-48	D-136	2.6	51.9	0.334, 0.652	490
Comp. Ex. 4-2	HT-1/HT-3	H2-125	D-136	3.0	64.9	0.337, 0.649	360
Comp. Ex. 4-3	HT-1/HT-3	H2-273	D-136	3.3	68.2	0.332, 0.654	440

Device Example 4-1: Preparation of an OLED Device by Co-Evaporating the First Host Compound and the Second Host Compound of the Present Invention

(1)

[0078] An OLED device was produced in the same manner as in Device Examples 1-1 to 1-6, except for using compound HT-4 for the second hole transport layer, and using the compounds as listed in Table 3 below for the first host compound and the second host compound used in the host of the light-emitting layer.

Comparative Example 5-1: Preparation of an OLED Device Using Only the Second Host Compound as a Host

[0079] An OLED device was produced in the same manner as in Device Example 4-1, except for using only the second host compound of Table 3 as a host of the light-emitting layer.

[0080] The driving voltage at 1,000 nit, luminous efficiency, CIE color coordinate, and the time taken for the luminance at 5,000 nit to be reduced from 100% to 90% at a constant current of the OLEDs produced as above were measured.

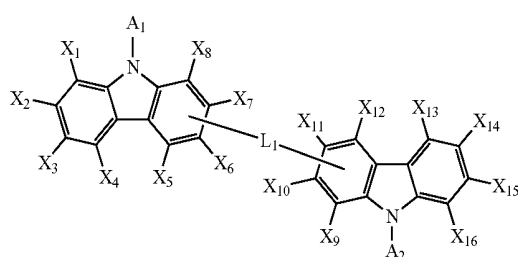
[0081] Table 3 below shows the luminous characteristics of the organic electroluminescent devices produced as in the examples above.

TABLE 3

Device No.	HTL	Host	Dopant	Voltage [V]	Efficiency [cd/A]	Color Coordinate (x, y)	Lifespan [hr]
Example 4-1	HT-1/HT-4	H1-7:H2-41	D-96	3.4	30.7	0.665, 0.333	400
Comp. Ex. 5-1	HT-1/HT-4	H2-41	D-96	3.1	28.3	0.668, 0.331	300

[0082] The organic electroluminescent device of the present invention comprises a light-emitting layer comprising a host and a phosphorus dopant, and the host consists of a specific combination of multi-component host compounds. The device of the present invention provides superior lifespan characteristics to conventional devices.

1. An organic electroluminescent device comprising at least one light-emitting layer between an anode and a cathode, wherein the light-emitting layer comprises a host and a phosphorescent dopant, the host consists of multi-component host compounds, at least a first host compound of the multi-component host compounds is represented by the following formula 1, and a second host compound is represented by the following formula 2.



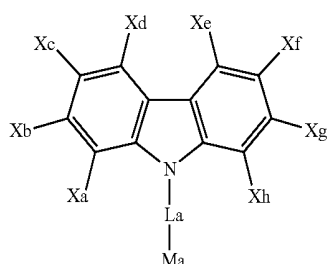
wherein

A<sub>1</sub> and A<sub>2</sub> each independently represent a substituted or unsubstituted (C6-C30)aryl;

L<sub>1</sub> represents a substituted or unsubstituted (C6-C30)arylene;

X<sub>1</sub> to X<sub>16</sub> each independently represent hydrogen, deuterium, a halogen, a cyano, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C2-C30)alkenyl, a substituted or unsubstituted (C2-C30)alky-

nyl, a substituted or unsubstituted (C3-C30)cycloalkyl, a substituted or unsubstituted (C6-C60)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, a substituted or unsubstituted tri(C1-C30)alkylsilyl, a substituted or unsubstituted tri(C6-C30)arylsilyl, a substituted or unsubstituted di(C1-C30)alkyl(C6-C30)arylsilyl, a substituted or unsubstituted (C1-C30)alkyldi(C6-C30)arylsilyl, or a substituted or unsubstituted mono- or di-(C6-C30)aryl-amino; or are linked to an adjacent substituent(s) to form a substituted or unsubstituted, mono- or polycyclic, (C3-C30) alicyclic or aromatic ring, whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen and sulfur;



(2)

wherein

Ma represents a substituted or unsubstituted nitrogen-containing (5- to 11-membered)heteroaryl;

La represents a single bond, or a substituted or unsubstituted (C6-C30)arylene;

Xa to Xh each independently represent hydrogen, deuterium, a halogen, a cyano, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C2-C30)alkenyl, a substituted or unsubstituted (C2-C30)alkynyl, a substituted or unsubstituted (C3-C30)cycloalkyl, a substituted or unsubstituted (C6-C60)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, a substituted or unsubstituted tri(C1-C30)alkylsilyl, a substituted or unsubstituted tri(C6-C30)arylsilyl, a substituted or unsubstituted di(C1-C30)alkyl(C6-C30)arylsilyl, or a substituted or unsubstituted mono- or di-(C6-C30)arylamino; or are linked to an adjacent substituent(s) to form a substituted or unsubstituted, mono- or polycyclic, (C3-C30) alicyclic or aromatic ring, whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen and sulfur; and

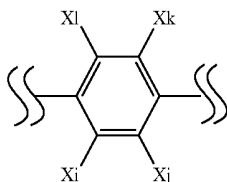
the heteroaryl contains at least one hetero atom selected from B, N, O, S, P(=O), Si, and P.

2. The organic electroluminescent device according to claim 1, wherein in formula 1,

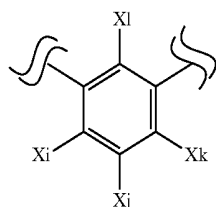
A<sub>1</sub> and A<sub>2</sub> each independently are selected from the group consisting of phenyl, biphenyl, terphenyl, naphthyl, fluorenyl, phenanthrenyl, anthracenyl, indenyl, triphenylenyl, pyrenyl, tetracenyl, perylenyl, chrysenyl, and fluoranthenyl.

3. The organic electroluminescent device according to claim 1, wherein in formula 1,

L<sub>1</sub> is represented by one of the following formulae 7 to 19:

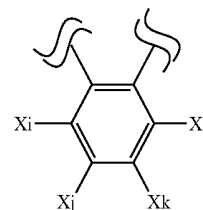


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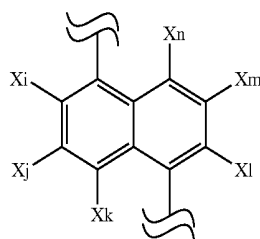


(8)

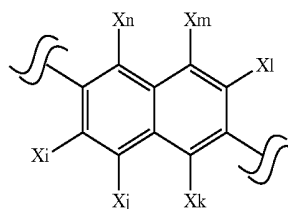
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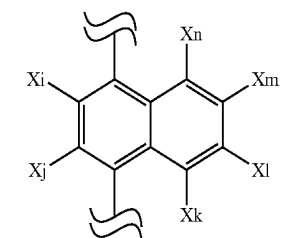
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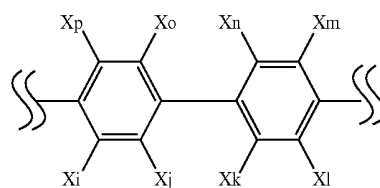
(10)



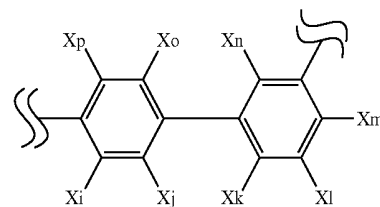
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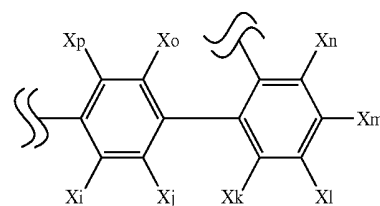
(12)



(13)

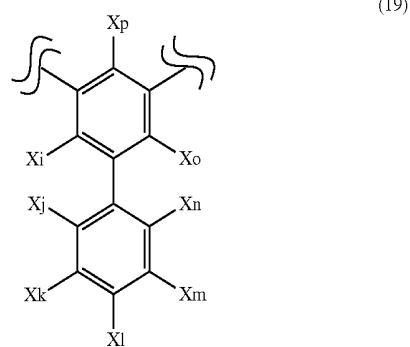
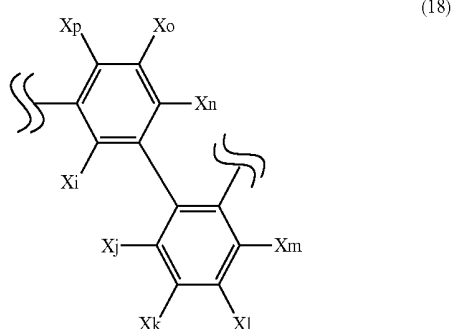
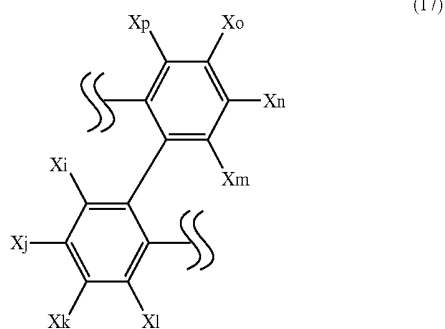
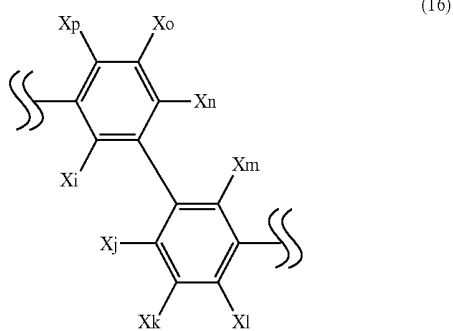


(14)



(15)

-continued



wherein

Xi to Xp each independently represent hydrogen, deuterium, a halogen, a cyano, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C2-C30)alkenyl, a substituted or unsubstituted (C2-C30)alkynyl, a substituted or unsubstituted (C3-C30)cycloalkyl, a substituted or unsubstituted (C6-C60)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, a substituted or unsubstituted tri(C1-C30)alkylsilyl, a substituted or unsubstituted tri(C6-C30)arylsilyl, a substituted or unsubstituted di(C1-C30)alkyl(C6-C30)arylsilyl, a substituted or unsubstituted (C1-C30)alkyldi

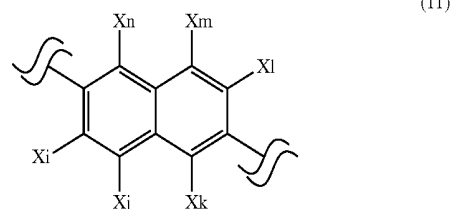
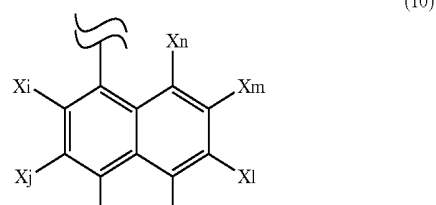
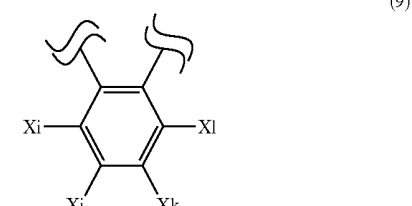
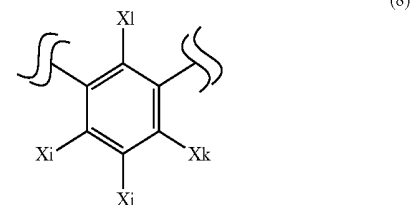
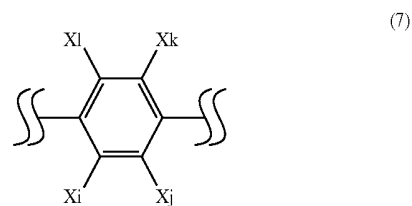
(C6-C30)arylsilyl, or a substituted or unsubstituted mono- or di-(C6-C30)arylamino; or are linked to an adjacent substituent(s) to form a substituted or unsubstituted, mono- or polycyclic, (C3-C30) alicyclic or aromatic ring, whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen and sulfur.

4. The organic electroluminescent device according to claim 1, wherein in formula 2,

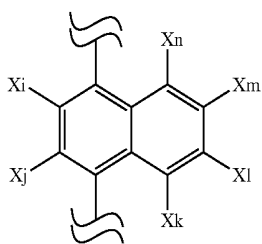
Ma represents a monocyclic heteroaryl selected from the group consisting of pyrrolyl, imidazolyl, pyrazolyl, triazinyl, tetrazinyl, triazolyl, tetrazolyl, pyridyl, pyrazinyl, pyrimidinyl, and pyridazinyl, or a fused heteroaryl selected from the group consisting of benzimidazolyl, isoindolyl, indolyl, indazolyl, benzothiadiazolyl, quinolyl, isoquinolyl, cinnolinyl, quinazolinyl, naphthyridinyl, and quinoxalinyl.

5. The organic electroluminescent device according to claim 1, wherein in formula 2,

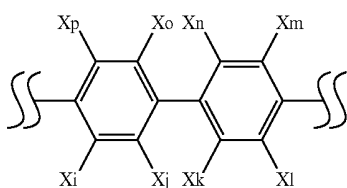
La is a single bond, or represented by one of the following formulae 7 to 19:



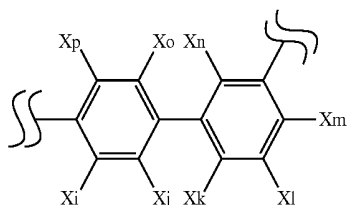
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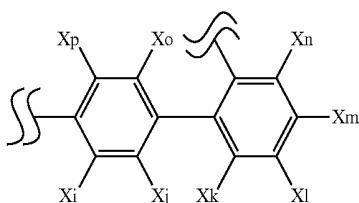
(12)



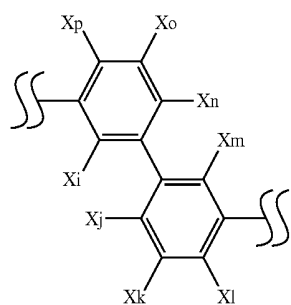
(13)



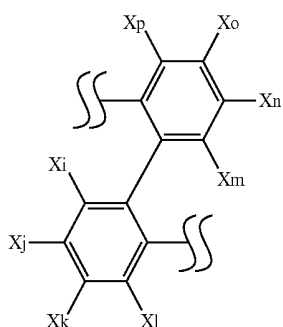
(14)



(15)

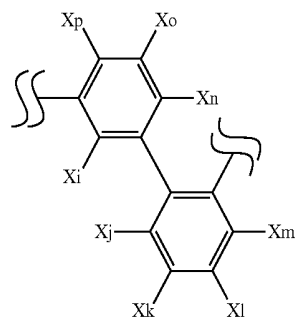


(16)

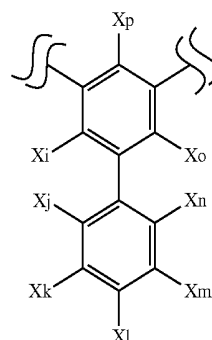


(17)

-continued



(18)



(19)

wherein

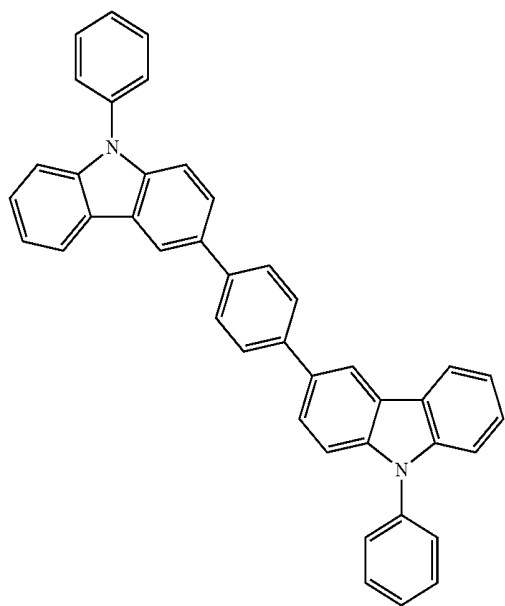
Xi to Xp each independently represent hydrogen, deuterium, a halogen, a cyano, a substituted or unsubstituted (C1-C30)alkyl, a substituted or unsubstituted (C2-C30)alkenyl, a substituted or unsubstituted (C2-C30)alkynyl, a substituted or unsubstituted (C3-C30)cycloalkyl, a substituted or unsubstituted (C6-C60)aryl, a substituted or unsubstituted (3- to 30-membered)heteroaryl, a substituted or unsubstituted tri(C1-C30)alkylsilyl, a substituted or unsubstituted tri(C6-C30)arylsilyl, a substituted or unsubstituted di(C1-C30)alkyl(C6-C30)arylsilyl, a substituted or unsubstituted (C1-C30)alkyldi(C6-C30)arylsilyl, or a substituted or unsubstituted mono- or di-(C6-C30)arylamino; or are linked to an adjacent substituent(s) to form a substituted or unsubstituted, mono- or polycyclic, (C3-C30) alicyclic or aromatic ring, whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen and sulfur.

6. The organic electroluminescent device according to claim 1, wherein in formula 2,

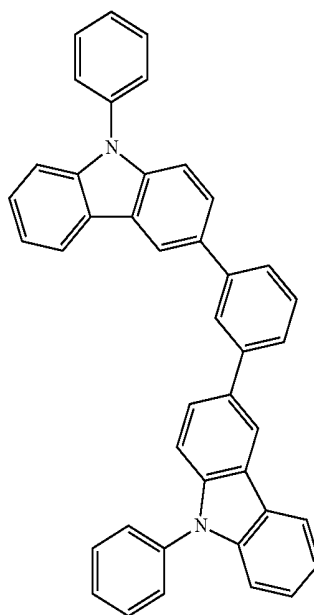
Xa to Xh each independently represent hydrogen; a cyano; a (C6-C15)aryl unsubstituted or substituted with a tri(C6-C10)arylsilyl; a (10- to 20-membered)heteroaryl unsubstituted or substituted with a (C6-C12)aryl or a cyano(C6-C12)aryl; or an unsubstituted tri(C6-C10)arylsilyl; or are linked to an adjacent substituent(s) to form a substituted or unsubstituted benzene, a substituted or unsubstituted indole, a substituted or unsubstituted benzindole, a substituted or unsubstituted indene, a substituted or unsubstituted benzofuran, or a substituted or unsubstituted benzothiophene.

7. The organic electroluminescent device according to claim 1, wherein in formula 1, a triarylsilyl as X<sub>1</sub> to X<sub>16</sub> is a triphenylsilyl.

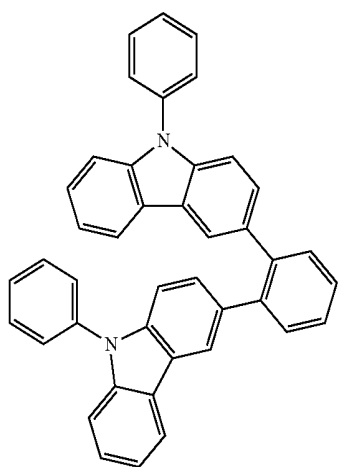
8. The organic electroluminescent device according to claim 1, wherein the compound represented by formula 1 is selected from the group consisting of:



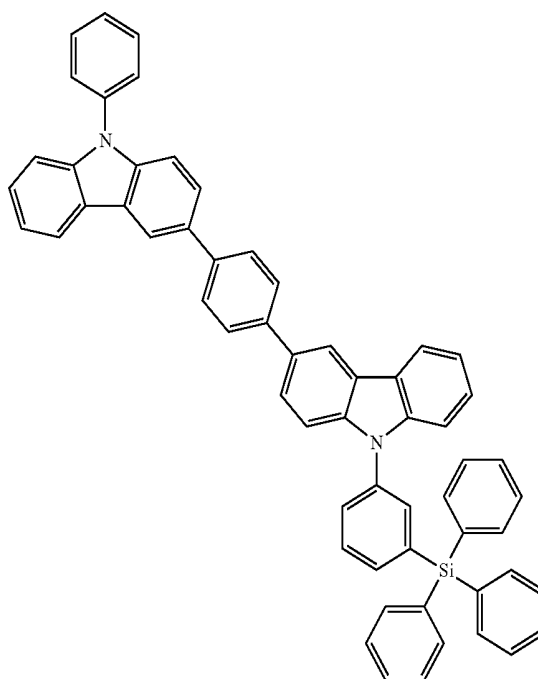
H1-1



H1-2



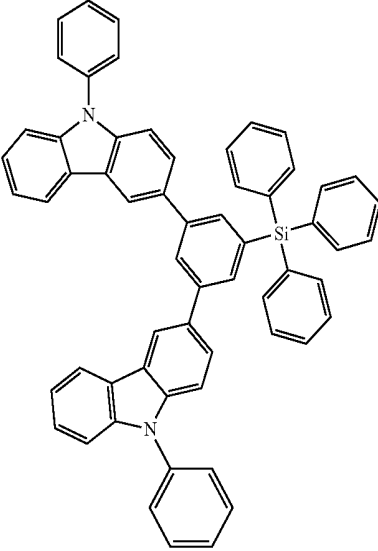
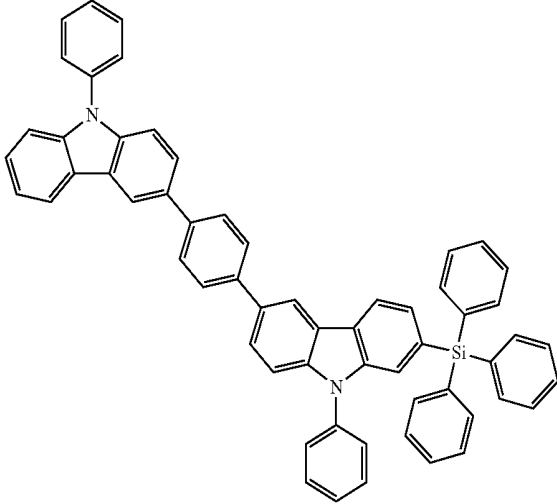
H1-3



H1-4

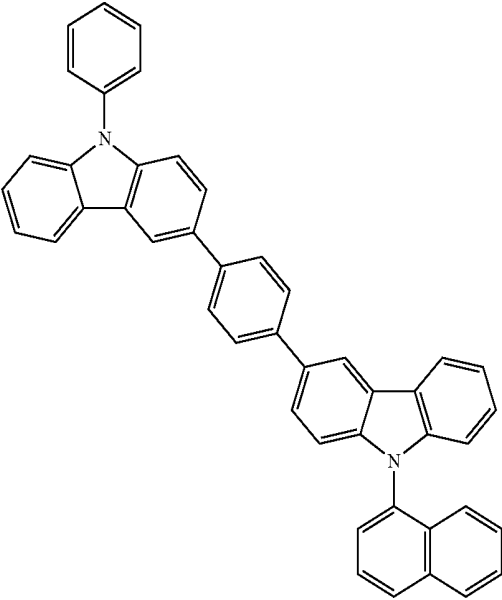
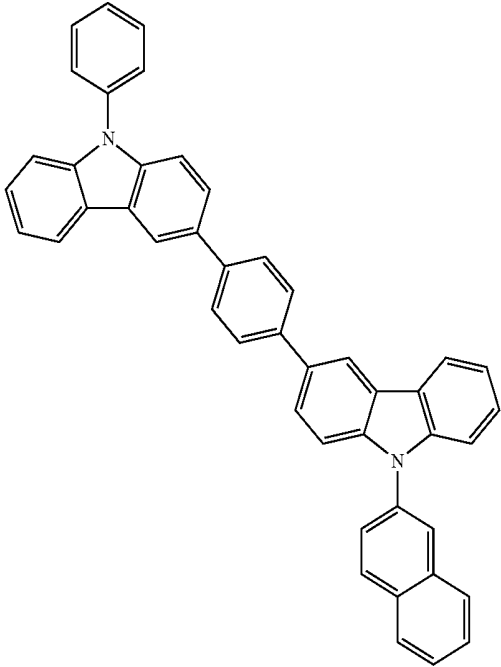
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H1-5

H1-6



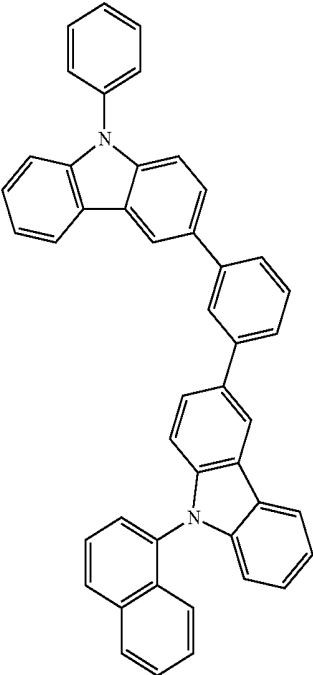
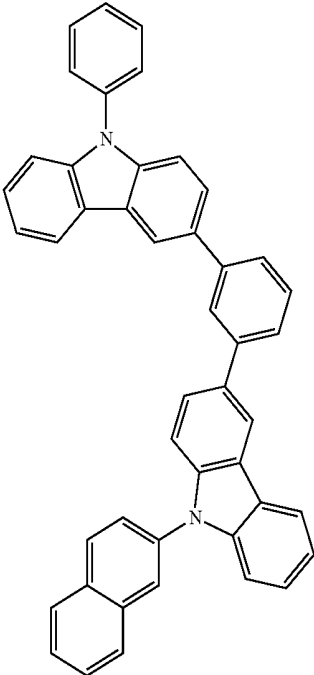
H1-7

H1-8



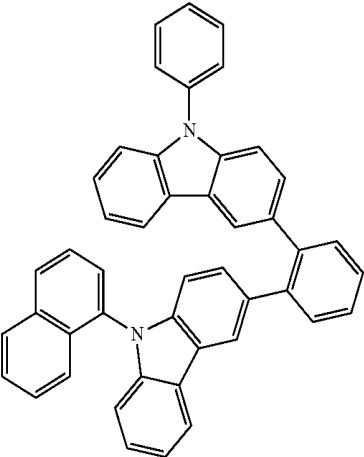
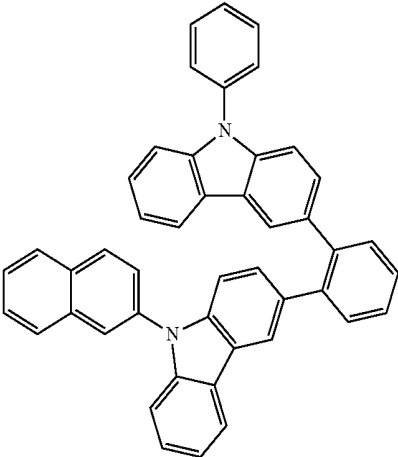
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H1-9

H1-10



H1-11

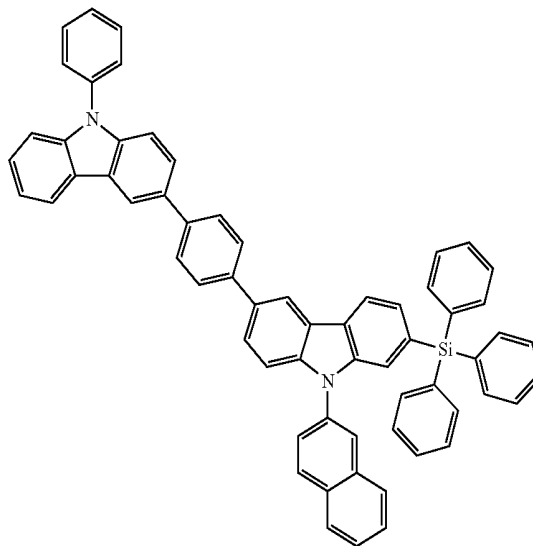
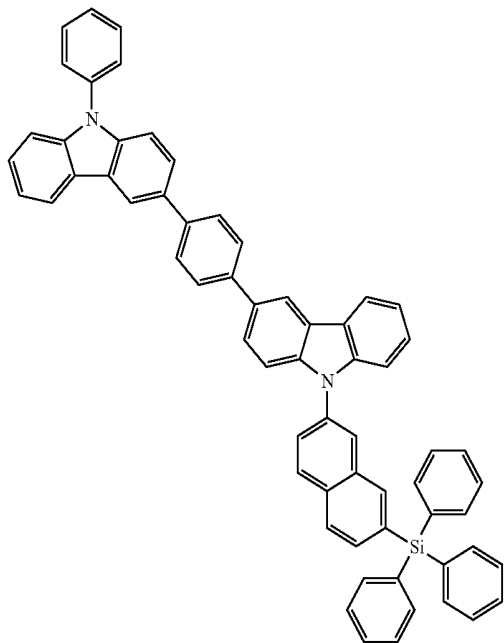
H1-12



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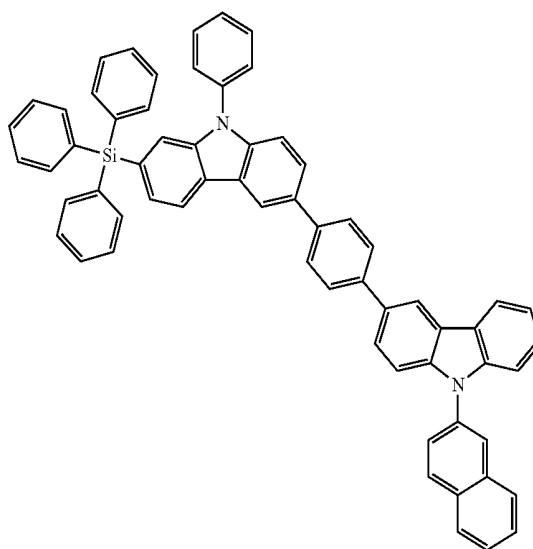
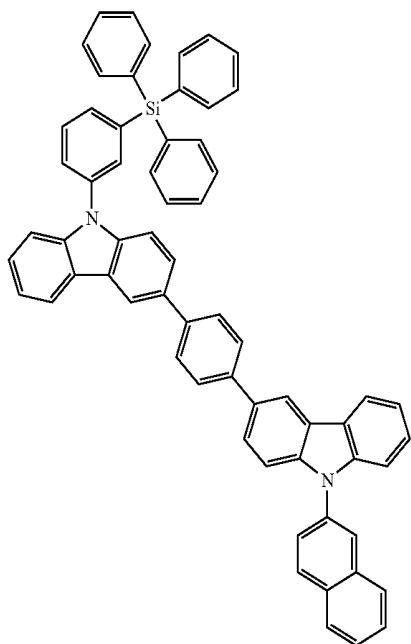
H1-13

H1-14



H1-15

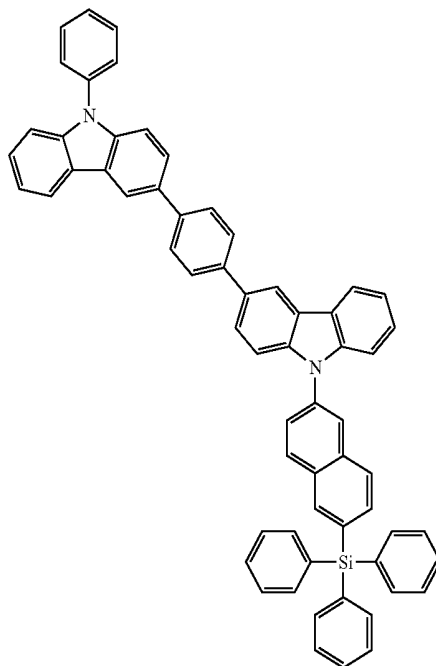
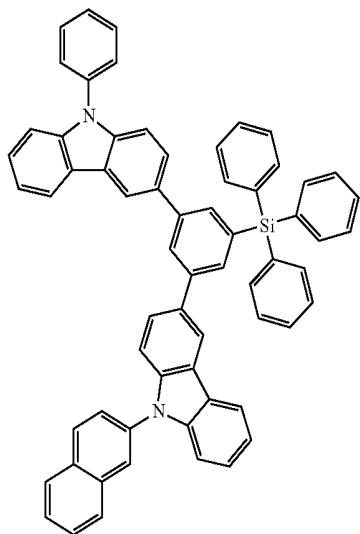
H1-16



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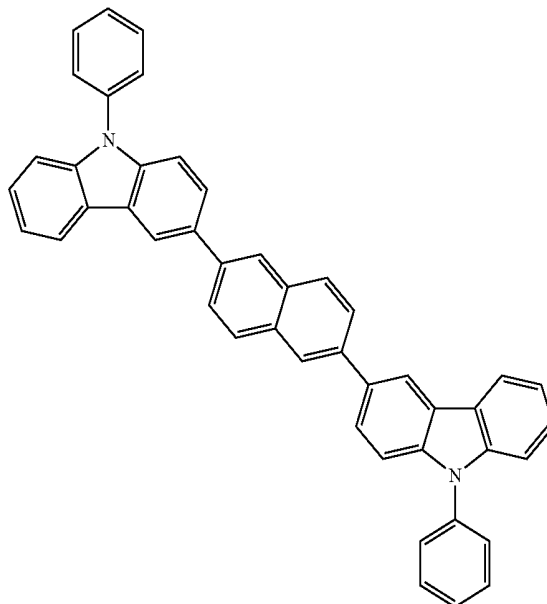
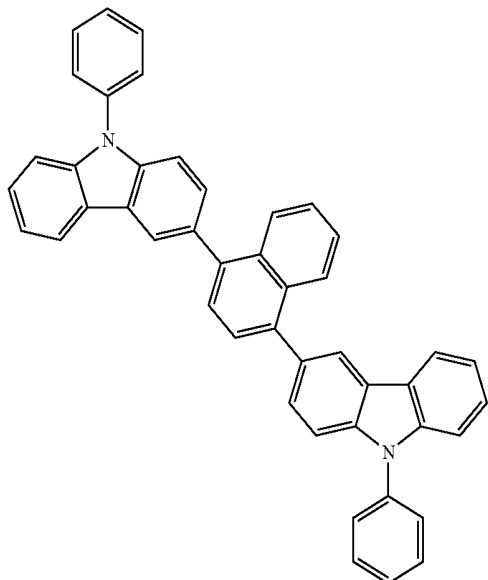
H1-17

H1-18



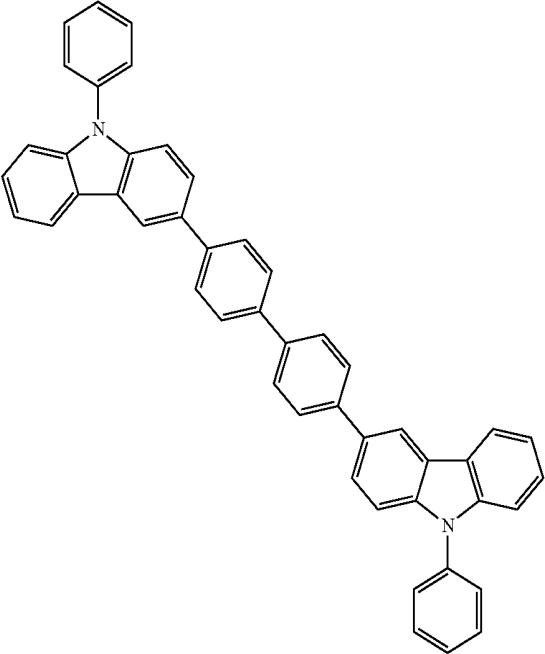
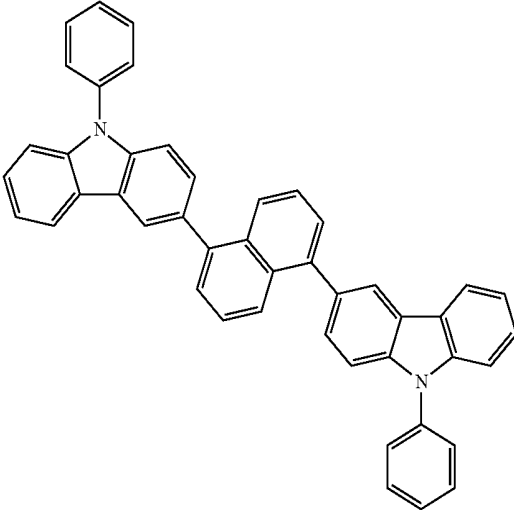
H1-19

H1-20



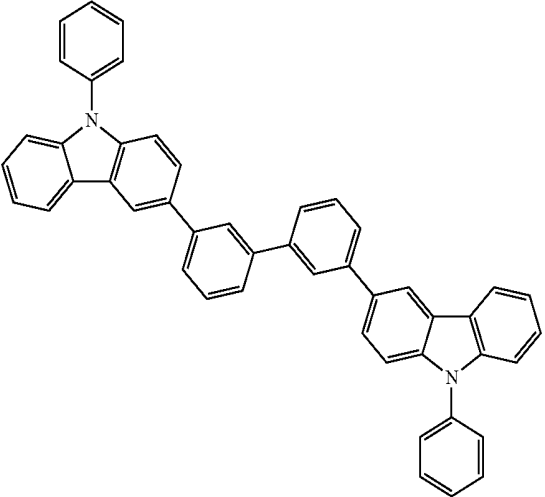
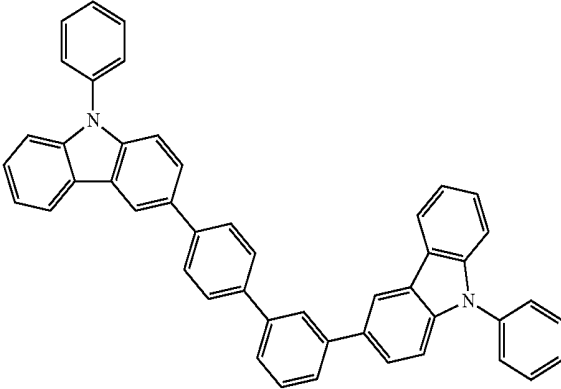
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H1-21

H1-22



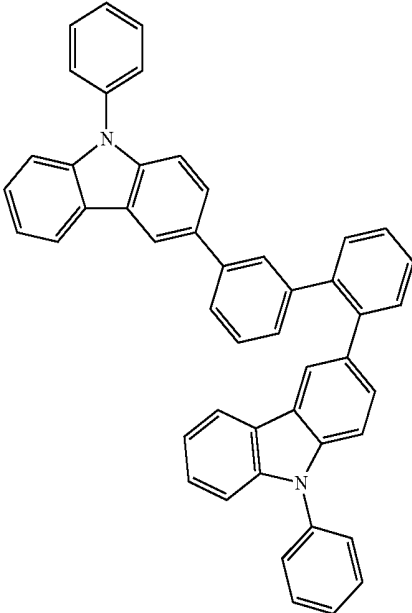
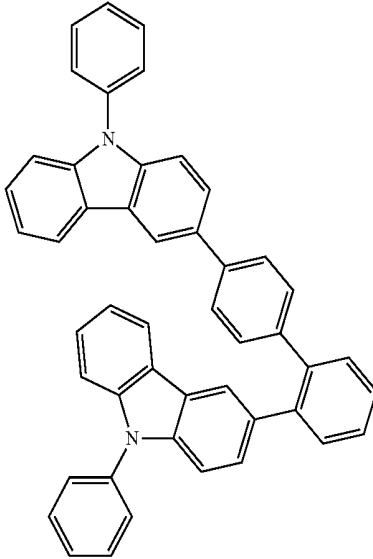
H1-23

H1-24



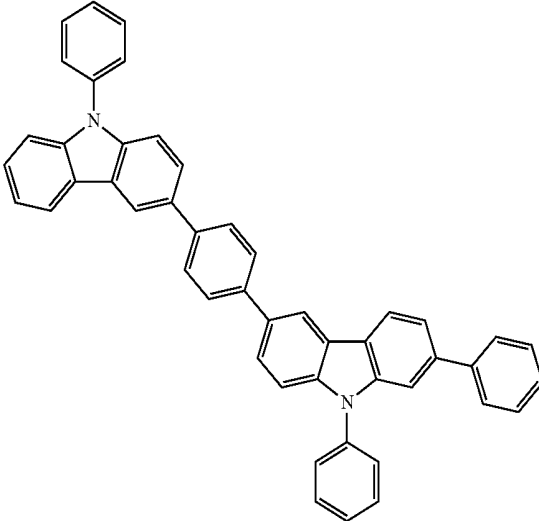
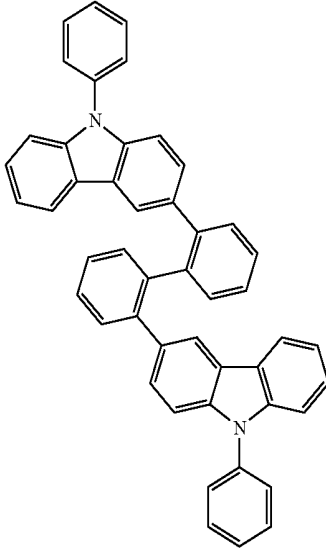
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H1-25

H1-26



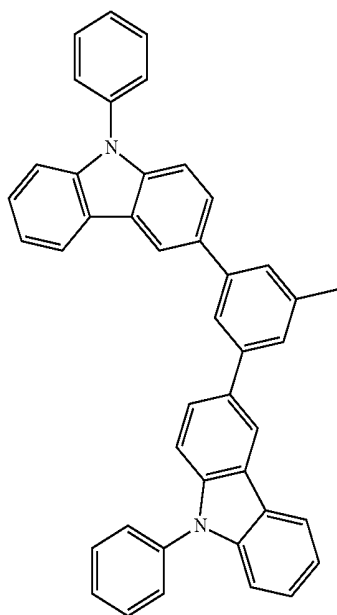
H1-27

H1-28

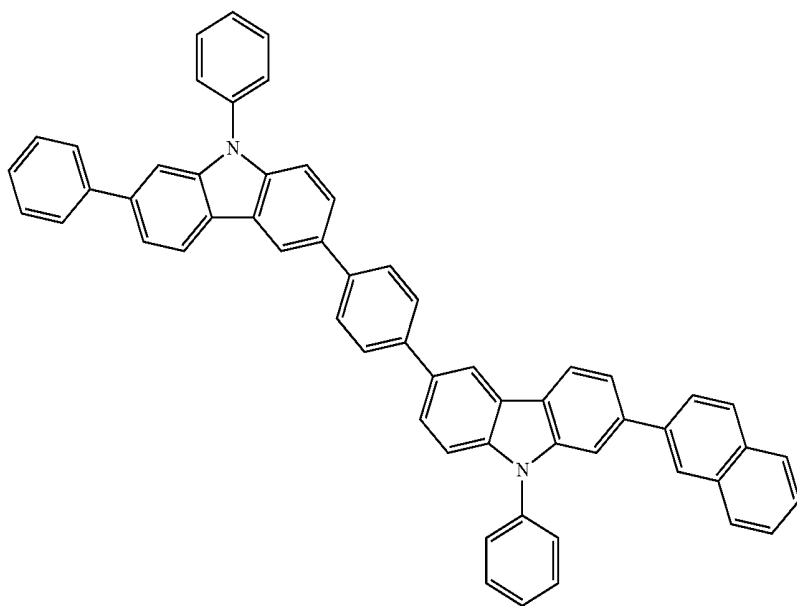


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H1-29

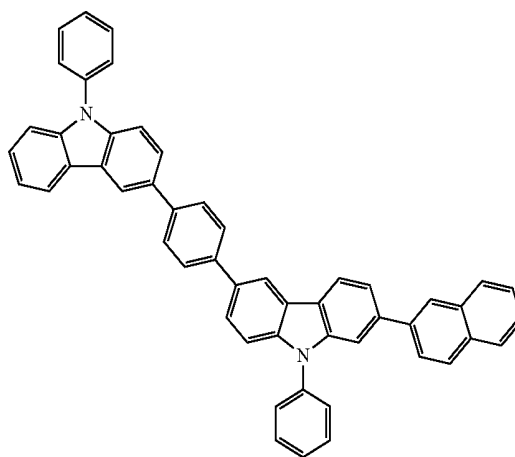
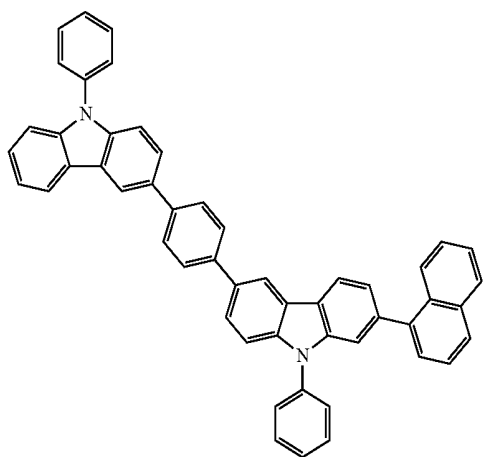


H1-30



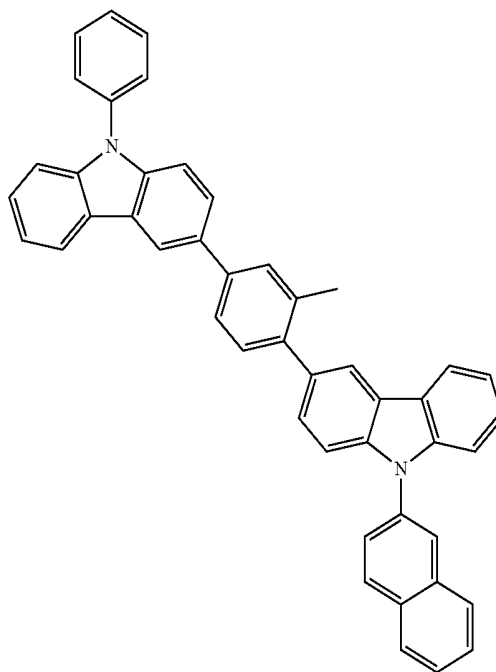
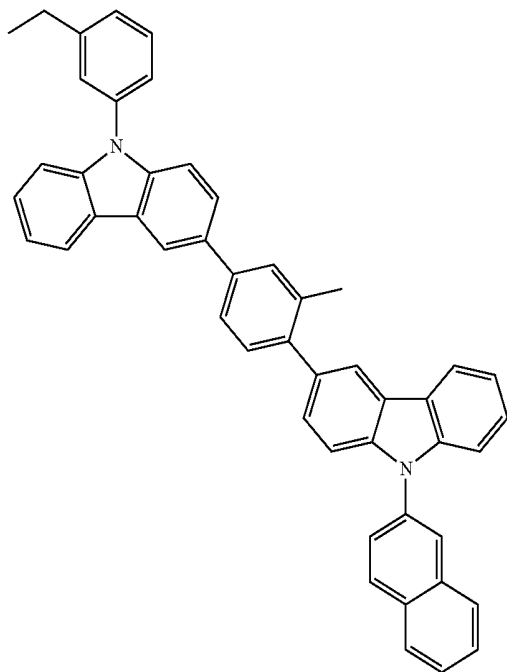
H1-31

H1-32



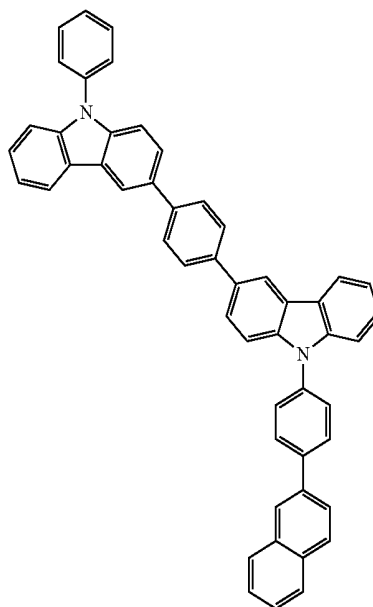
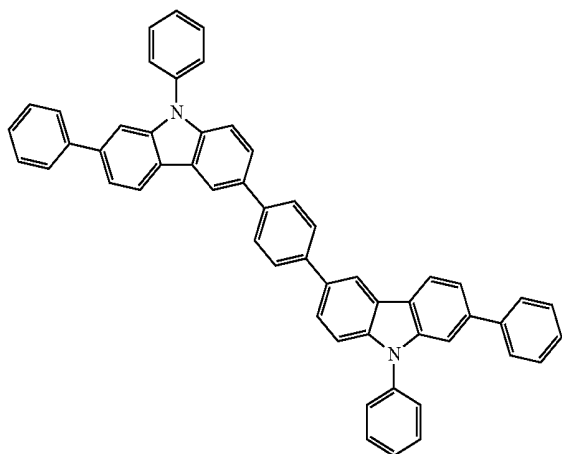
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H1-33

H1-34



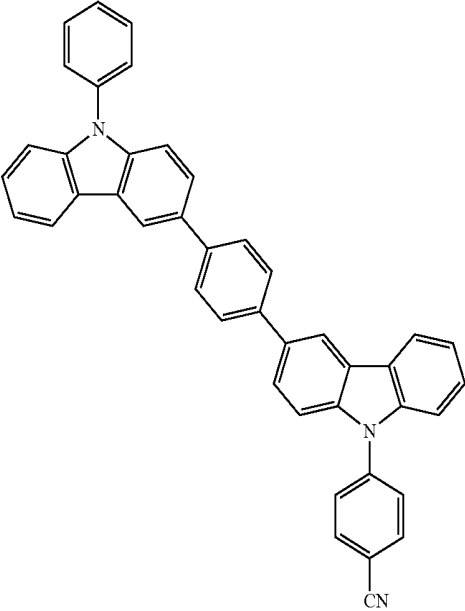
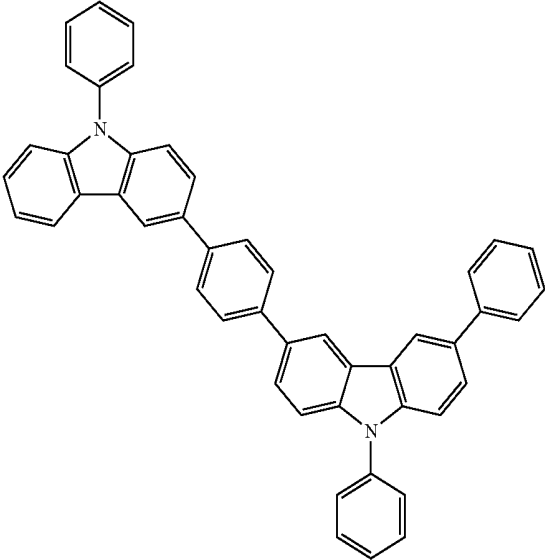
H1-35

H1-36



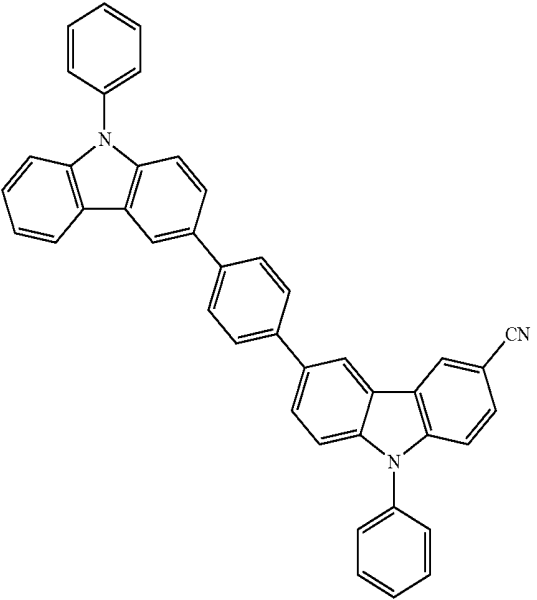
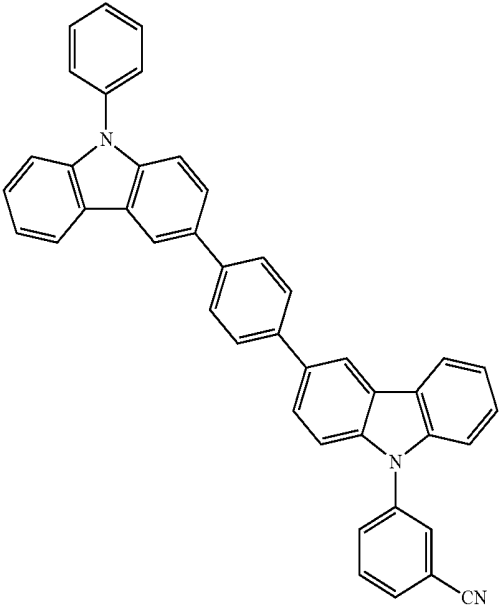
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H1-37

H1-38



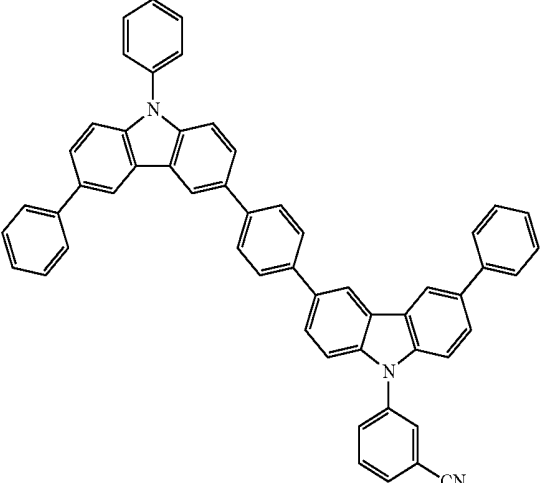
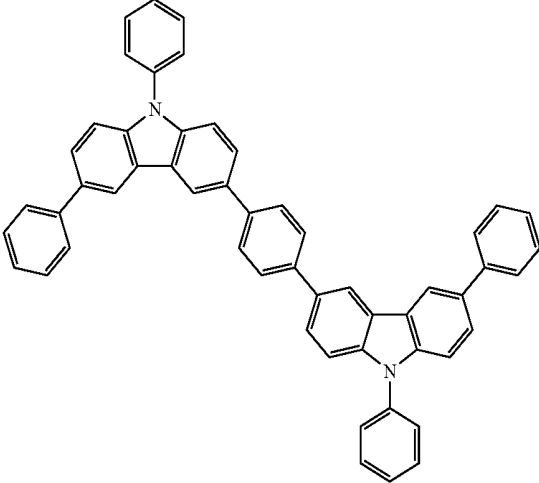
H1-39

H1-40



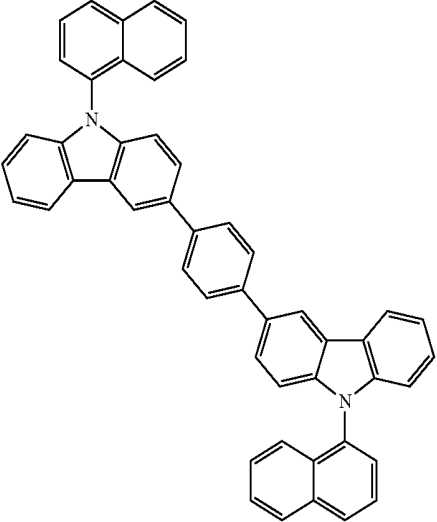
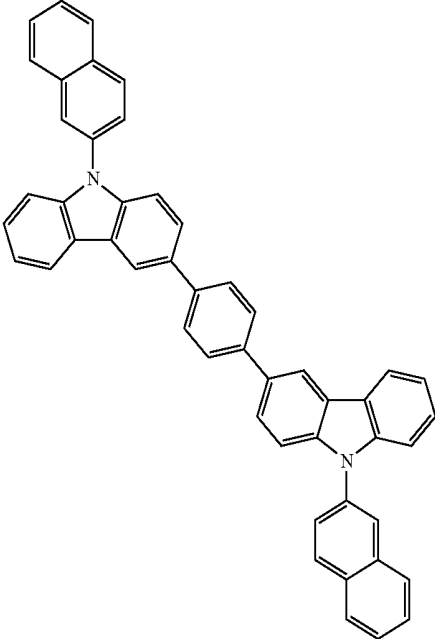
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H1-41

H1-42



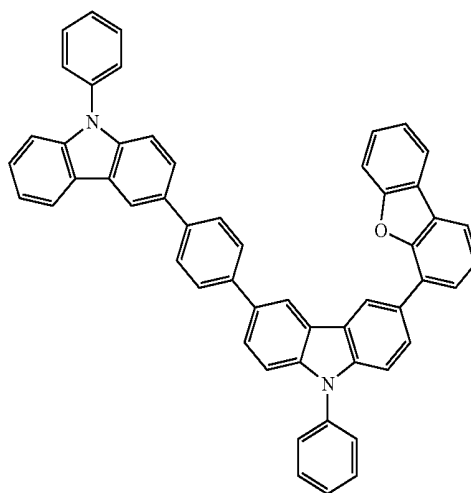
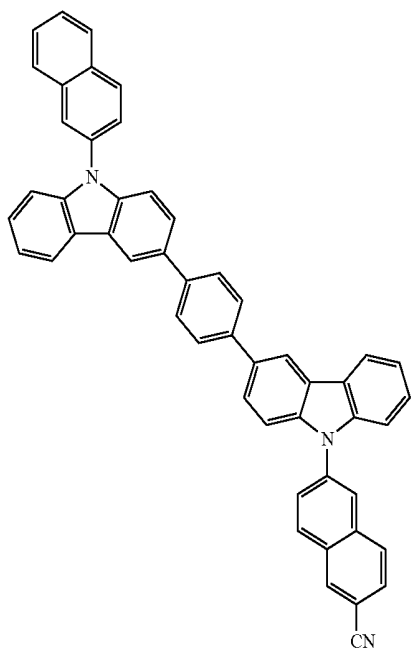
H1-43

H1-44



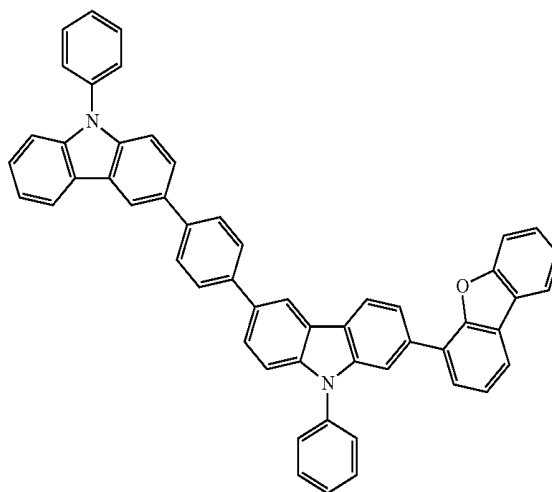
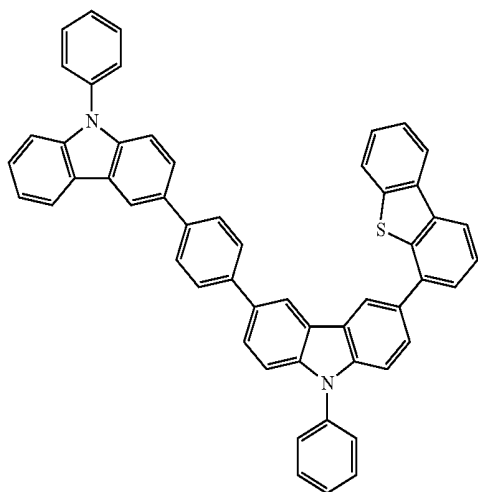
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H1-45

H1-46



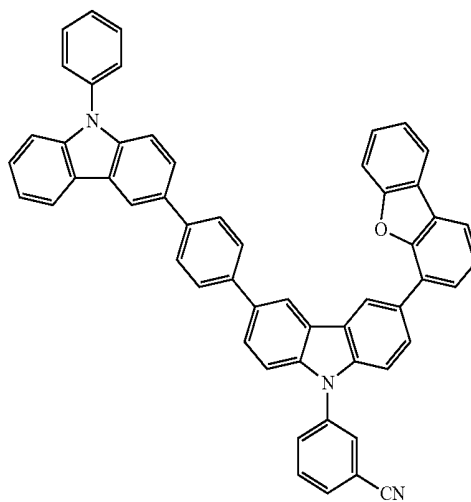
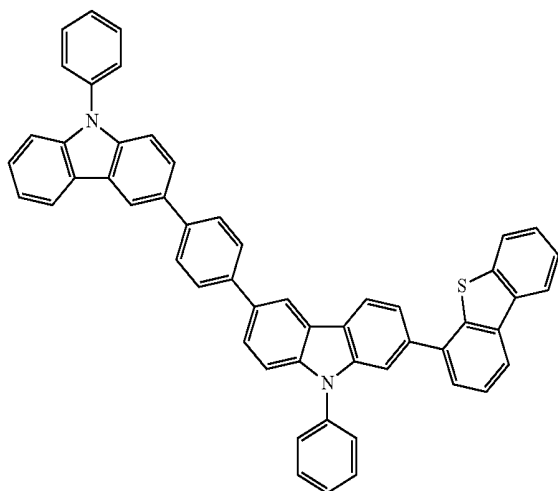
H1-47

H1-48



H1-49

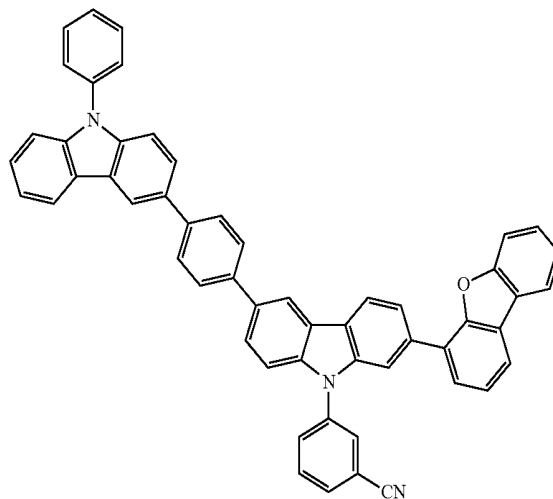
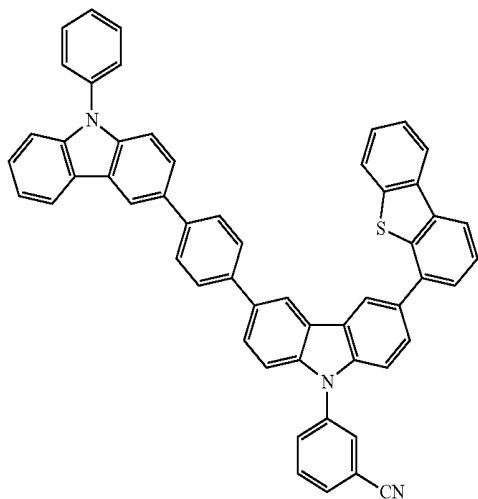
H1-50



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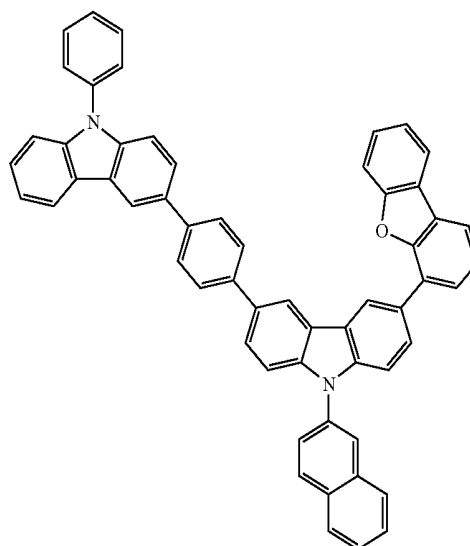
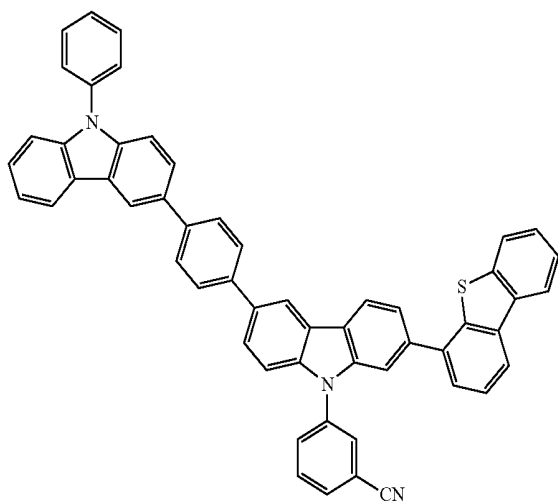
H1-51

H1-52



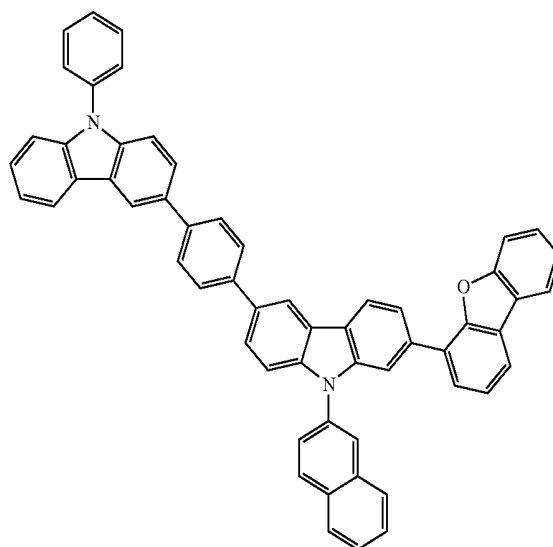
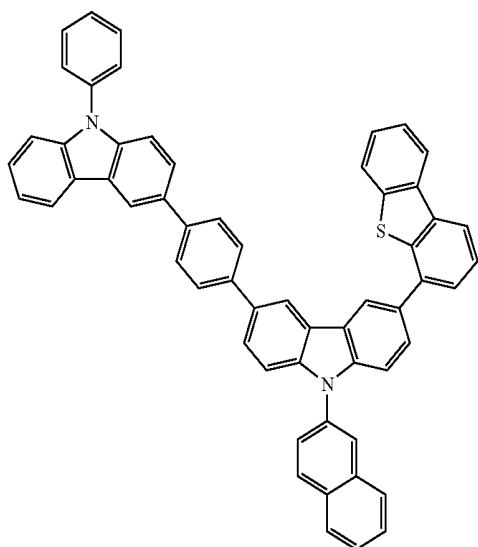
H1-53

H1-54



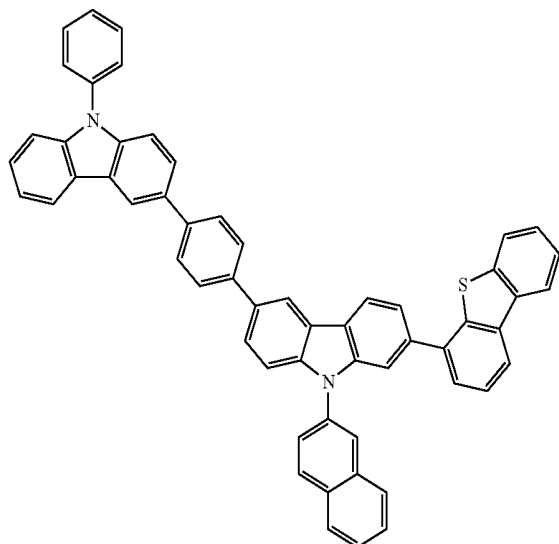
H1-55

H1-56

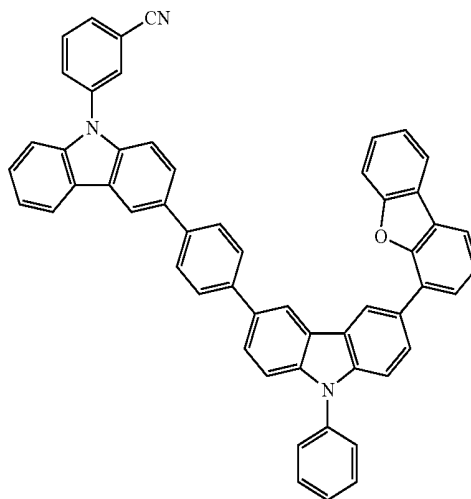


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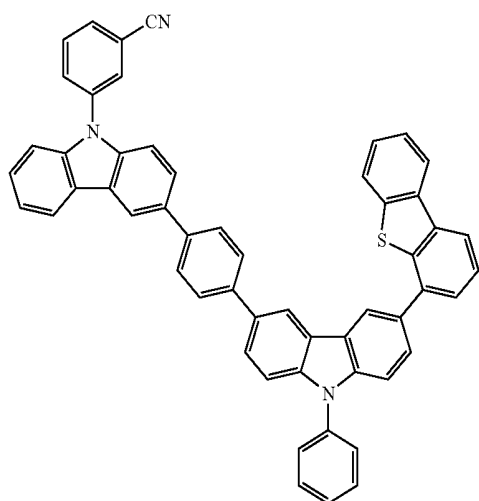
H1-57



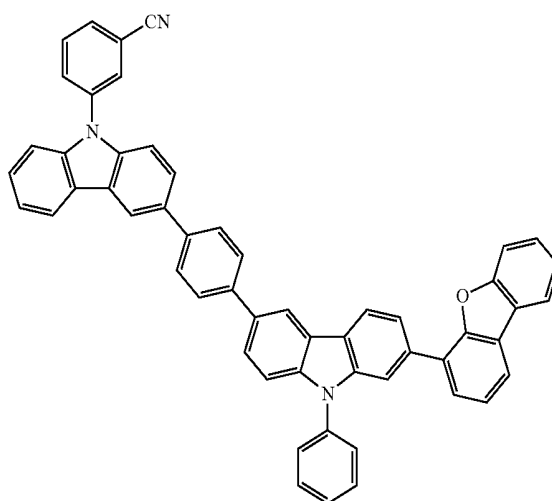
H1-58



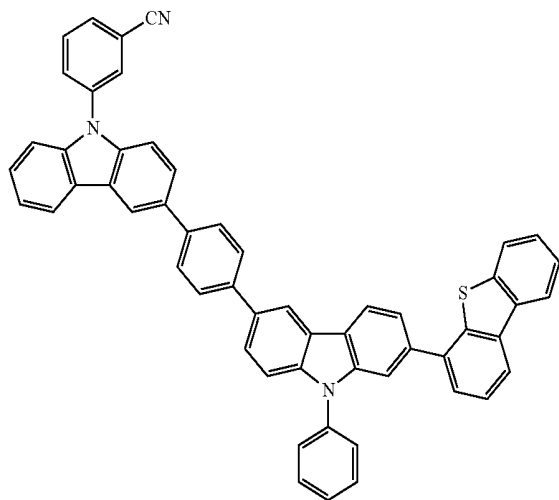
H1-59



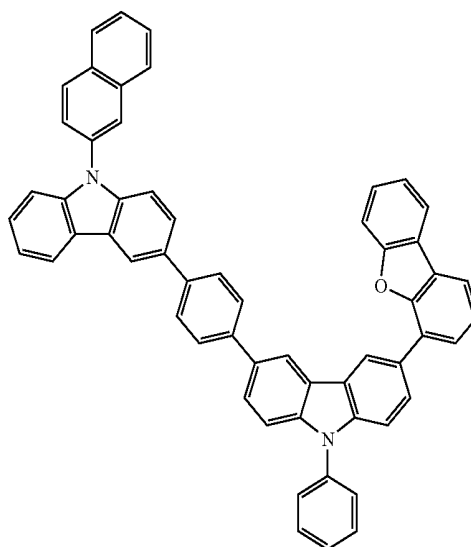
H1-60



H1-61

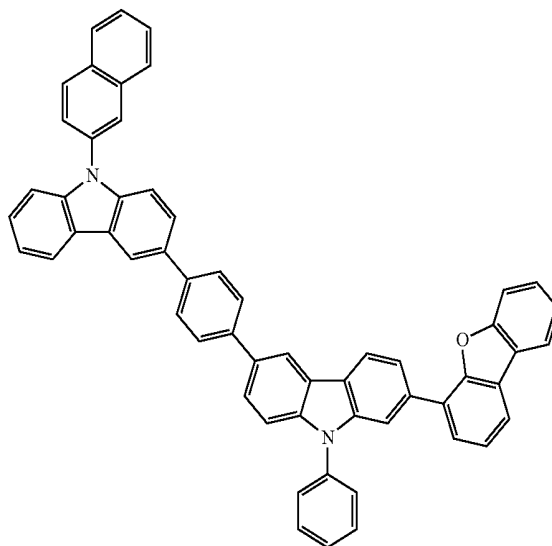
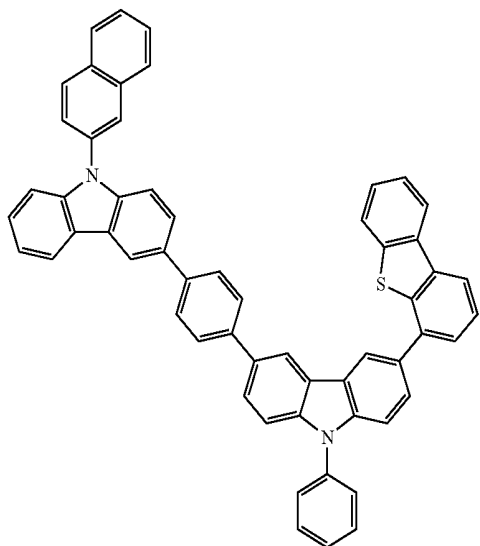


H1-62



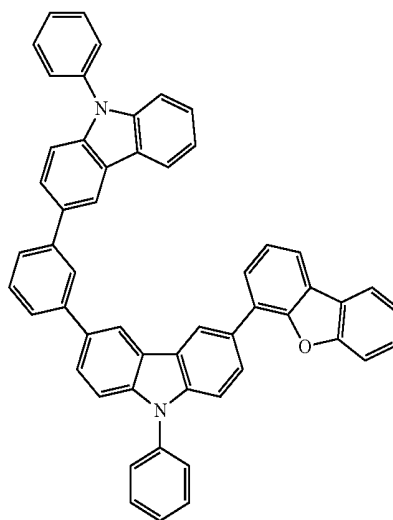
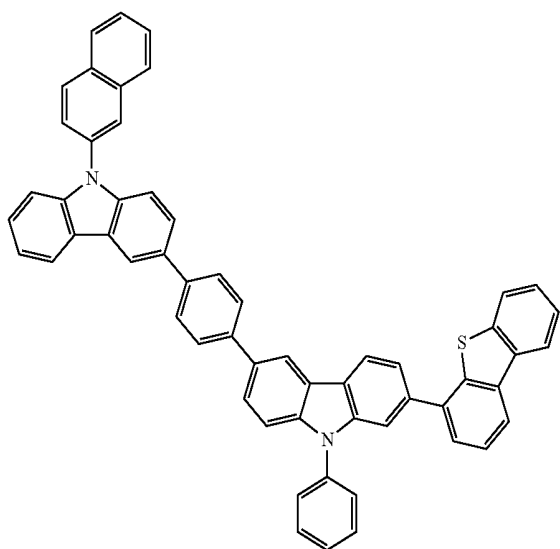
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H1-63

H1-64



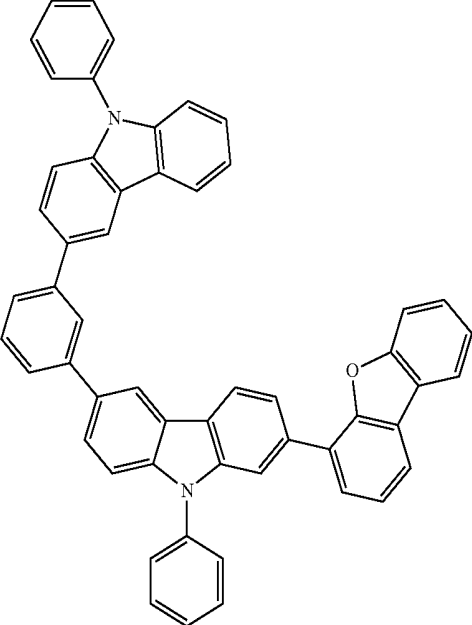
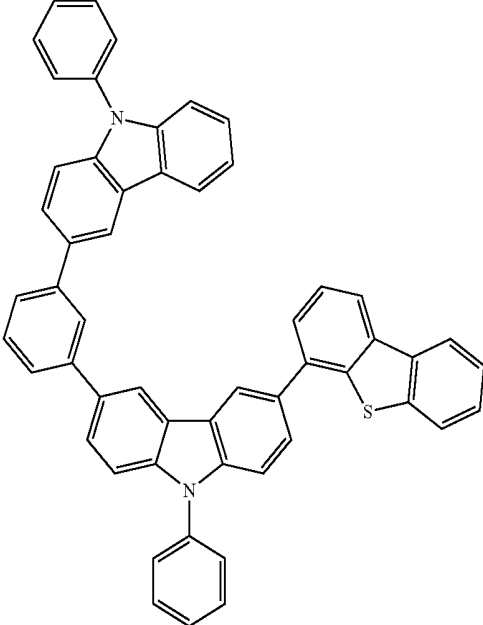
H1-65

H1-66



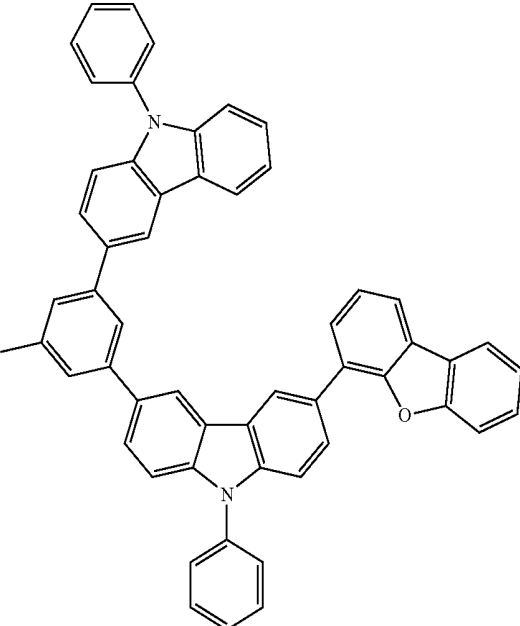
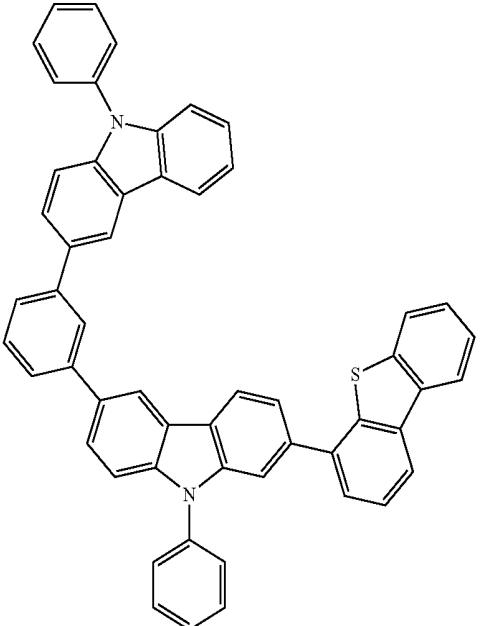
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H1-67

H1-68



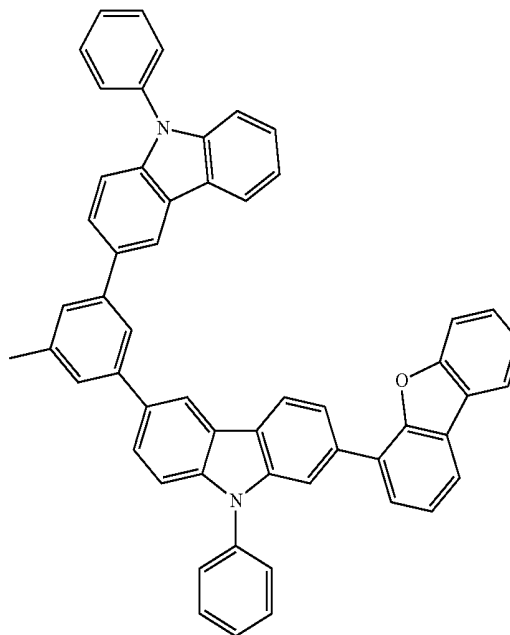
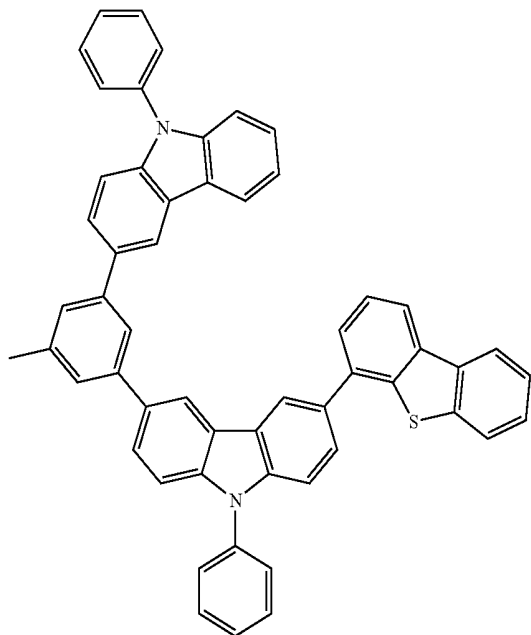
H1-69

H1-70



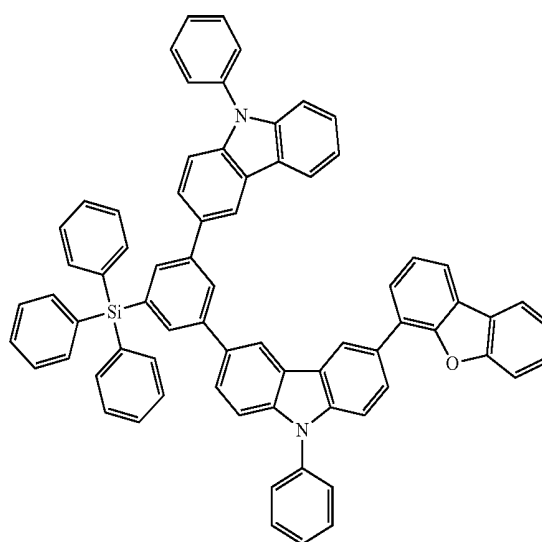
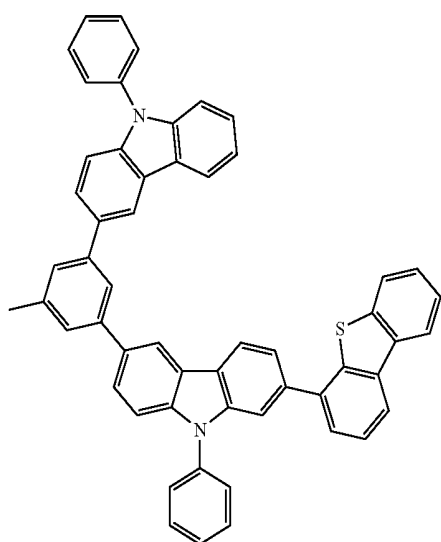
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H1-71

H1-72



H1-73

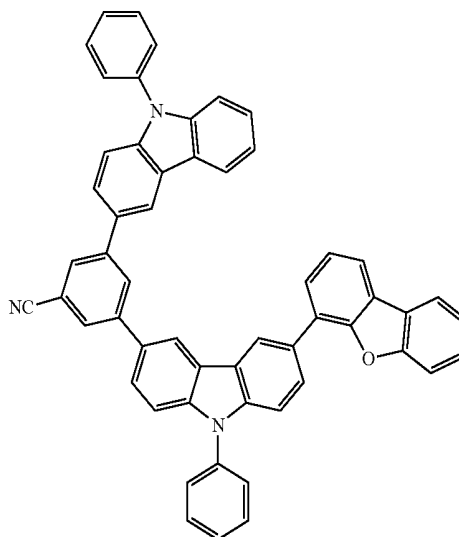
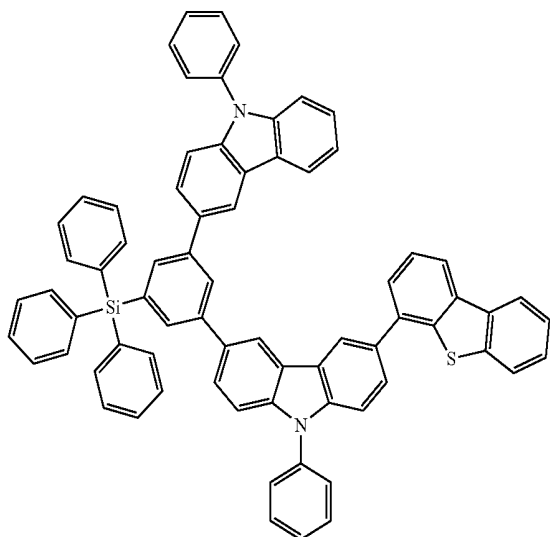
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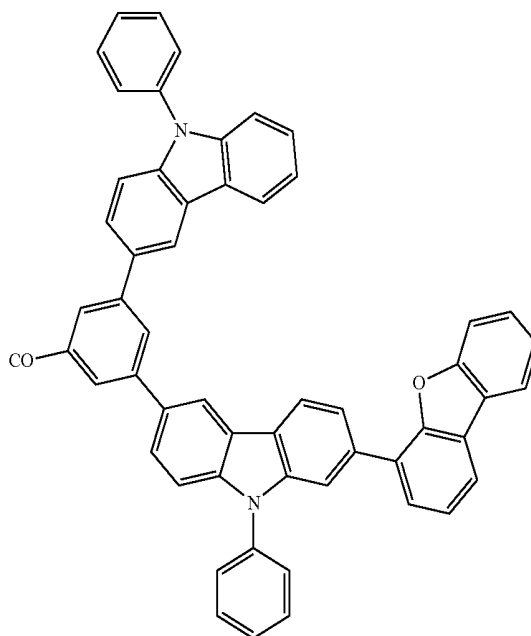
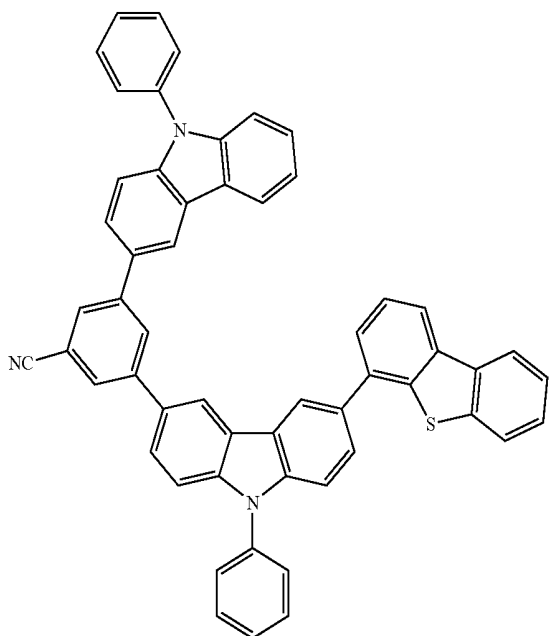
H1-75

H1-76



H1-77

H1-78

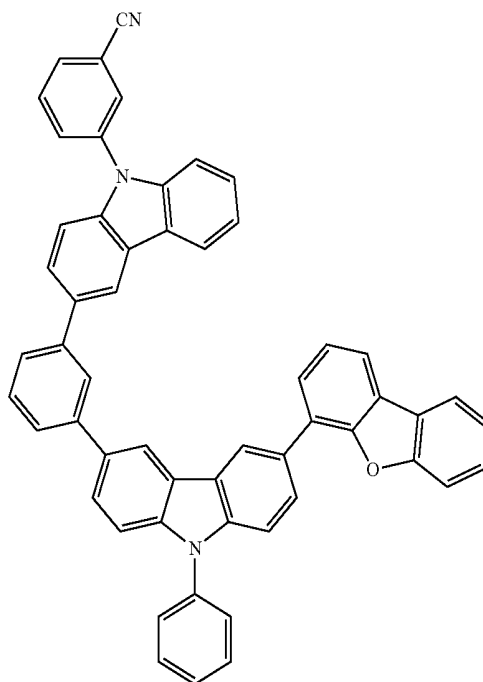
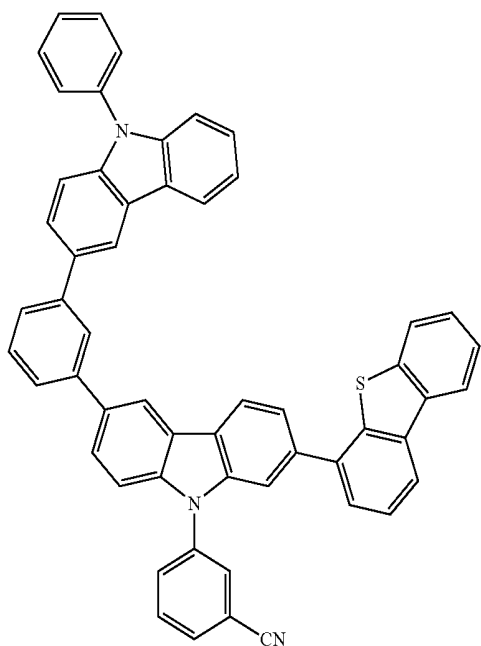




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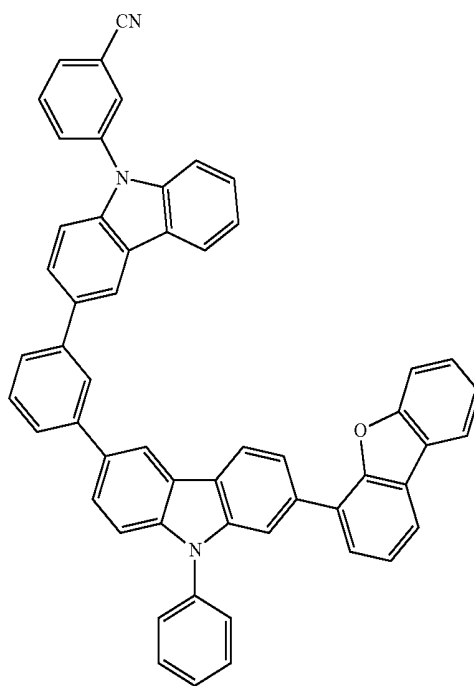
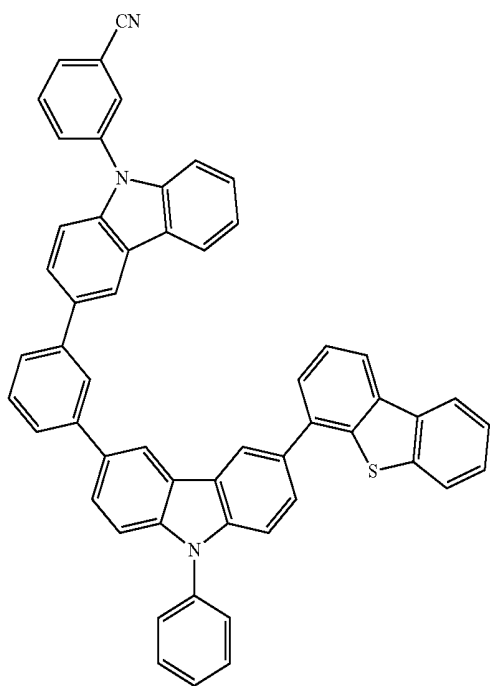
H1-83

H1-84



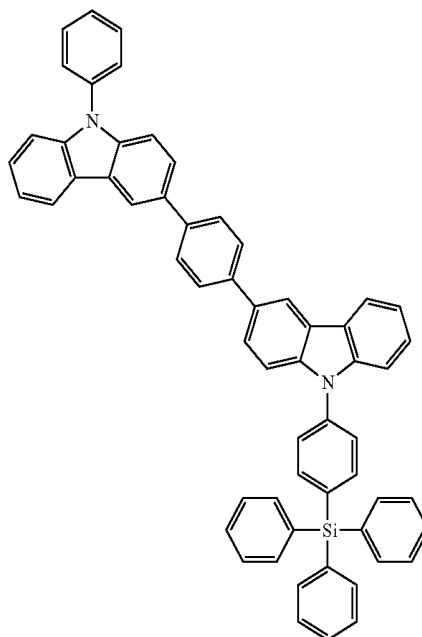
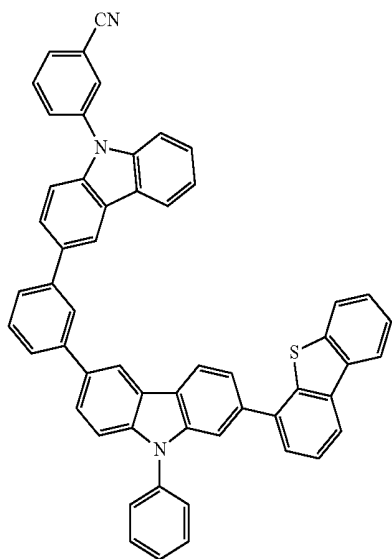
H1-85

H1-86



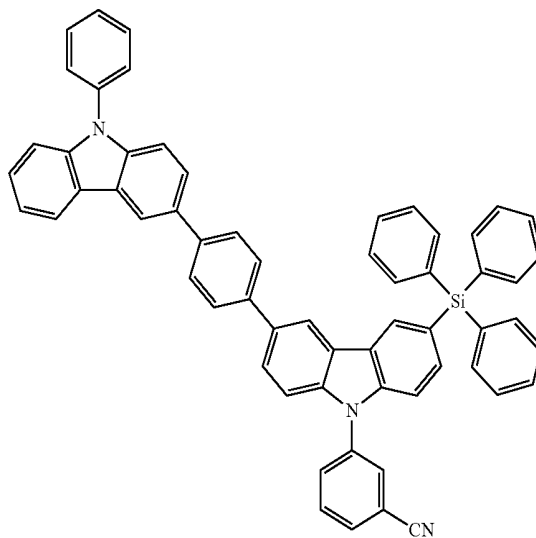
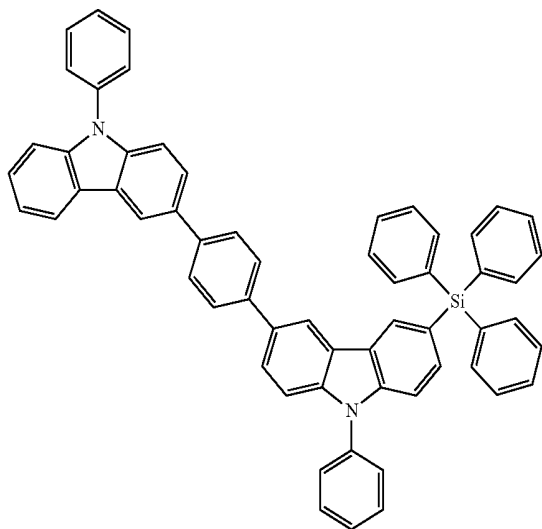
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H1-87

H1-88



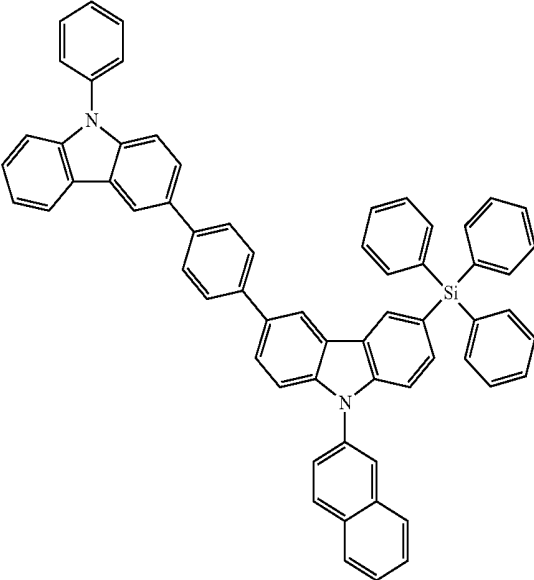
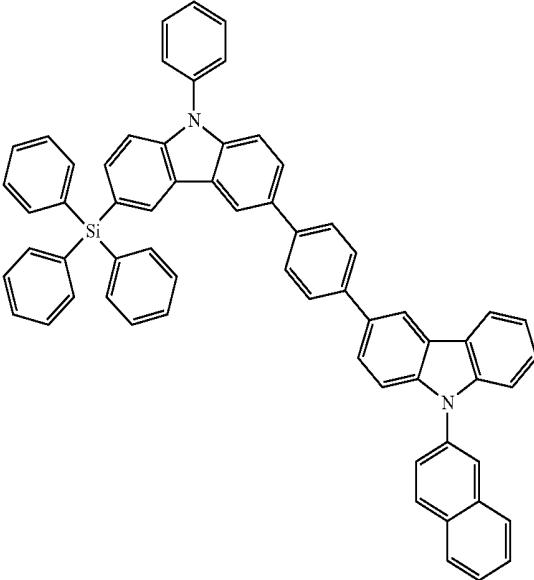
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H1-90



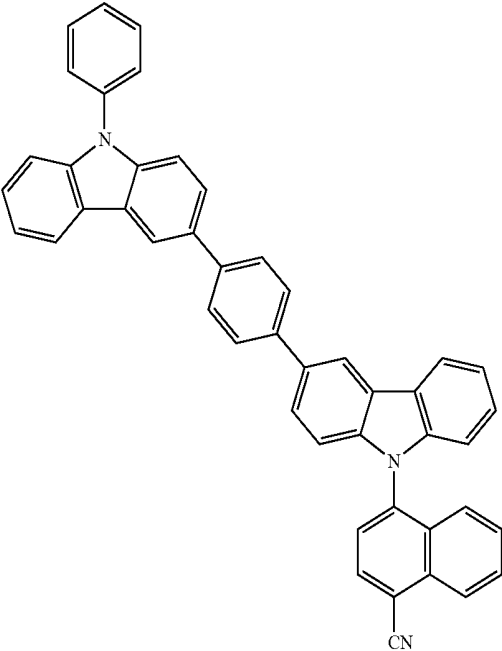
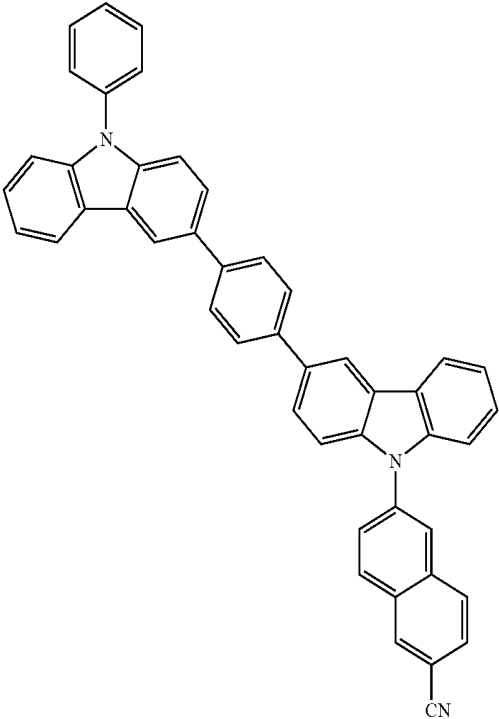
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H1-91

H1-92



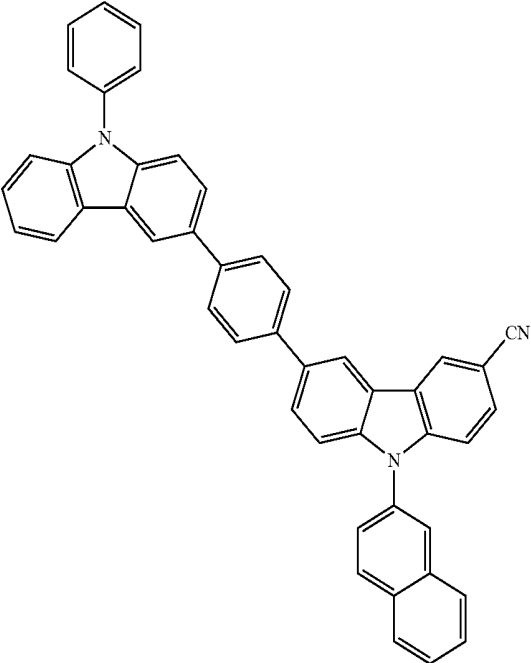
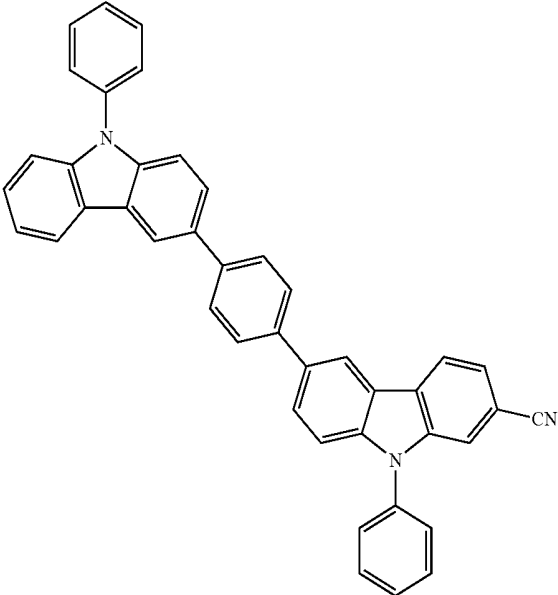
H1-93

H1-94

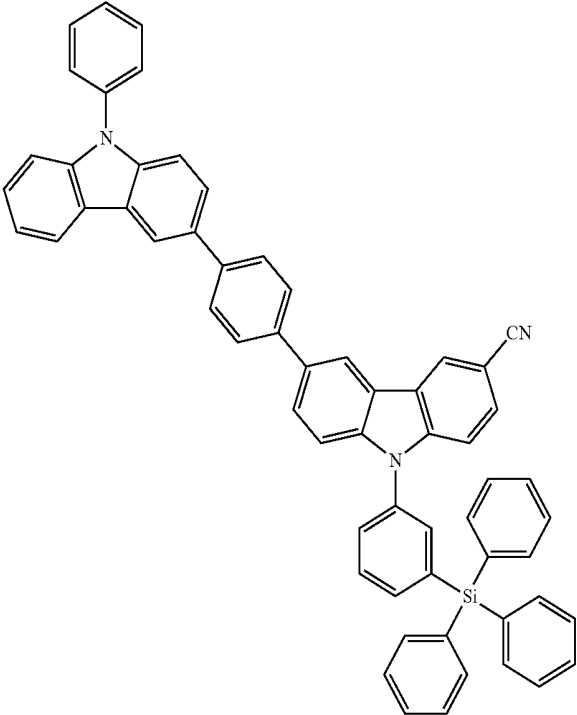


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H1-95

H1-96

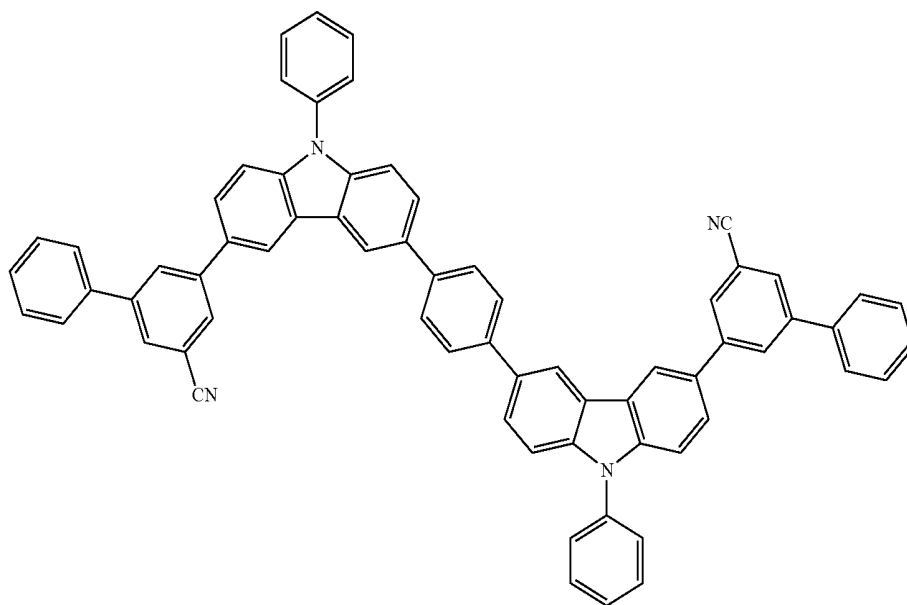


H1-97

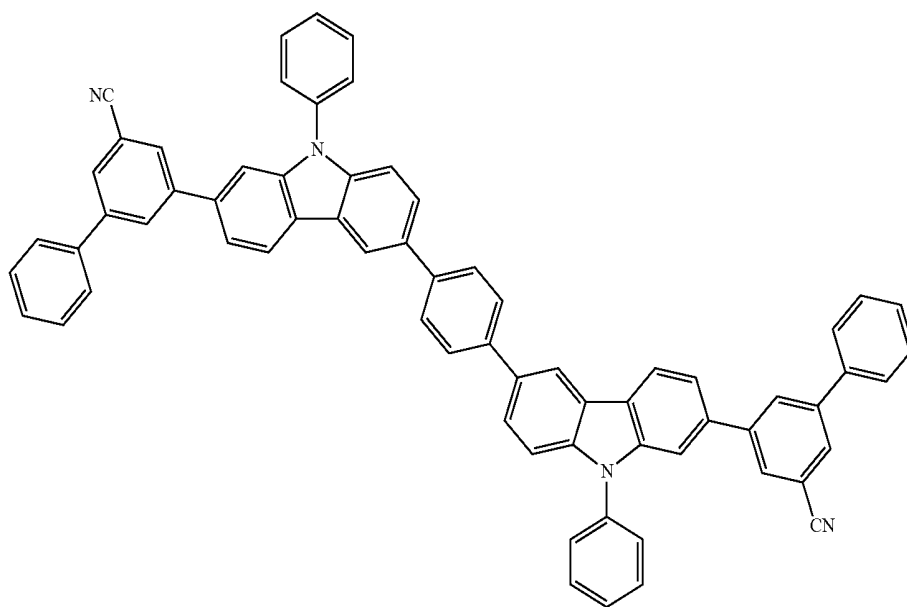


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H1-98

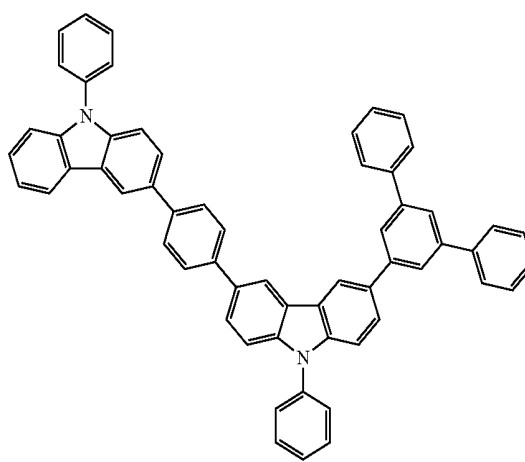
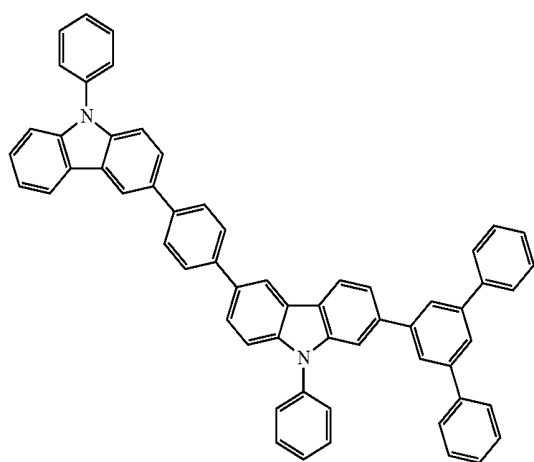


H1-99



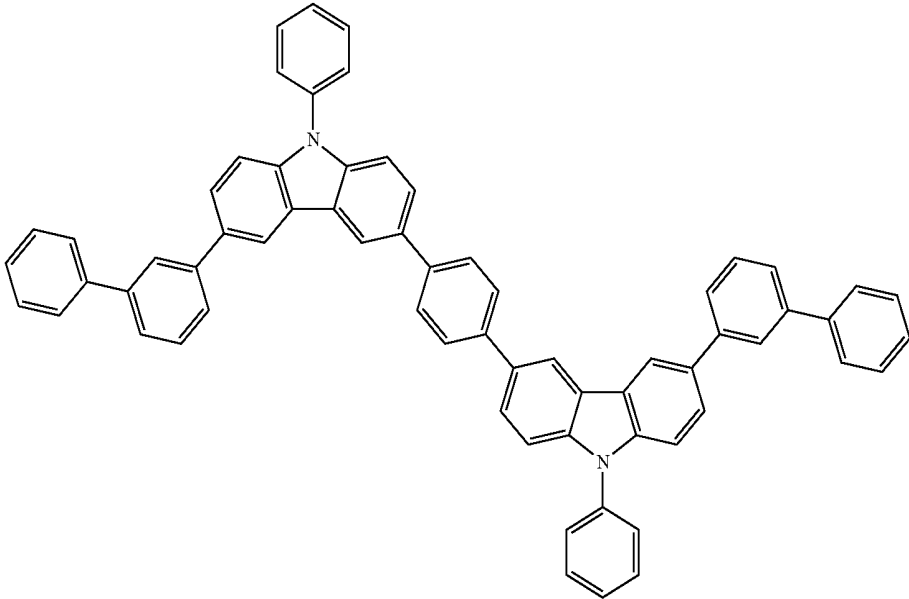
H1-100

H1-101

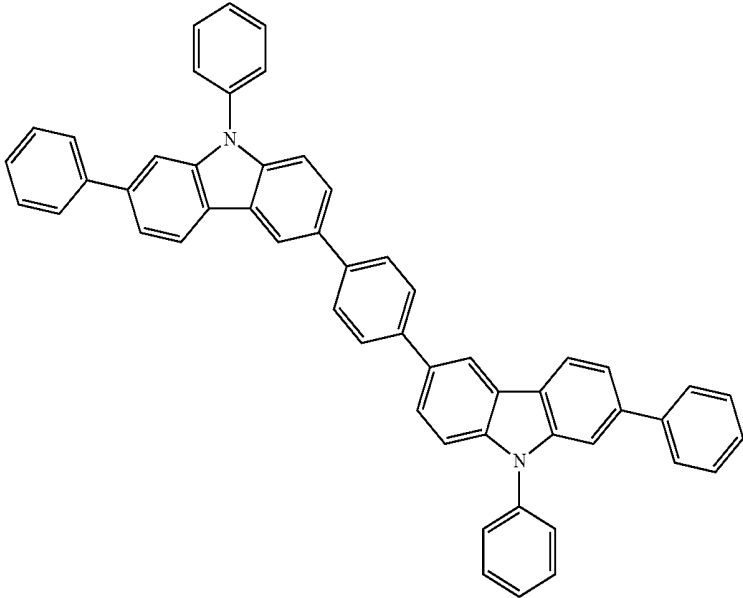


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H1-102

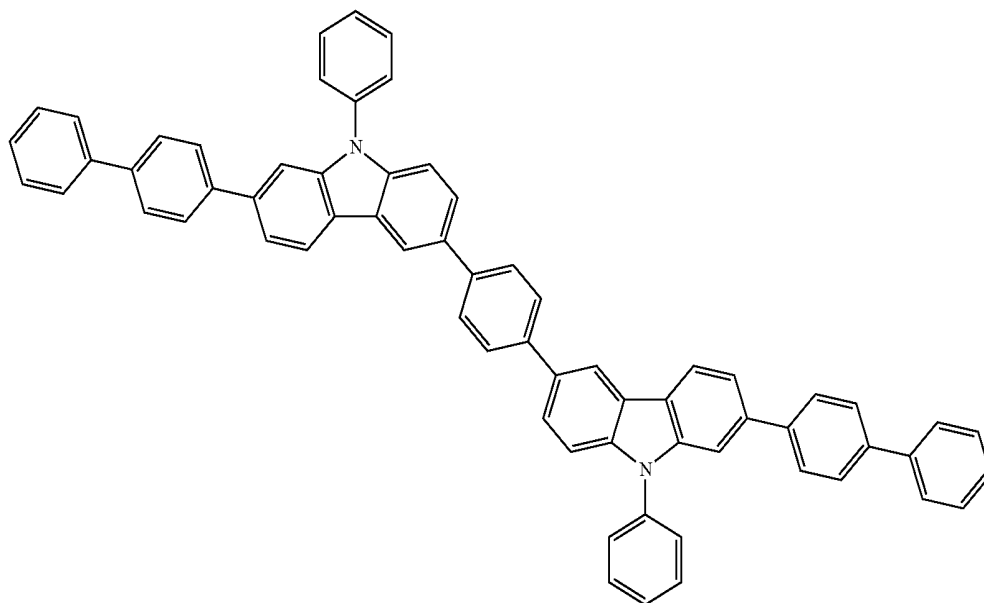


H1-103

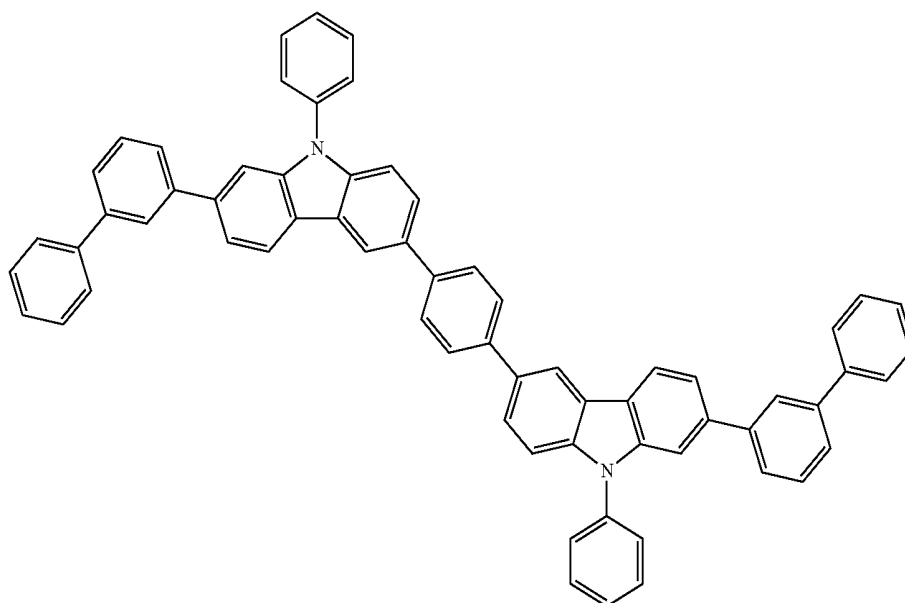


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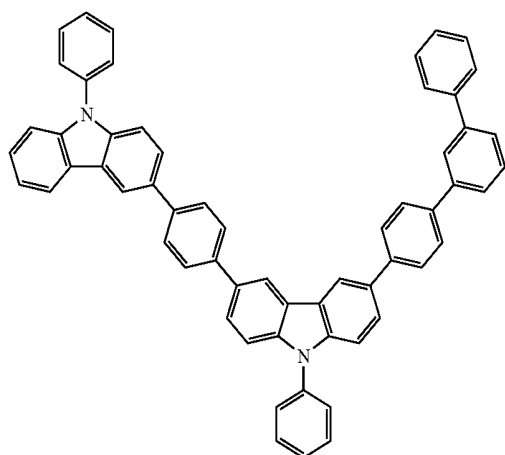
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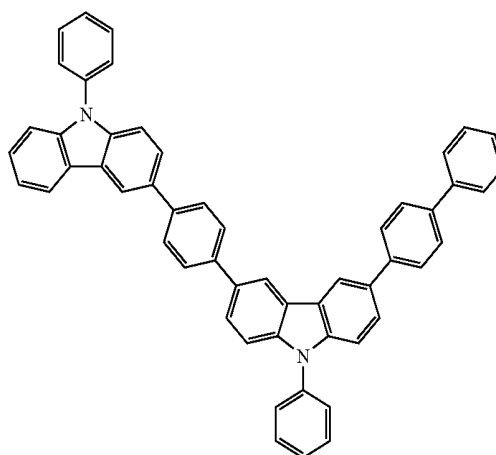
H1-105



H1-106

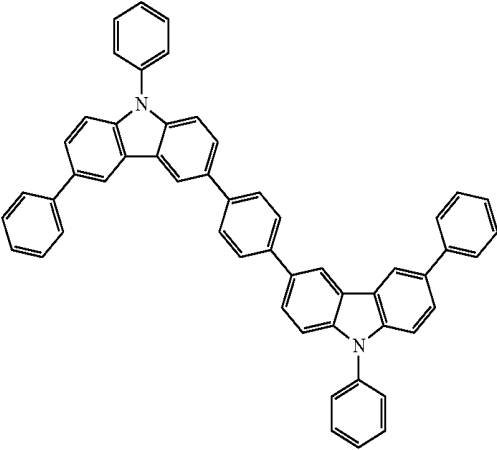
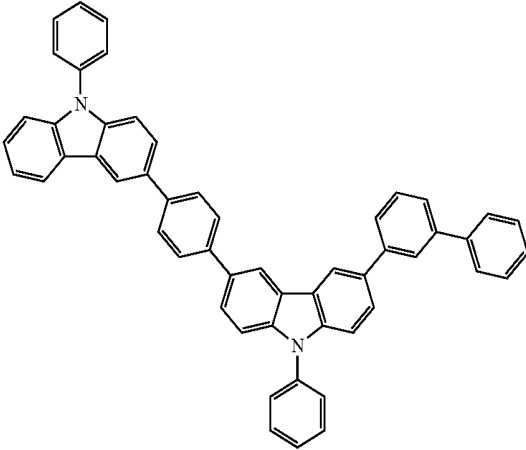


H1-107

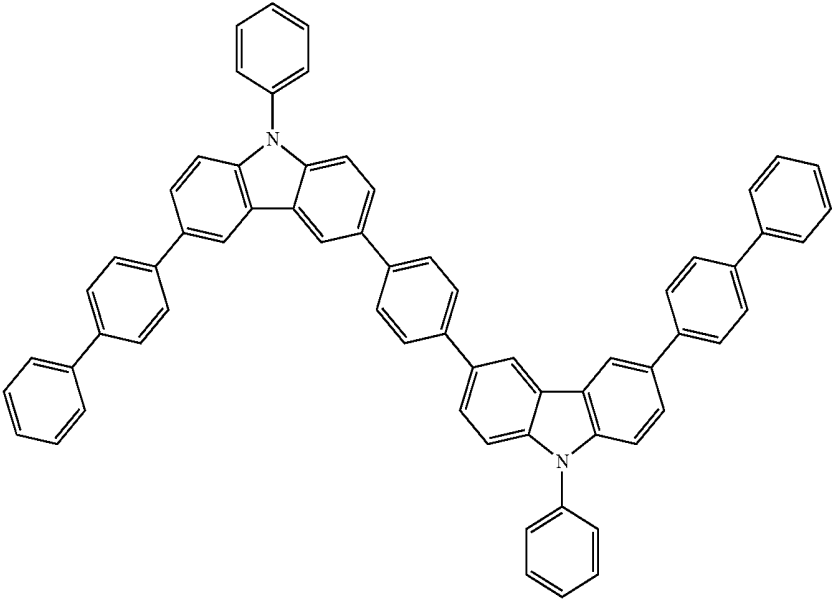


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H1-108

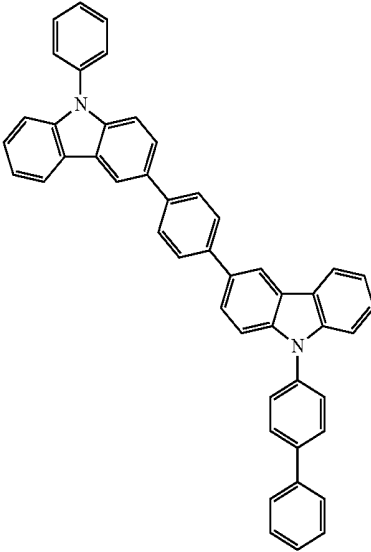
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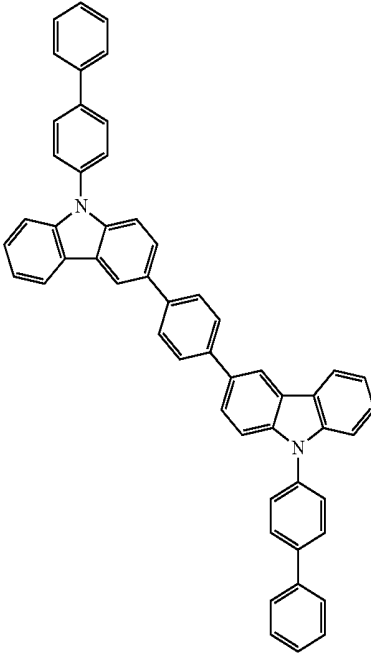
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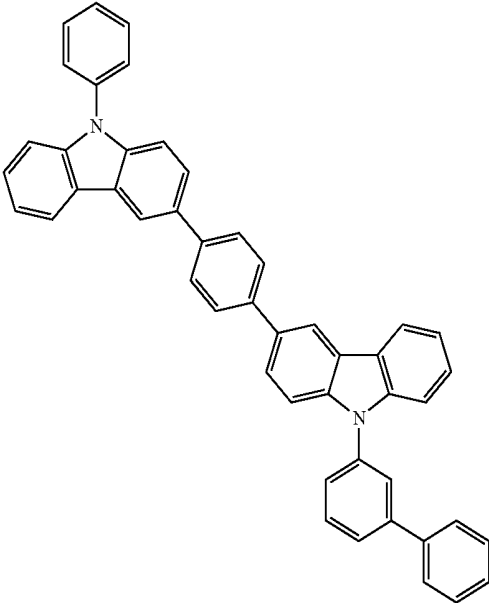
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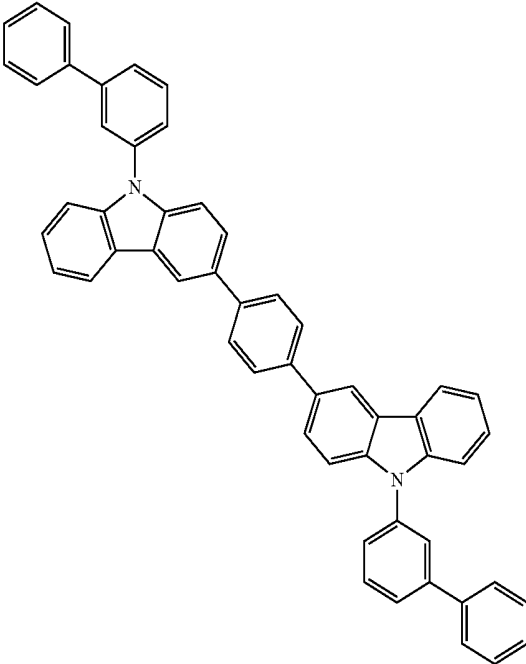
H1-112



H1-113



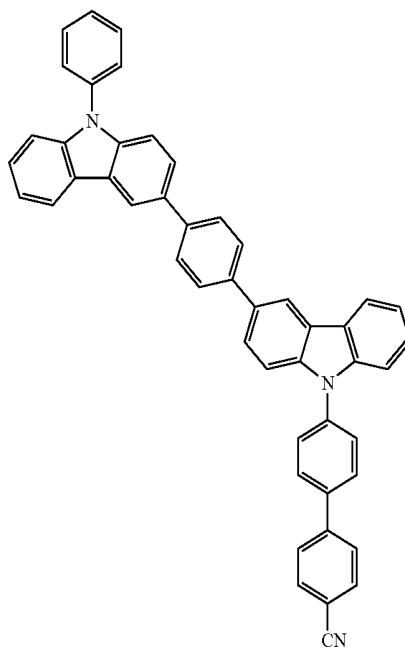
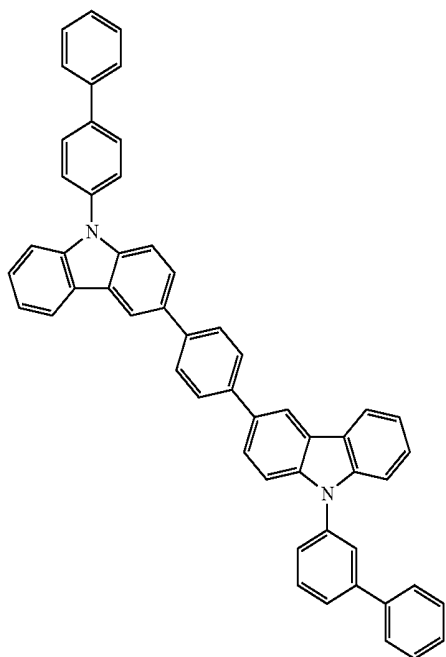
H1-114



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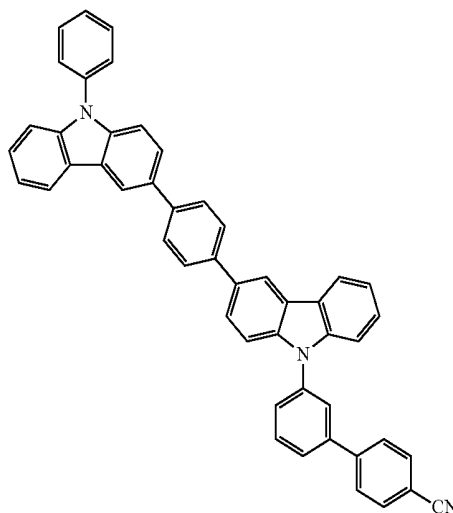
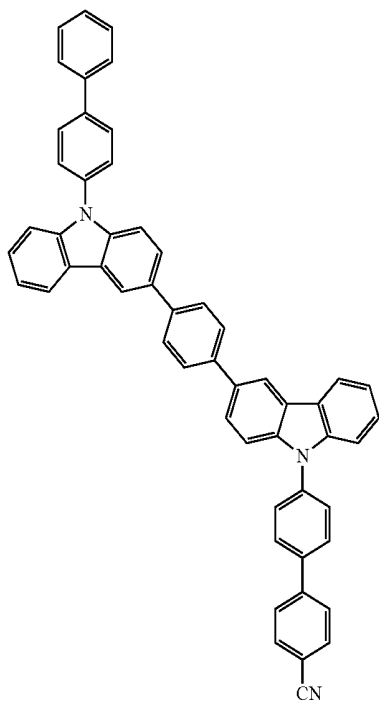
H1-115

H1-116



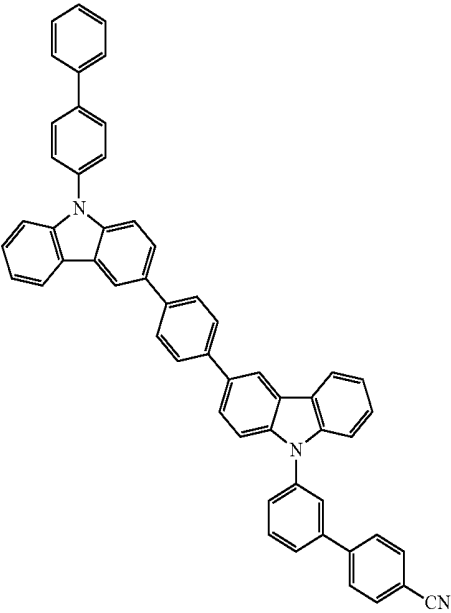
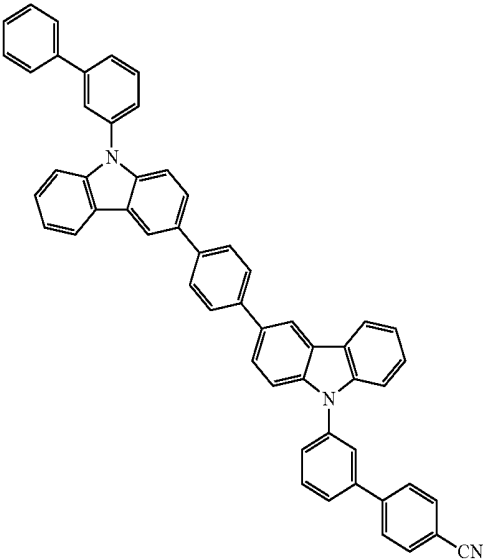
H1-117

H1-118



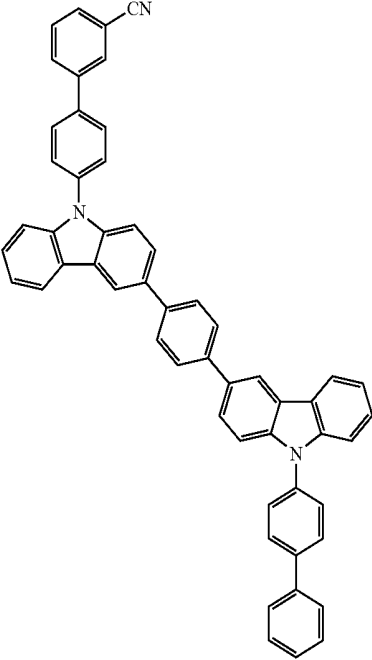
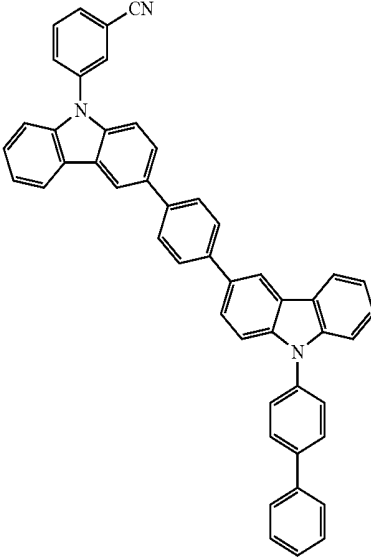
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H1-119

H1-120



H1-121

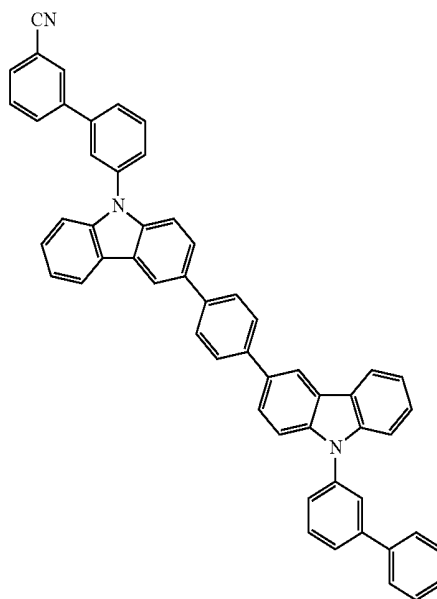
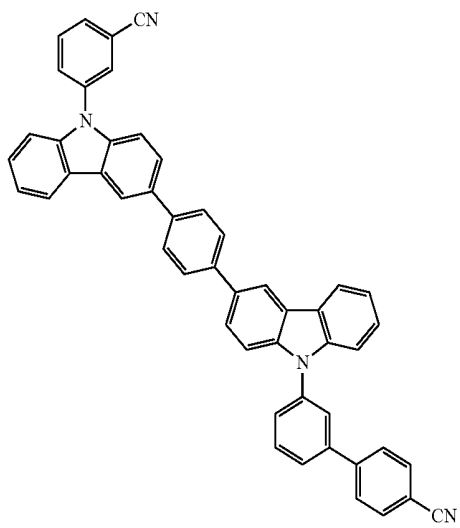
H1-122



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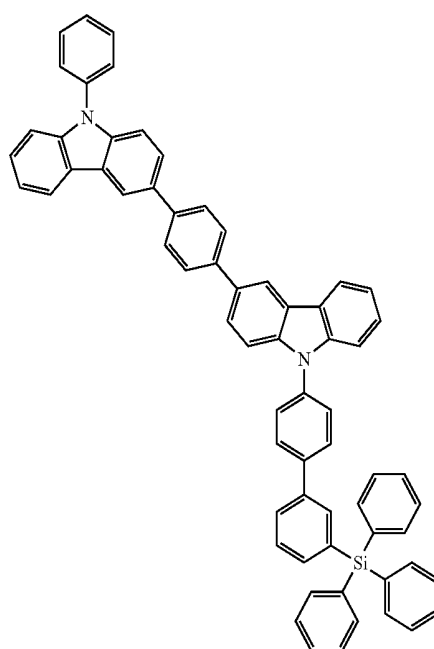
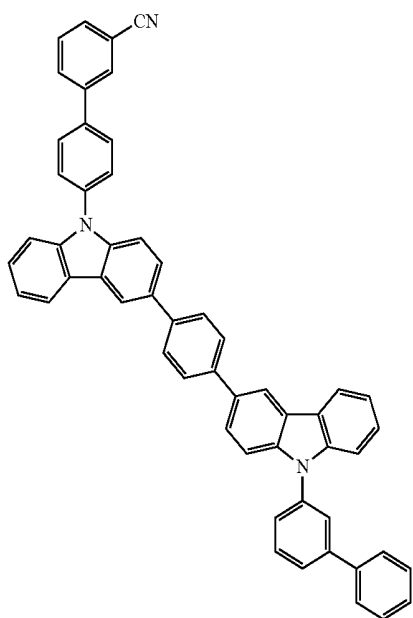
H1-123

H1-124



H1-125

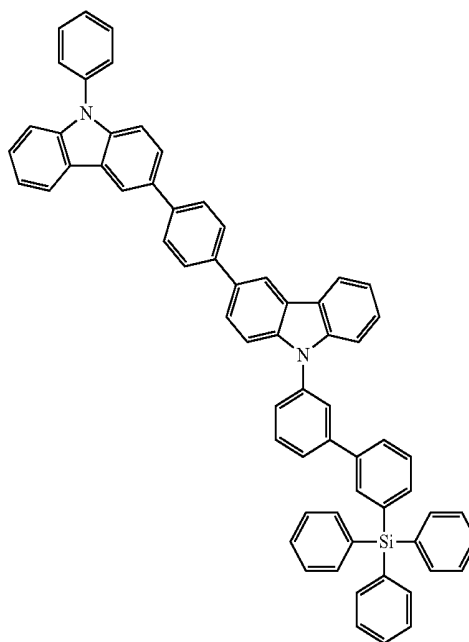
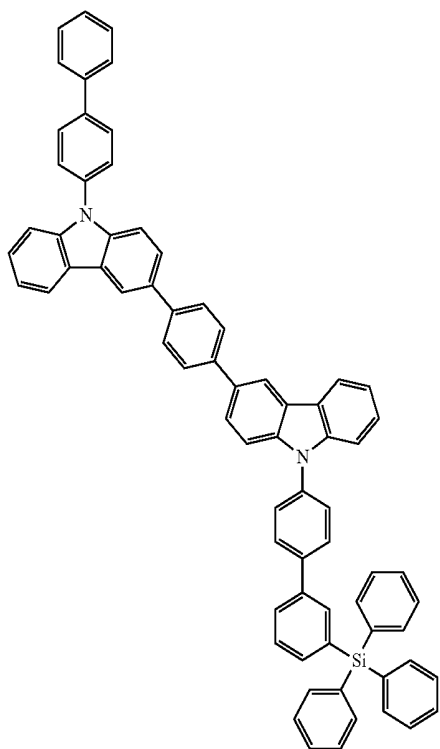
H1-126



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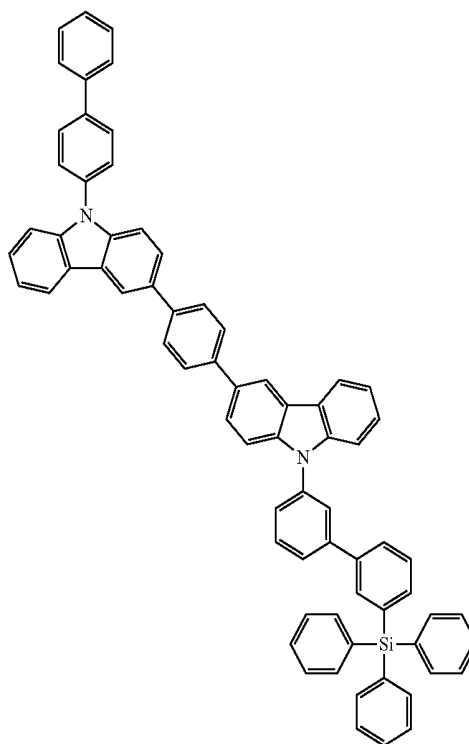
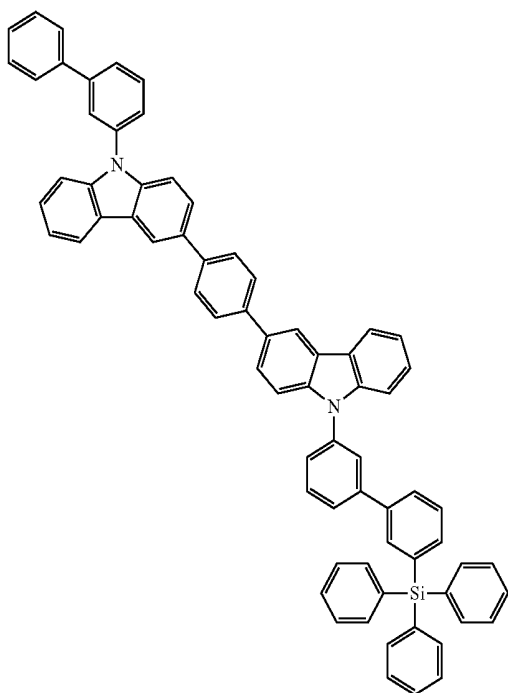
H1-127

H1-128



H1-129

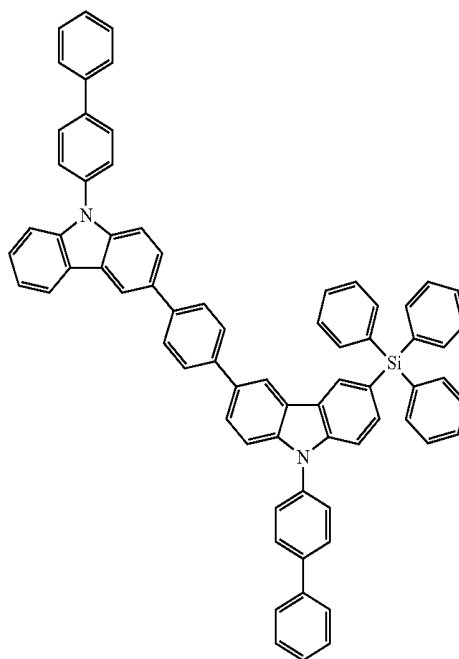
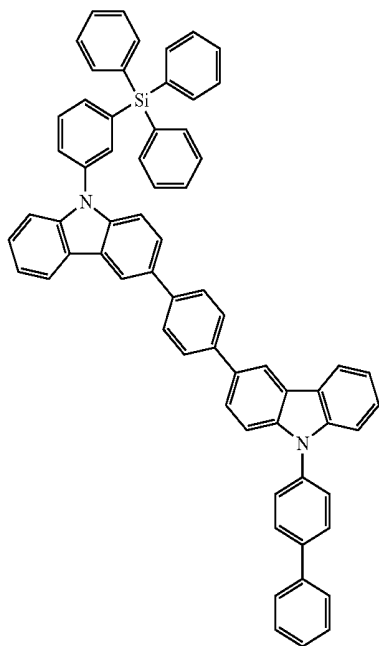
H1-130



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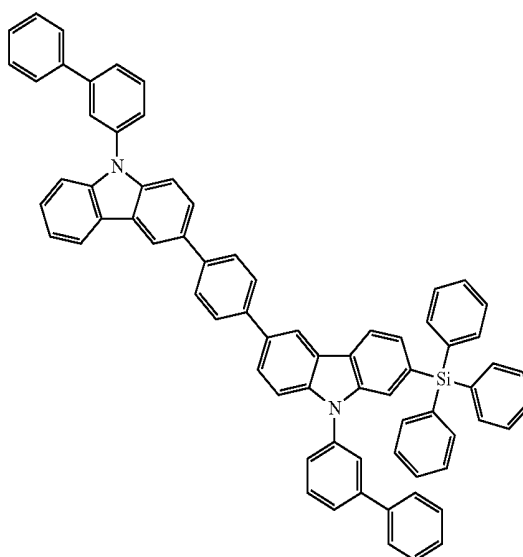
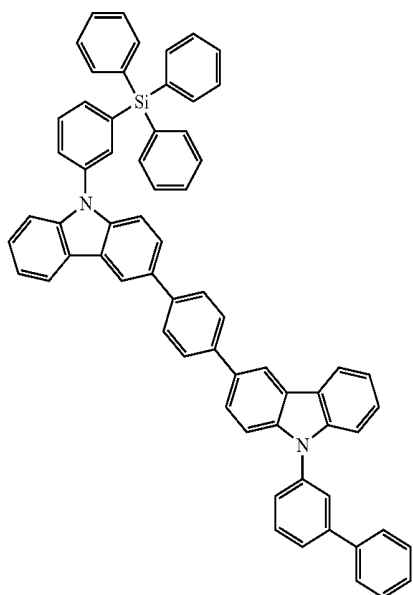
H1-131

H1-132



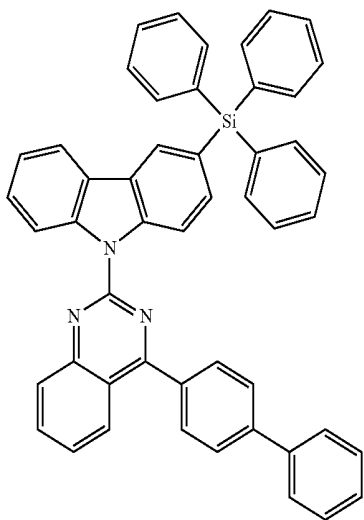
H1-133

H1-134



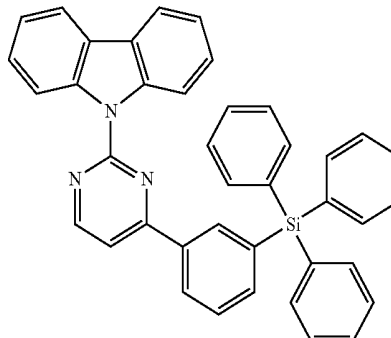


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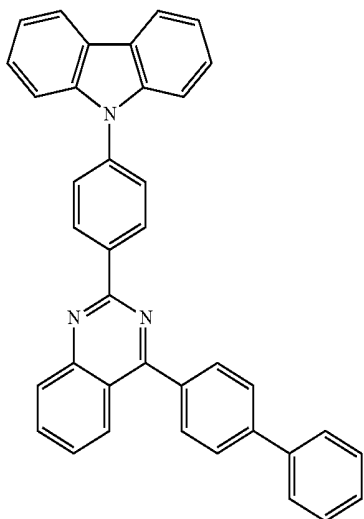


H2-5

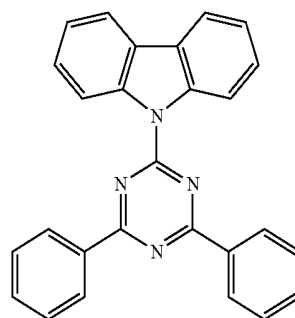
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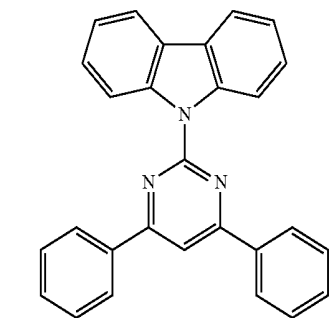
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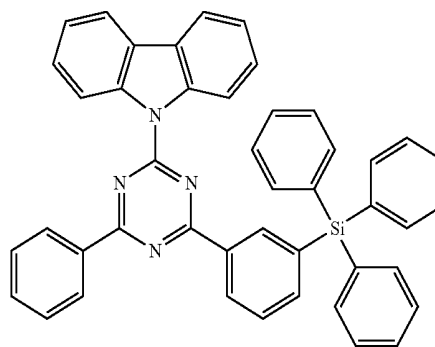
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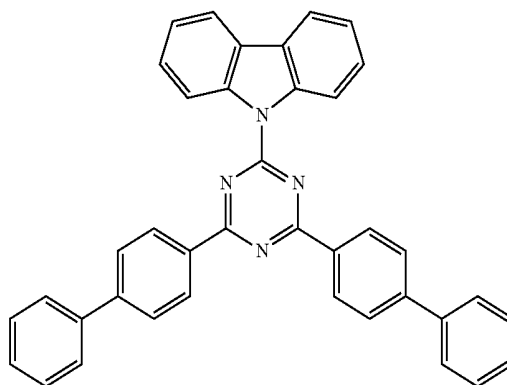
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H2-7

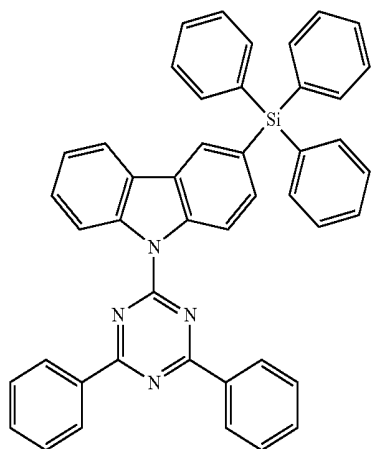


H2-10



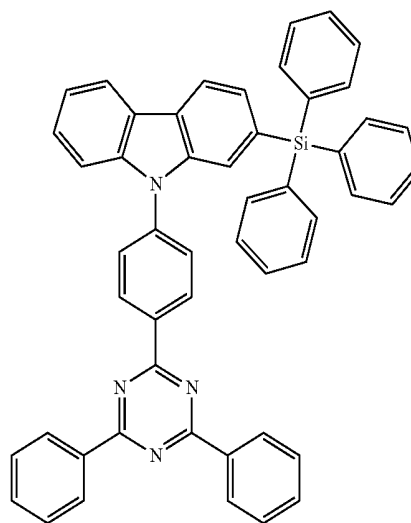
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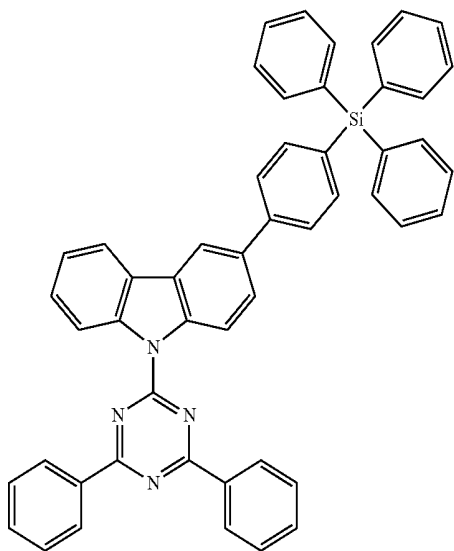
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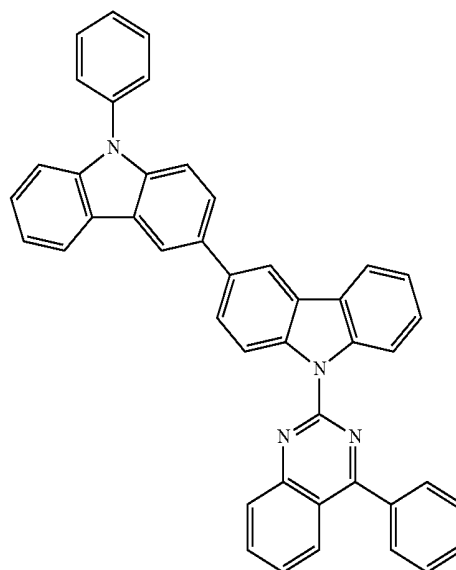


H2-15

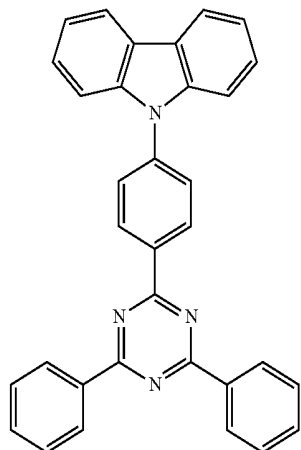
H2-13



H2-16

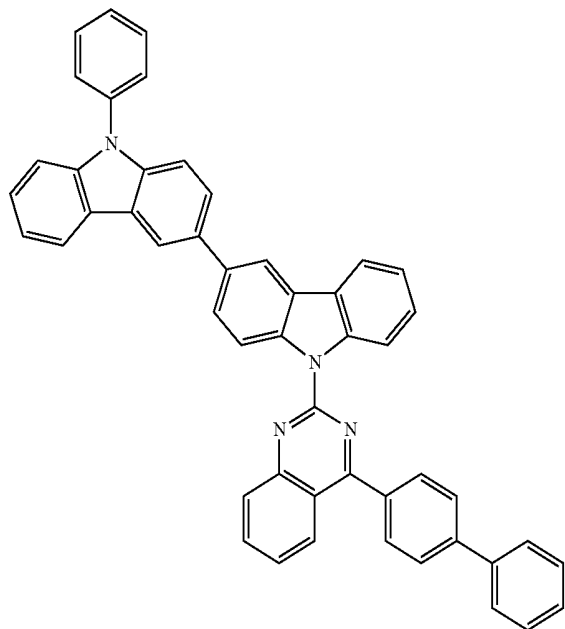


H2-14



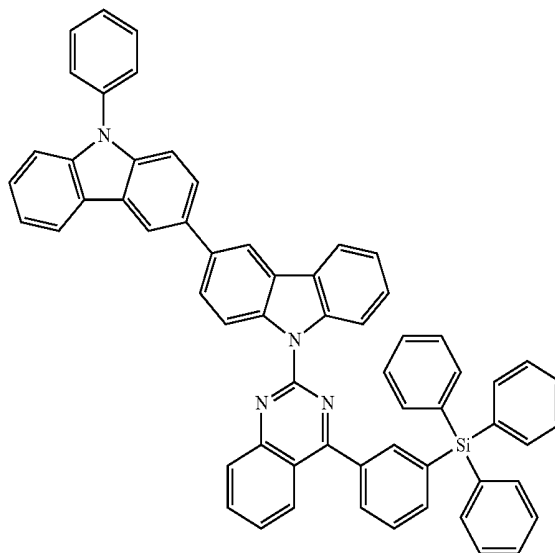
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H2-17



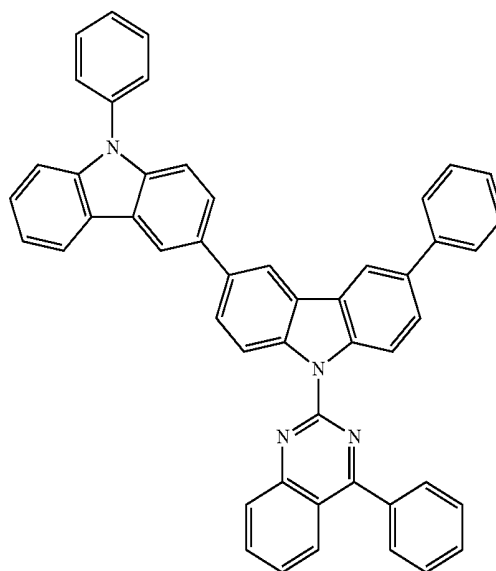
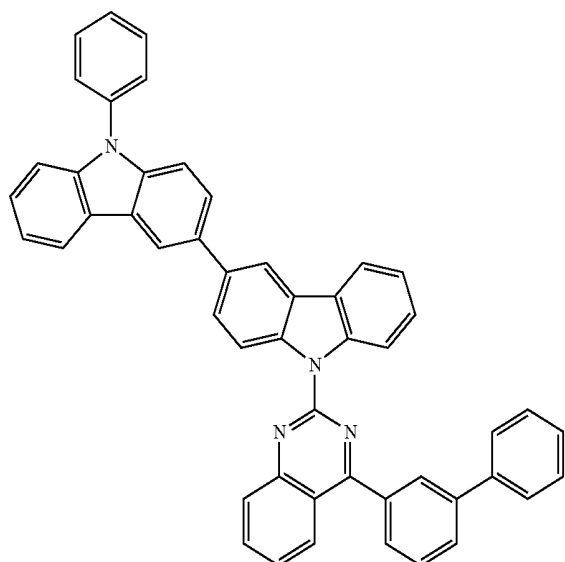
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H2-19



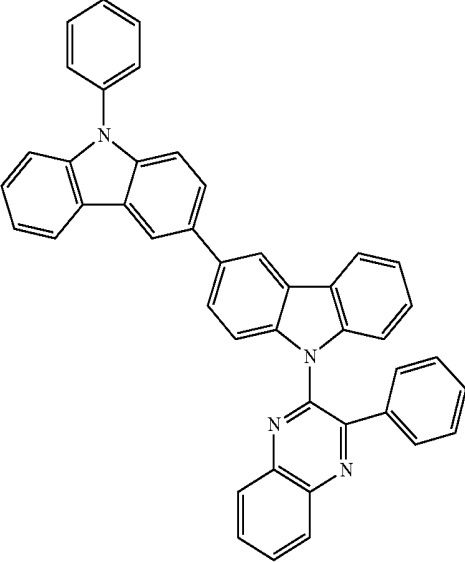
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H2-18



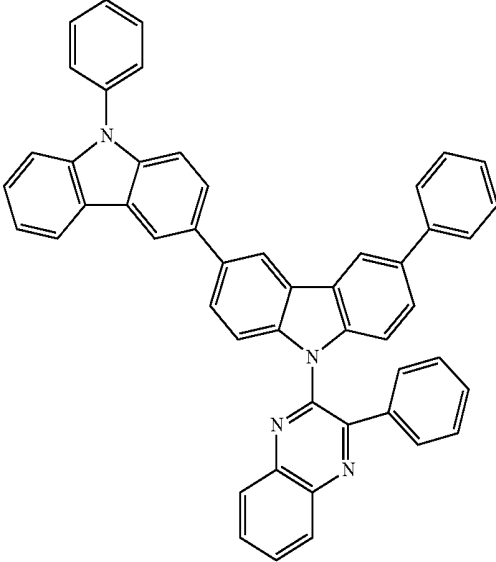
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H2-21

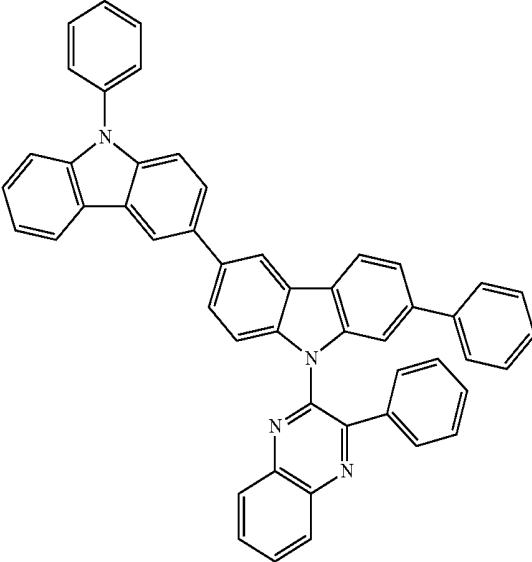


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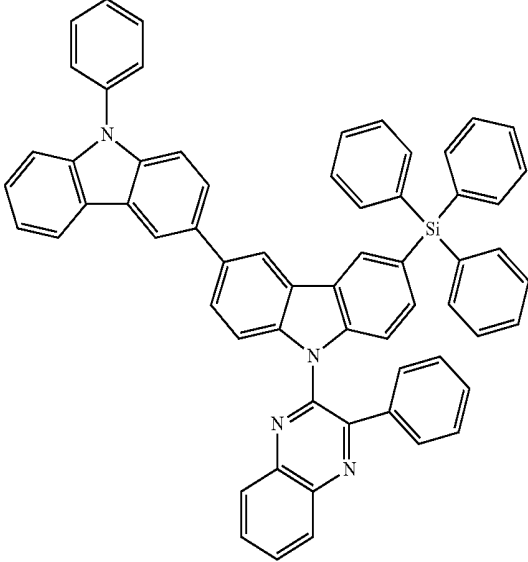
H2-23



H2-22

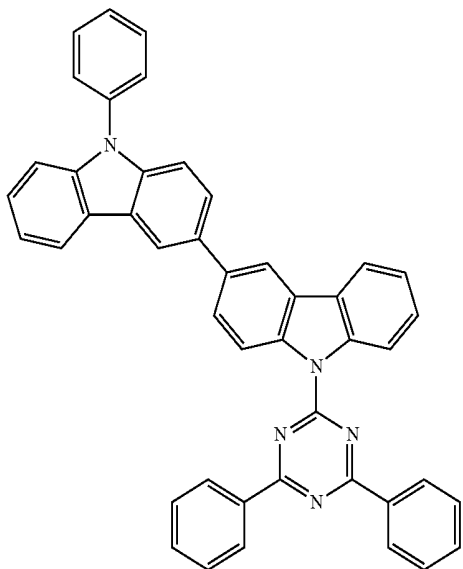


H2-24



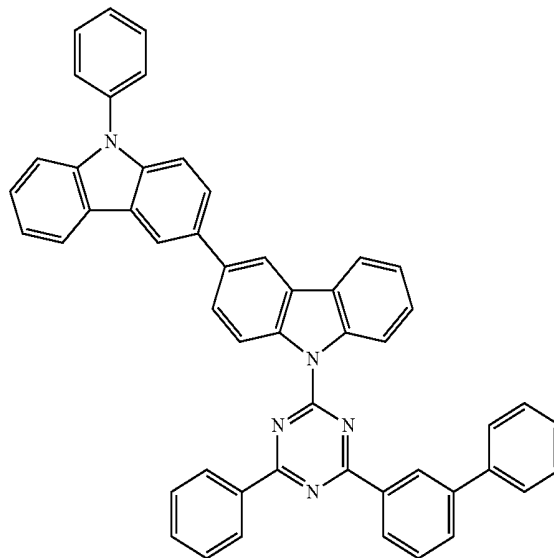
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H2-25

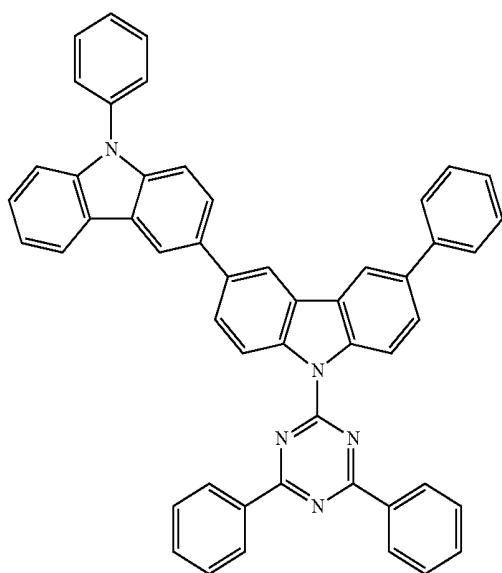


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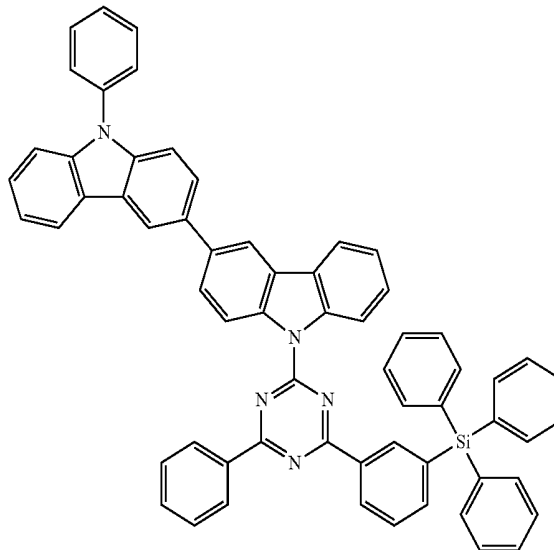
H2-27



H2-26

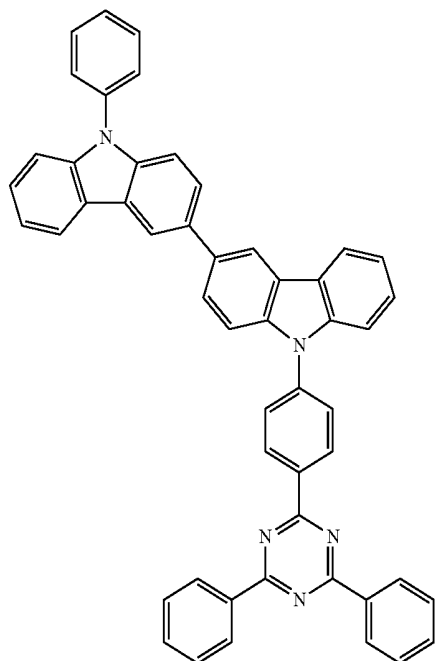


H2-28



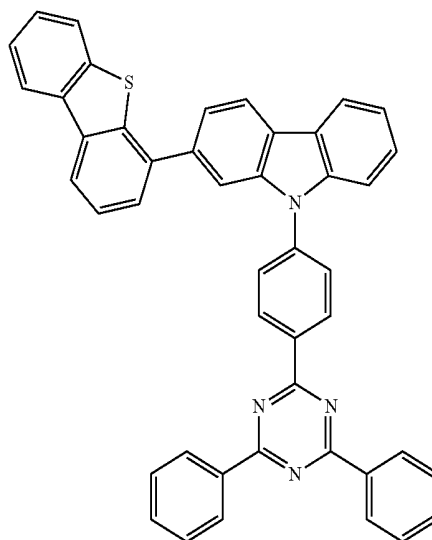
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H2-29



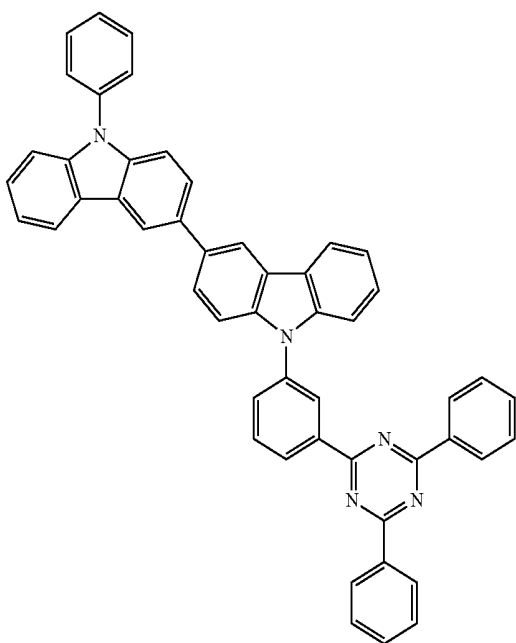
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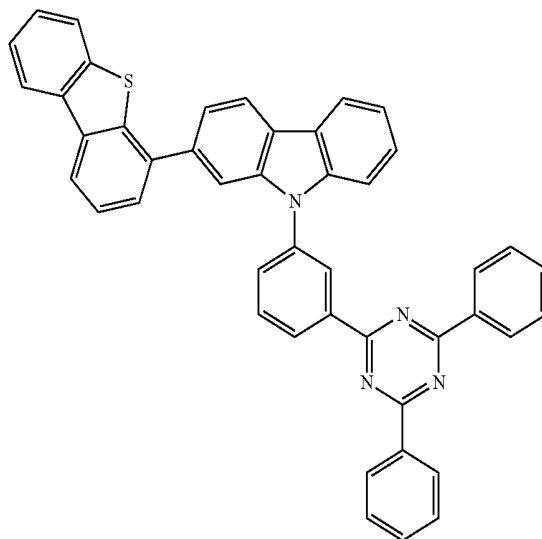


H2-32

H2-30

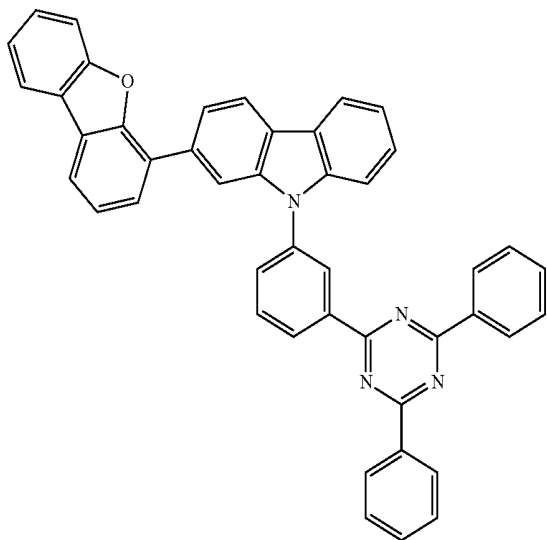


H2-33



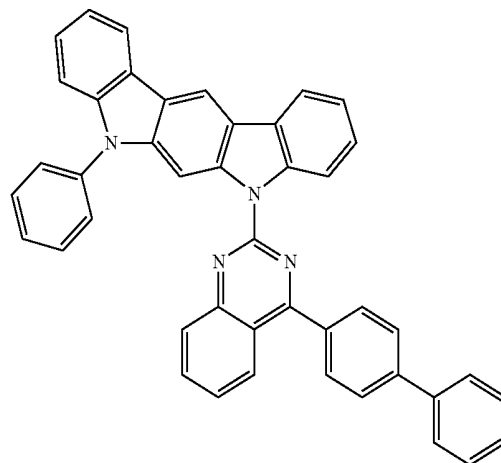
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H2-34

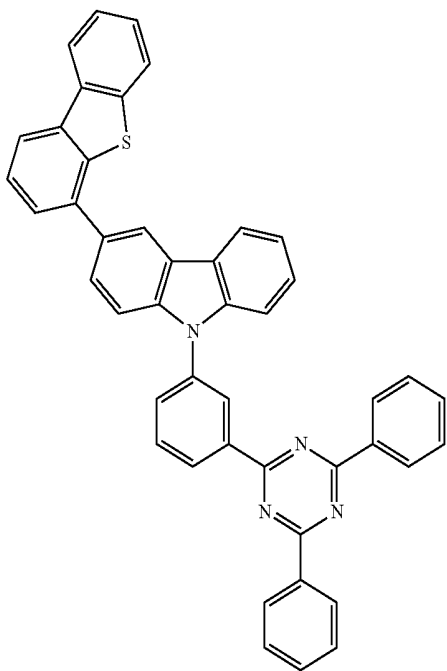


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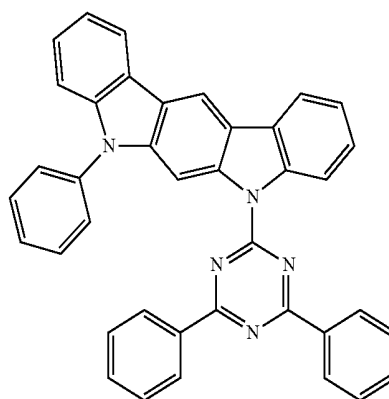
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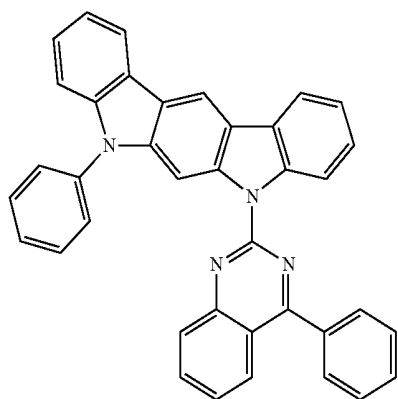
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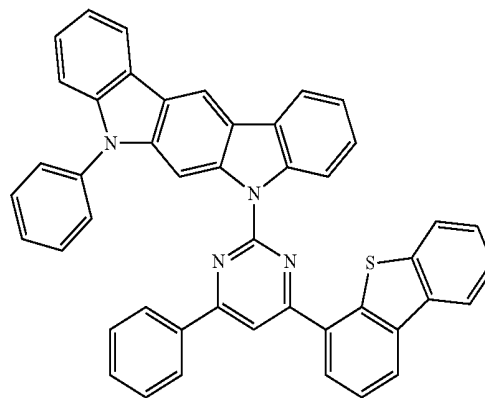
H2-38



H2-36

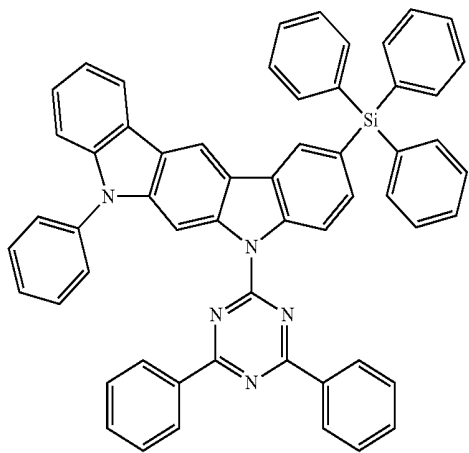


H2-39



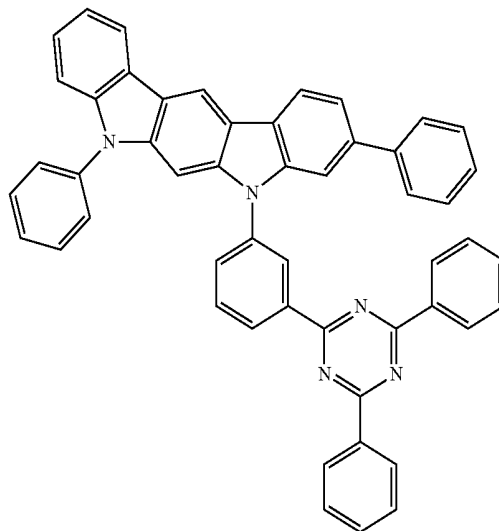
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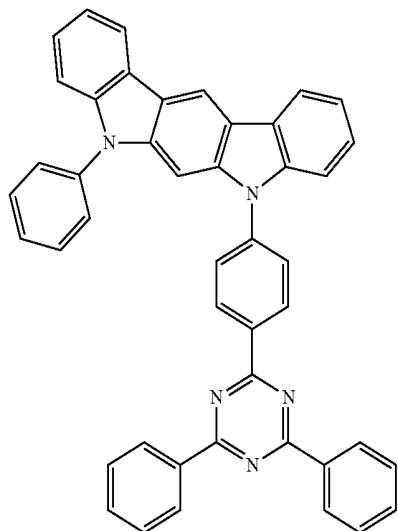


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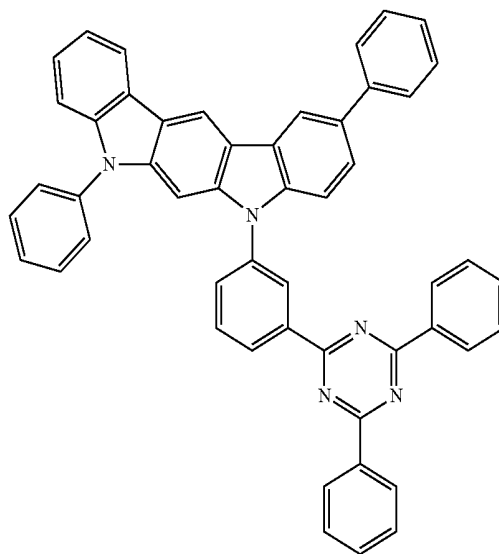
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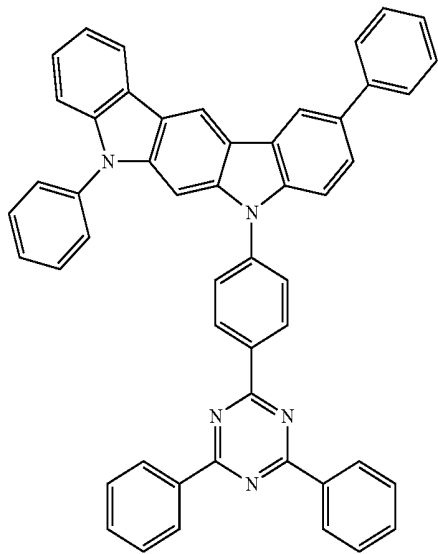
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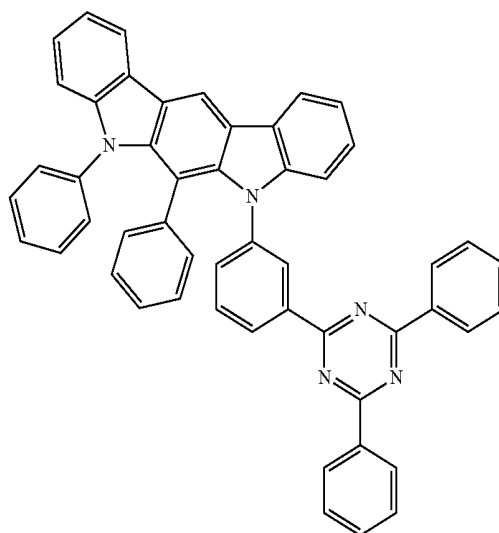
H2-44



H2-42

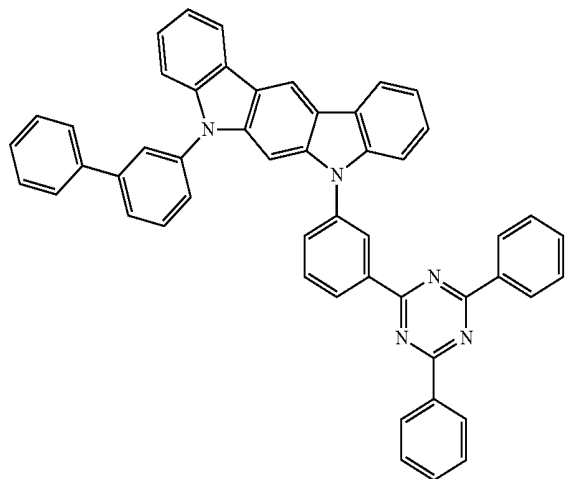


H2-45

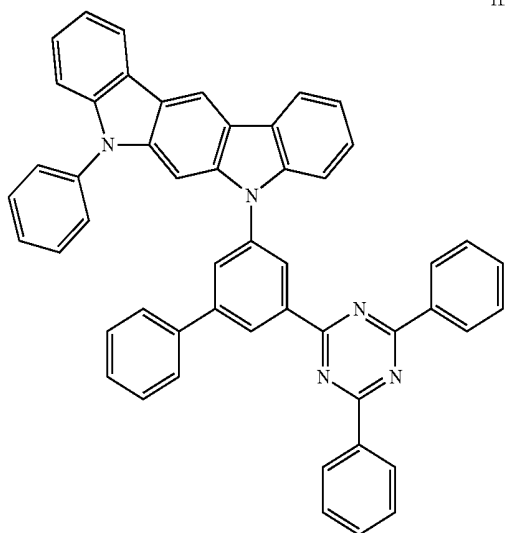


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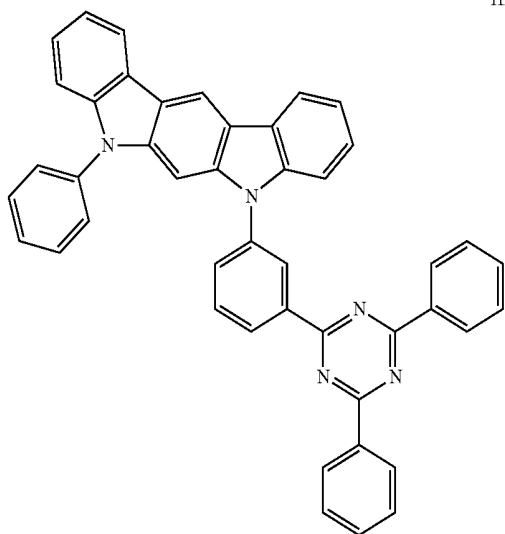
H2-46



H2-47

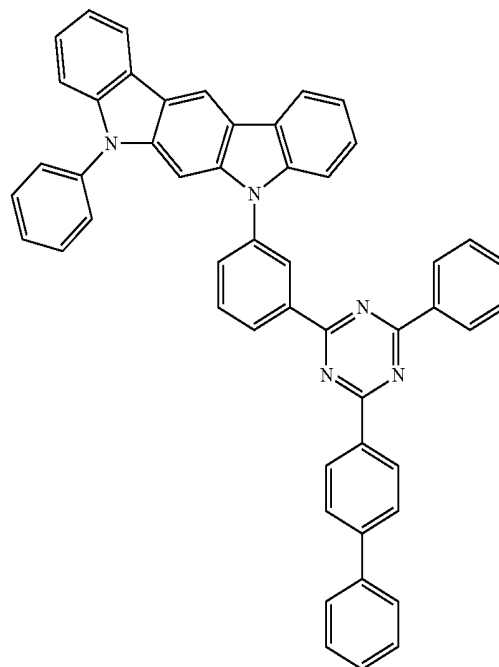


H2-48

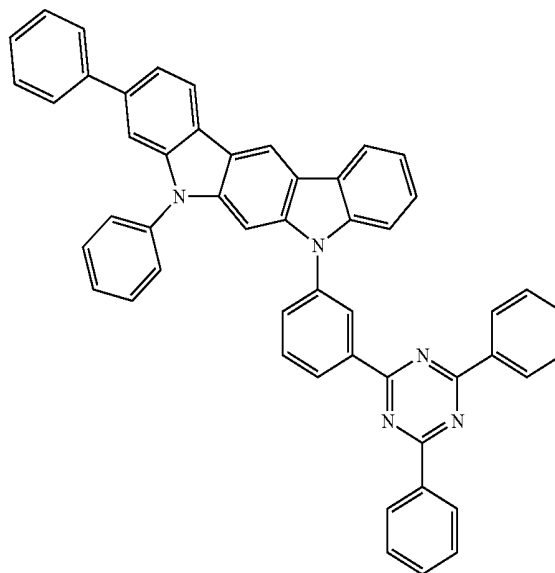


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H2-49

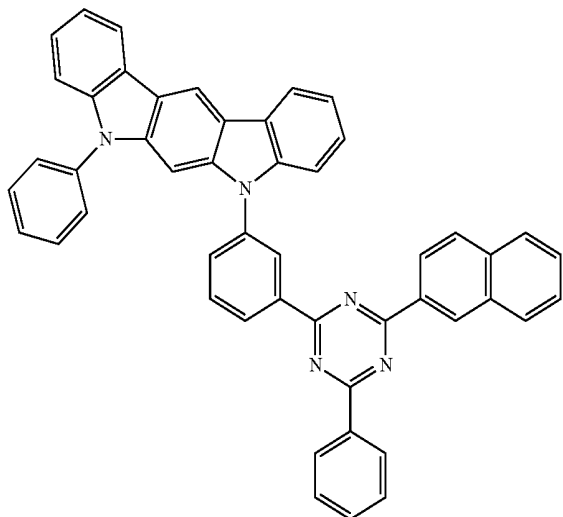


H2-50



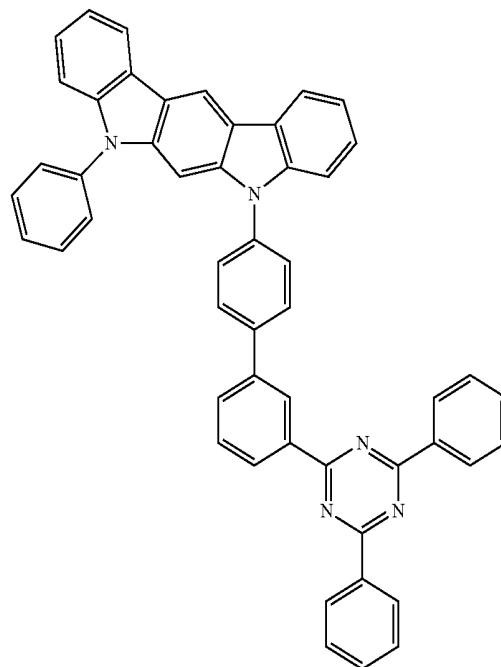
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H2-51

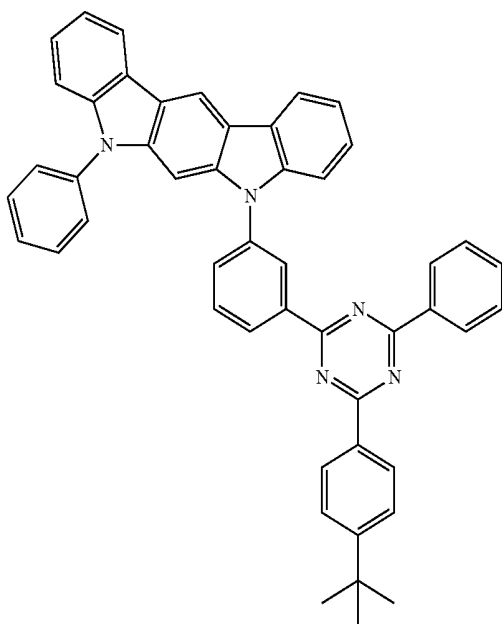


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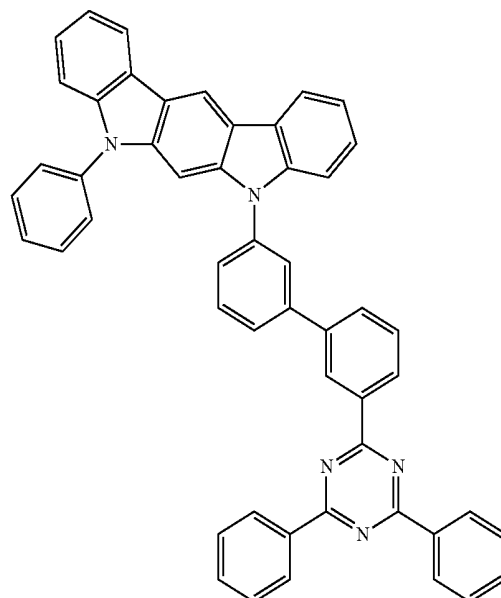
H2-53



H2-52

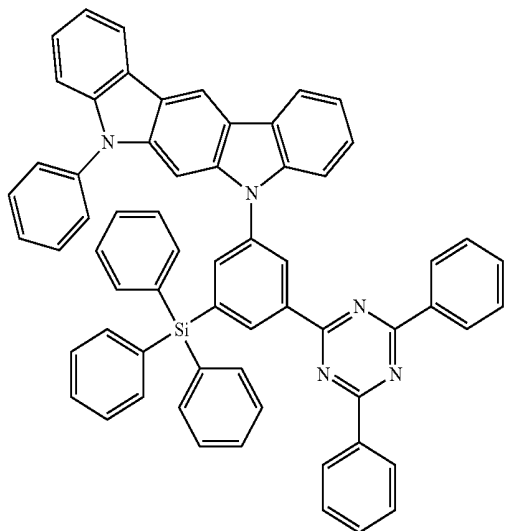


H2-54

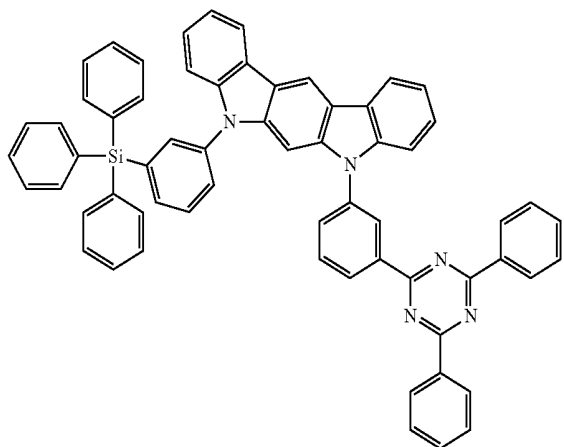


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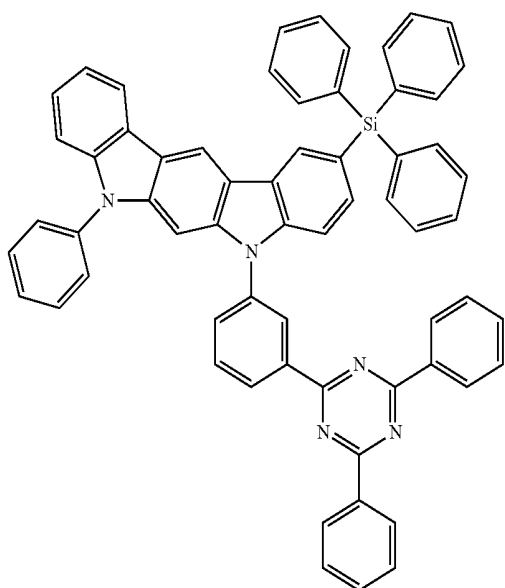
H2-55



H2-56

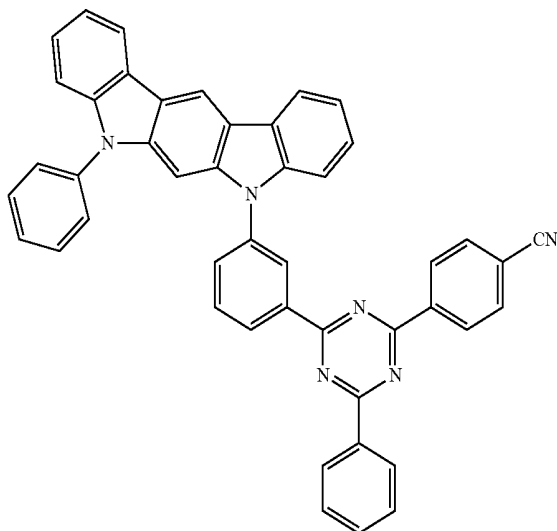


H2-57

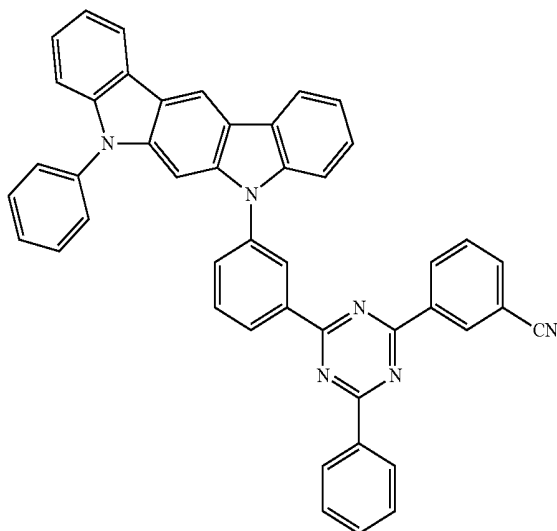


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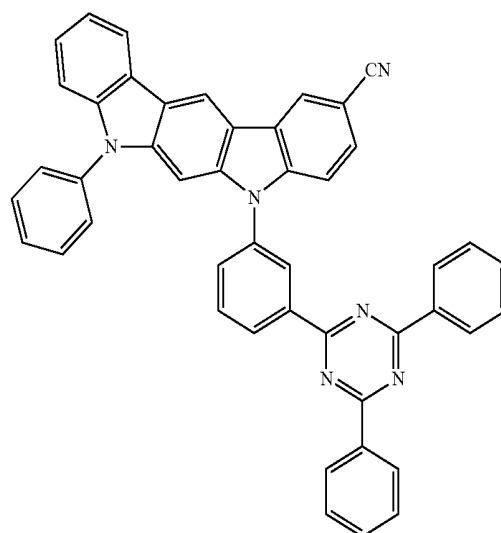
H2-58



H2-59

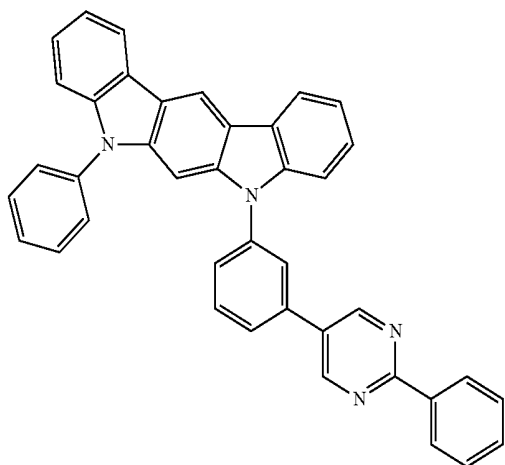


H2-60

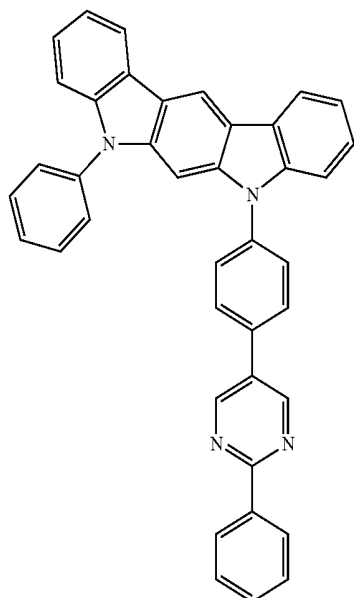


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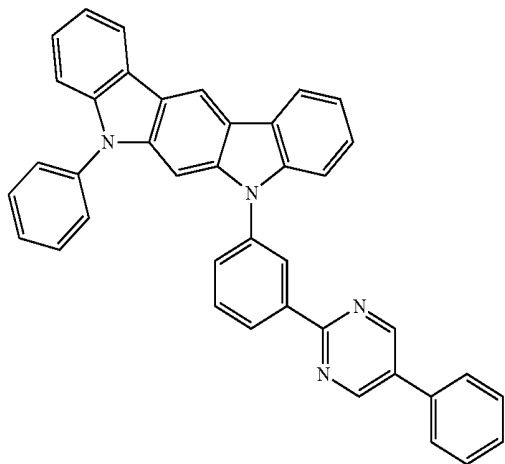
H2-61



H2-62

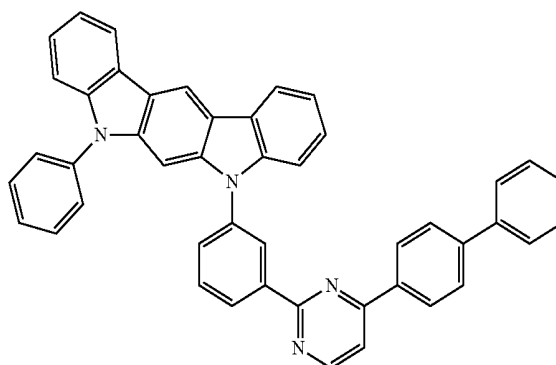


H2-63

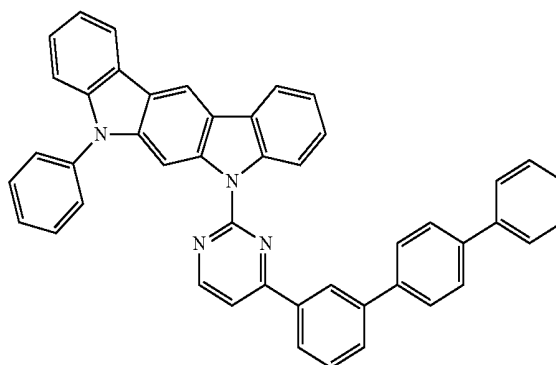


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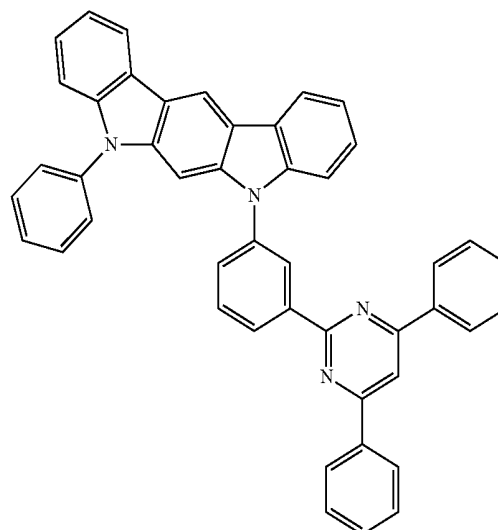
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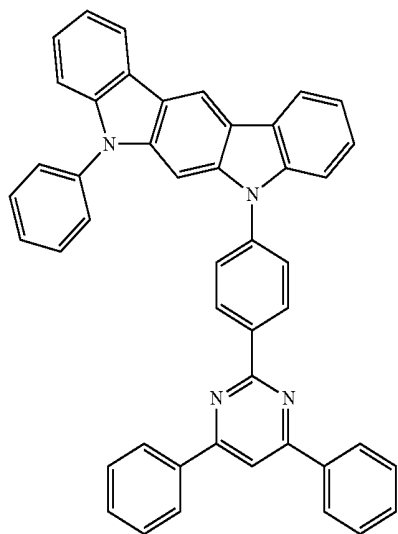
H2-65



H2-66

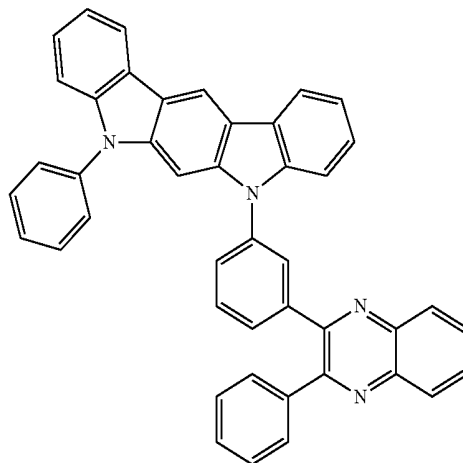


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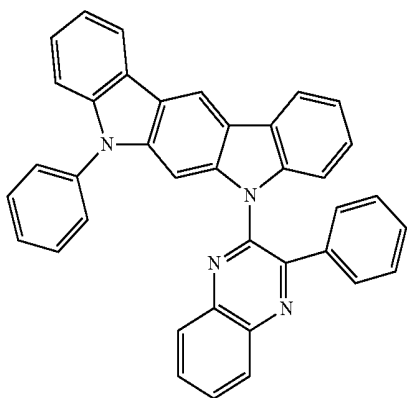


H2-67

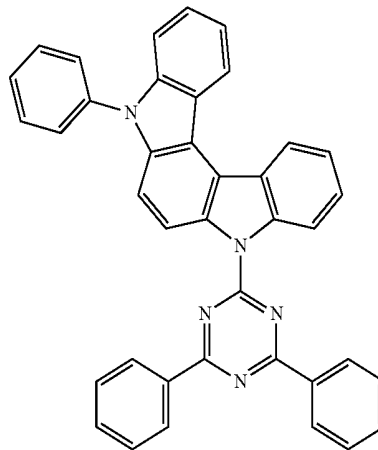
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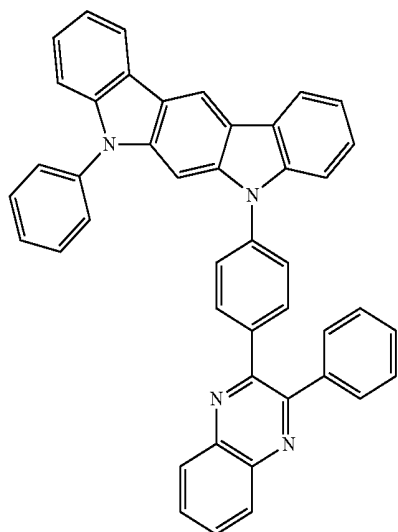
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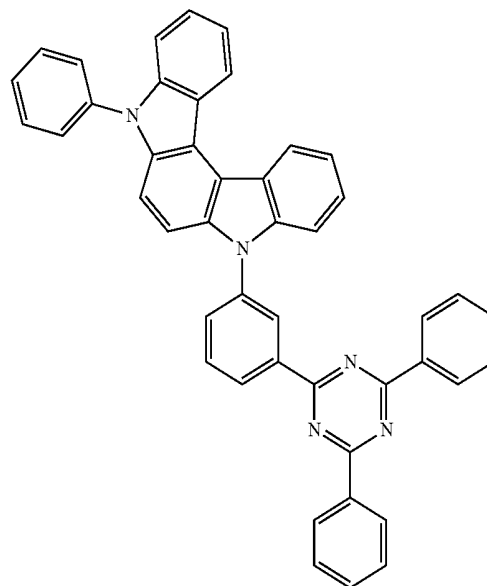
H2-68



H2-71



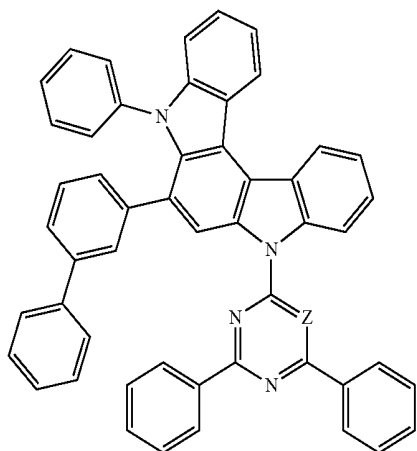
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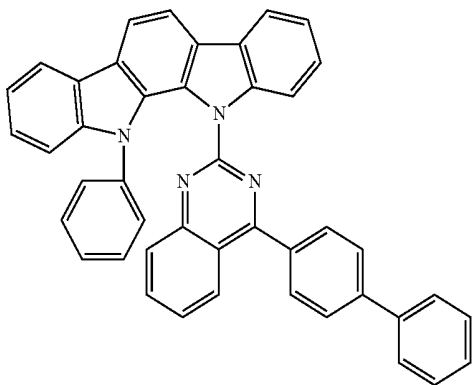
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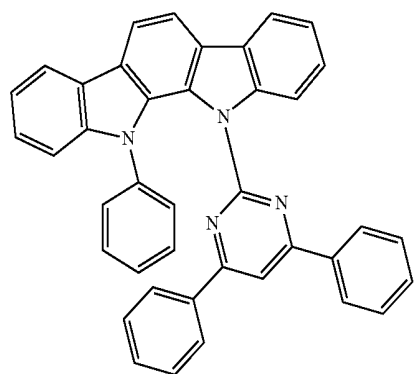
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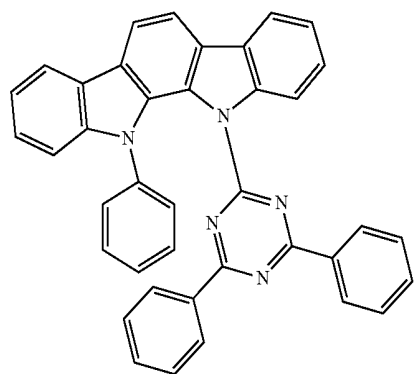
H2-74



H2-75

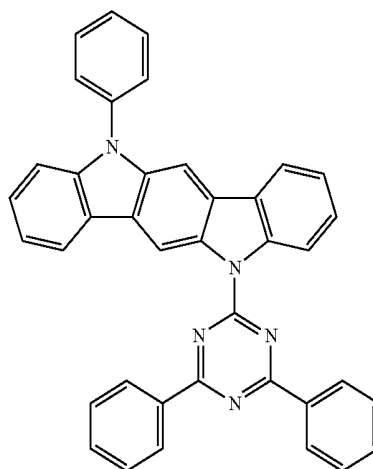


H2-76

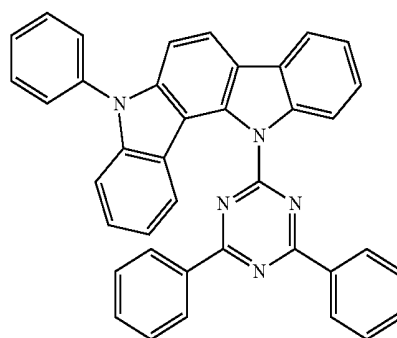


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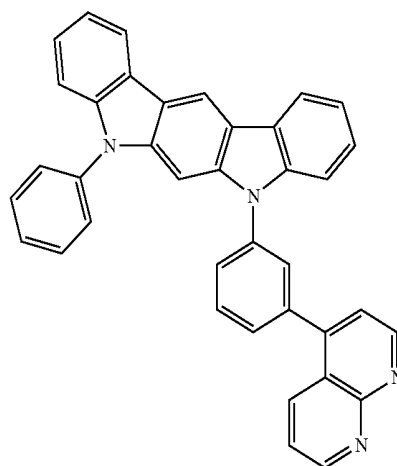
H2-77



H2-78

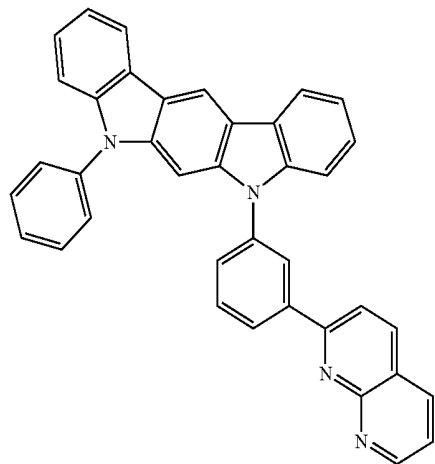


H2-79

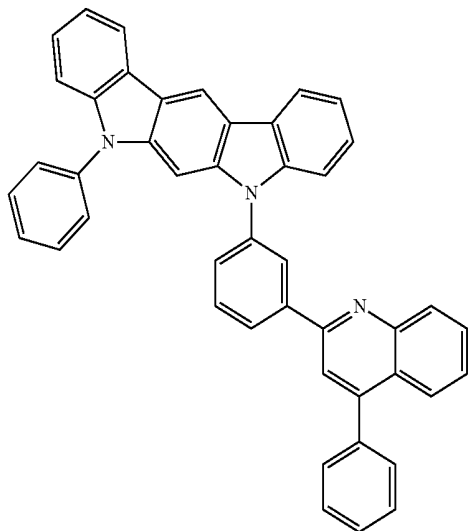


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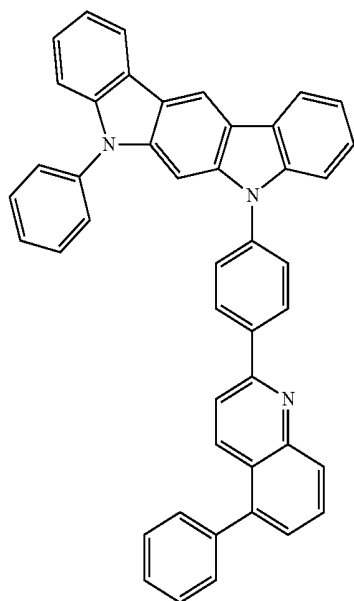
H2-80



H2-81

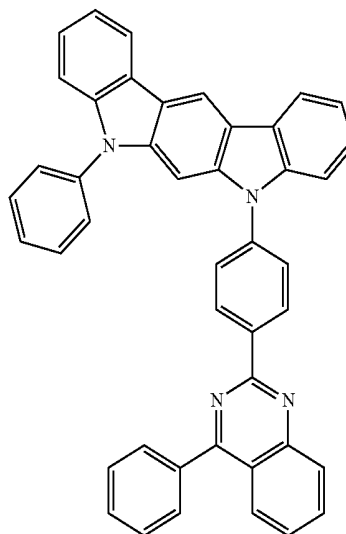


H2-82

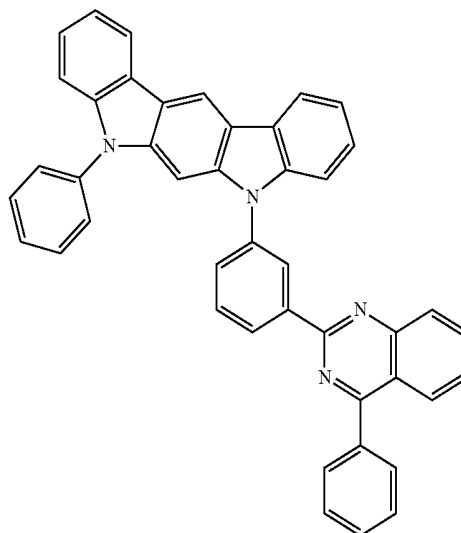


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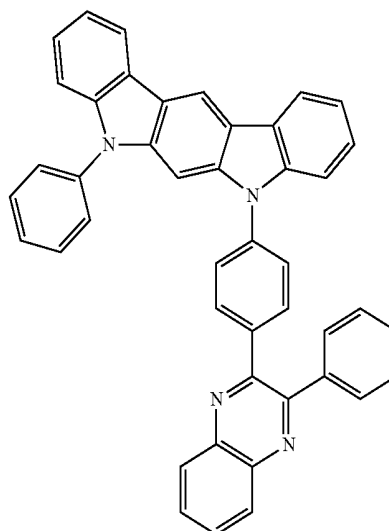
H2-83



H2-84

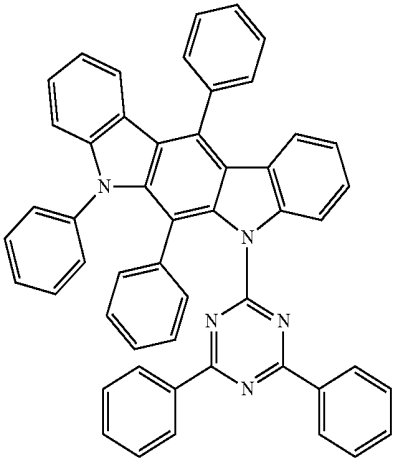


H2-85



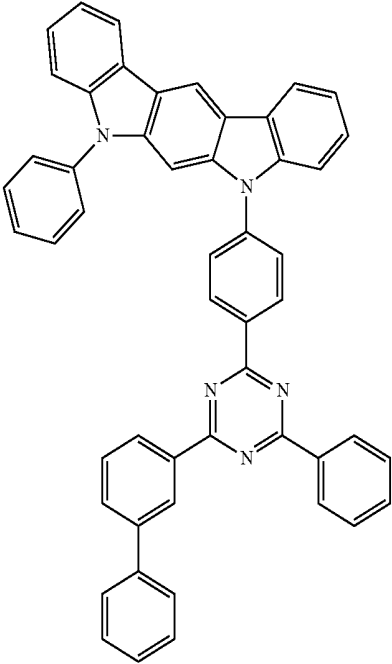
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H2-86

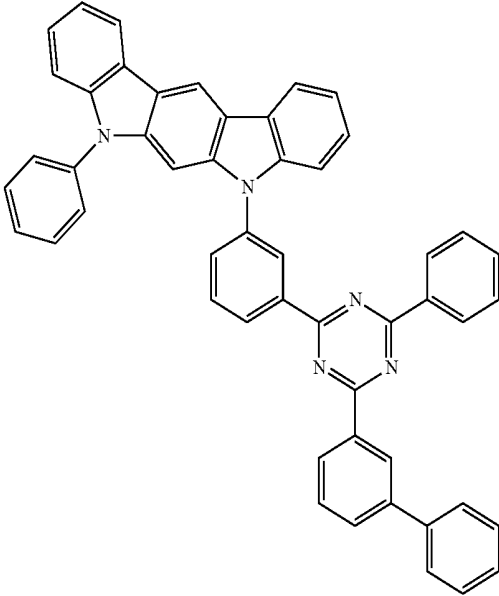


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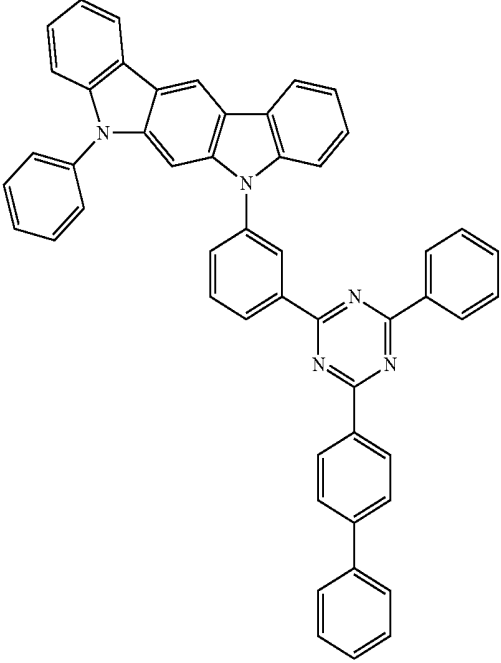
H2-88



H2-87

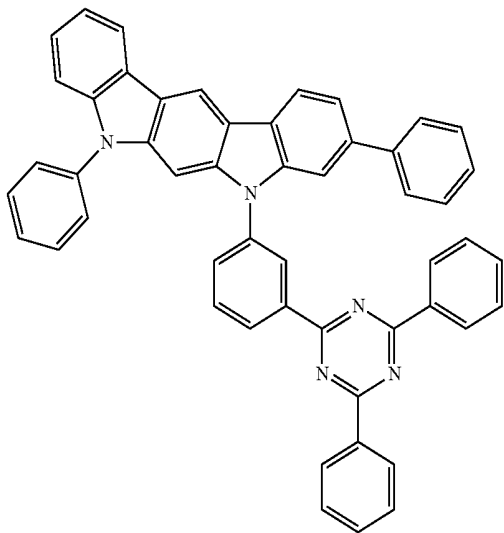


H2-89

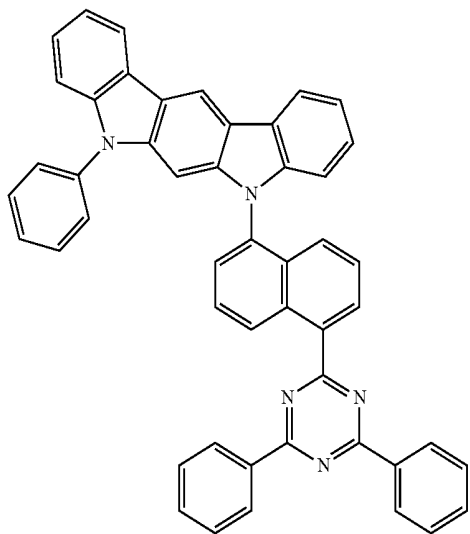


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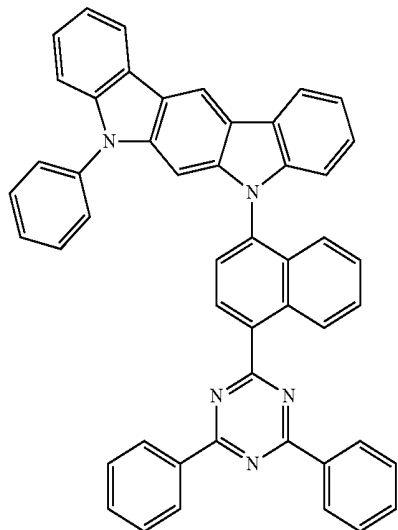
H2-90



H2-91

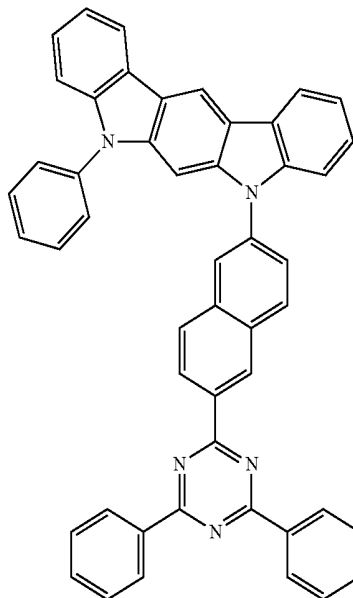


H2-92

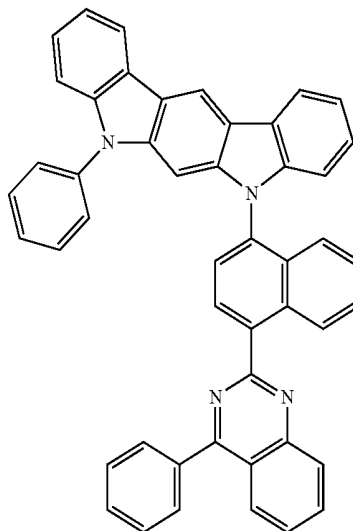


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H2-93

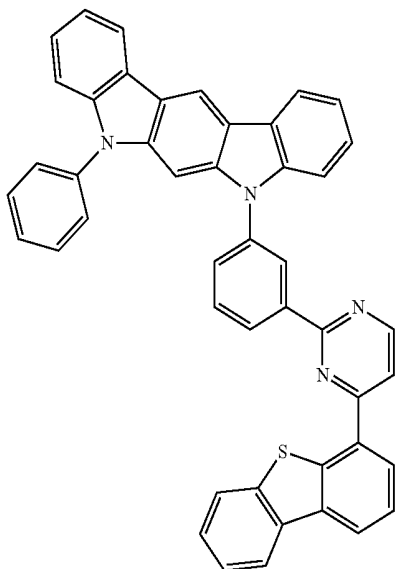


H2-94



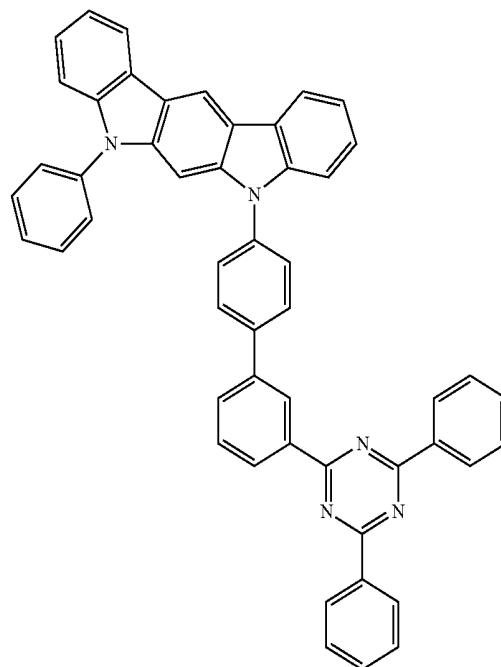
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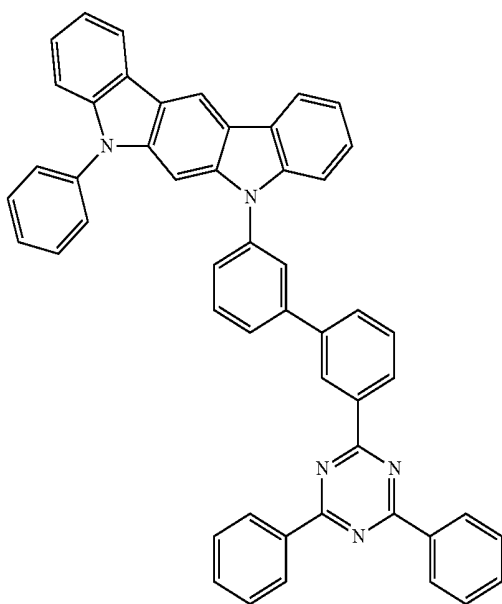


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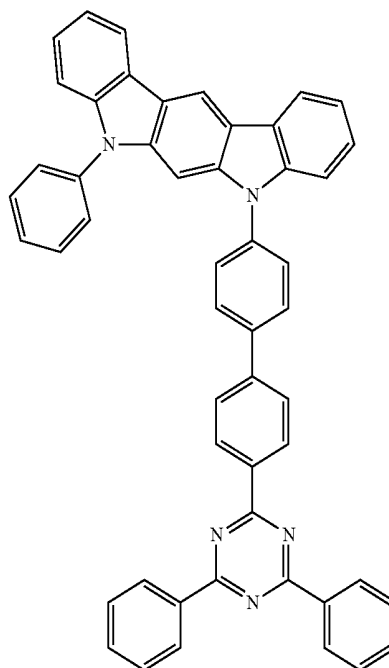
H2-97



H2-96

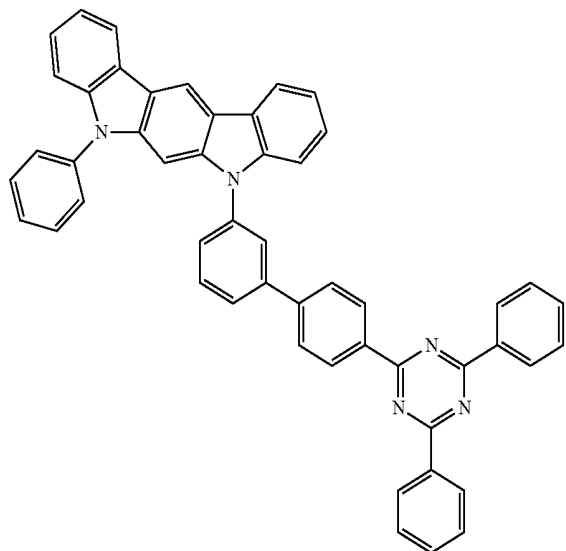


H2-98

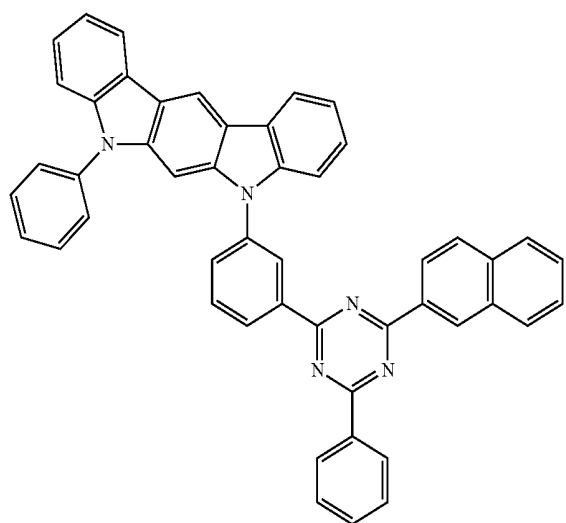


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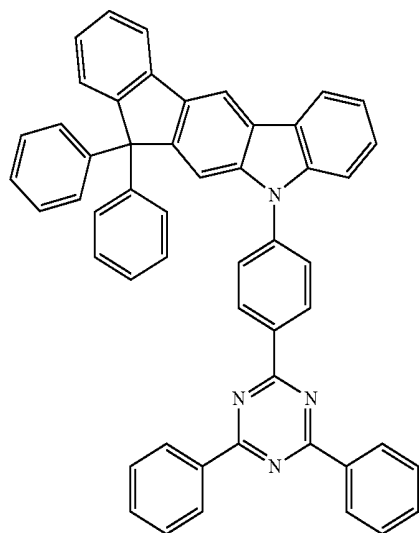
H2-99



H2-100

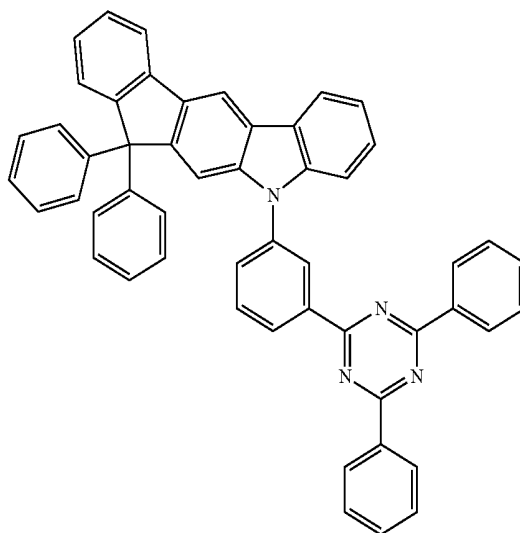


H2-101

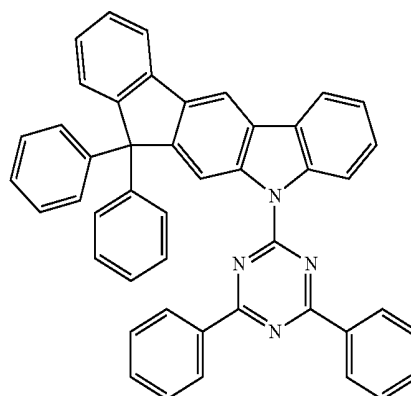


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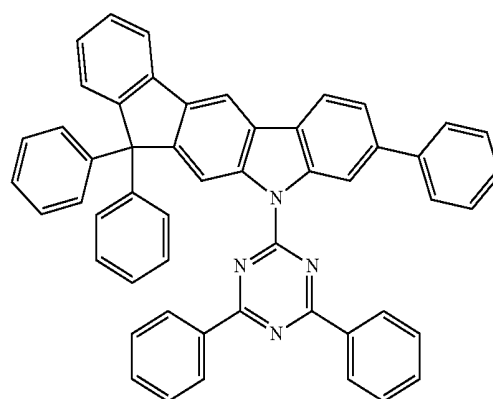
H2-102



H2-103

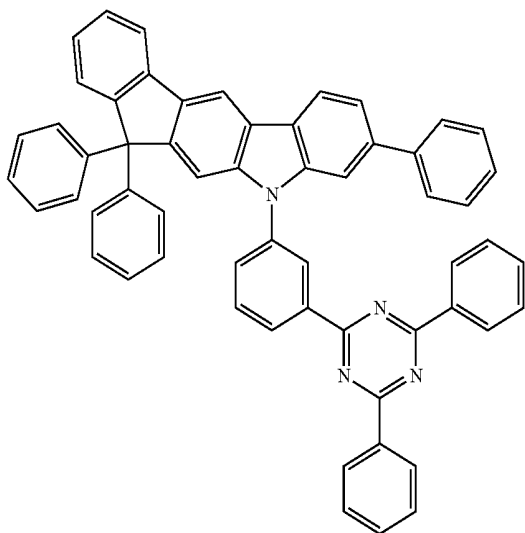


H2-104



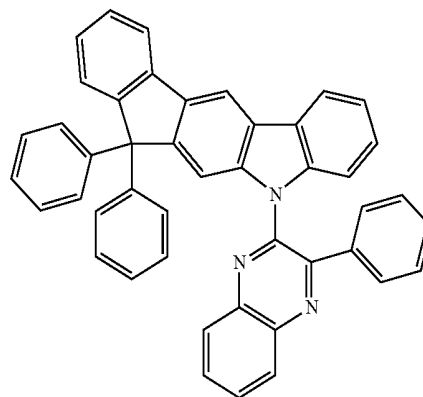
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H2-105

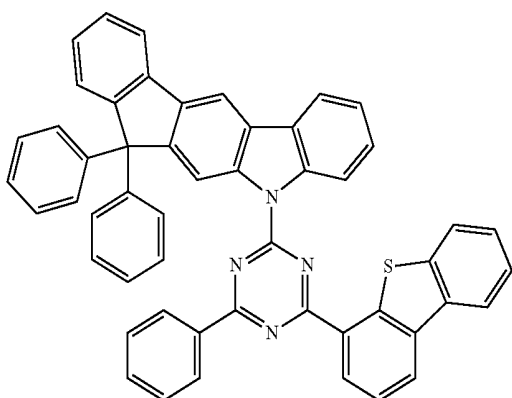


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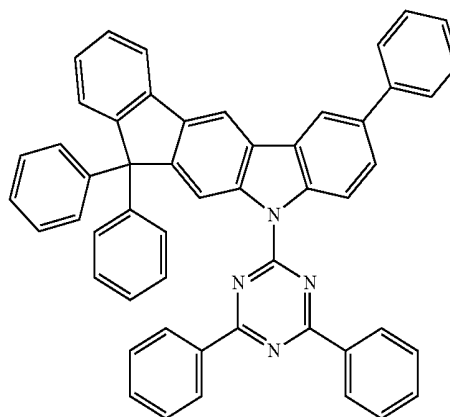
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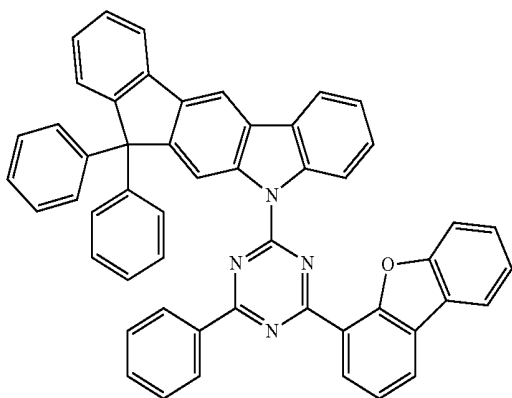
H2-106



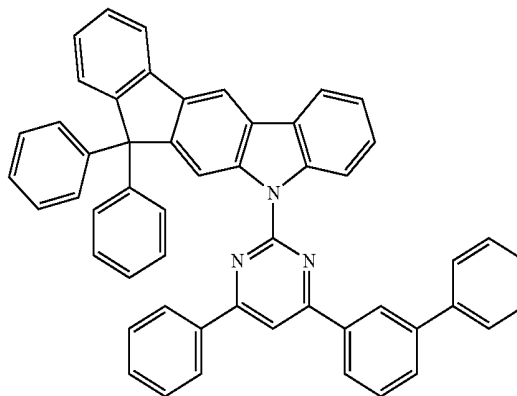
H2-109



H2-107

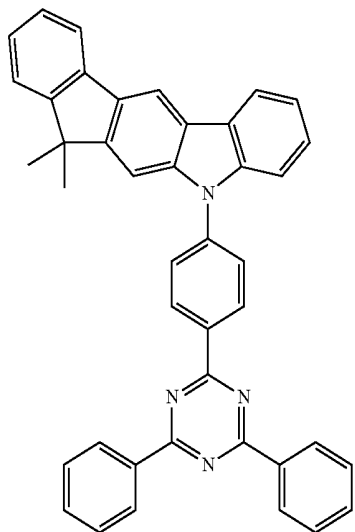


H2-110



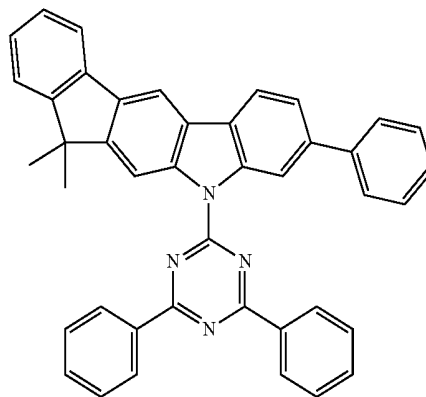
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H2-111

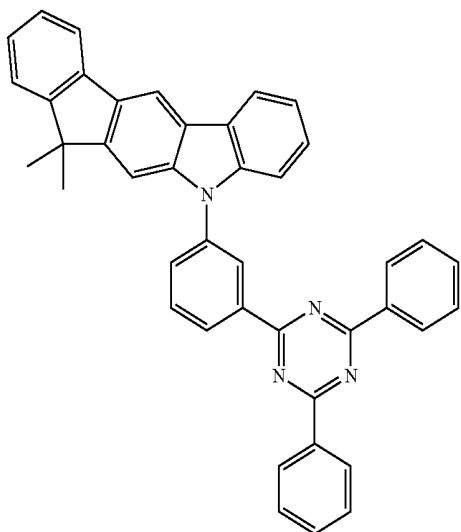


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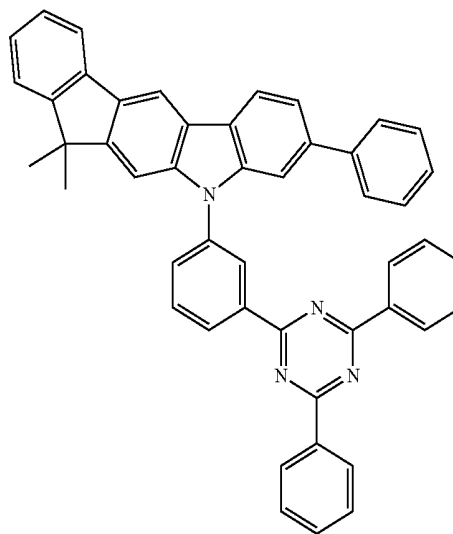
H2-114



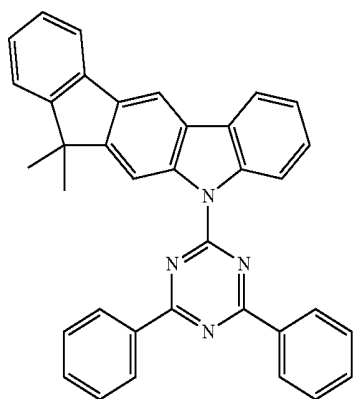
H2-112



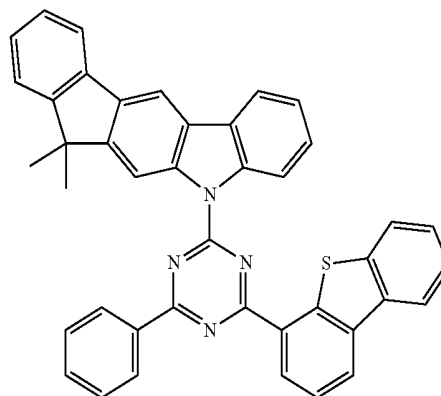
H2-115



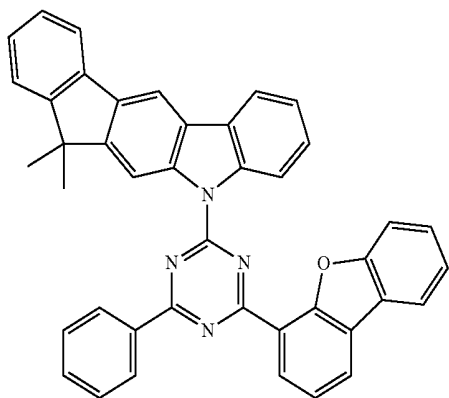
H2-113



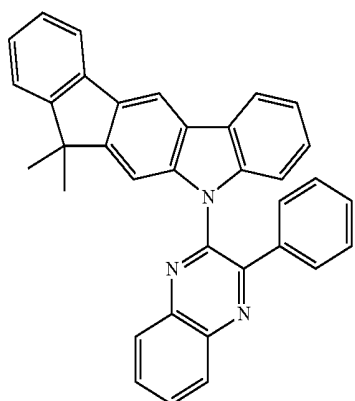
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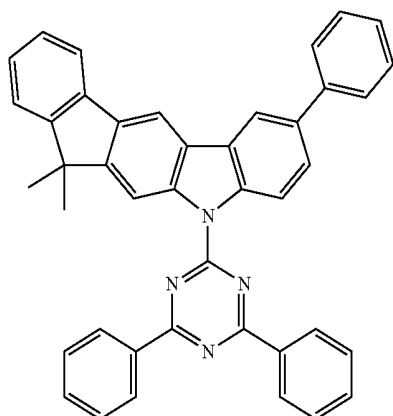
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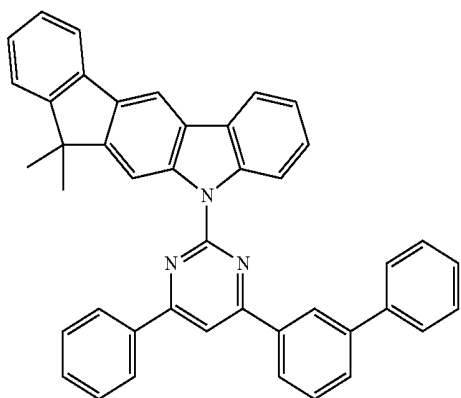
H2-117



H2-118

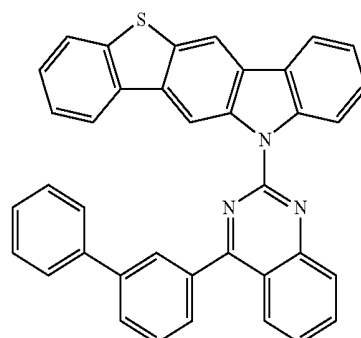


H2-119

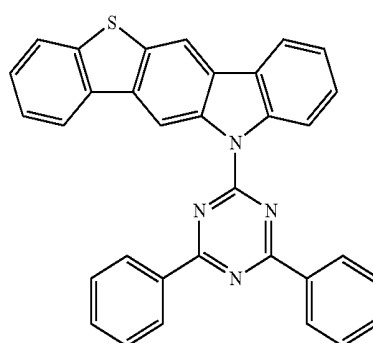


H2-120

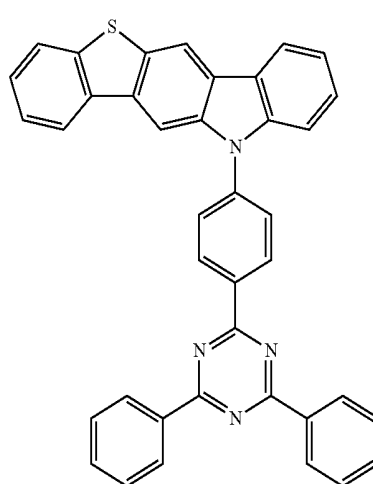
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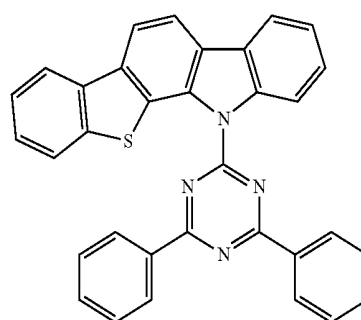
H2-121



H2-122

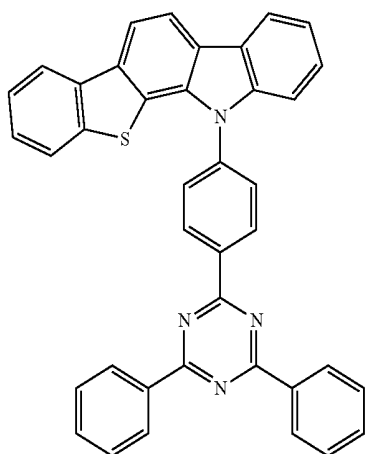


H2-123



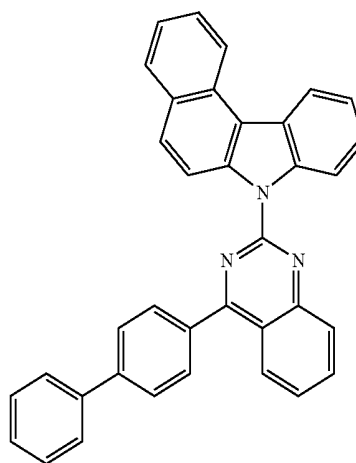
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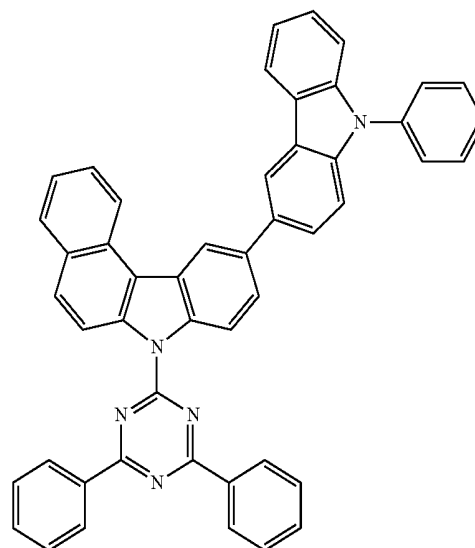
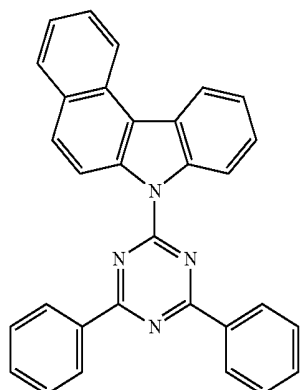
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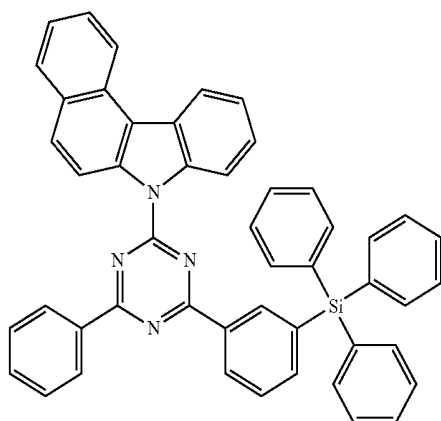
H2-128

H2-126

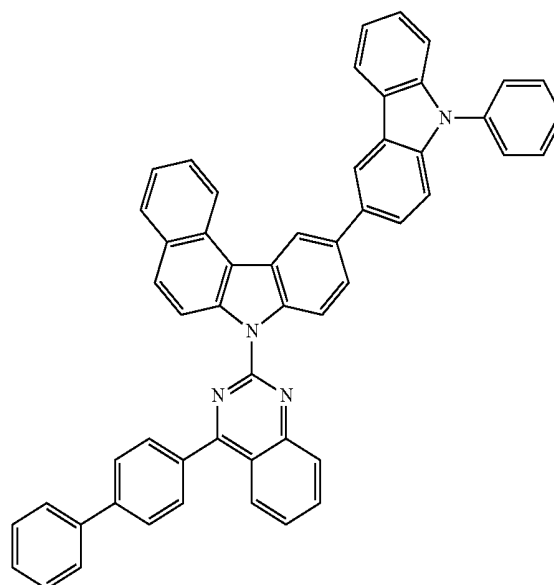


H2-129

H2-127



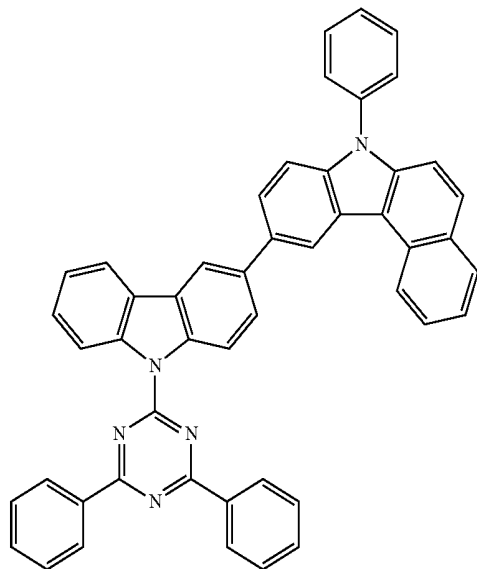
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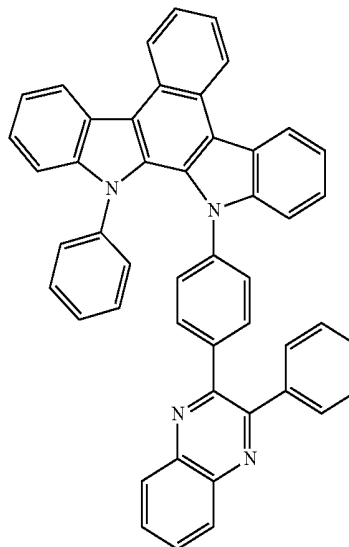
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H2-135

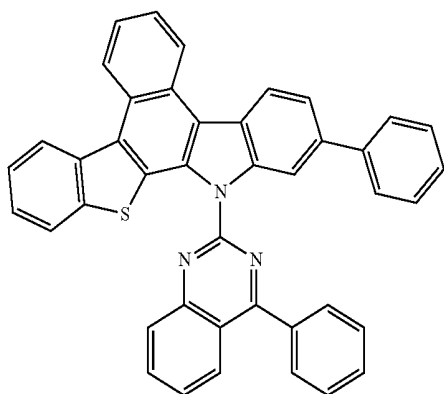


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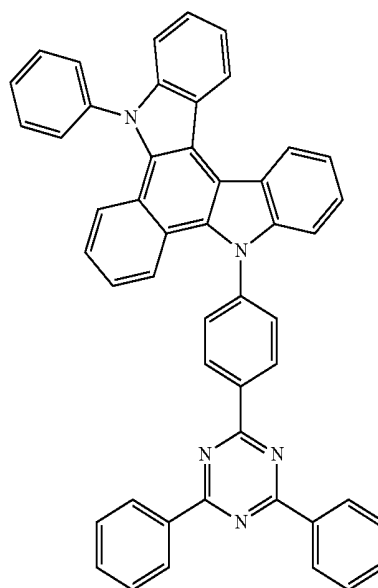
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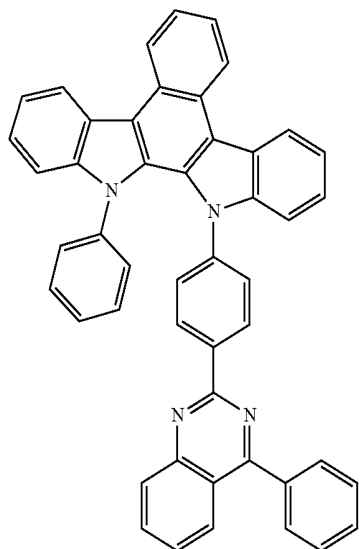
H2-136



H2-139

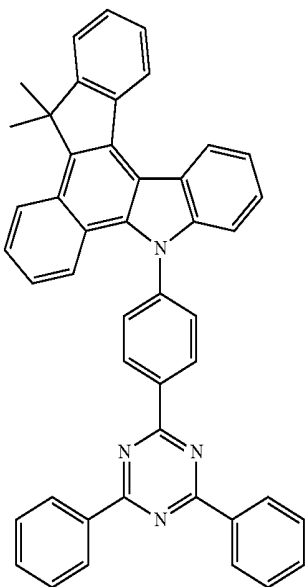


H2-137



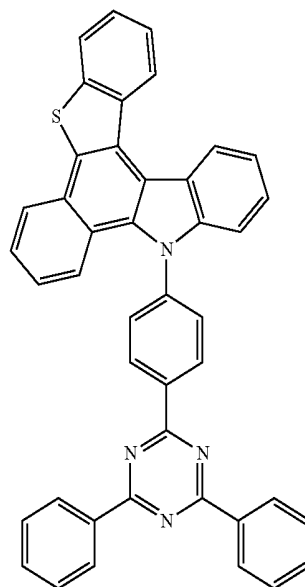
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H2-140

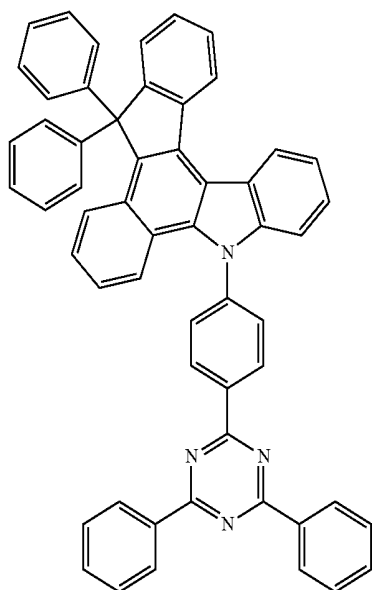


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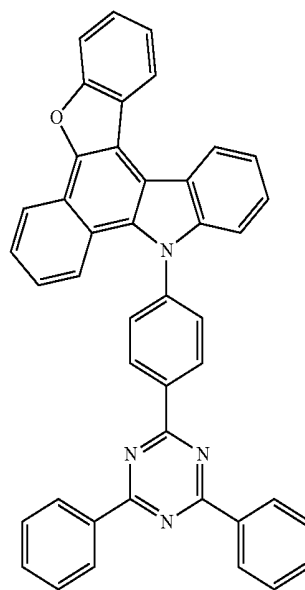
H2-142



H2-141

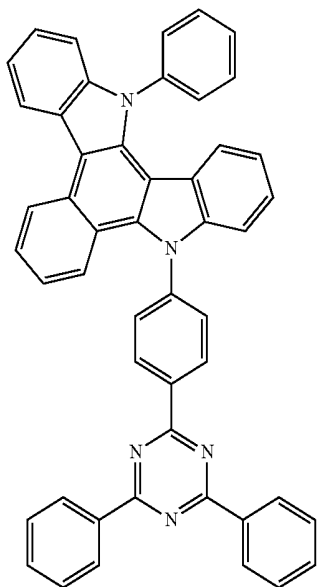


H2-143



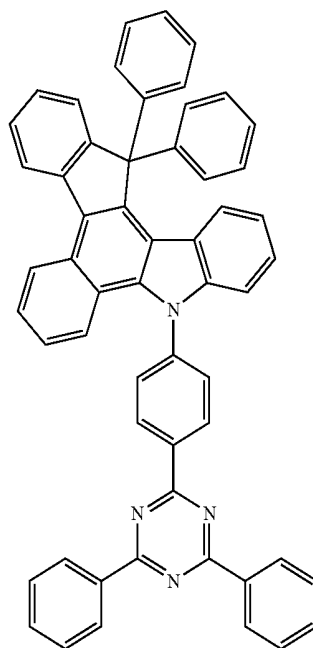
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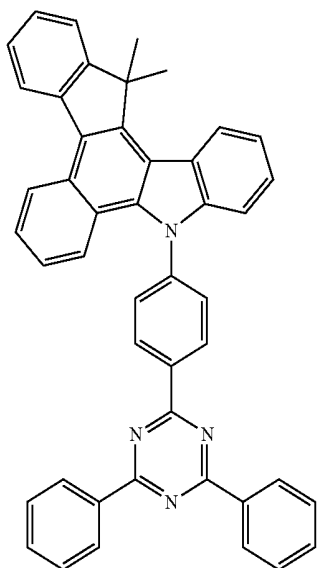


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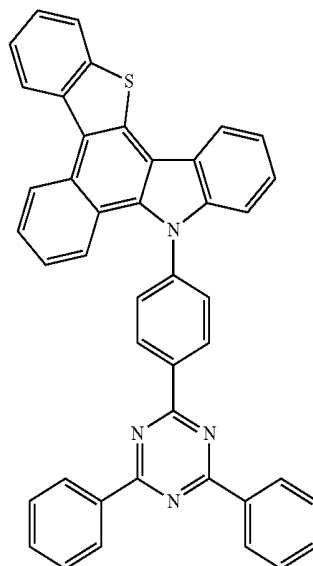
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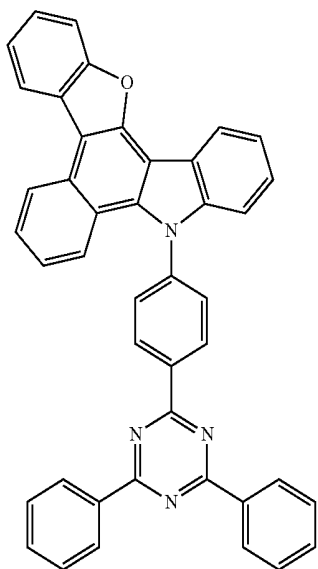
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H2-147

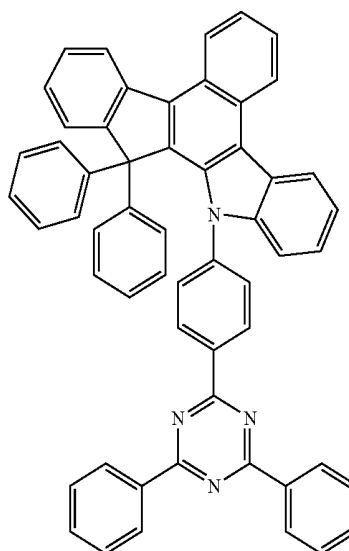


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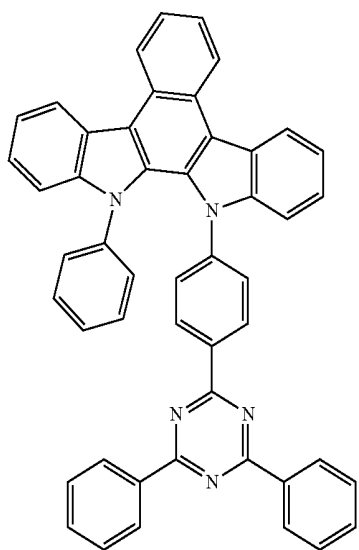


H2-148

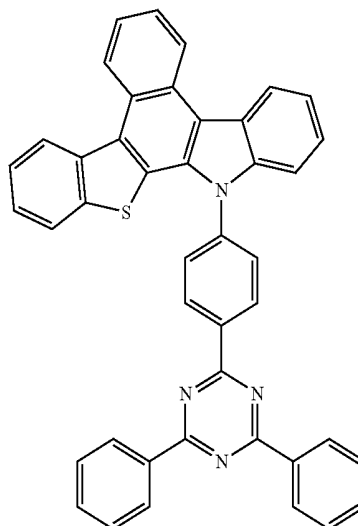
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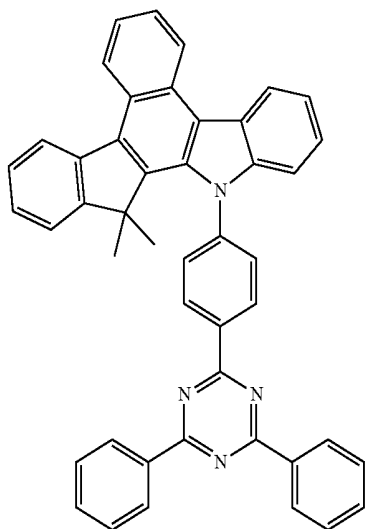
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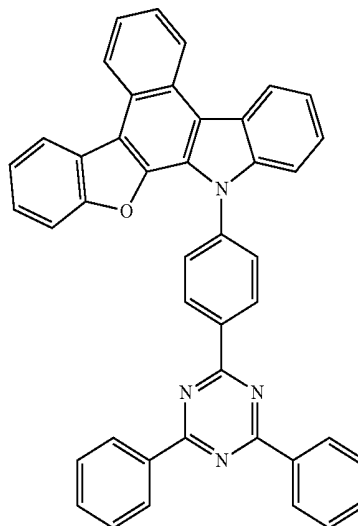
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H2-152



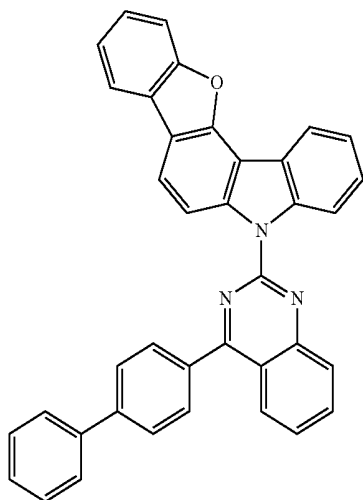
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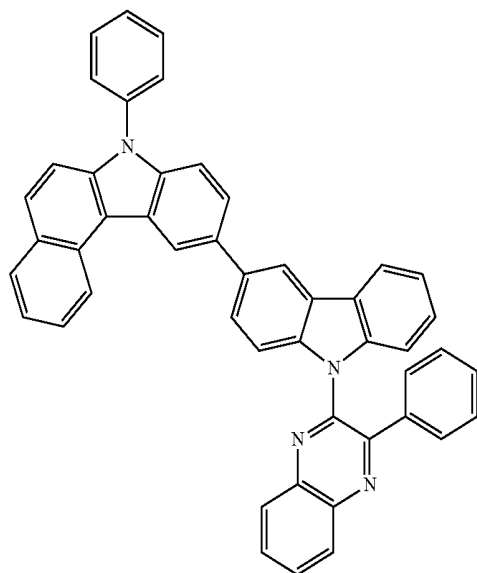
H2-153

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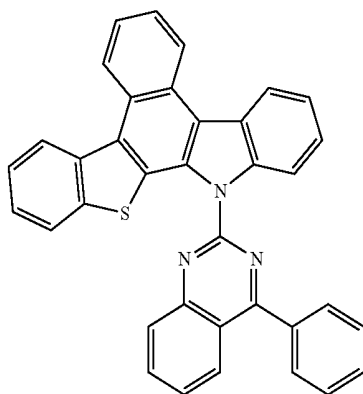
H2-154



H2-155

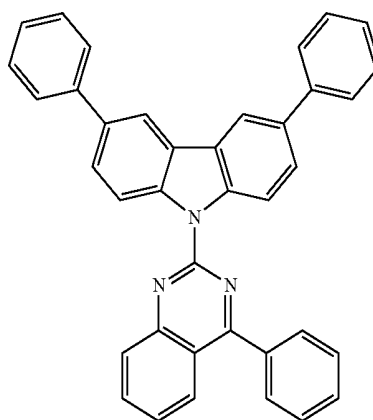


H2-156

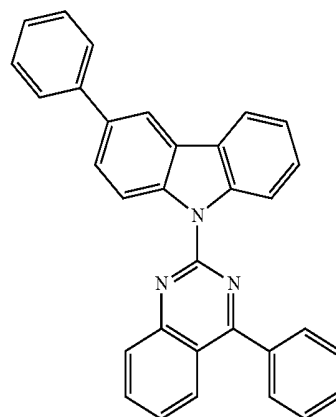


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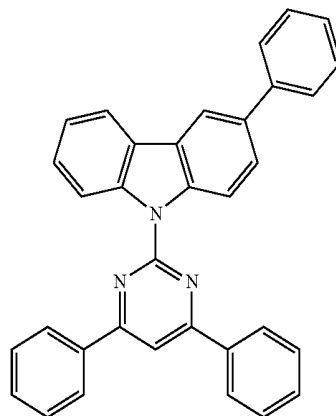
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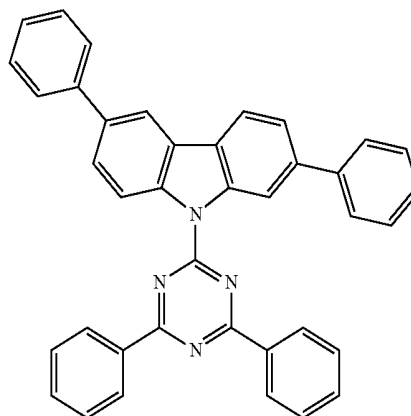
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H2-159

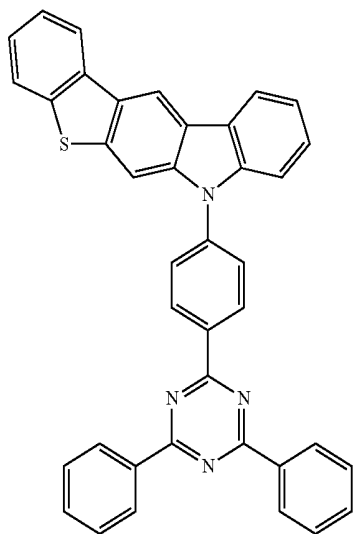


H2-160

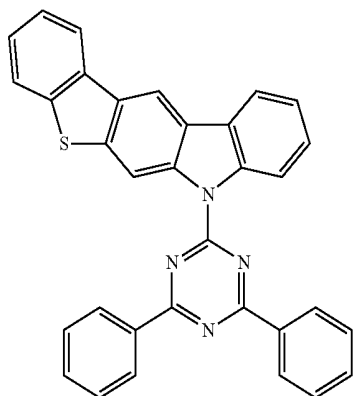


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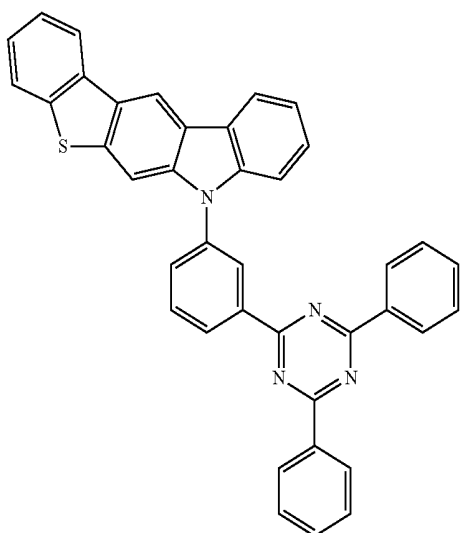
H2-161



H2-162

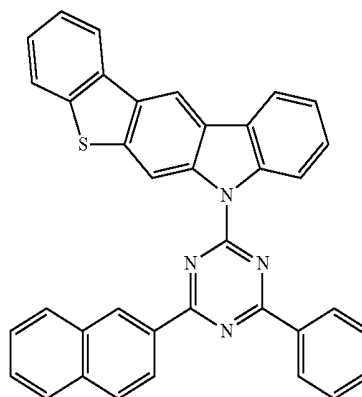


H2-163

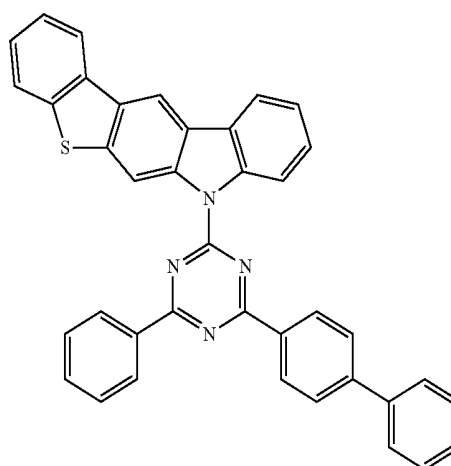


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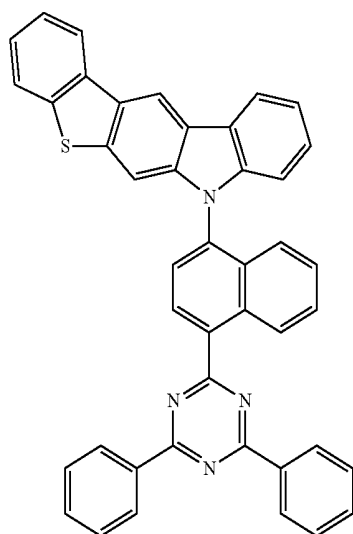
H2-164



H2-165

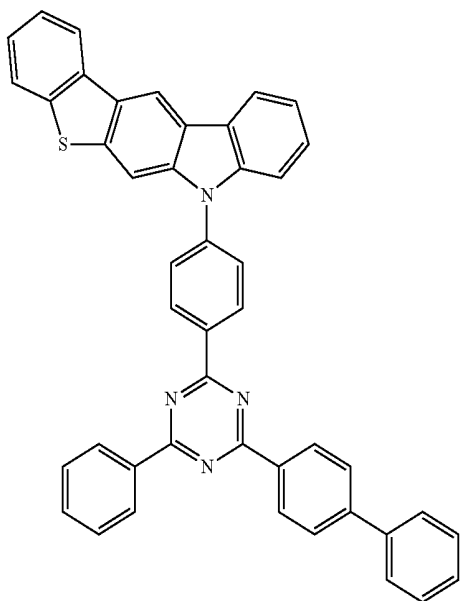


H2-166



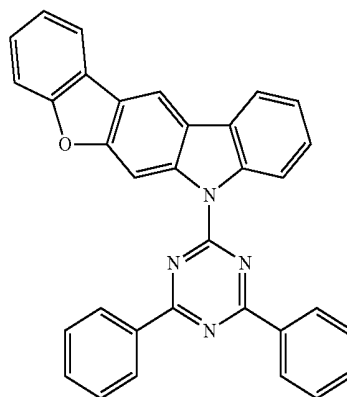
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H2-167

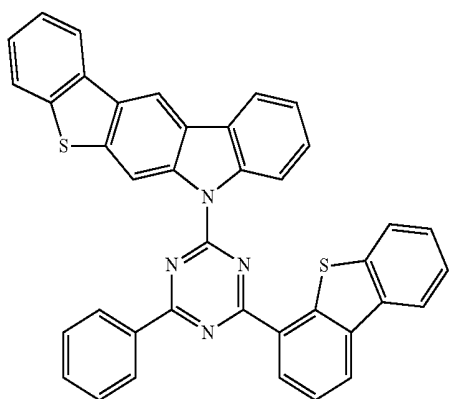


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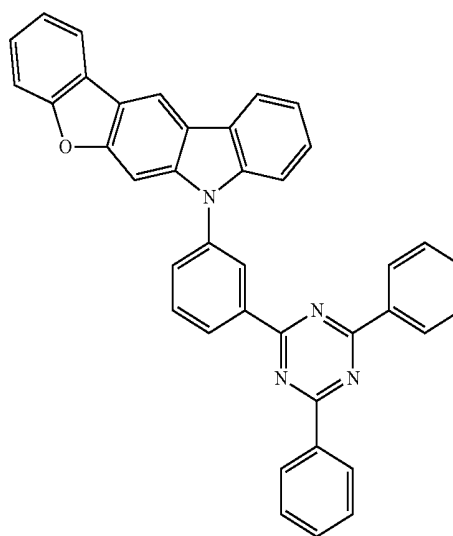
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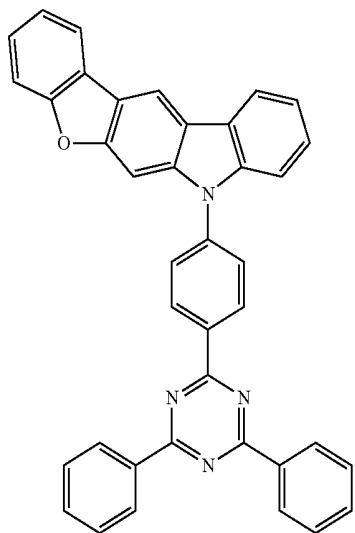
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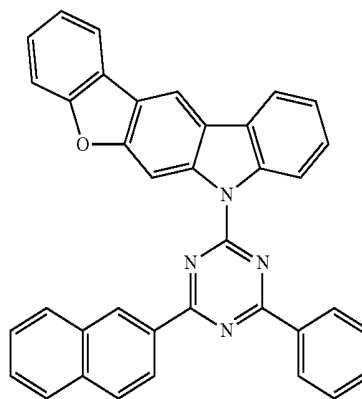
H2-171



H2-169

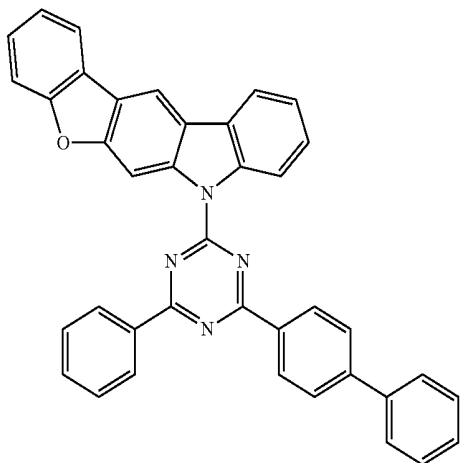


H2-172



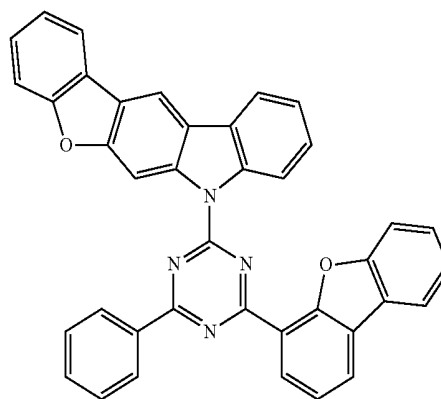
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H2-173



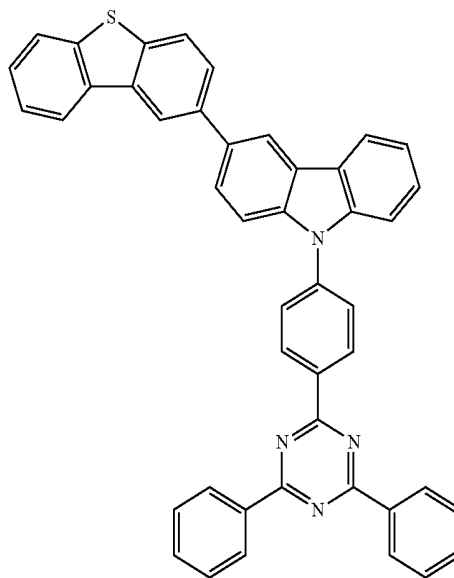
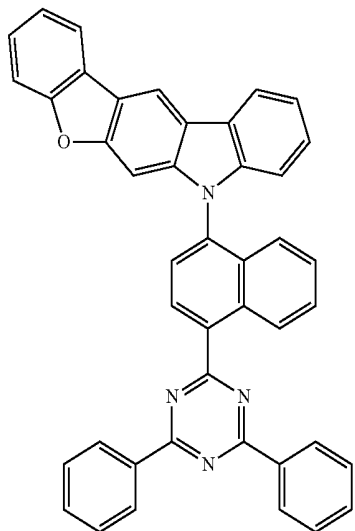
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H2-176

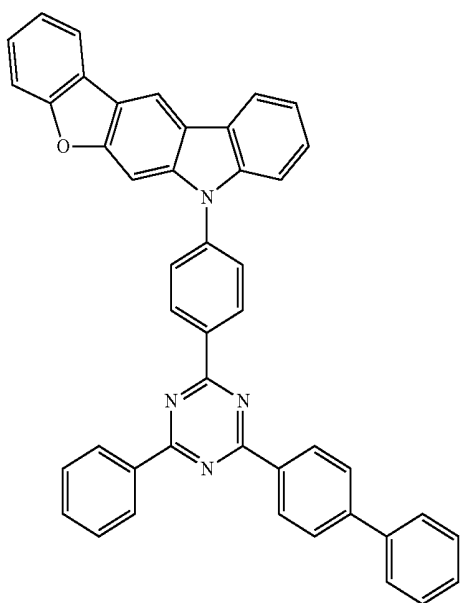


H2-177

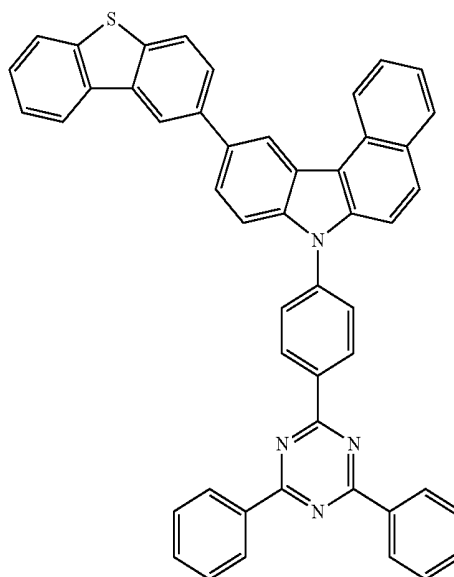
H2-174



H2-175

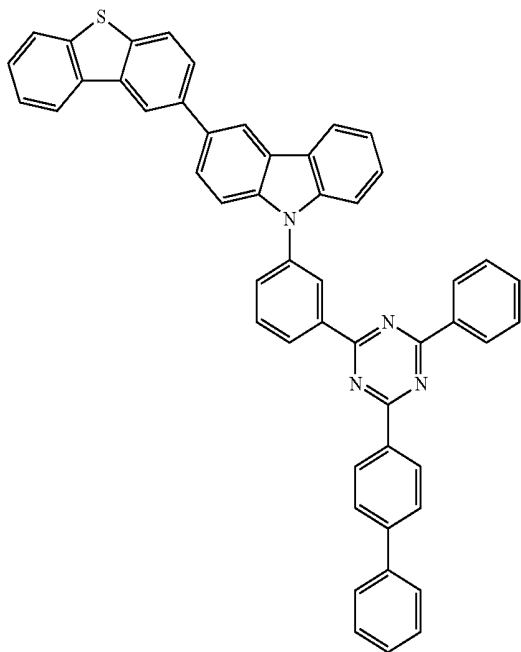


H2-178



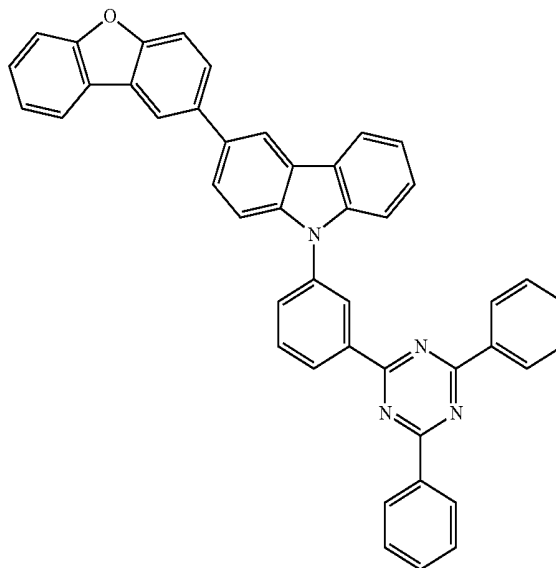
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H2-179



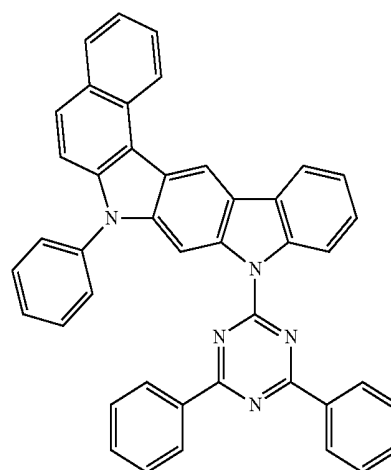
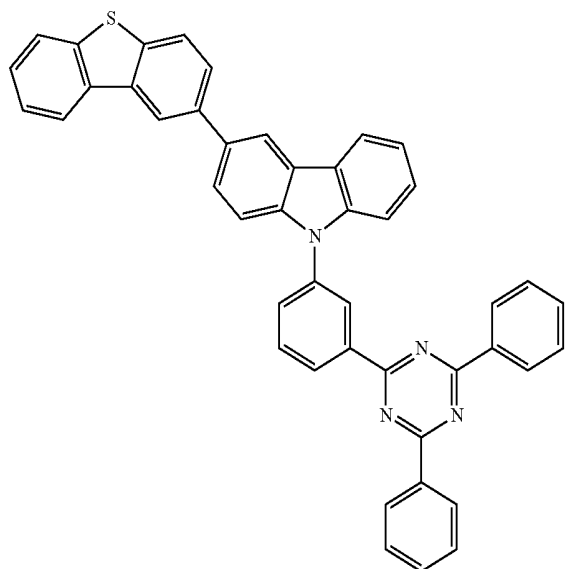
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H2-181

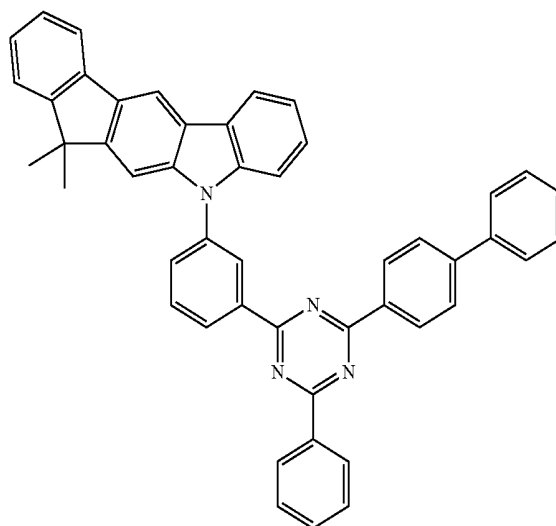


H2-182

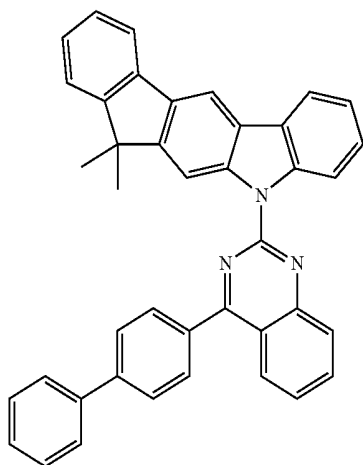
H2-180



H2-183

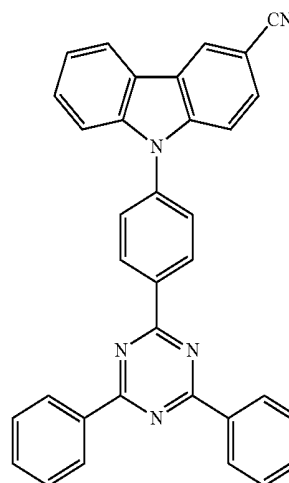


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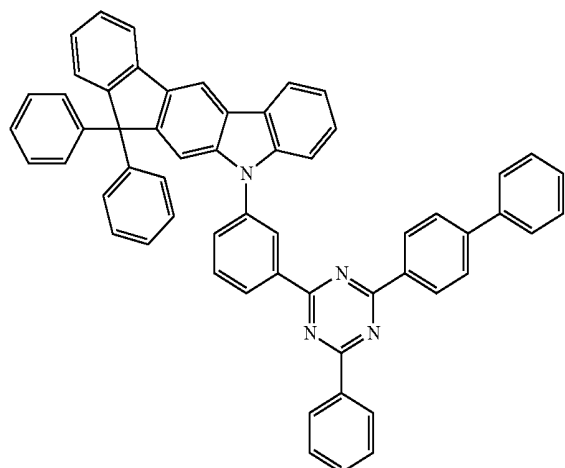


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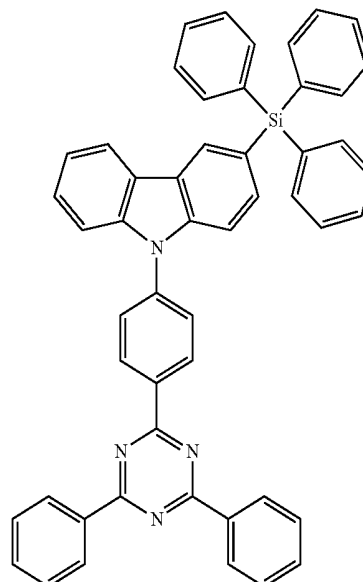
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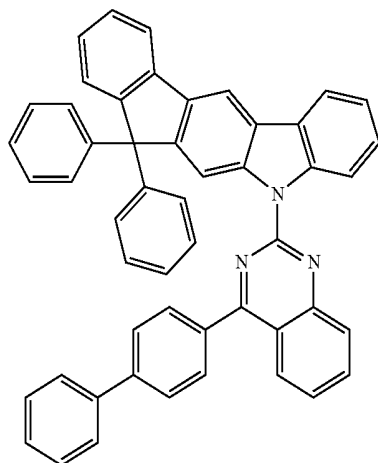
H2-187



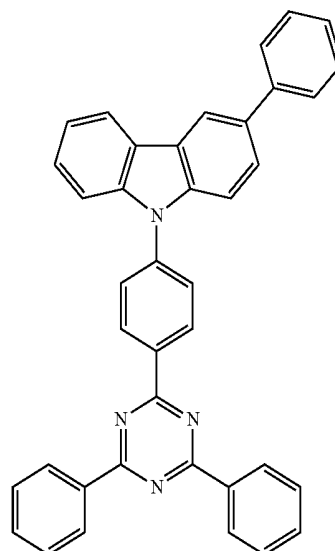
H2-185



H2-188

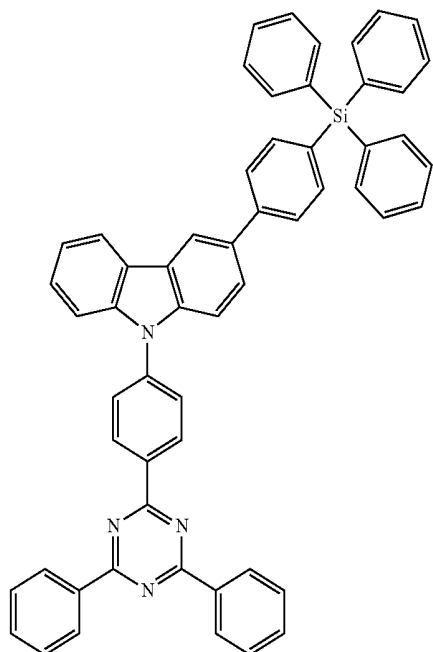


H2-186



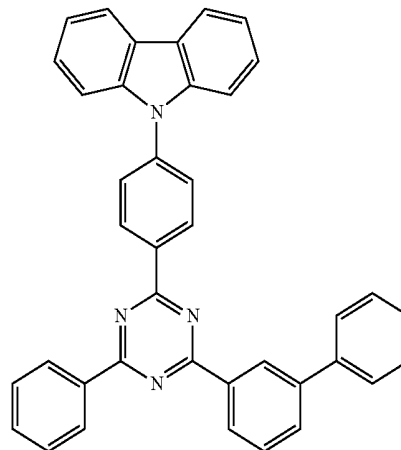
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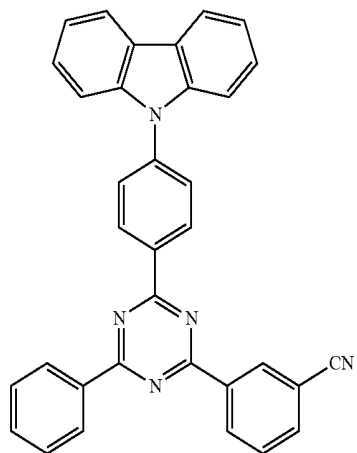
H2-190

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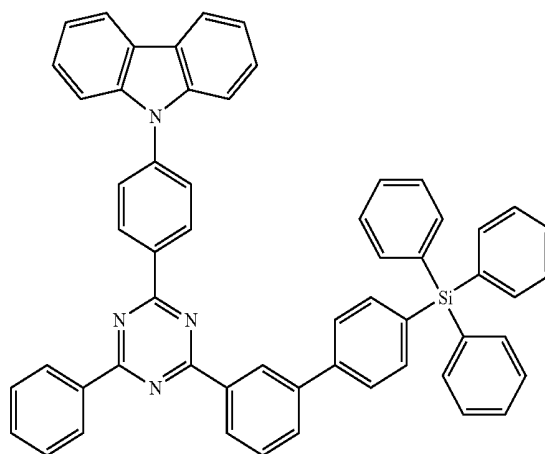


H2-193

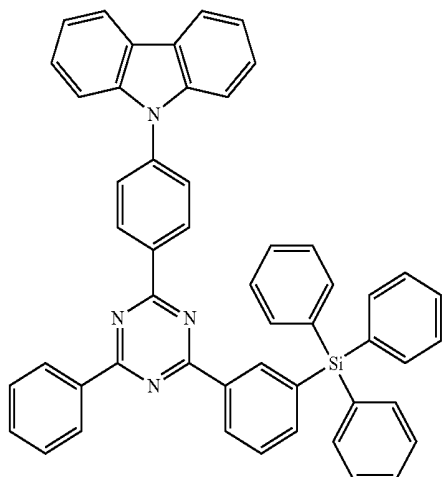
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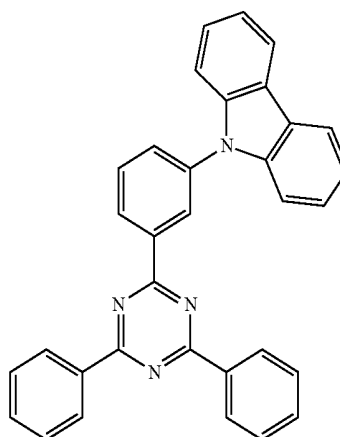
H2-194



H2-192

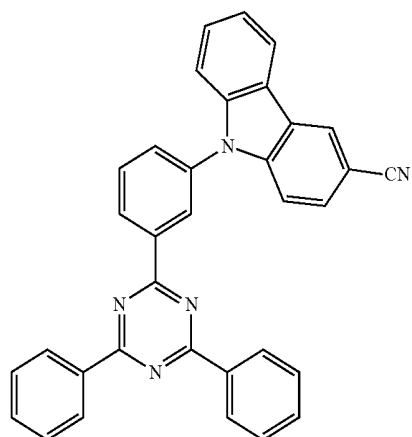


H2-195



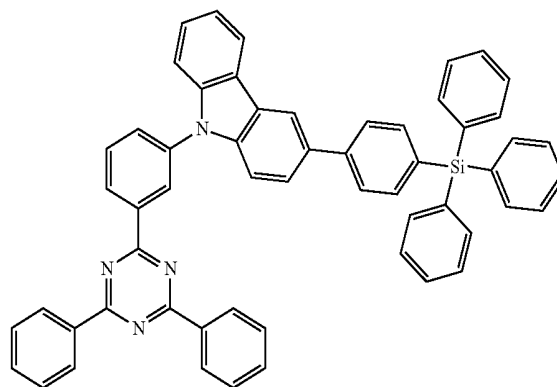
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H2-196

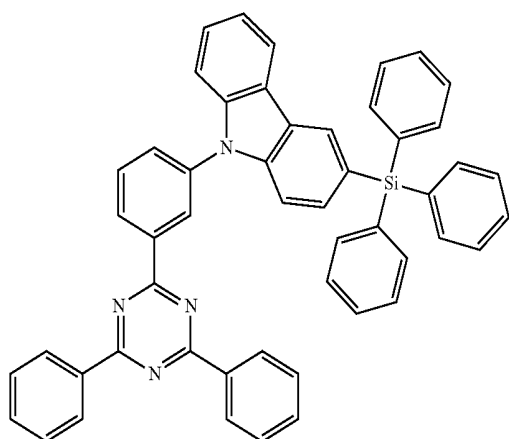


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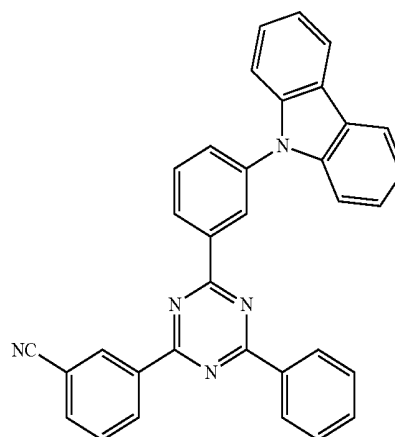
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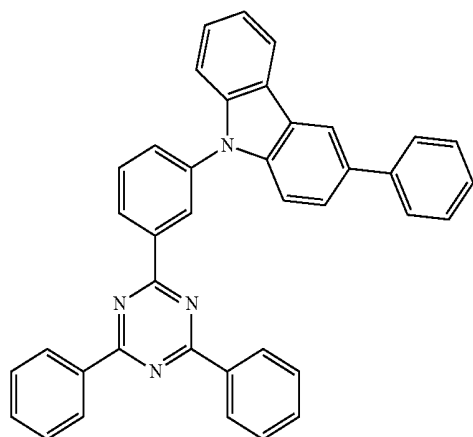
H2-197



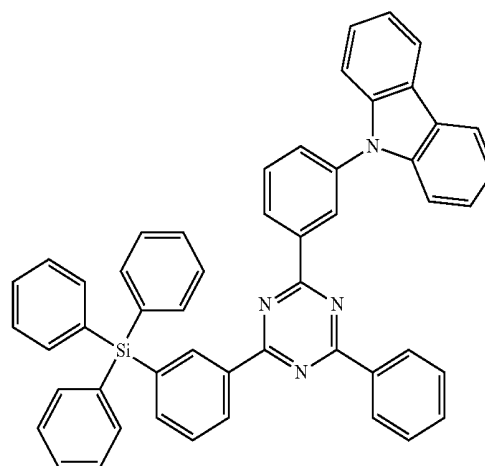
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H2-198

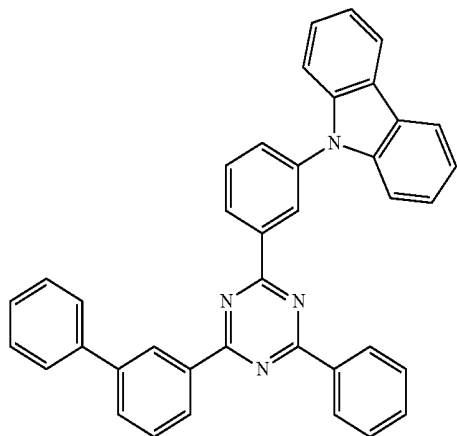


H2-201



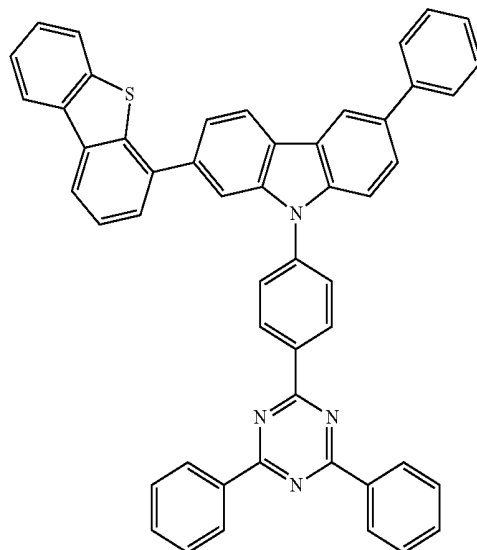
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H2-202

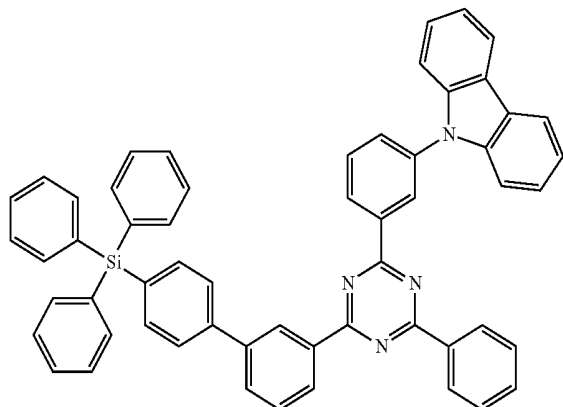


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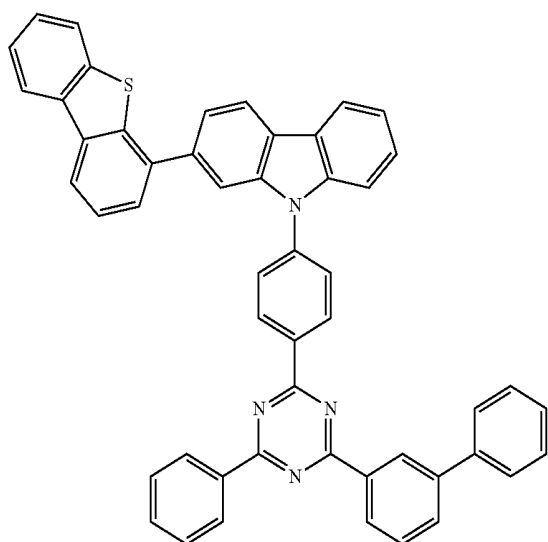
H2-205



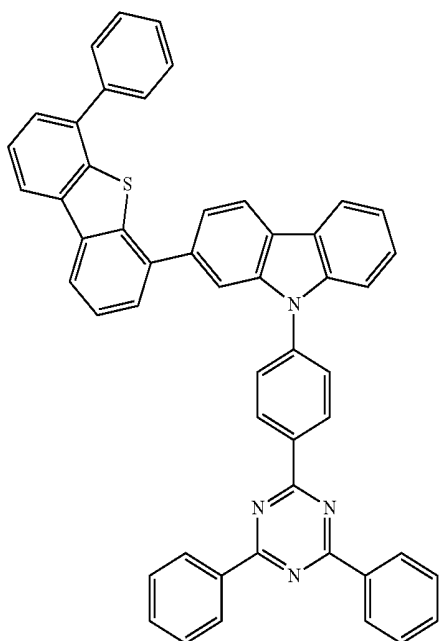
H2-203



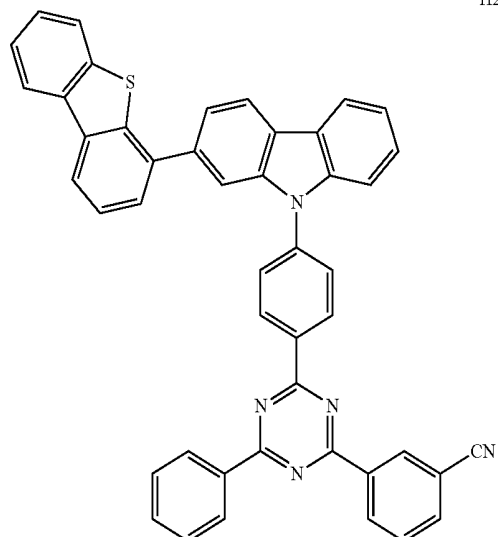
H2-206



H2-204

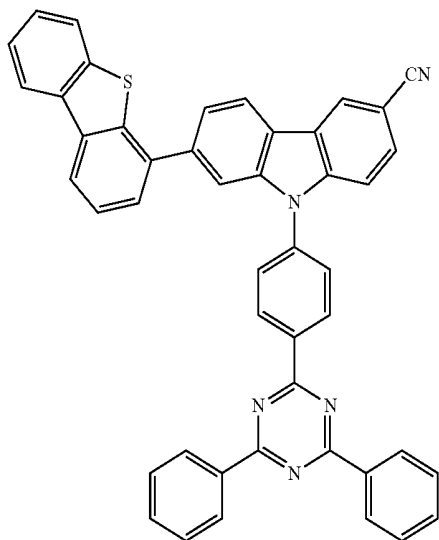


H2-207



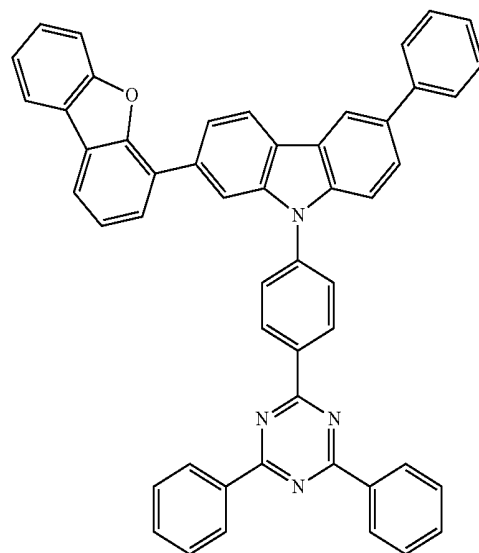
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H2-208



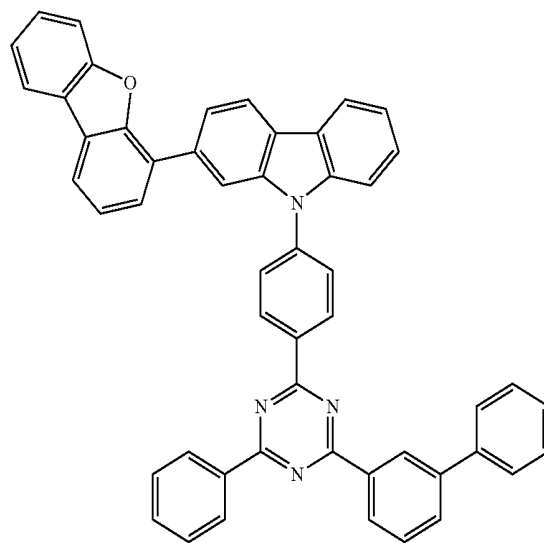
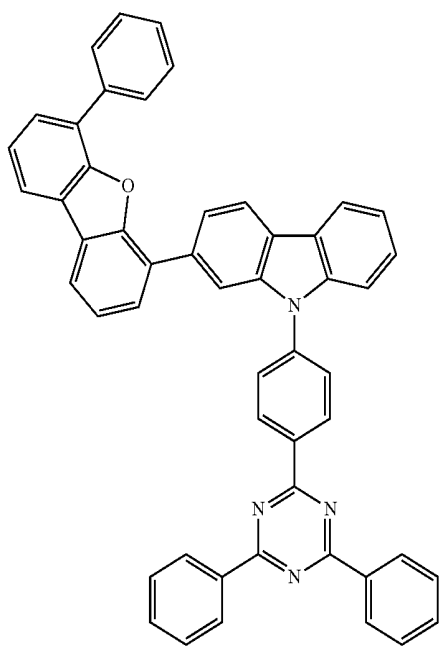
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H2-210

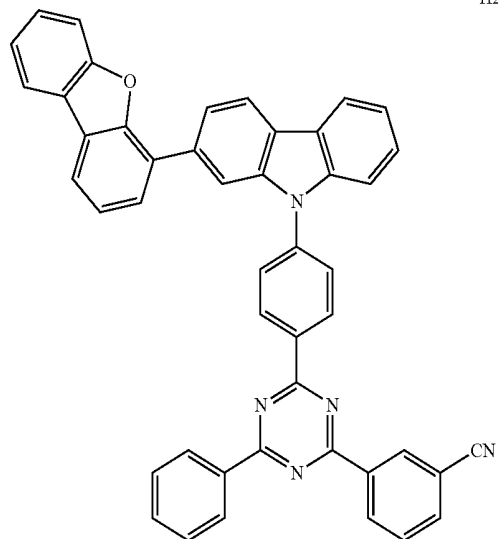


H2-211

H2-209

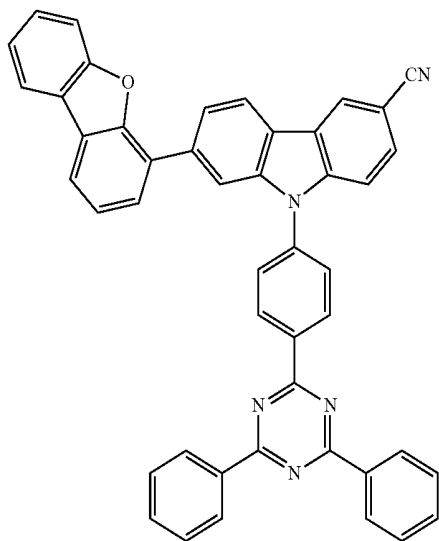


H2-212



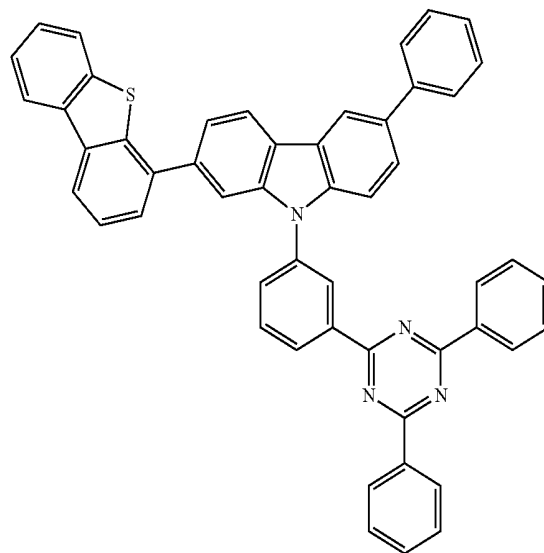
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H2-213



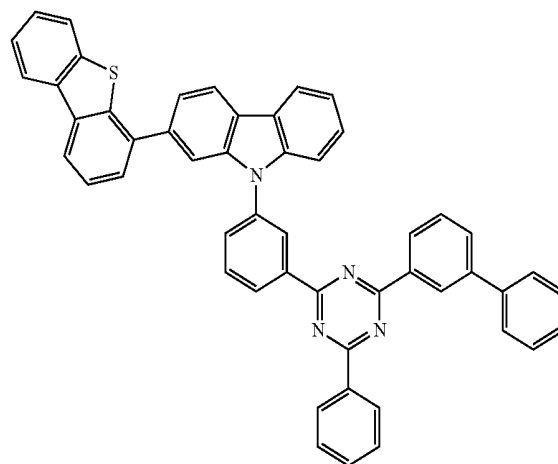
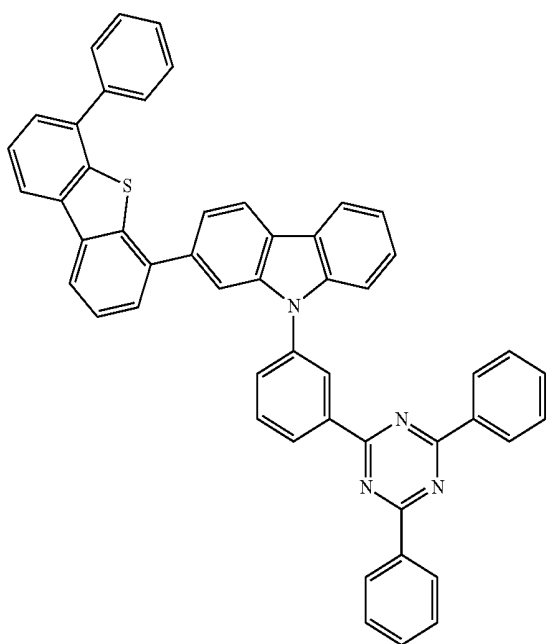
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H2-215

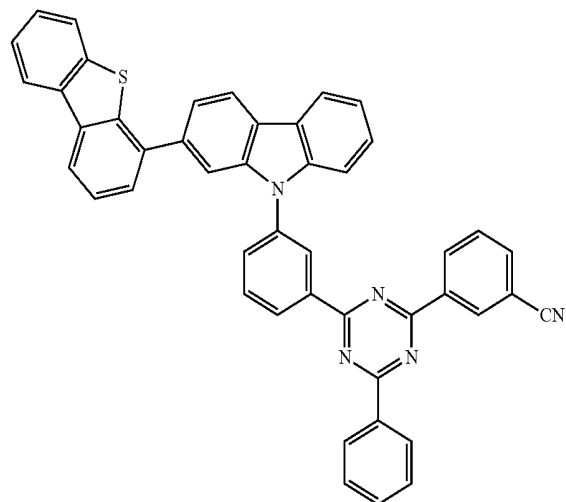


H2-216

H2-214

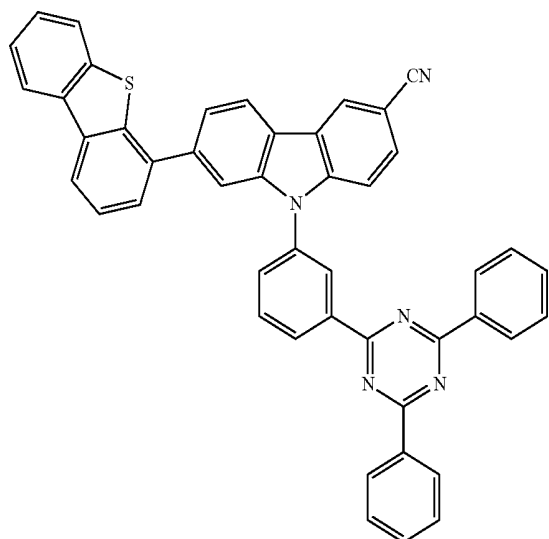


H2-217



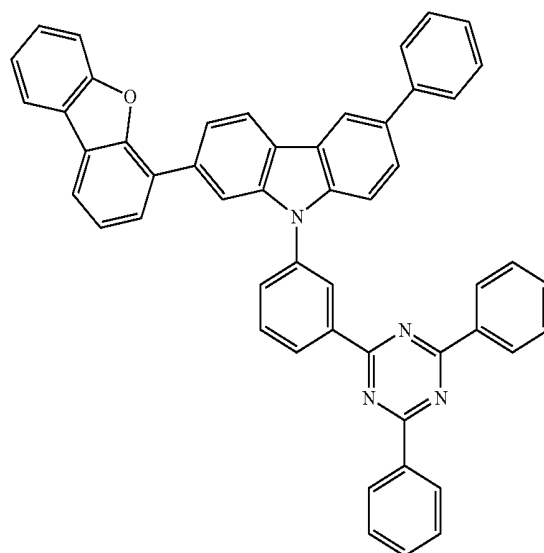
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H2-218



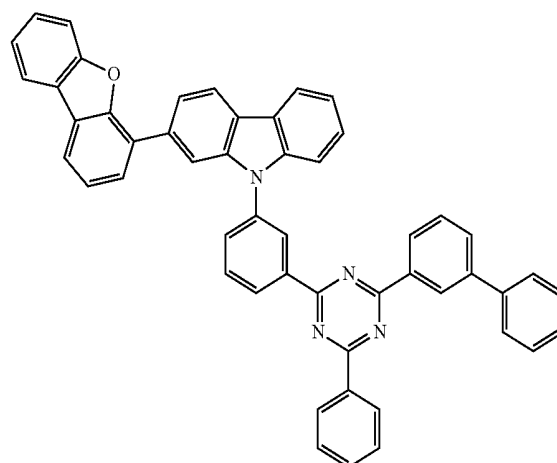
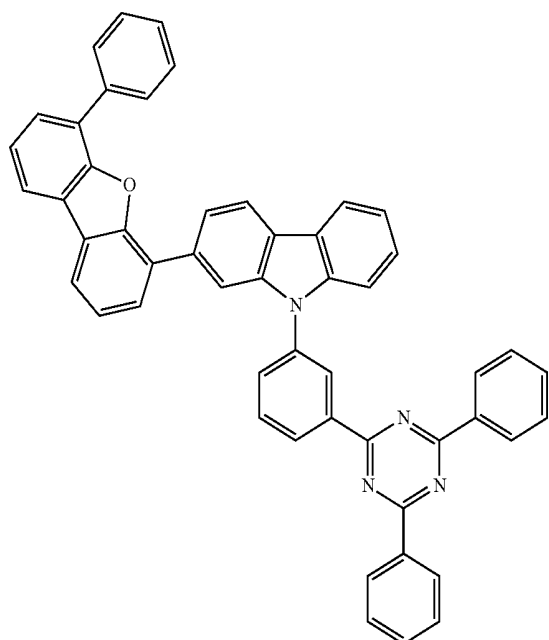
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H2-220

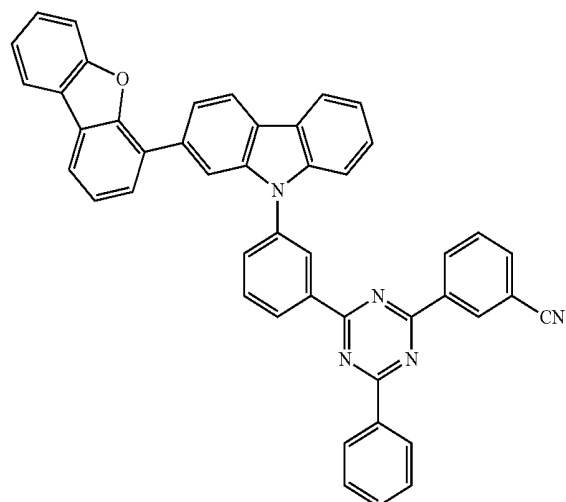


H2-221

H2-219

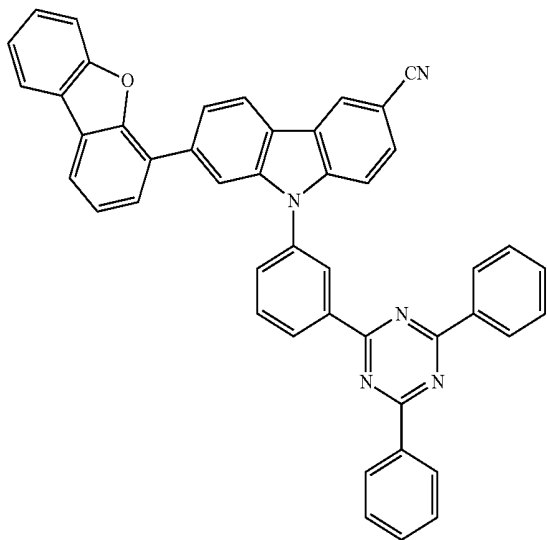


H2-222



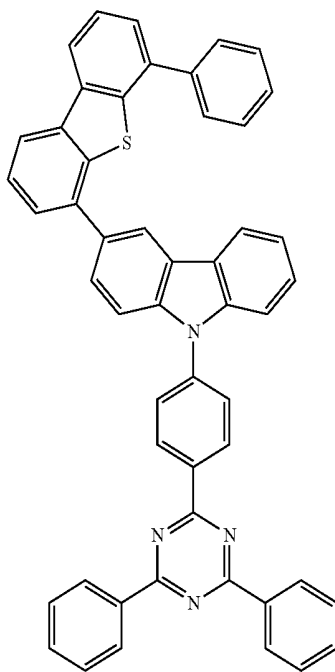
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H2-223

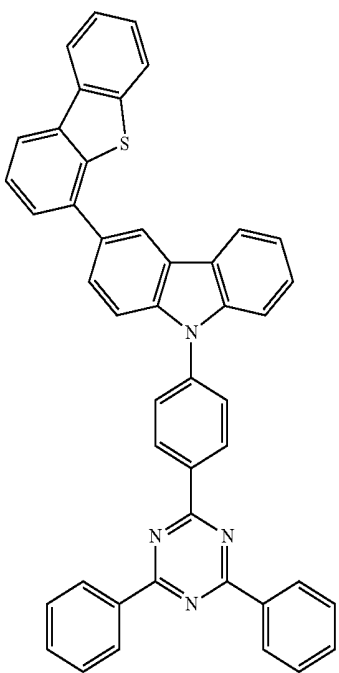


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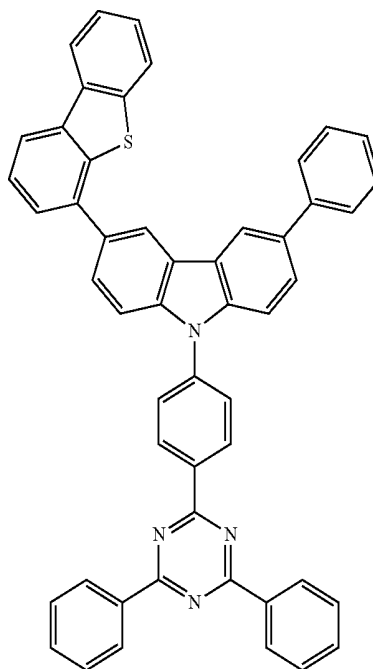
H2-225



H2-224

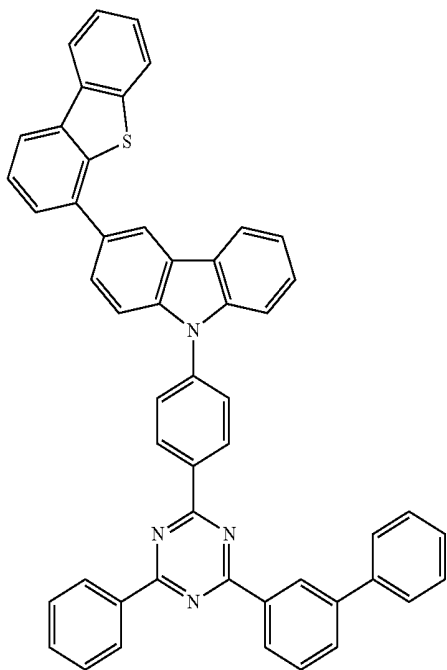


H2-226



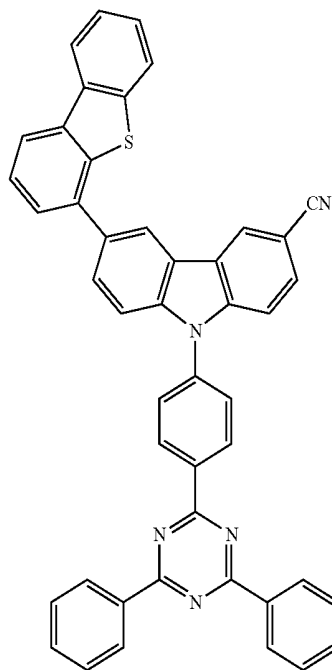
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H2-227

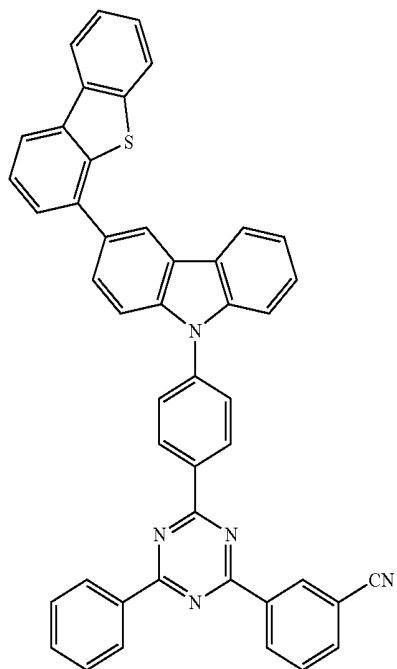


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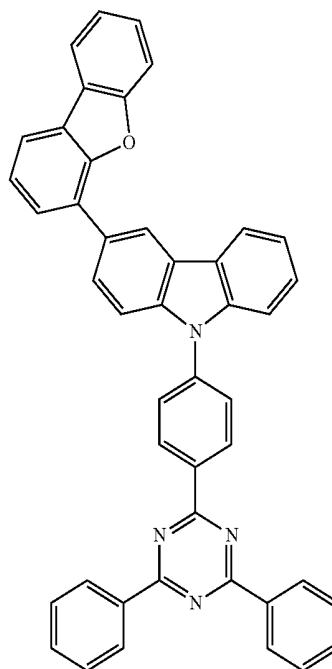
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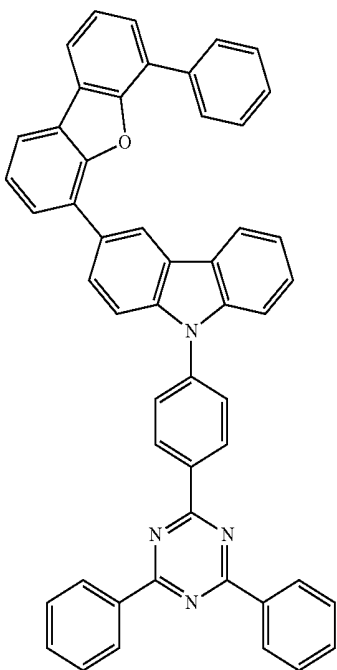
H2-228



H2-230

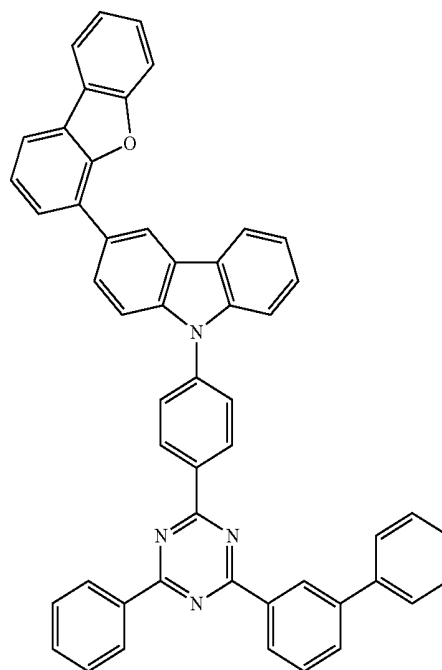


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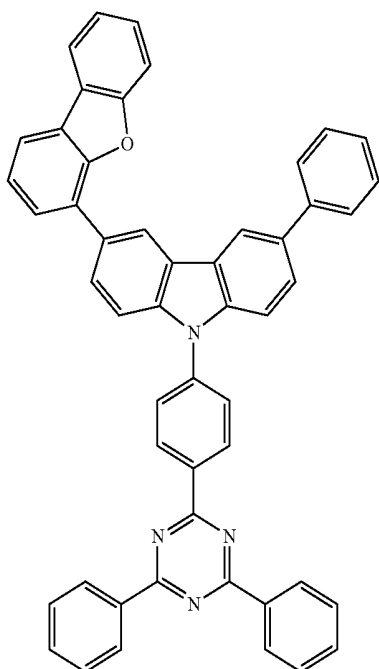


H2-231

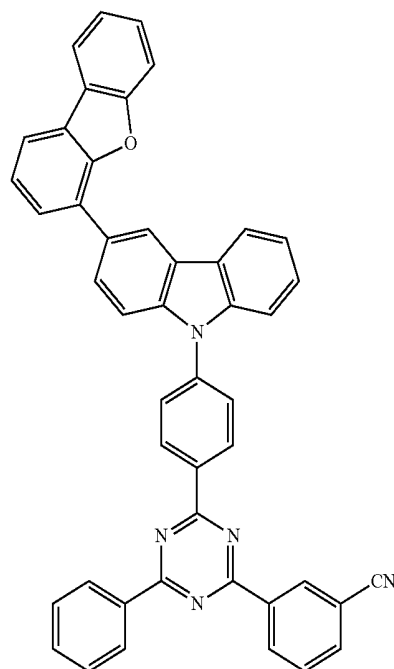
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H2-233

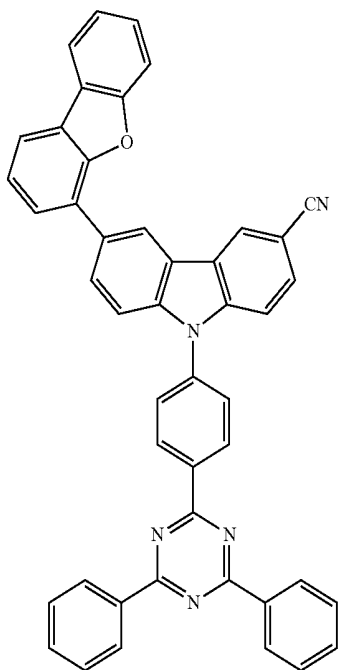


H2-232



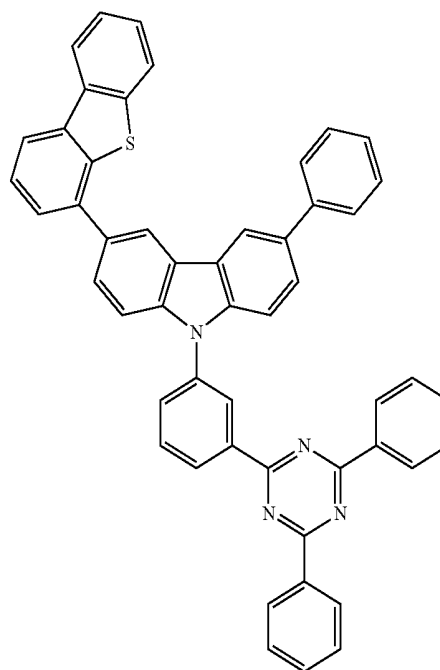
H2-234

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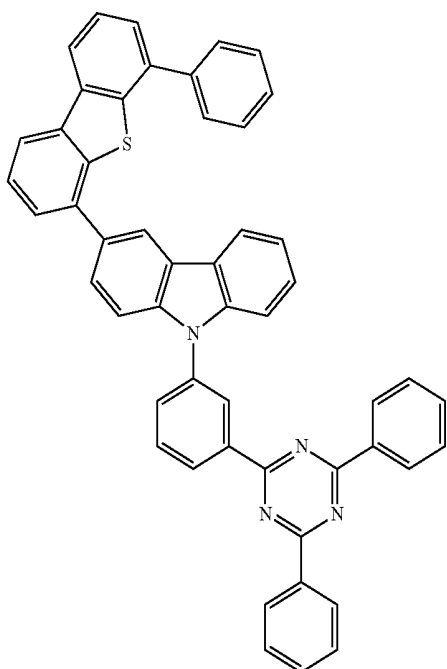
H2-235

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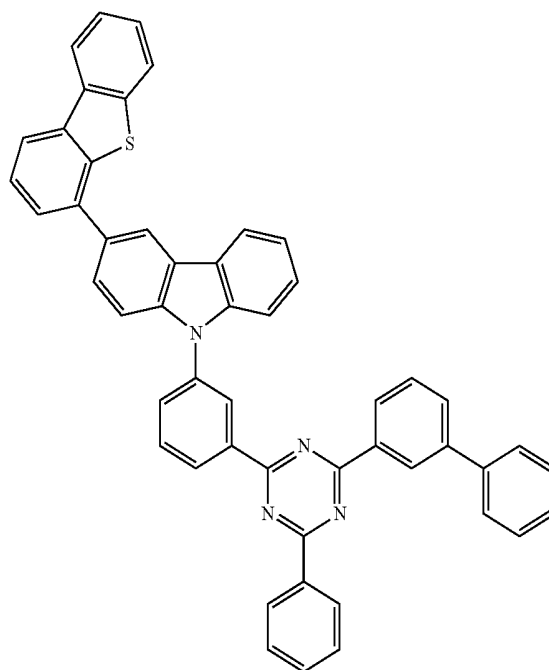


H2-237

H2-236

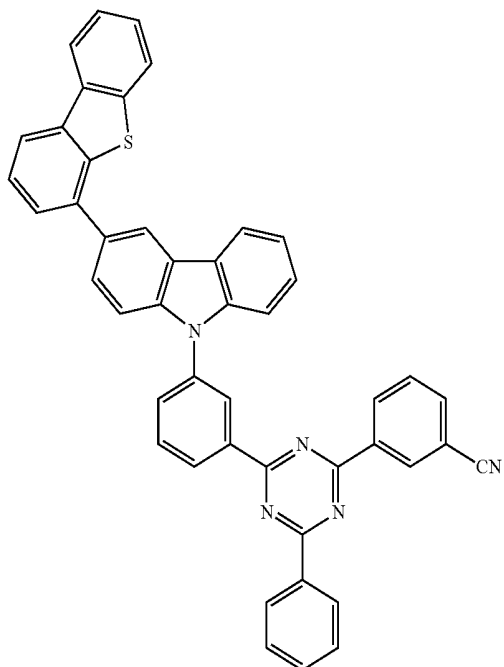


H2-238



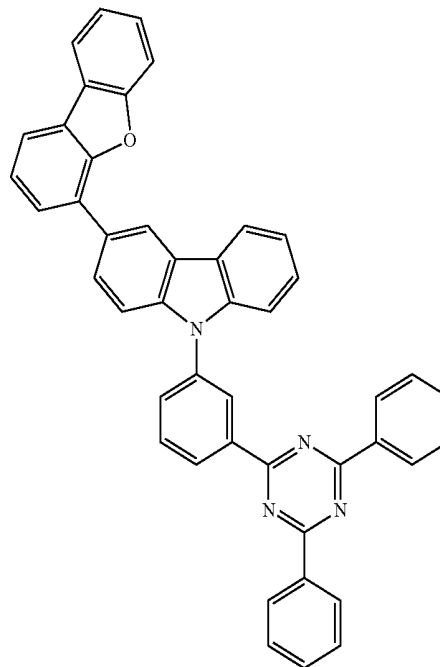
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H2-239

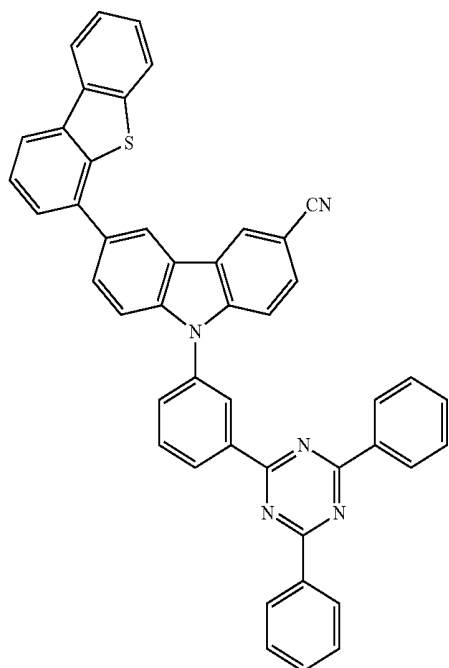


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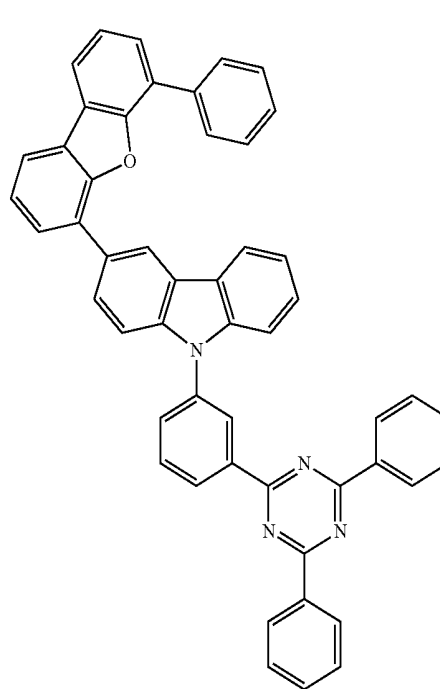
H2-241



H2-240

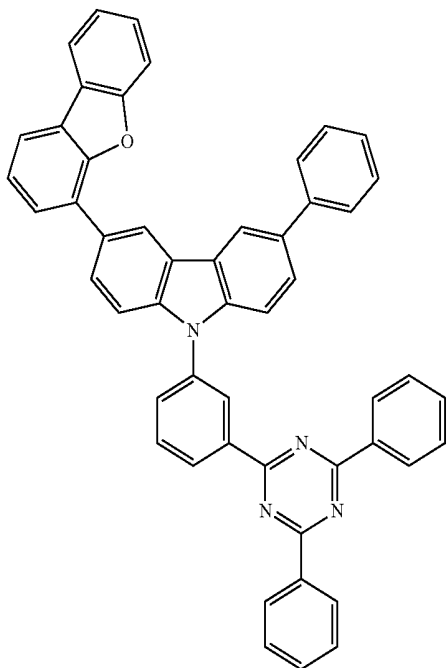


H2-242



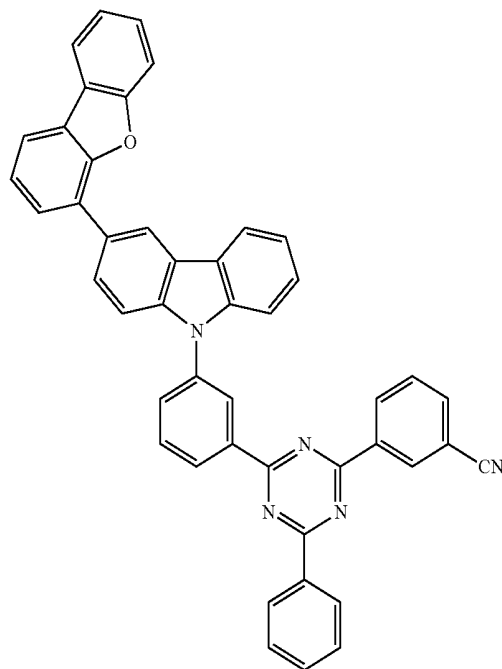
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H2-243

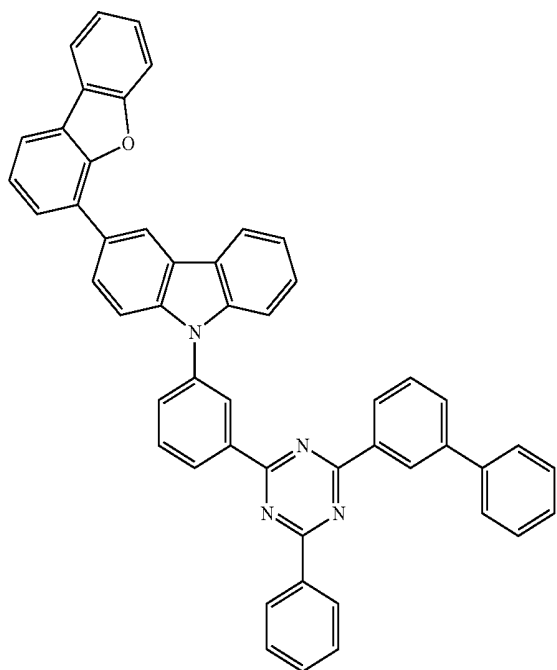


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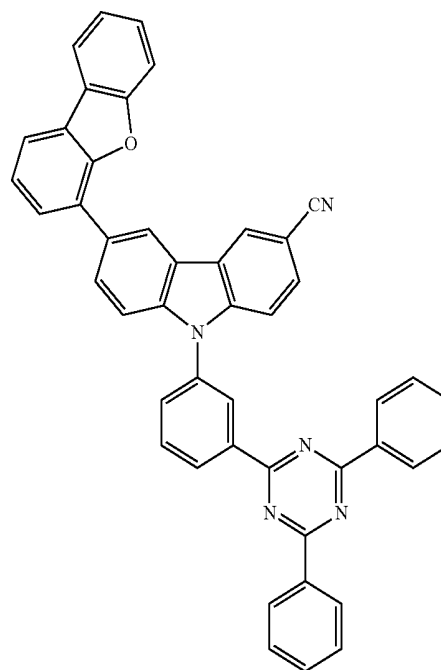
H2-245



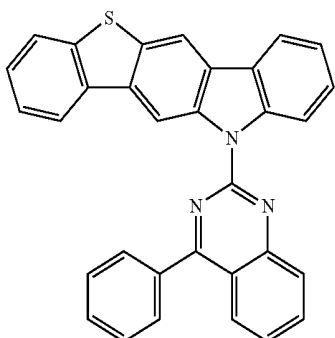
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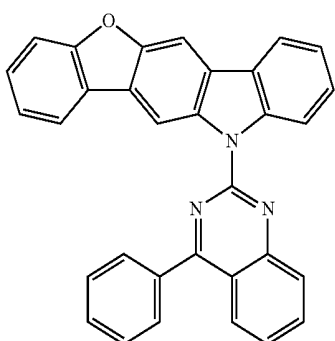
H2-246



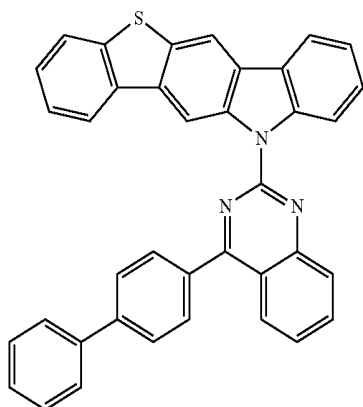
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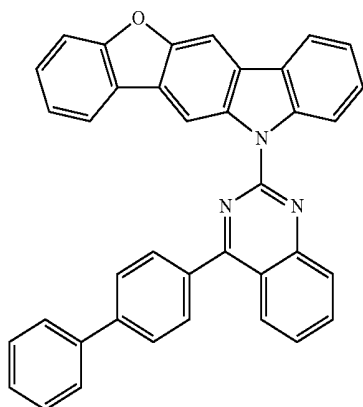
H2-247



H2-248

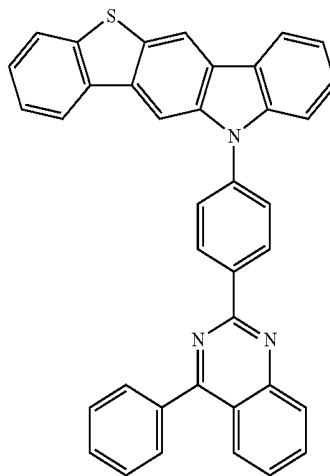


H2-249

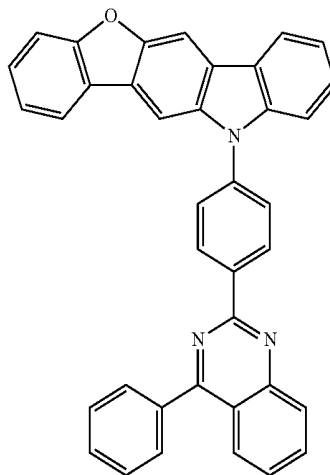


H2-250

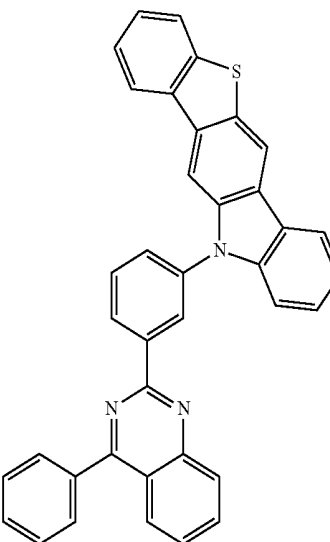
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H2-251



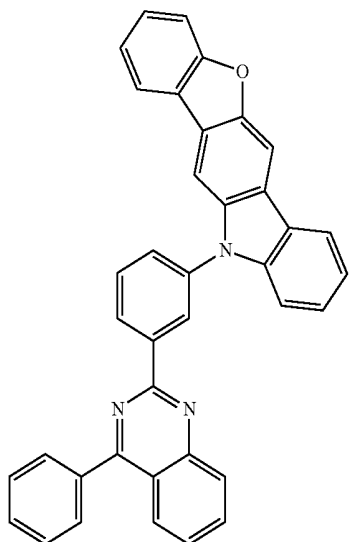
H2-252



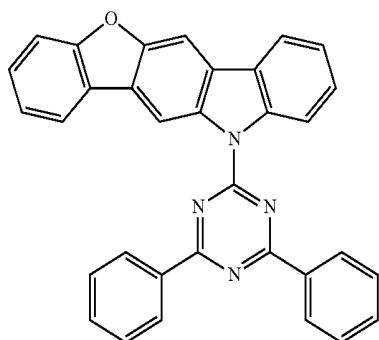
H2-253

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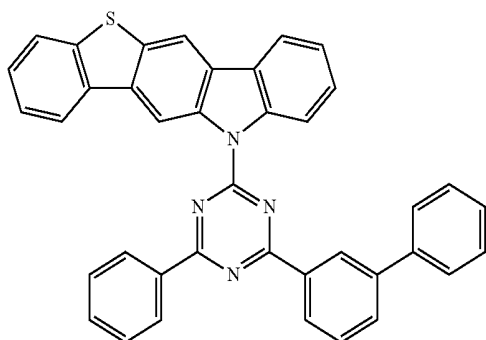
H2-254



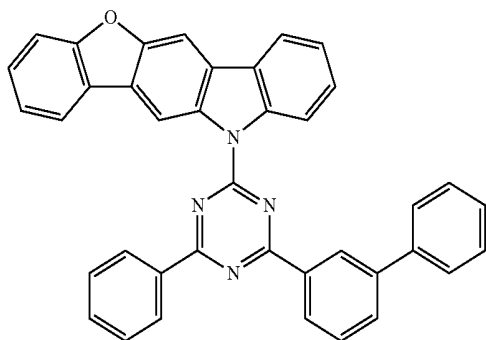
H2-255



H2-256

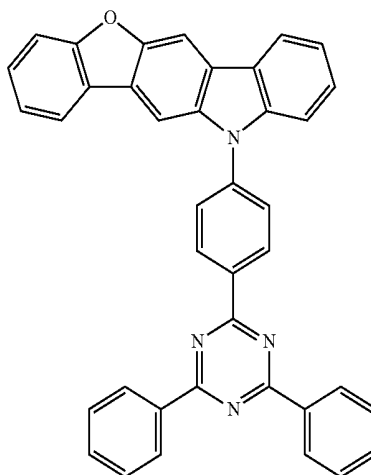


H2-257

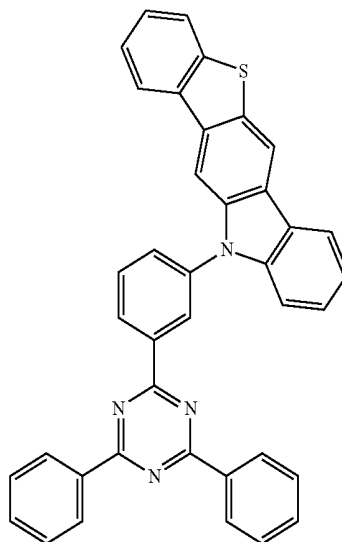


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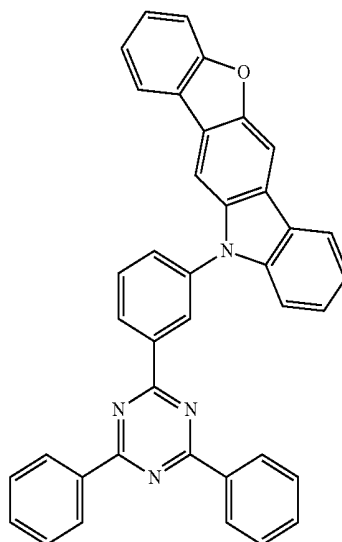
H2-258



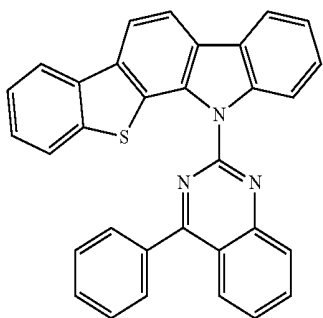
H2-259



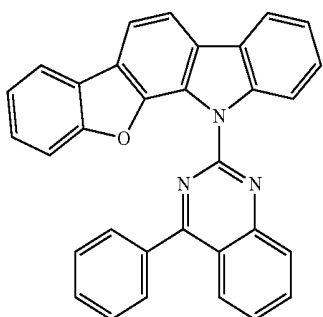
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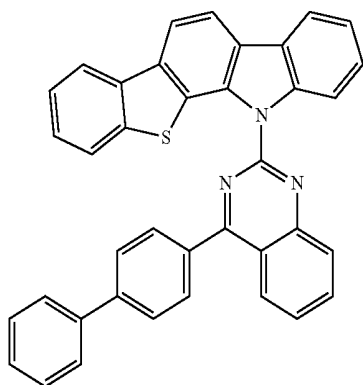
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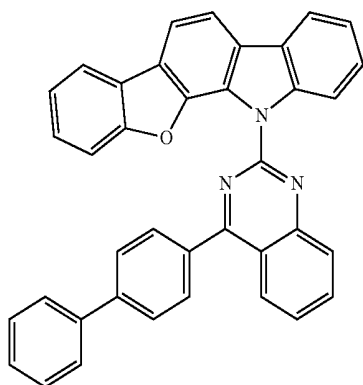
H2-261



H2-262

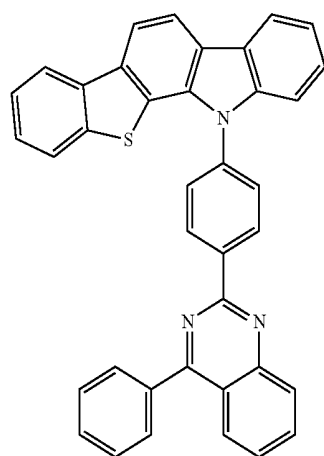


H2-263

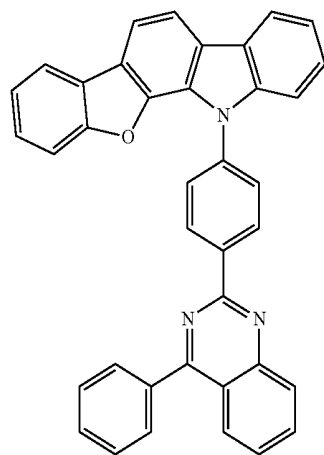


H2-264

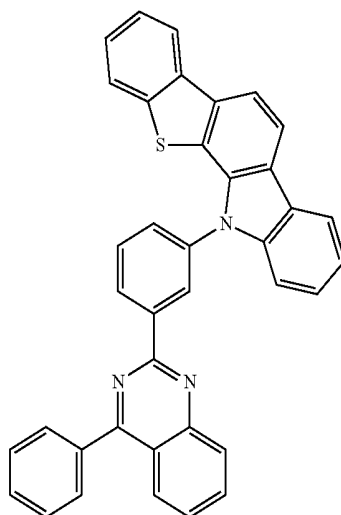
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H2-265



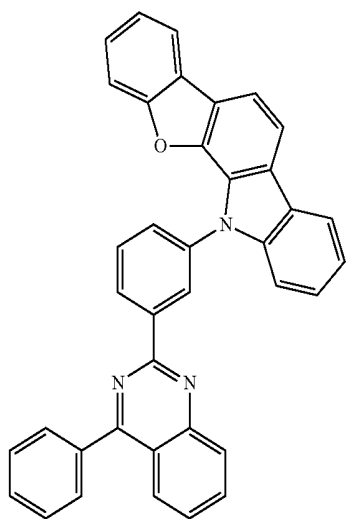
H2-266



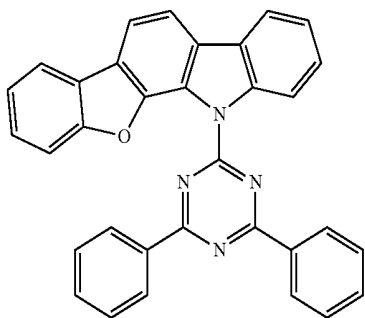
H2-267

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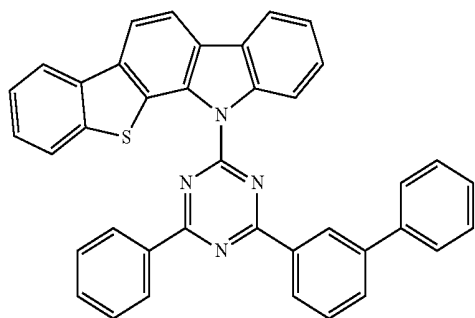
H2-268



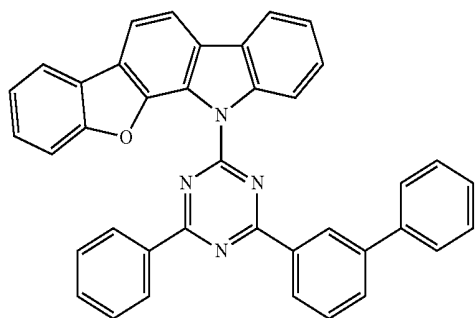
H2-269



H2-270

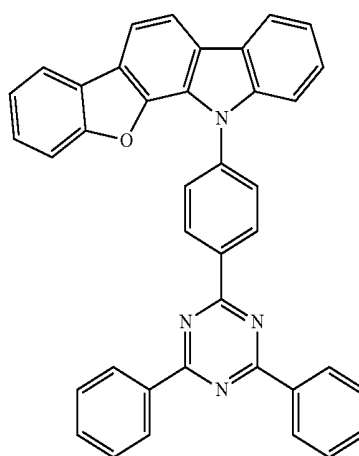


H2-271

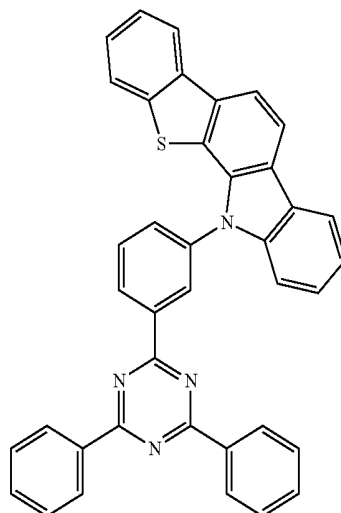


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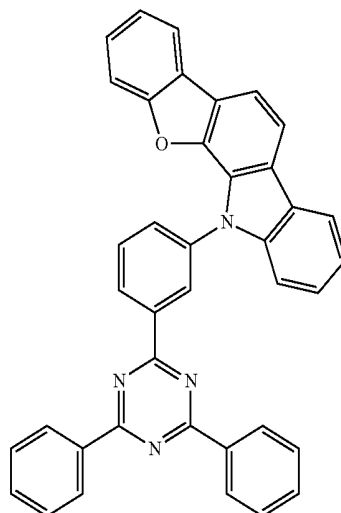
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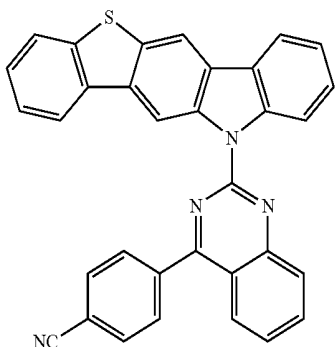
H2-273



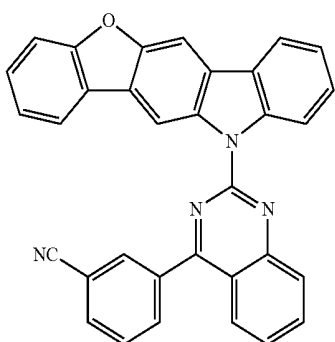
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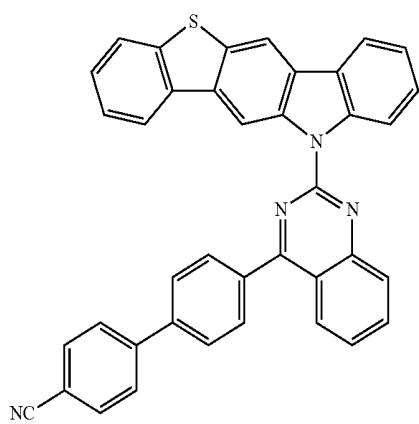
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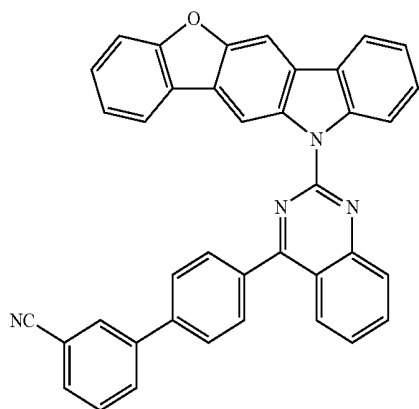
H2-275



H2-276

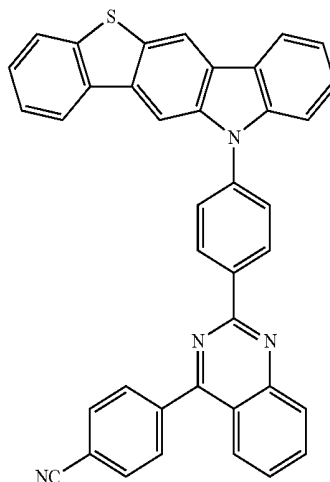


H2-277

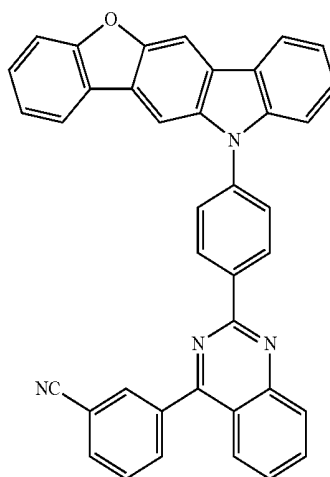


H2-278

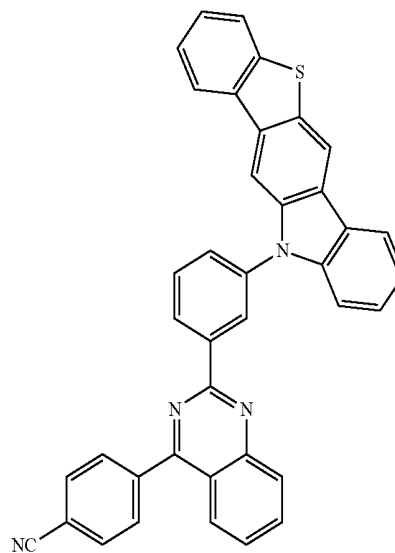
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H2-279



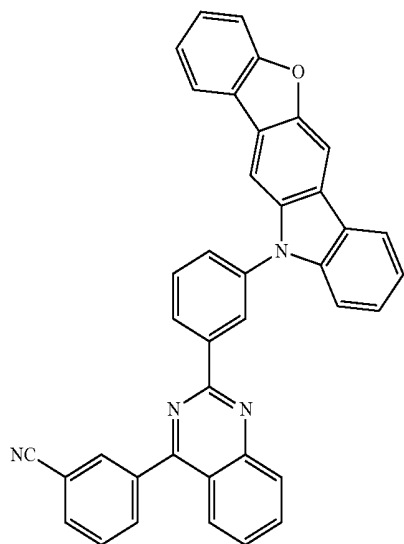
H2-280



H2-281

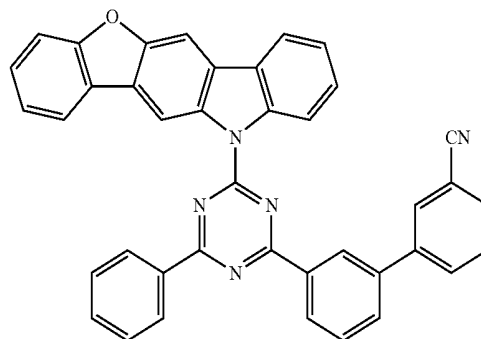
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H2-282



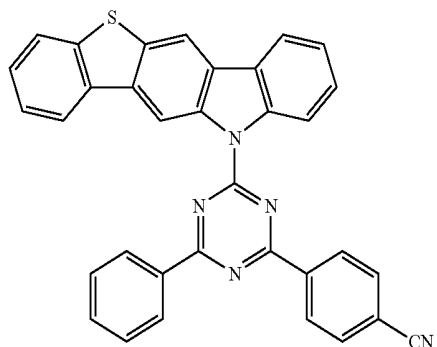
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H2-286

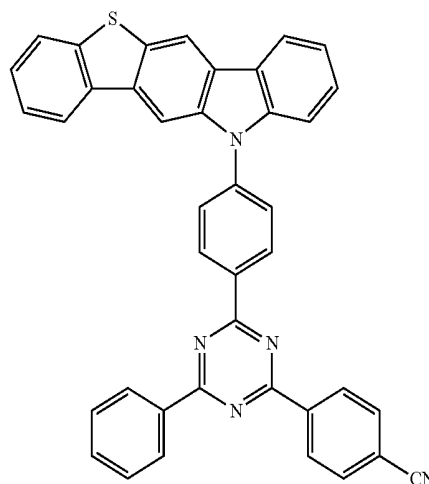


H2-287

H2-283

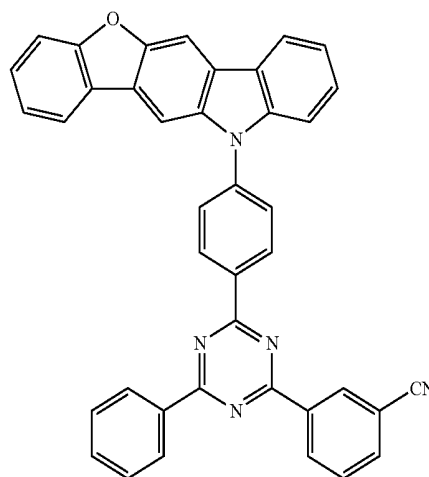
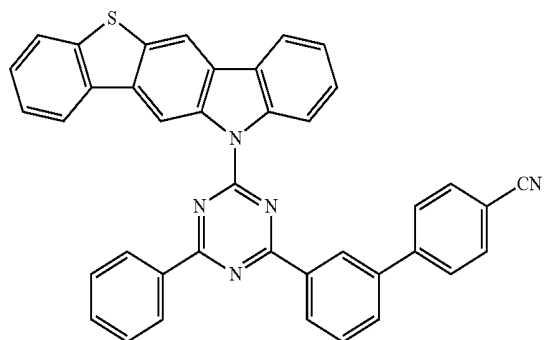


H2-284

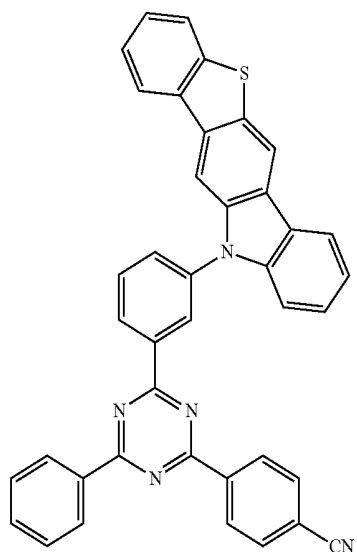


H2-288

H2-285

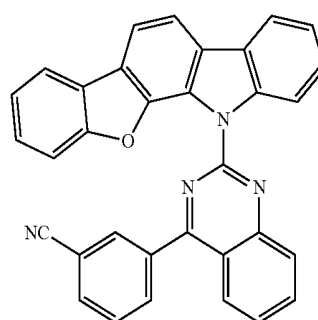


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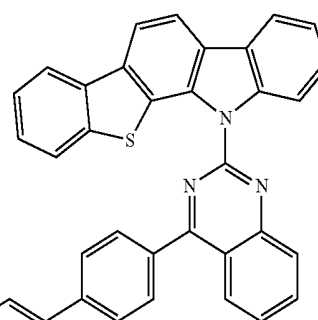


H2-289

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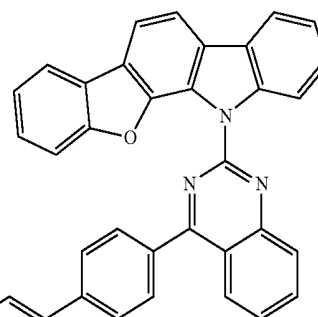
H2-292



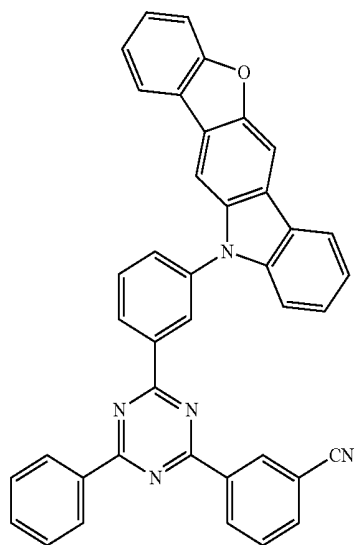
H2-293



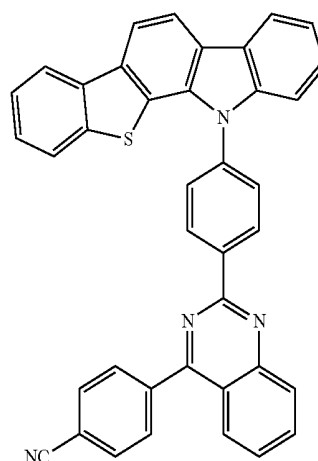
H2-290



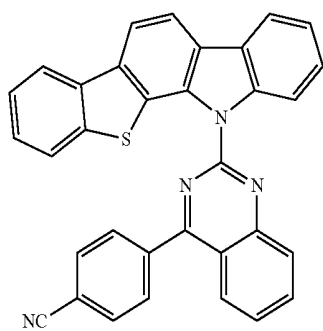
H2-294



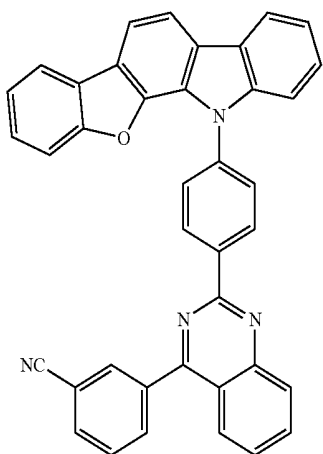
H2-291



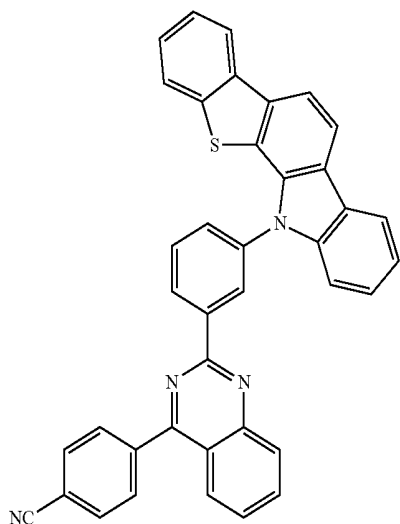
H2-295



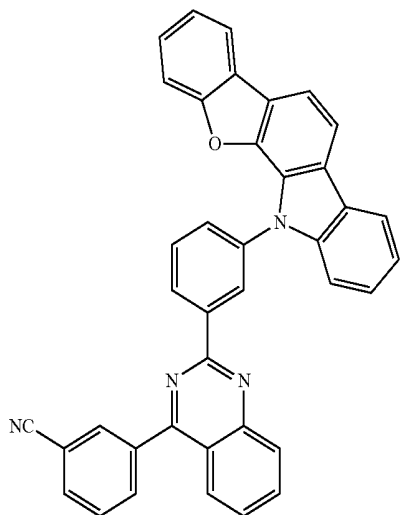
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H2-296

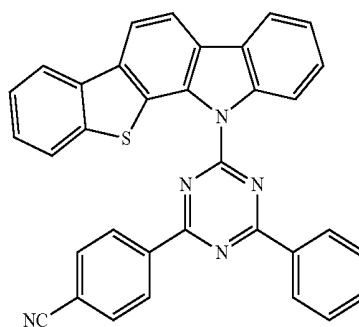


H2-297

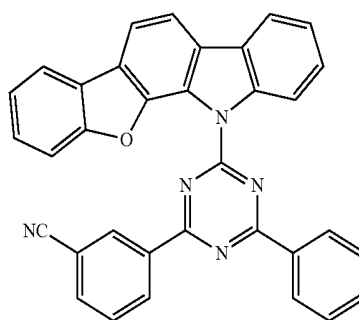


H2-298

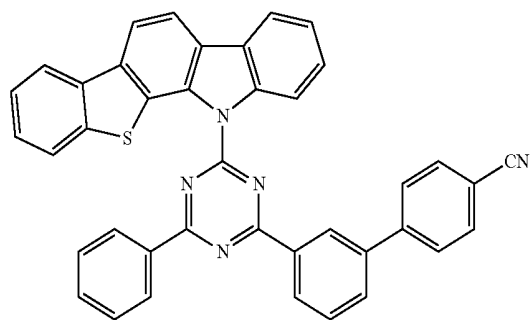
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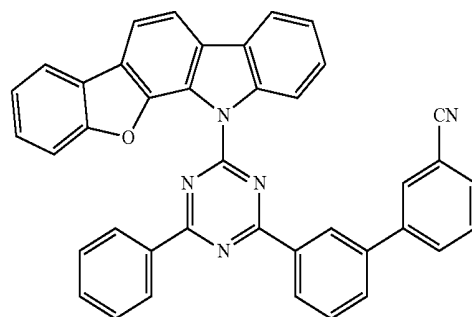
H2-299



H2-300

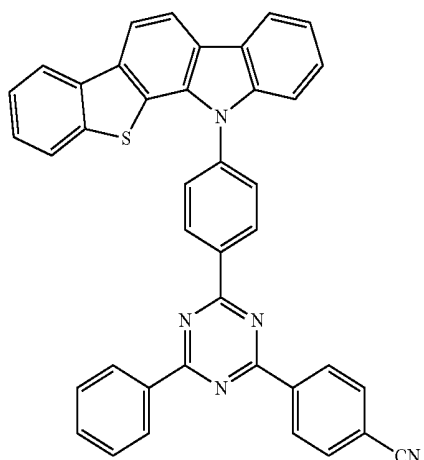


H2-301



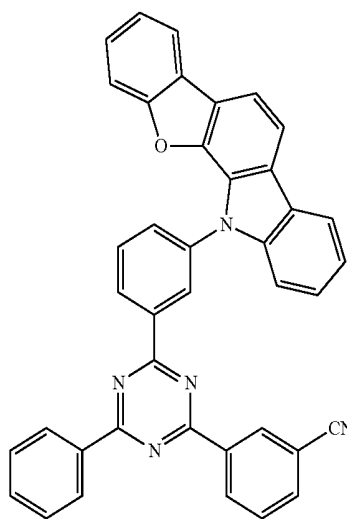
H2-302

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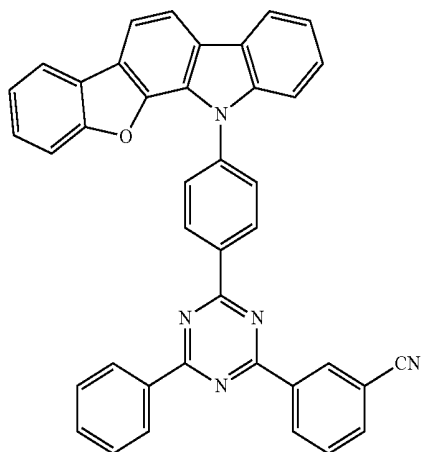


H2-303

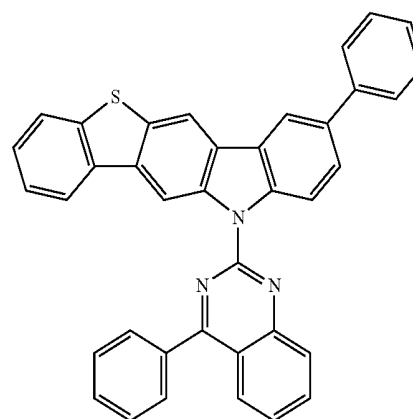
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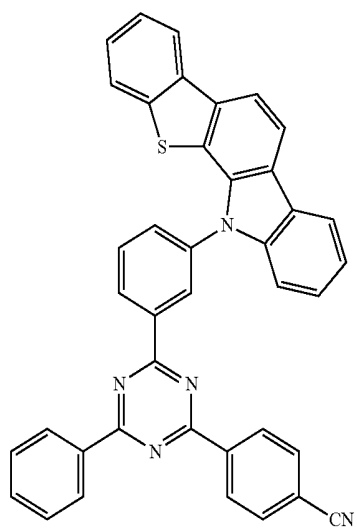
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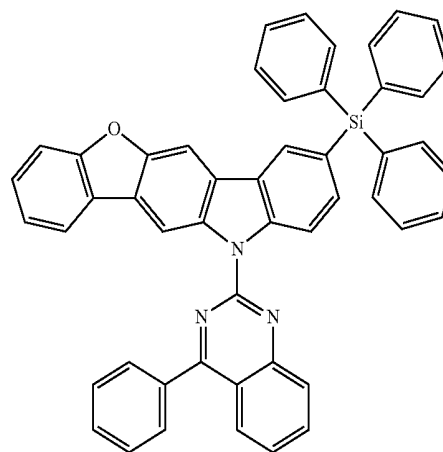
H2-304



H2-307



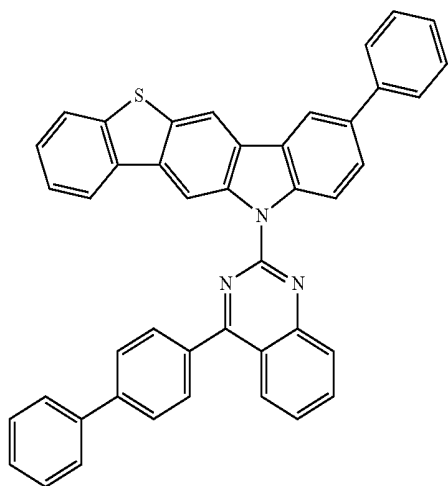
H2-305



H2-308

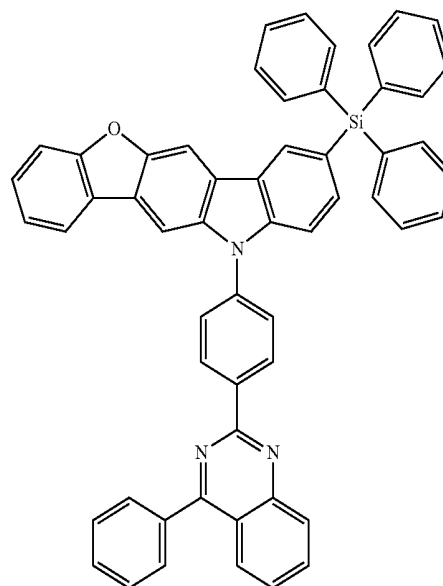
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H2-309

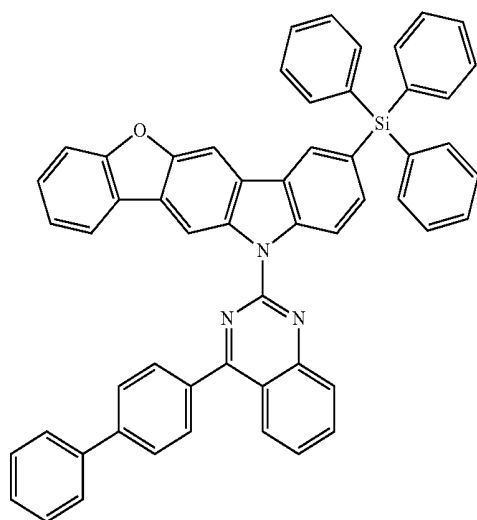


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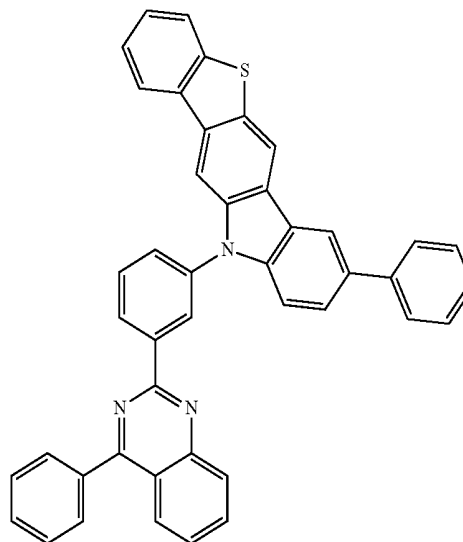
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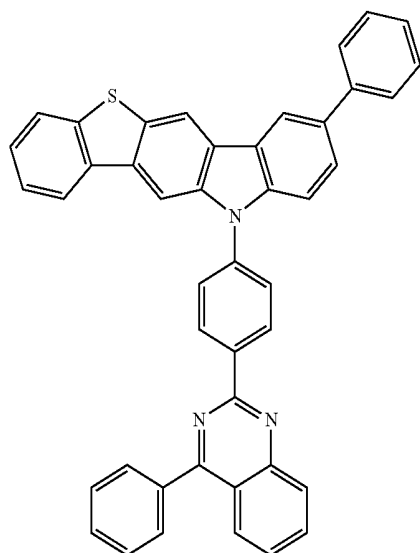
H2-310



H2-313

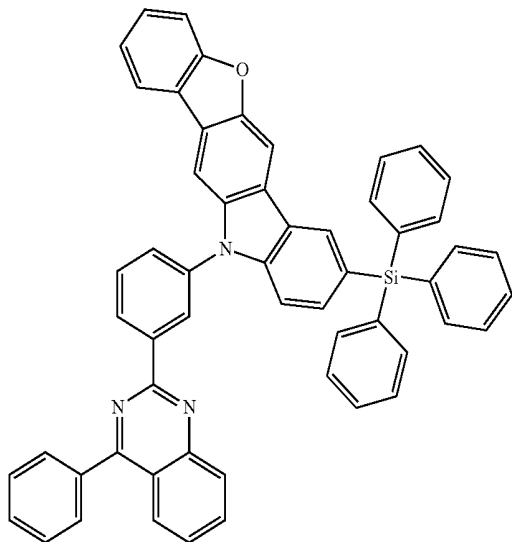


H2-311



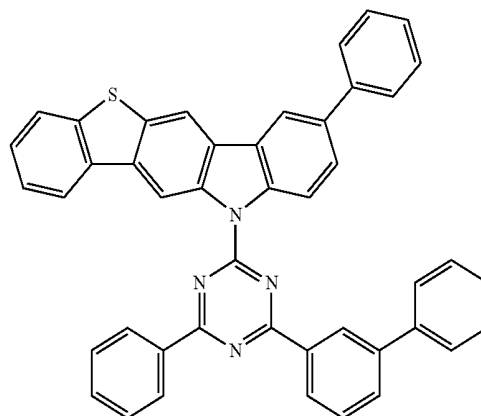
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H2-314



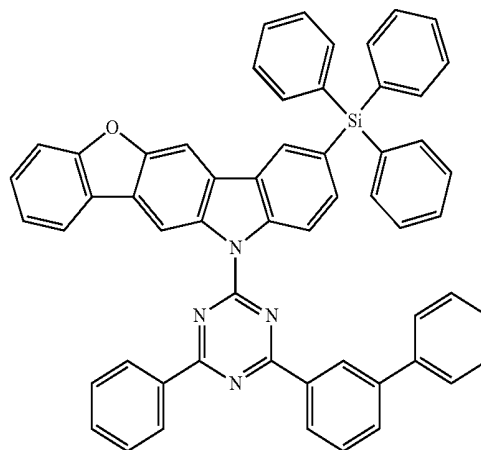
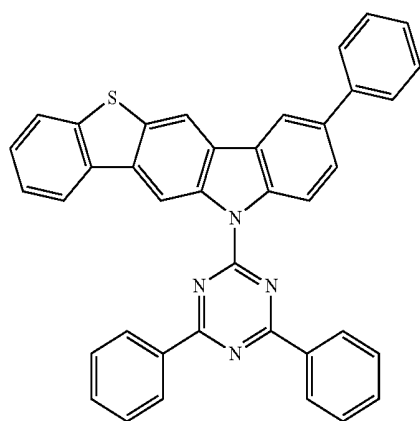
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H2-317



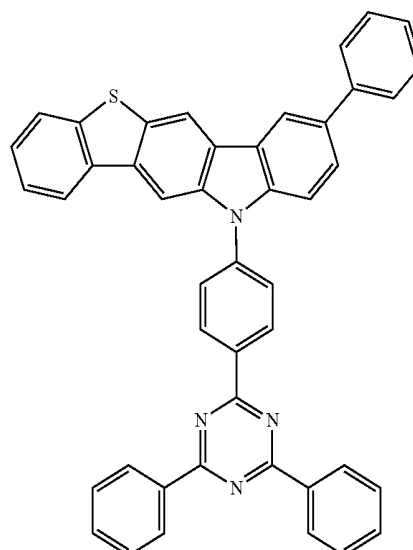
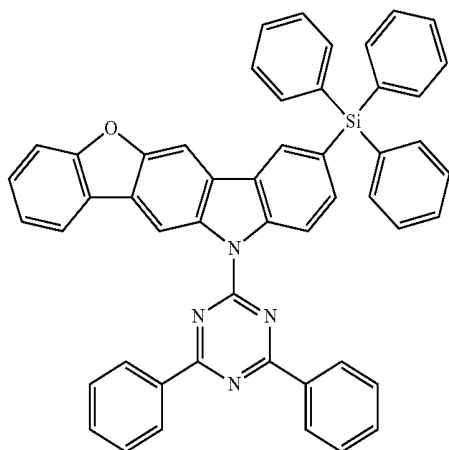
H2-318

H2-315



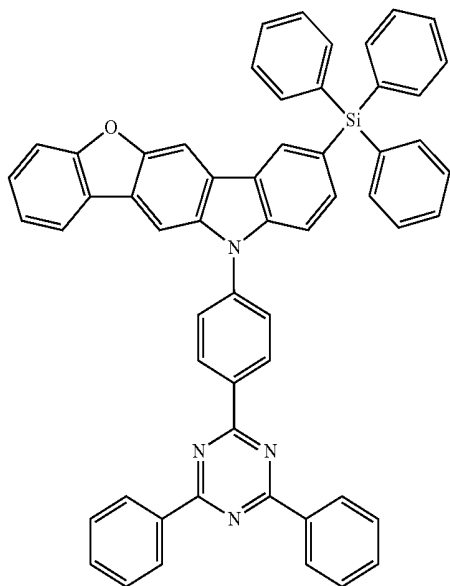
H2-319

H2-316



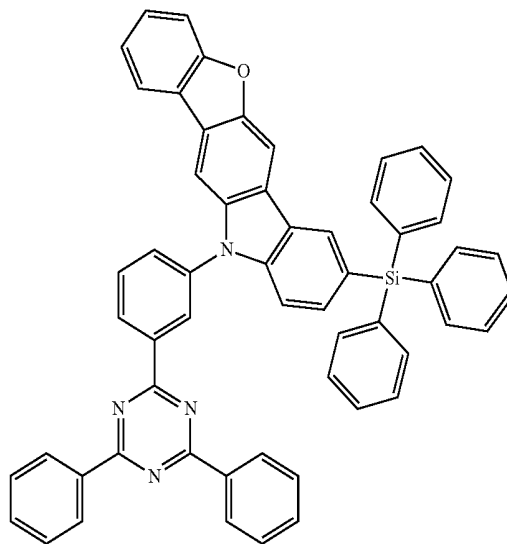
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H2-320

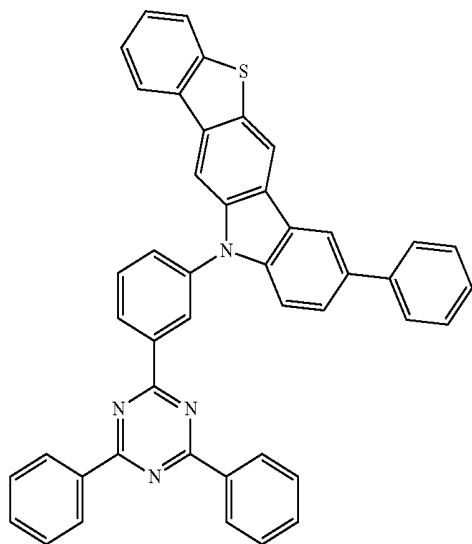


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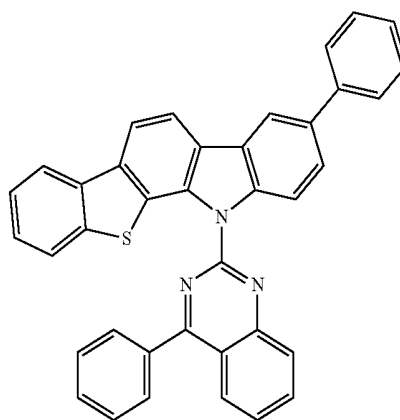
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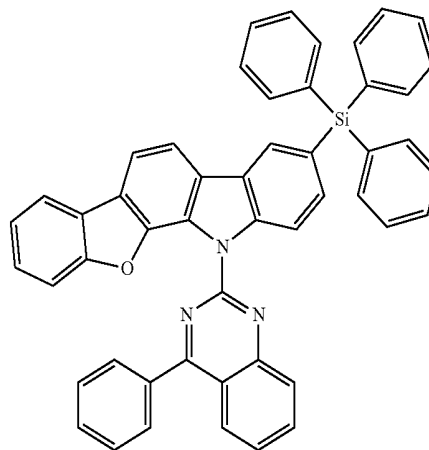
H2-321



H2-323

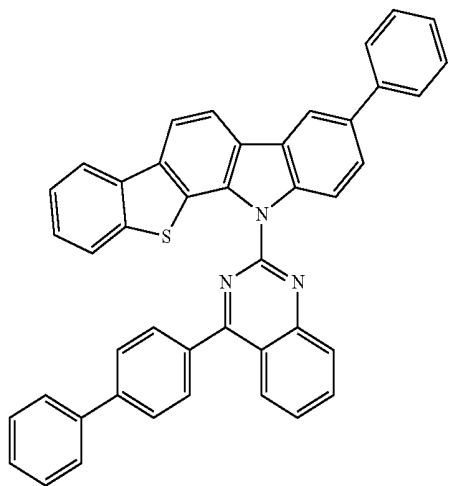


H2-324



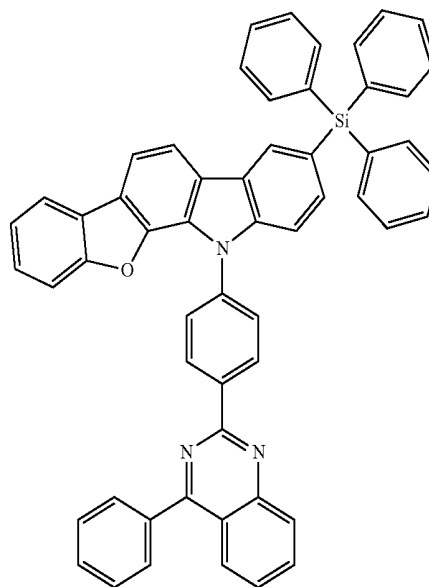
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H2-325

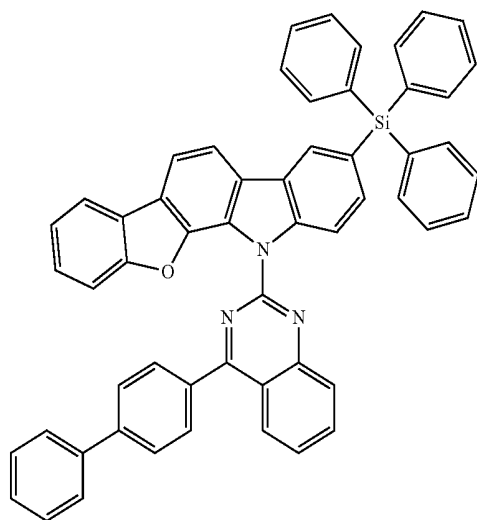


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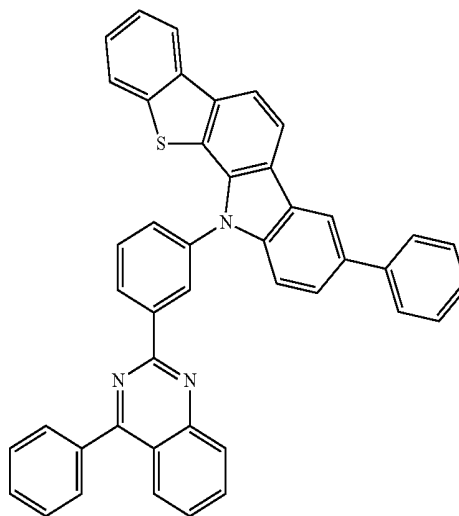
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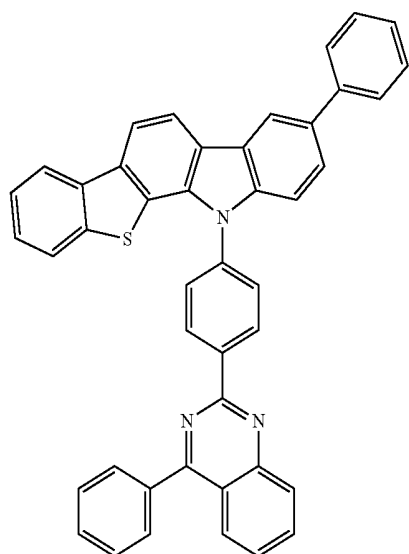
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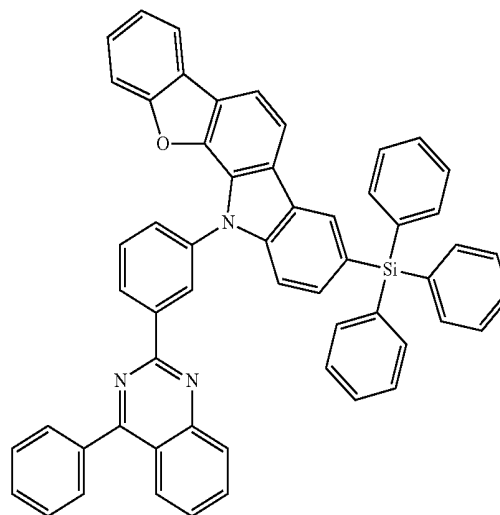
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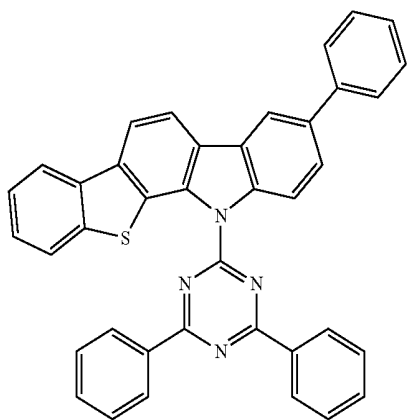
H2-327



H2-330

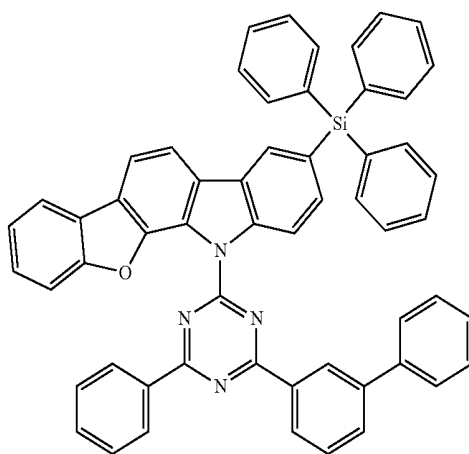


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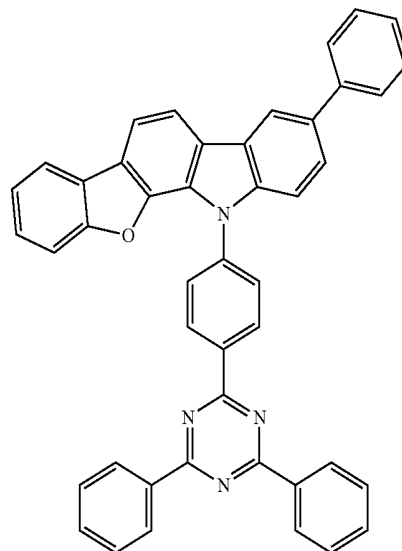
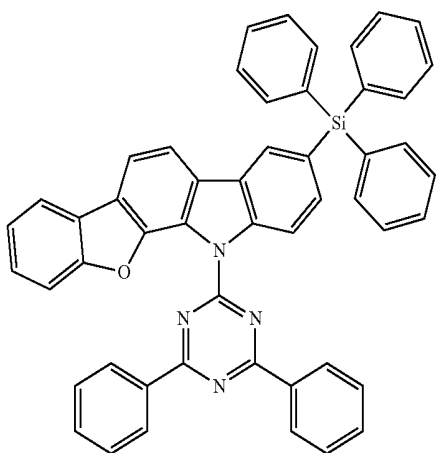
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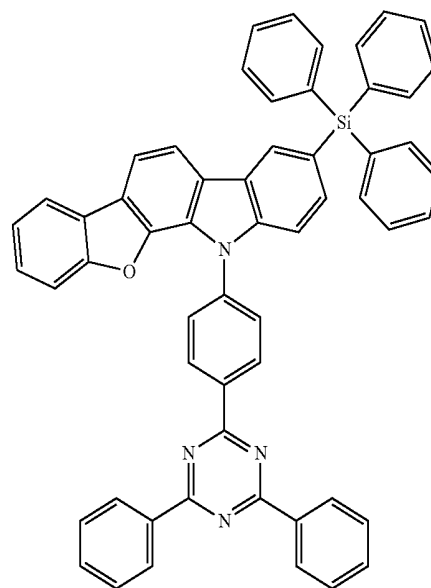
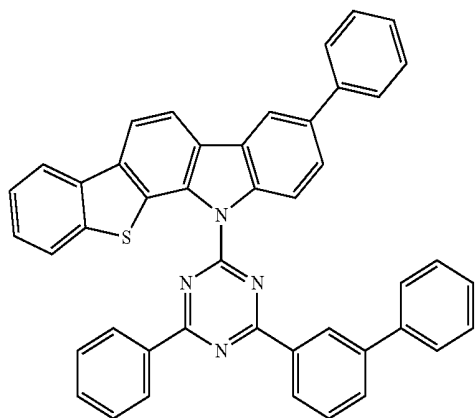
H2-334

H2-332



H2-335

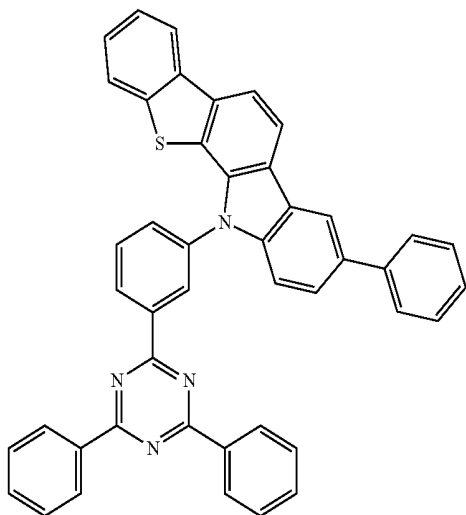
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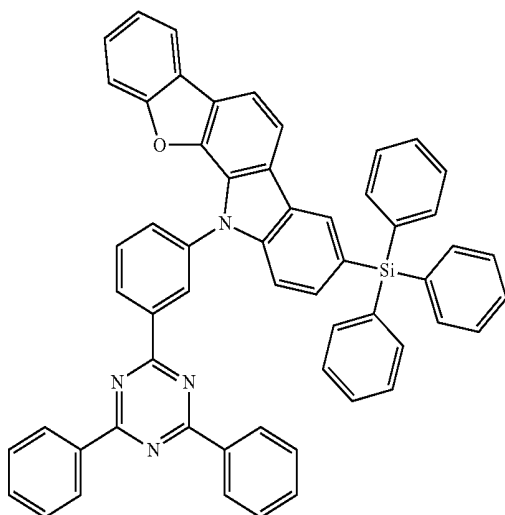
H2-336

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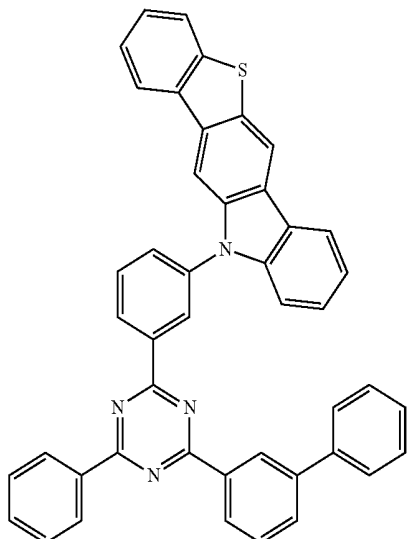
H2-337



H2-338

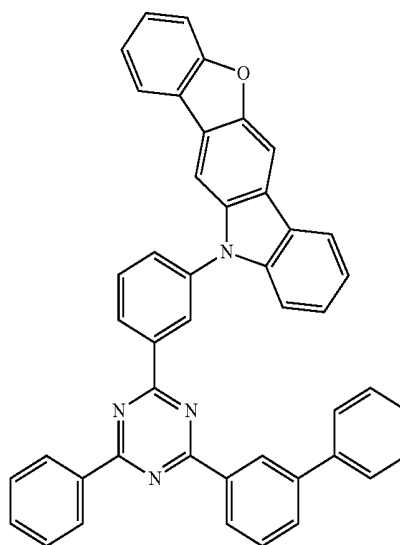


H2-339

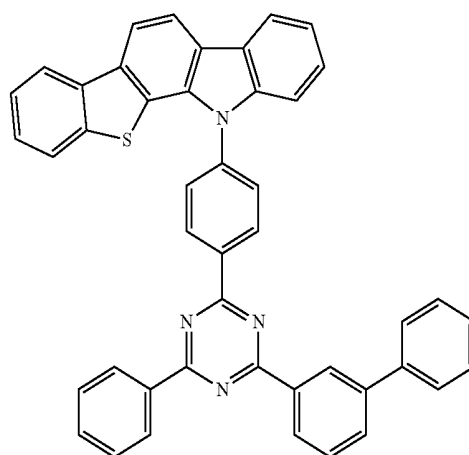


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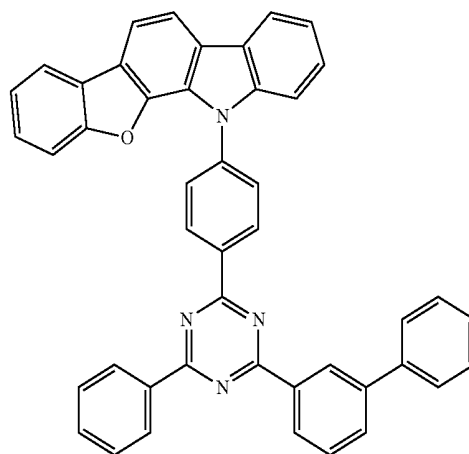
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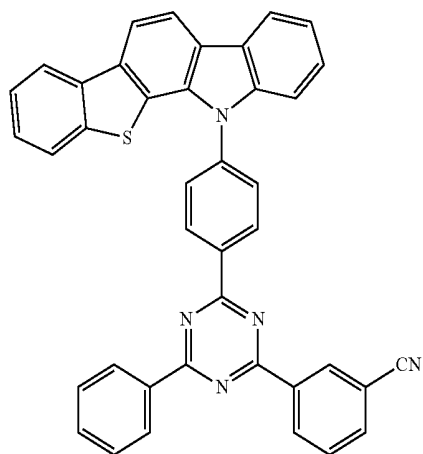
H2-341



H2-342

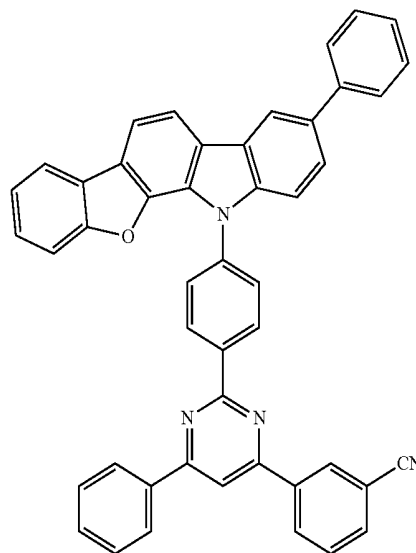


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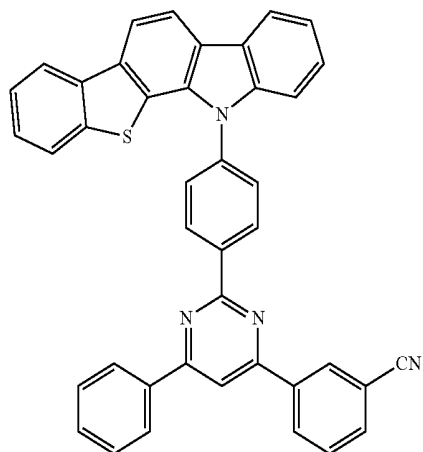


H2-343

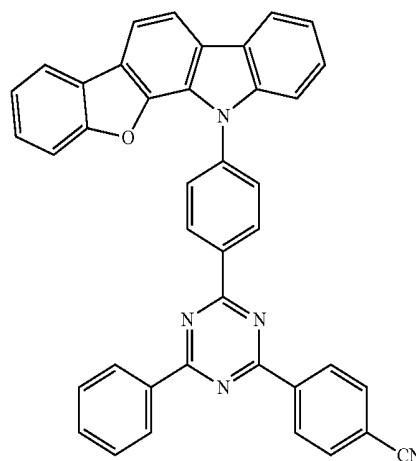
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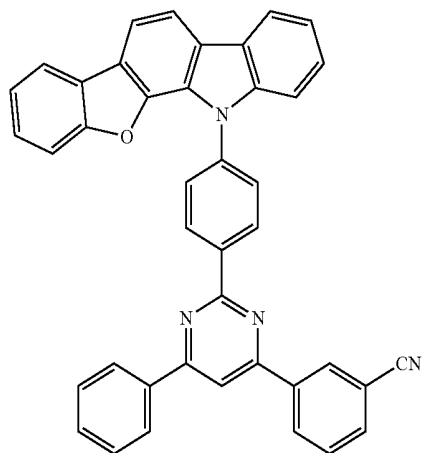
H2-346



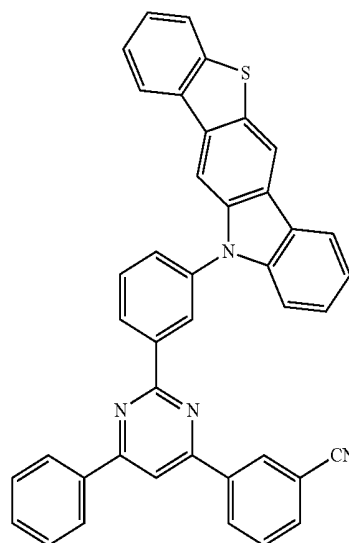
H2-344



H2-347

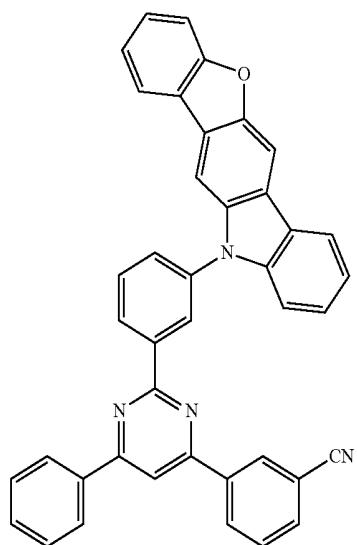


H2-345



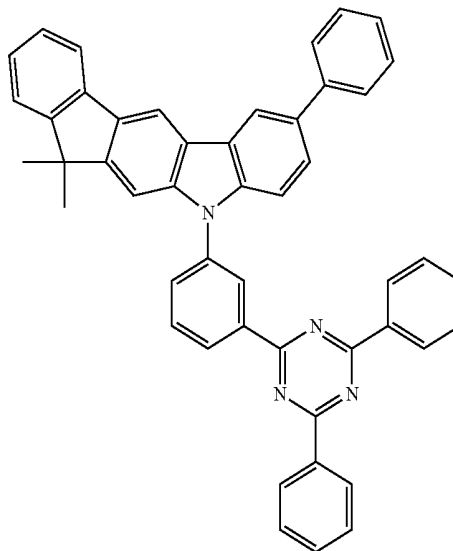
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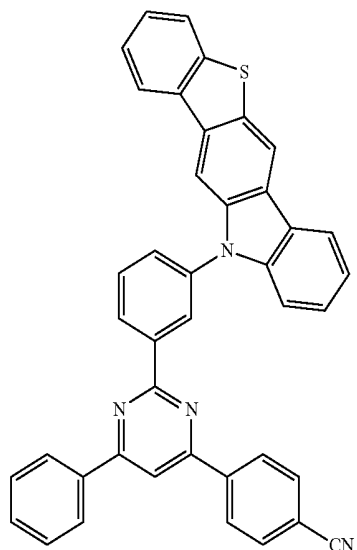
H2-349

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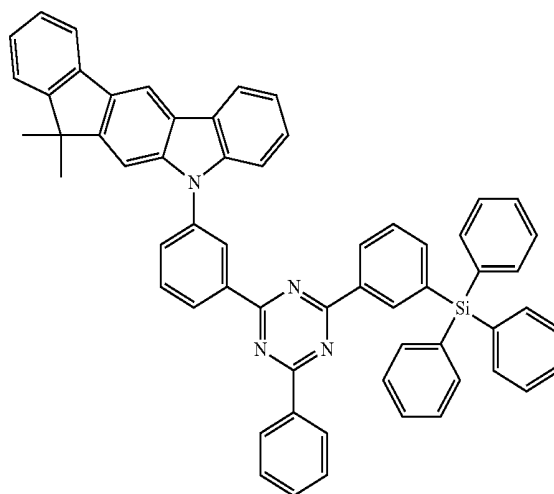


H2-352

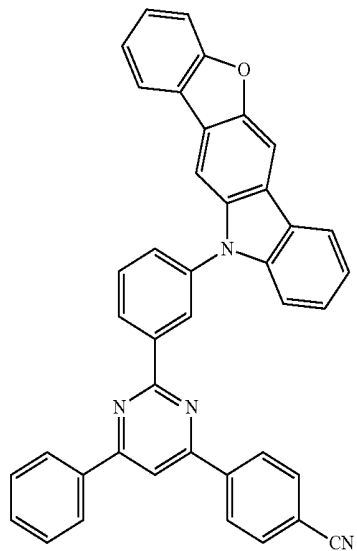
H2-350



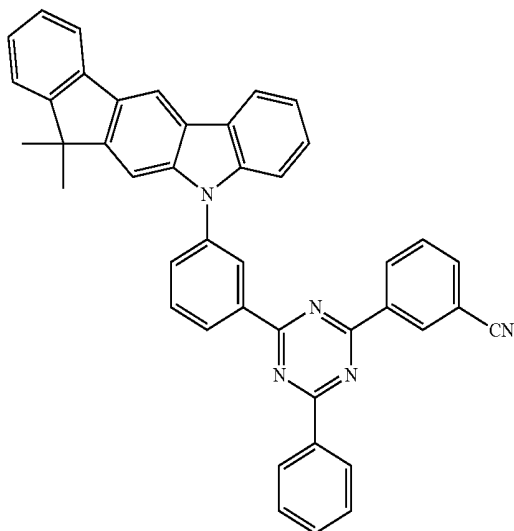
H2-353



H2-351

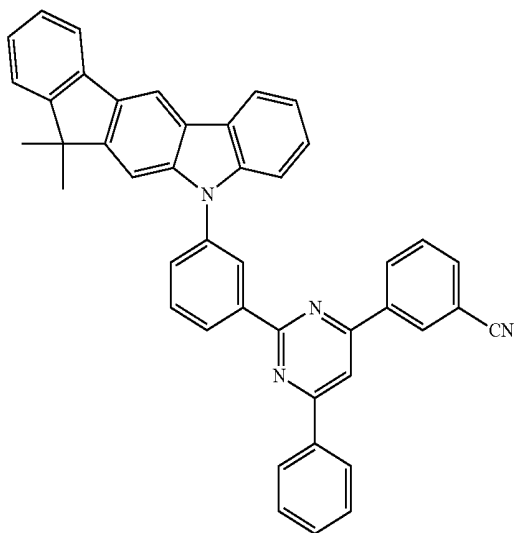


H2-354



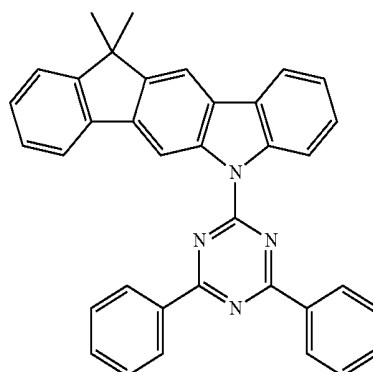
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H2-355



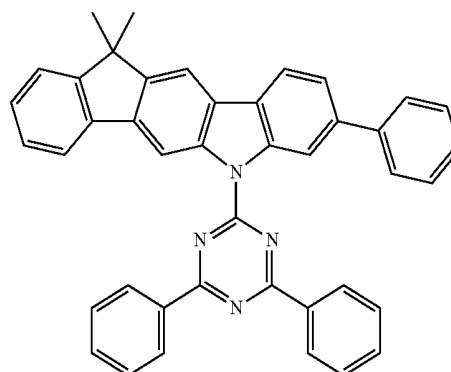
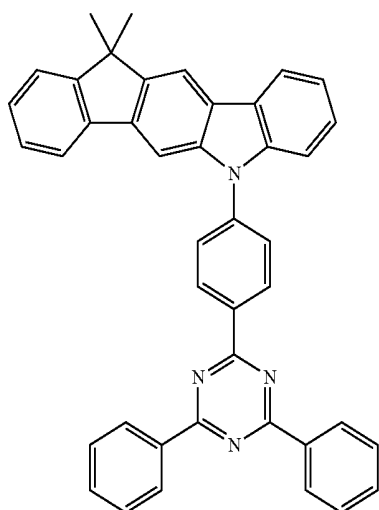
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H2-358



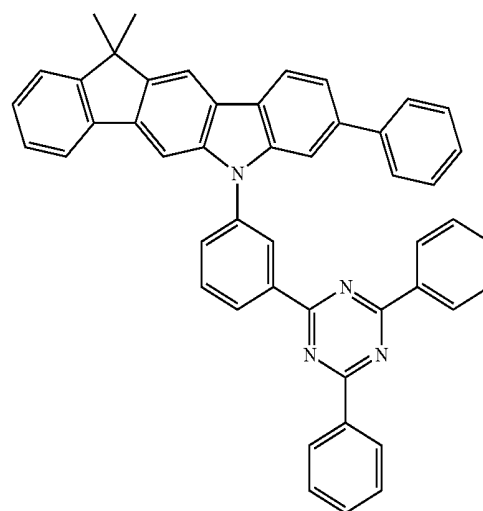
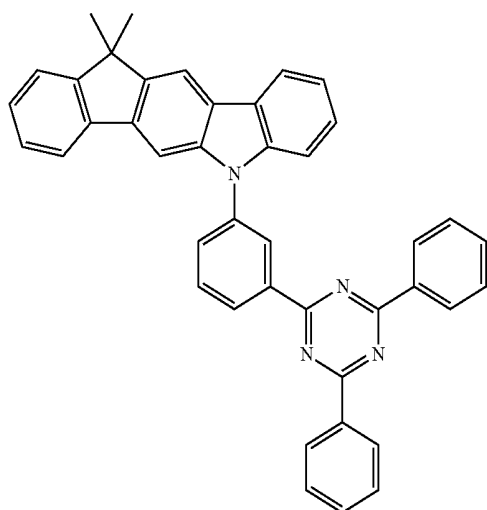
H2-359

H2-356



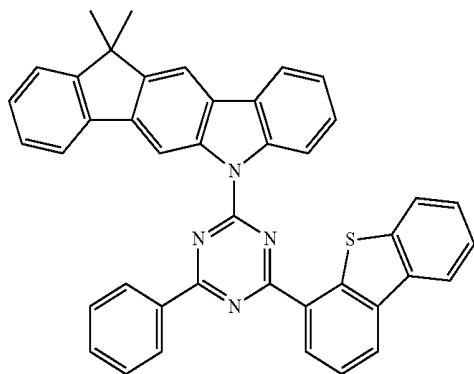
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H2-357

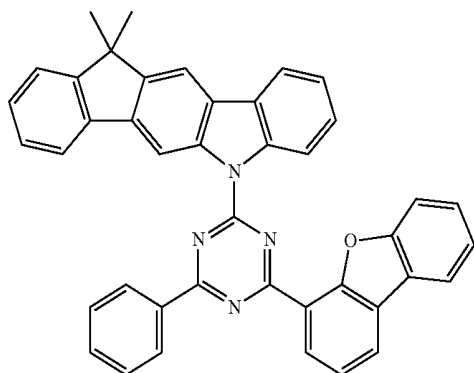


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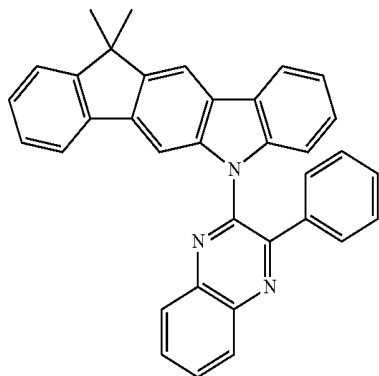
H2-361



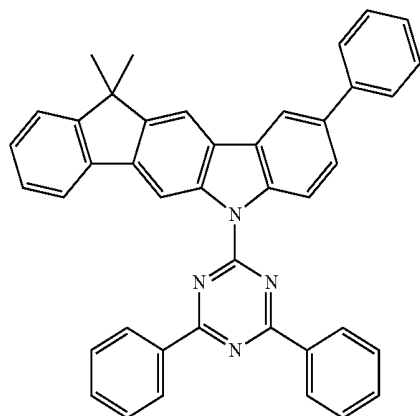
H2-362



H2-363

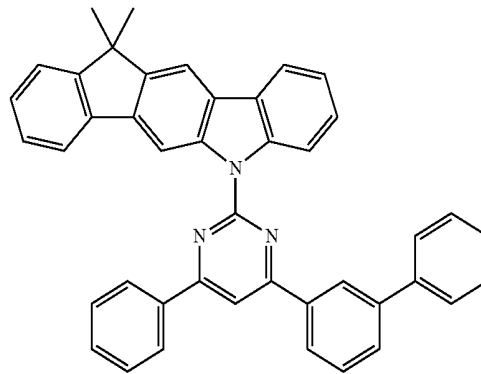


H2-364

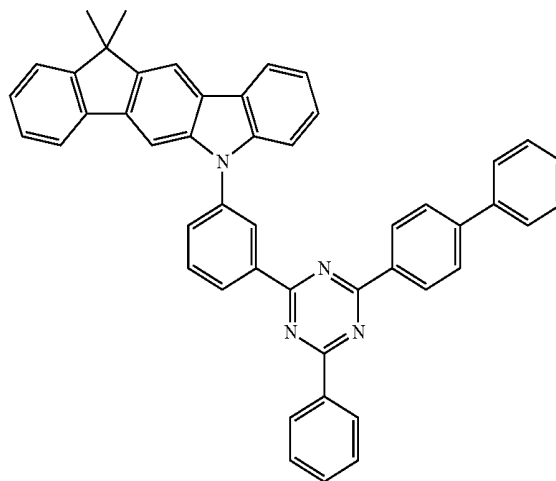


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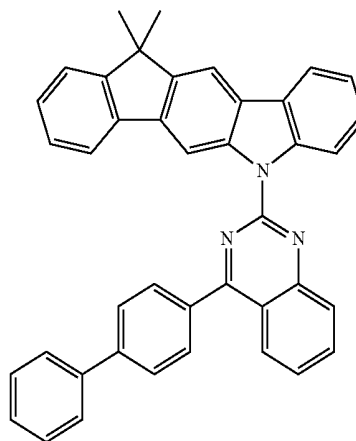
H2-365



H2-366

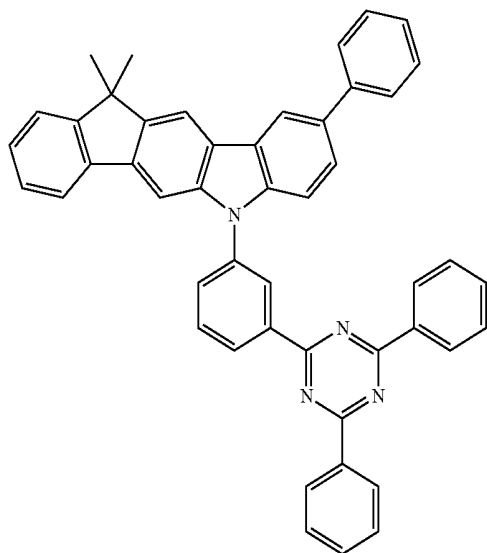


H2-367



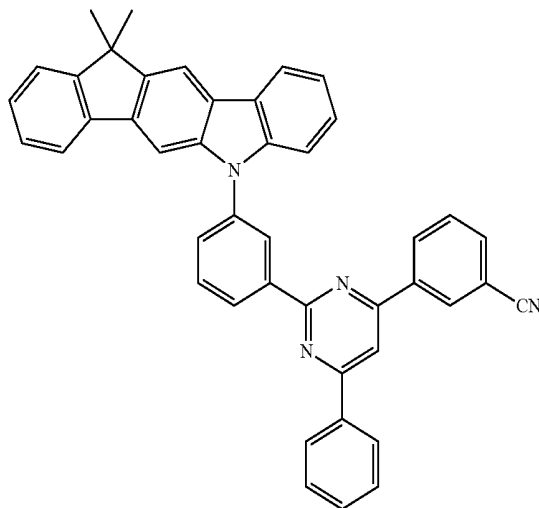
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H2-368

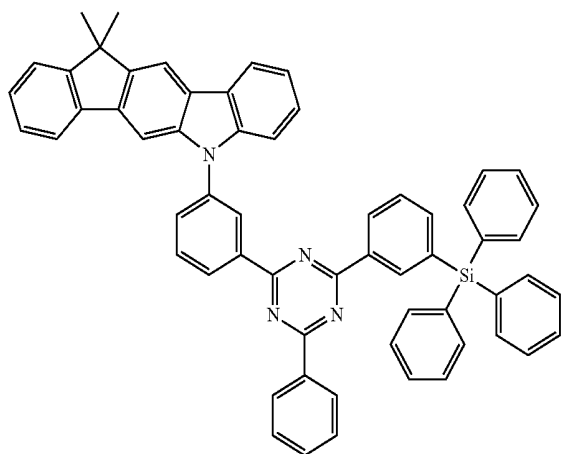


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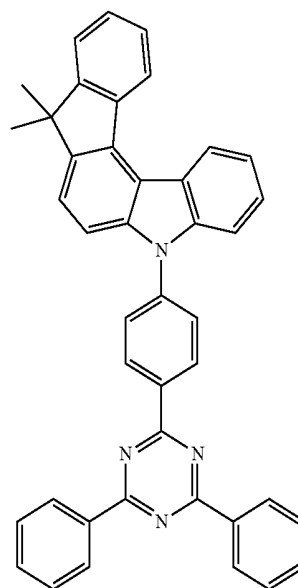
H2-371



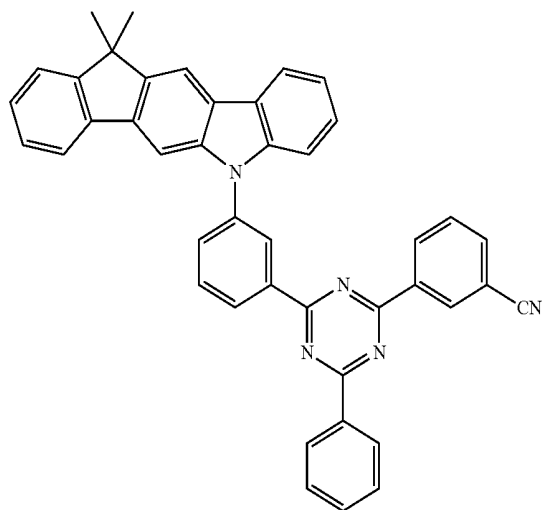
H2-369



H2-372

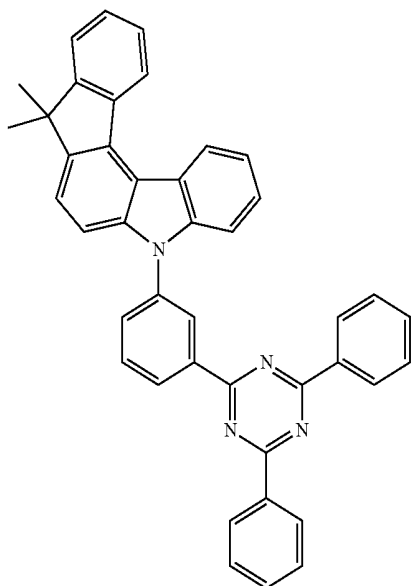


H2-370



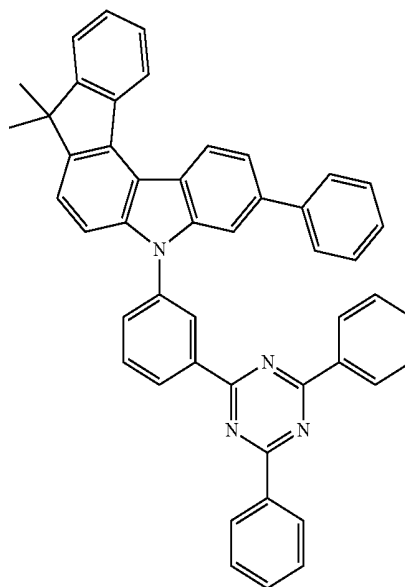
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H2-373

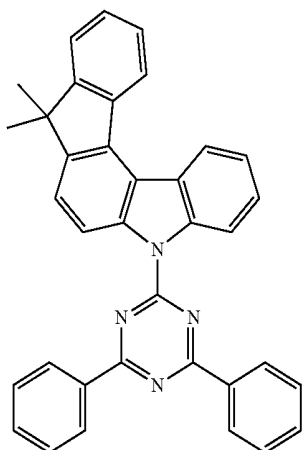


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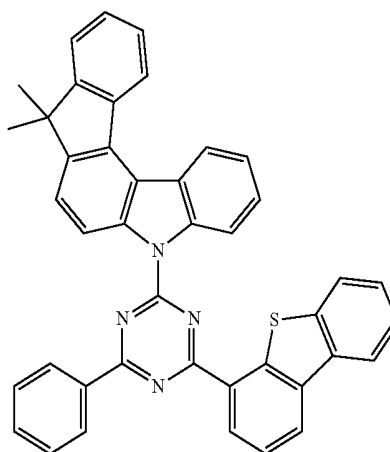
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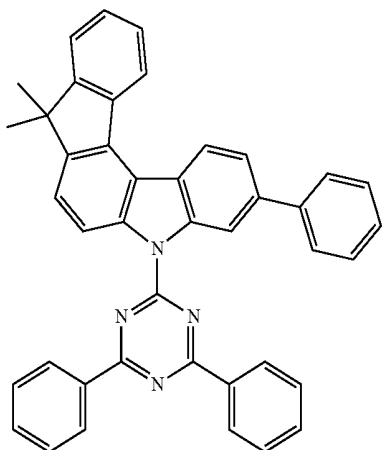
H2-374



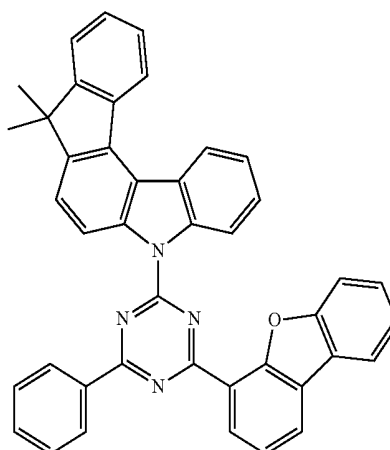
H2-377



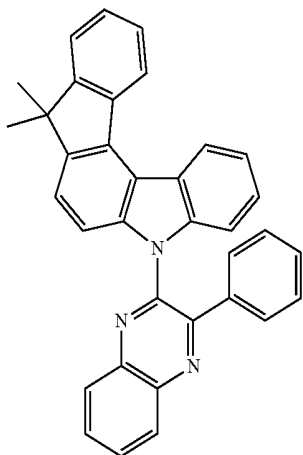
H2-375



H2-378

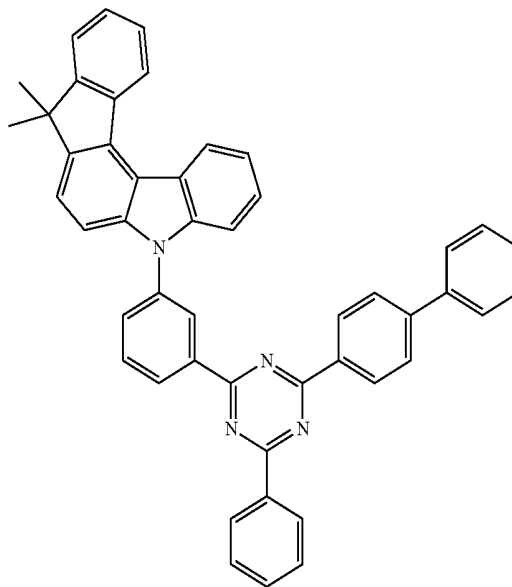


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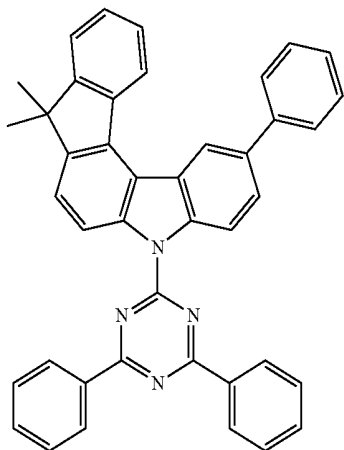


H2-379

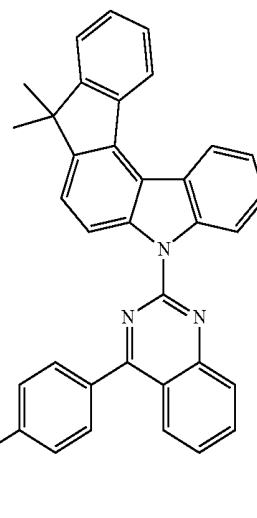
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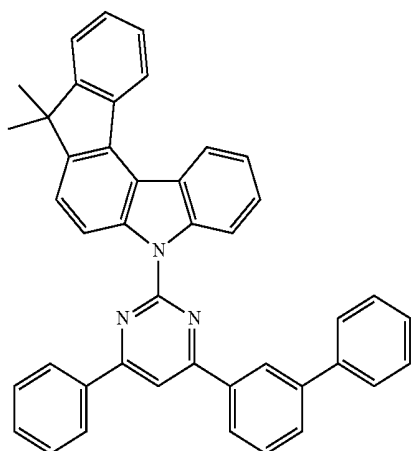
H2-382



H2-380



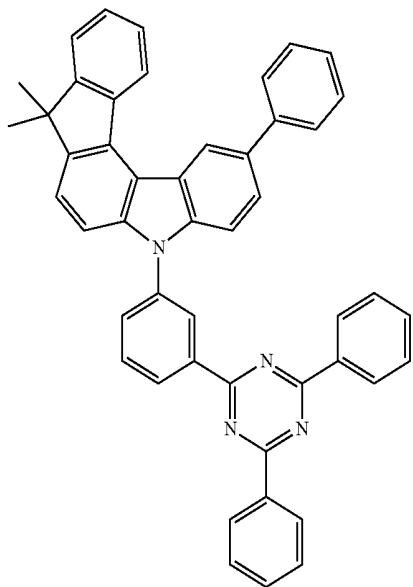
H2-383



H2-381

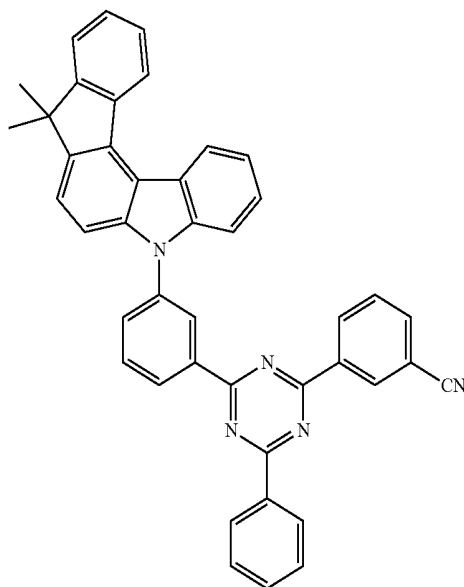
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H2-384



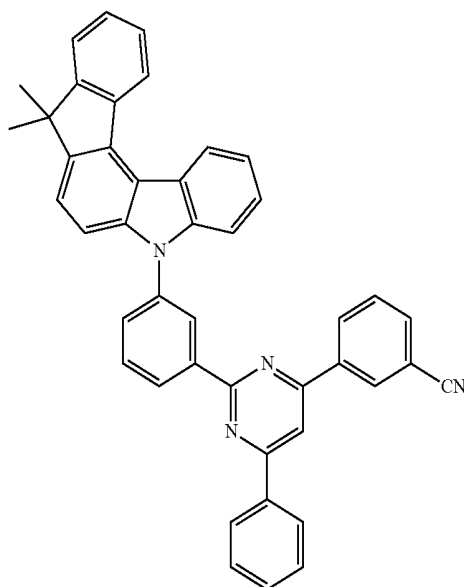
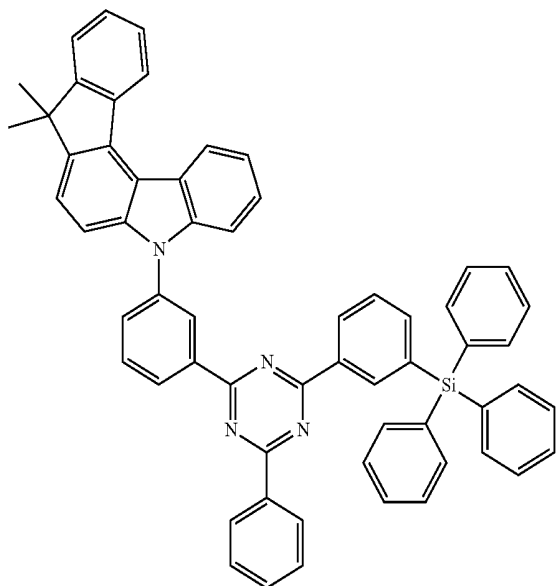
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H2-386

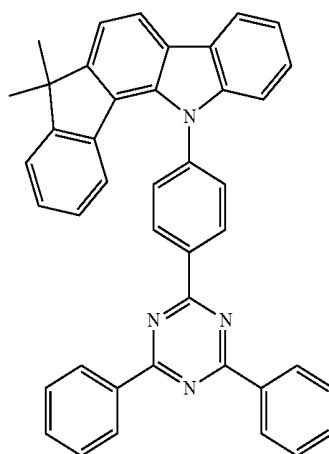


H2-387

H2-385

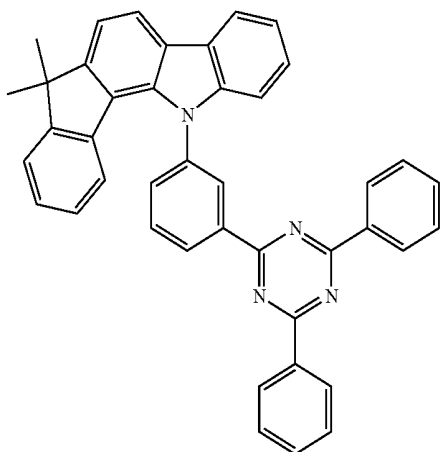


H2-388



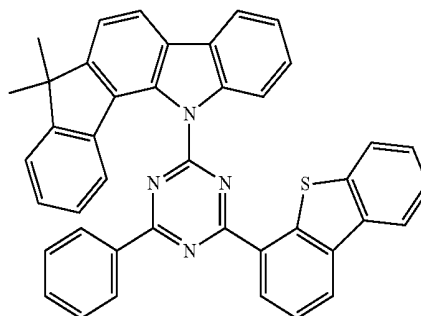
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H2-389



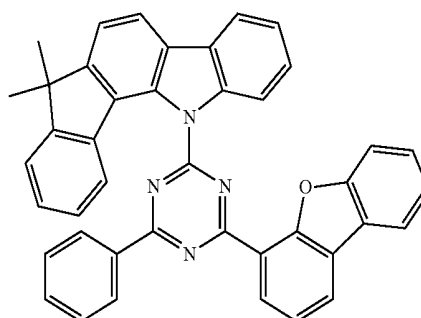
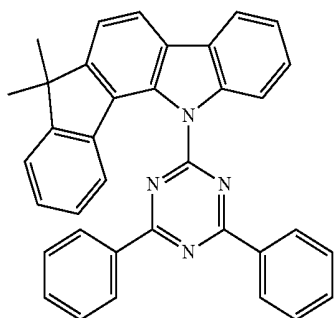
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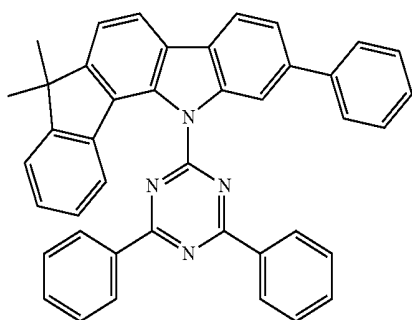


H2-394

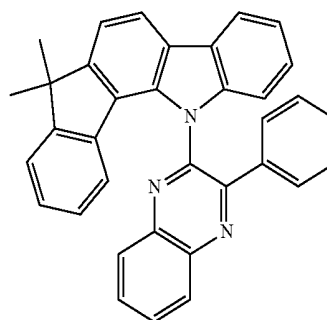
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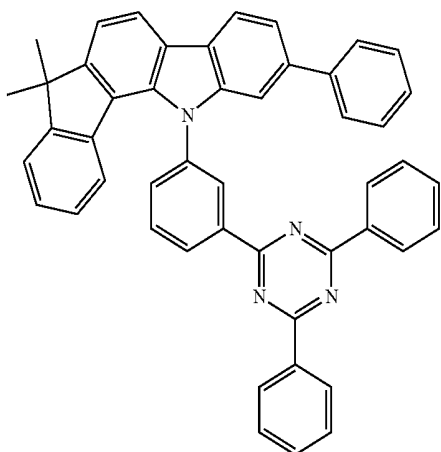
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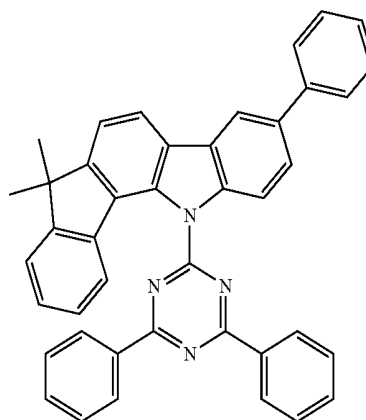
H2-395



H2-392

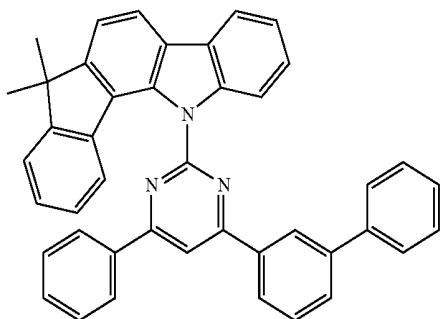


H2-396



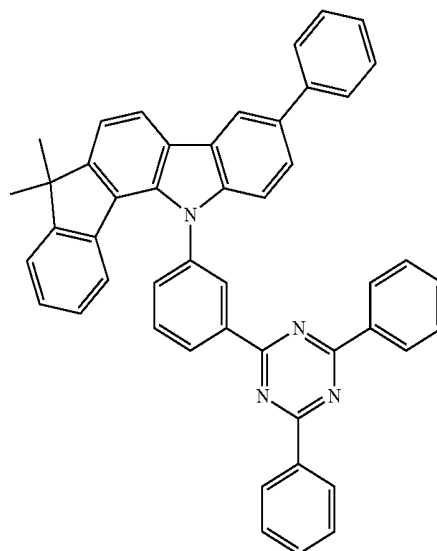
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H2-397

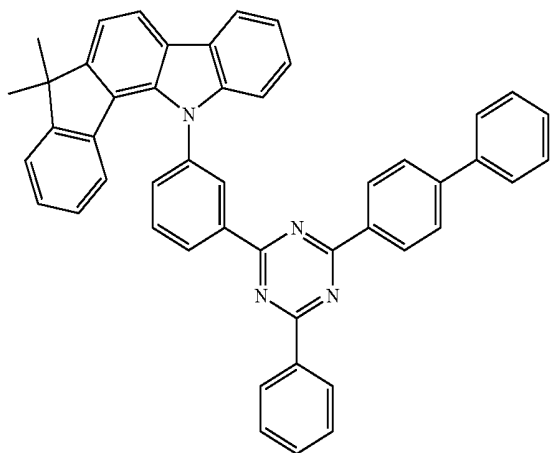


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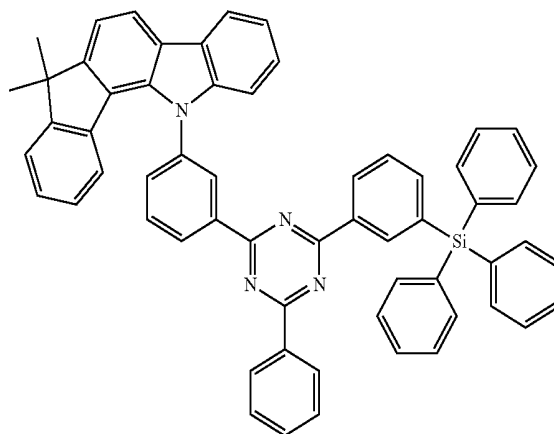
H2-400



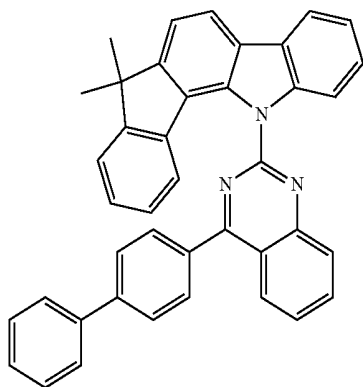
H2-398



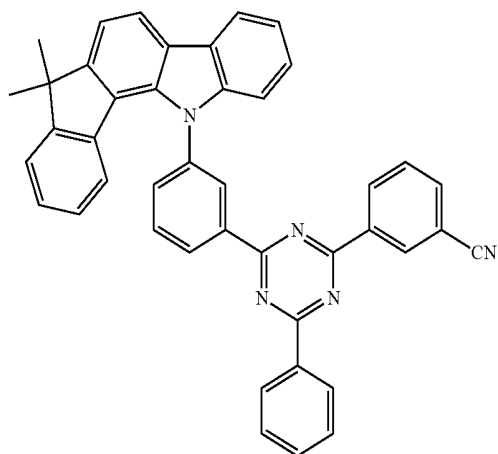
H2-401



H2-399

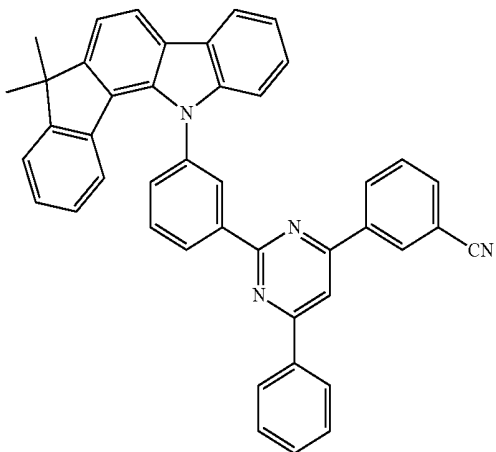


H2-402



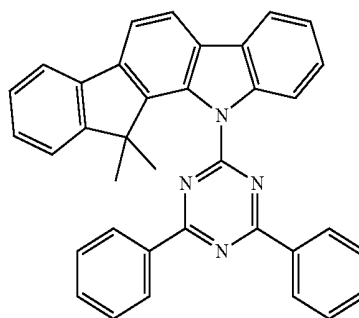
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H2-403

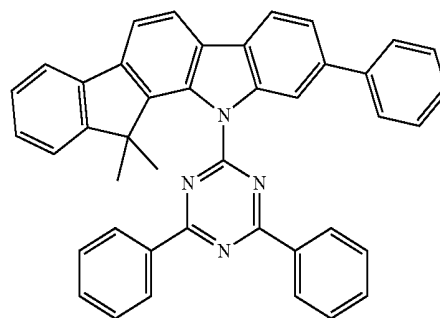


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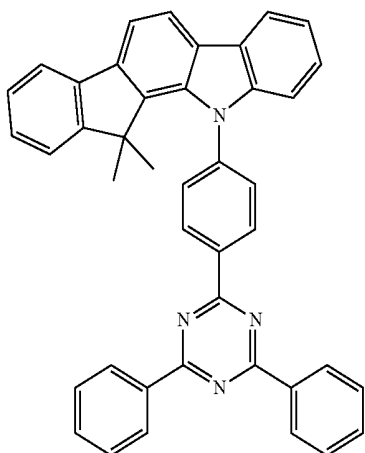
H2-406



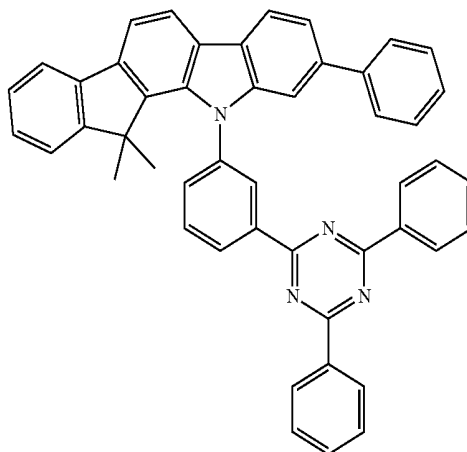
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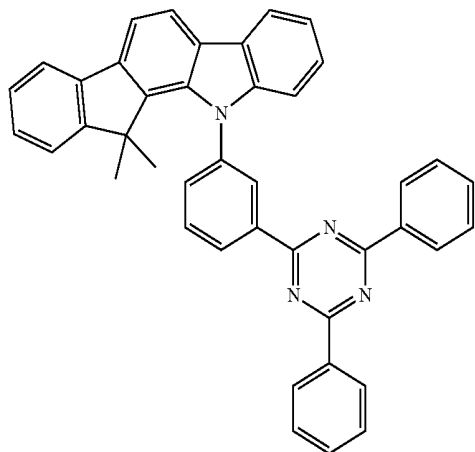
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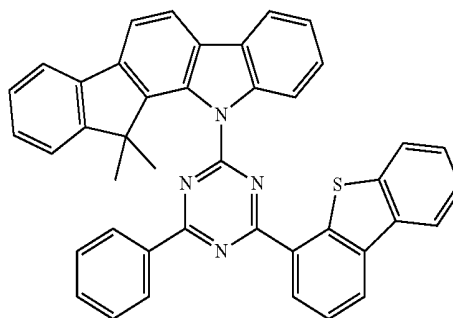
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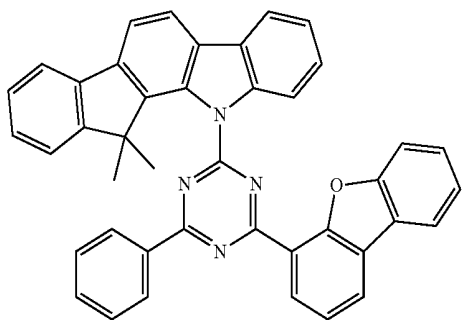
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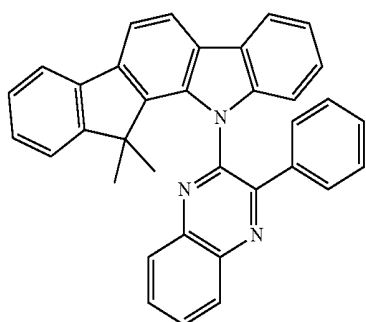
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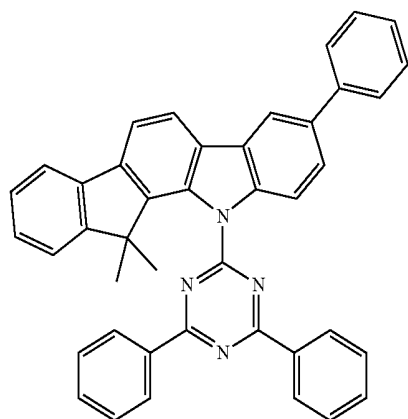
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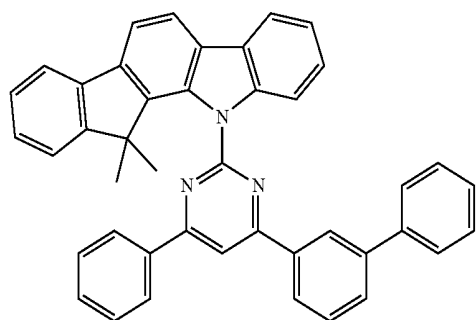
H2-410



H2-411

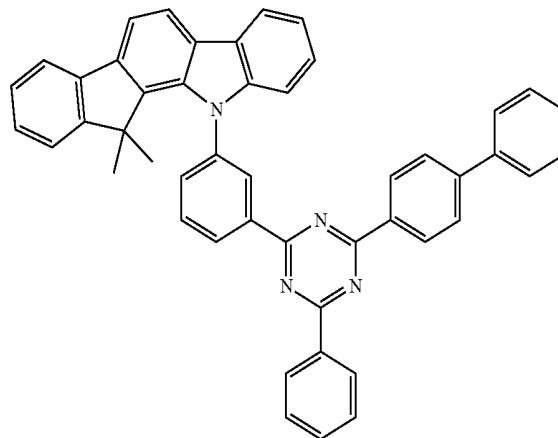


H2-412

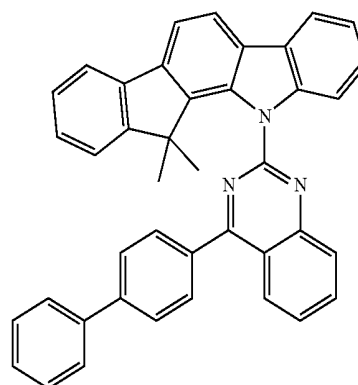


H2-413

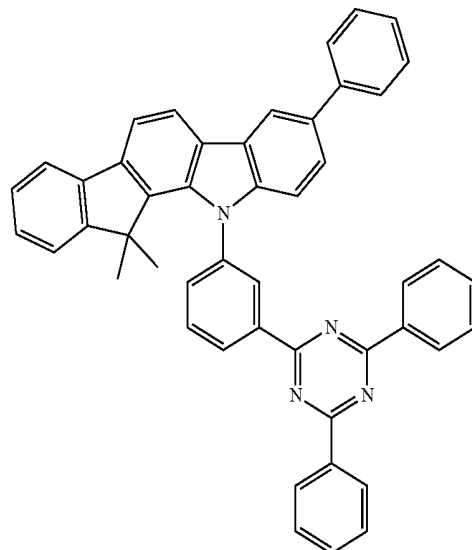
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H2-414



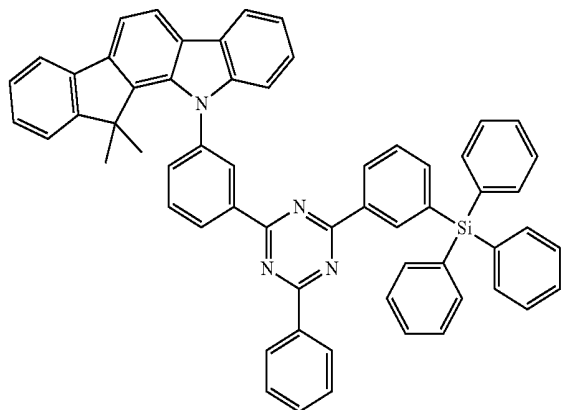
H2-415



H2-416

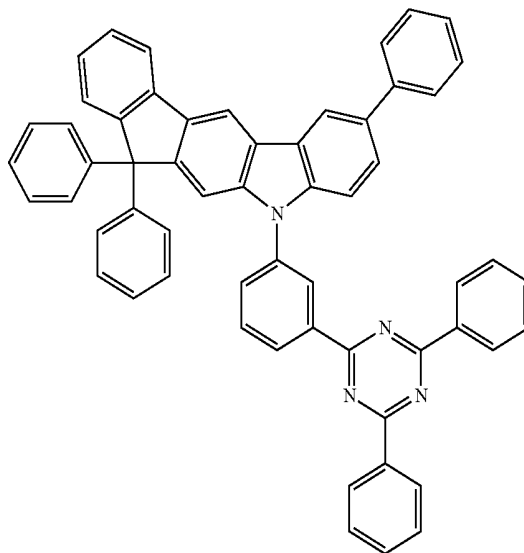
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H2-417

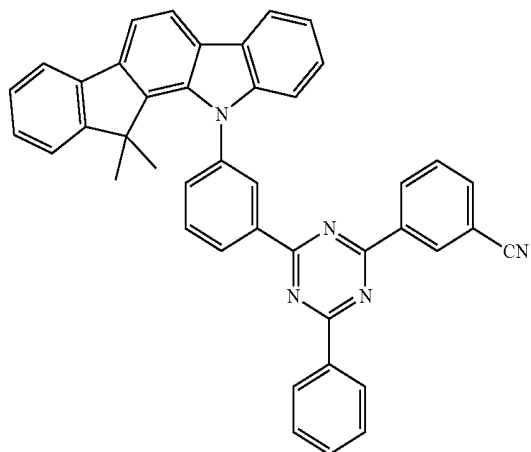


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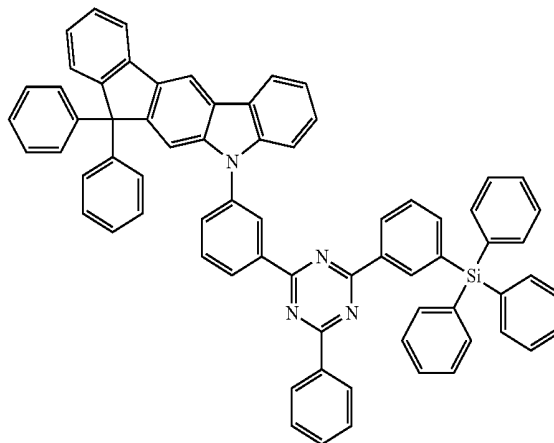
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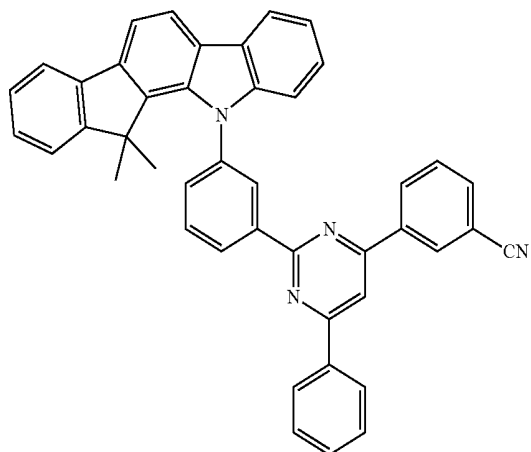
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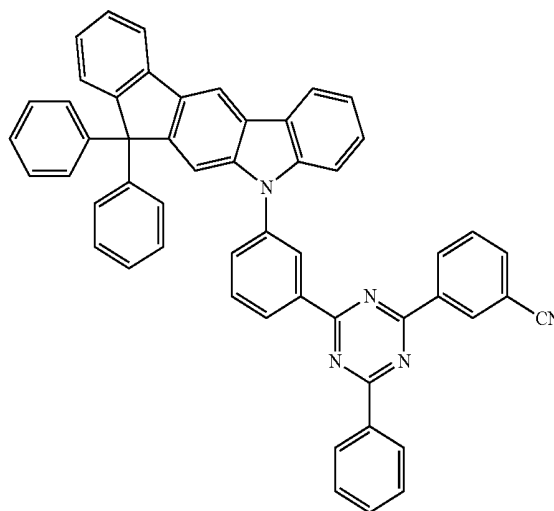
H2-421



H2-419

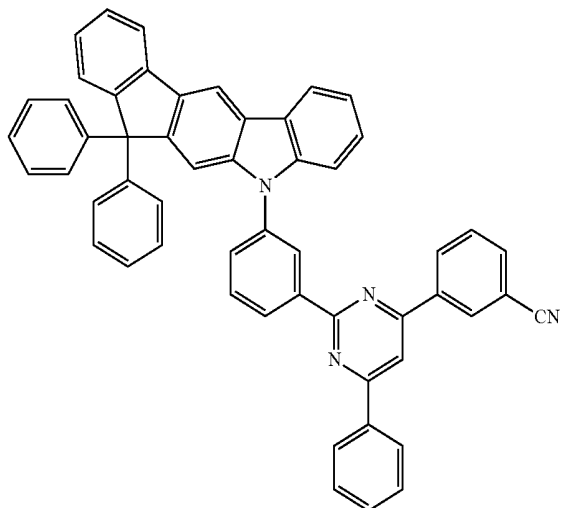


H2-422



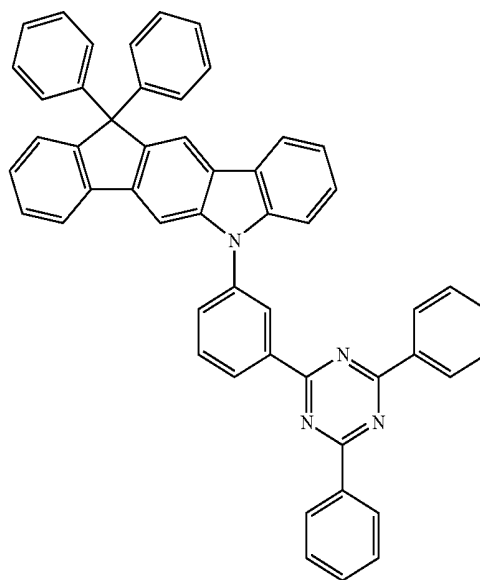
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H2-423

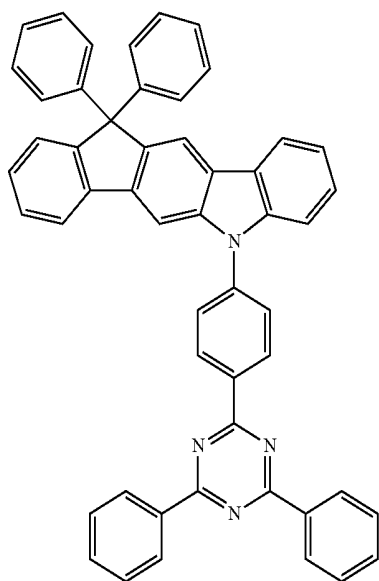


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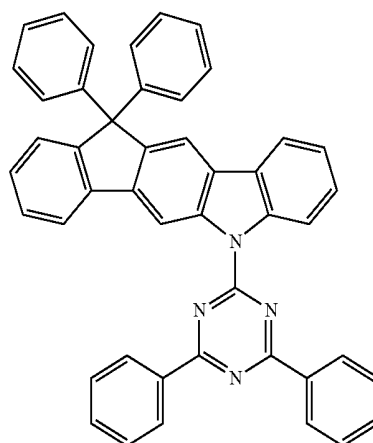
H2-425



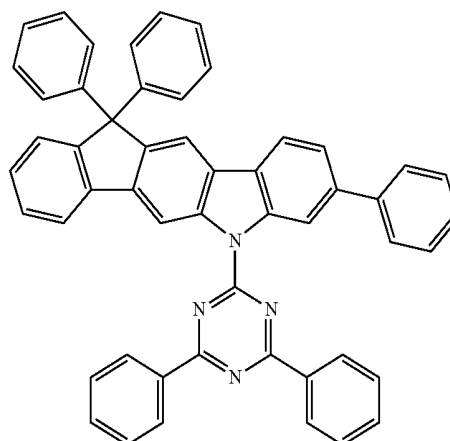
H2-424



H2-426

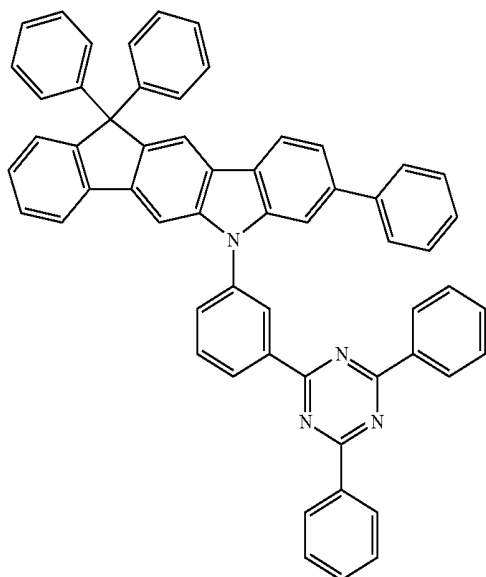


H2-427



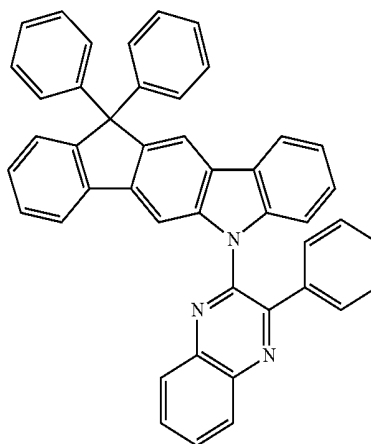
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H2-428

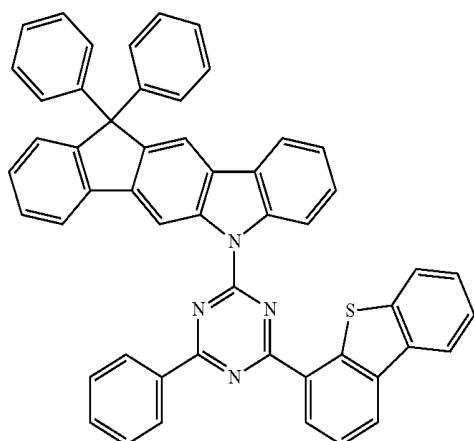


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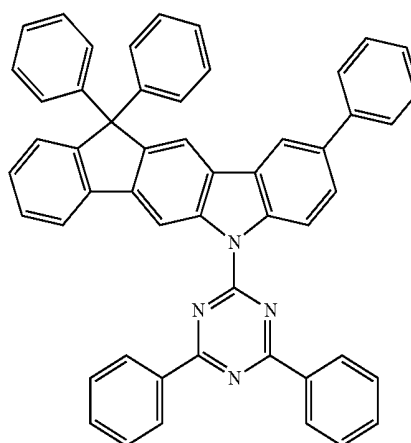
H2-431



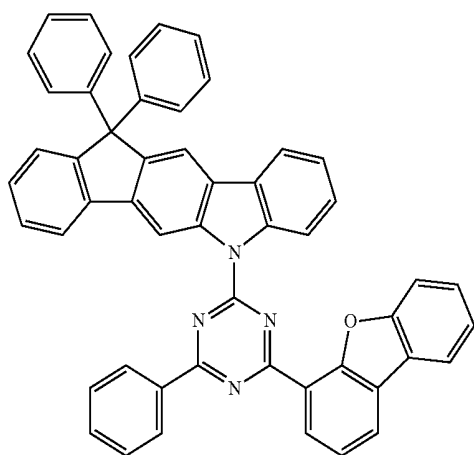
H2-429



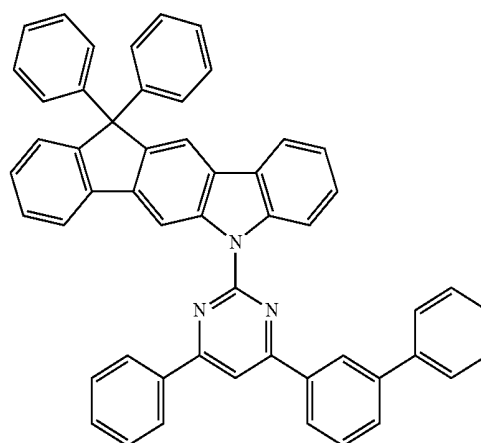
H2-432



H2-430

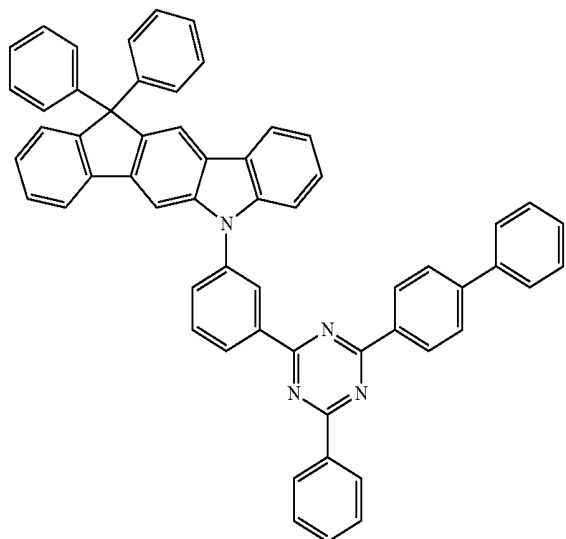


H2-433



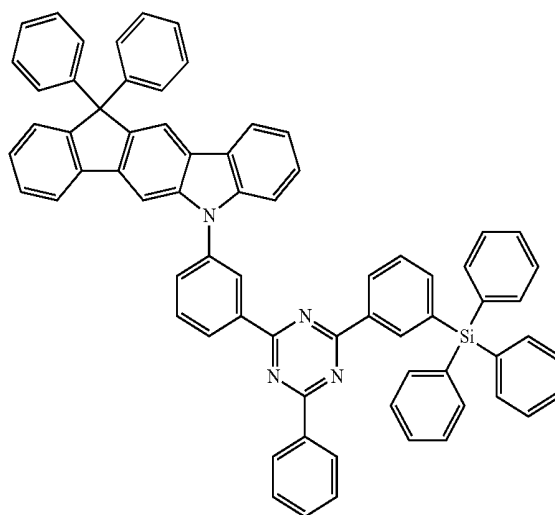
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H2-434

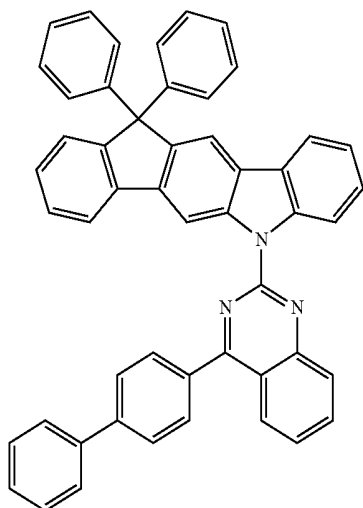


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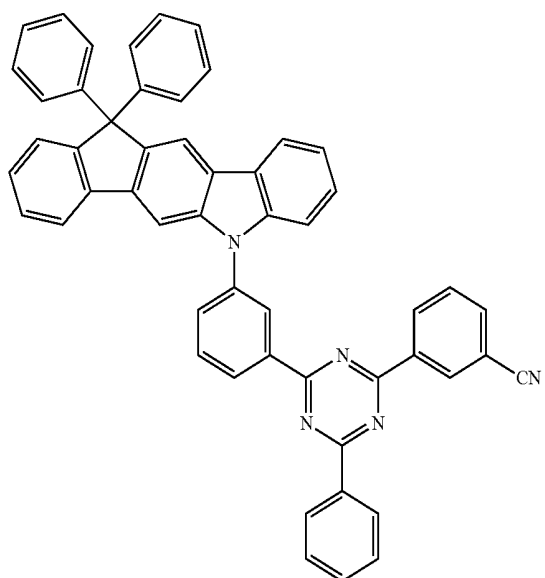
H2-437



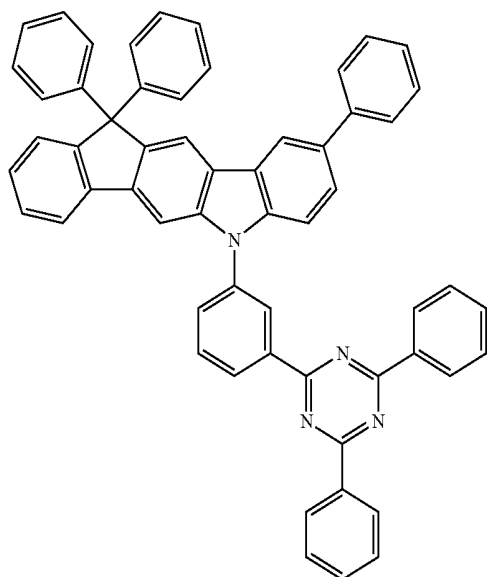
H2-435



H2-438

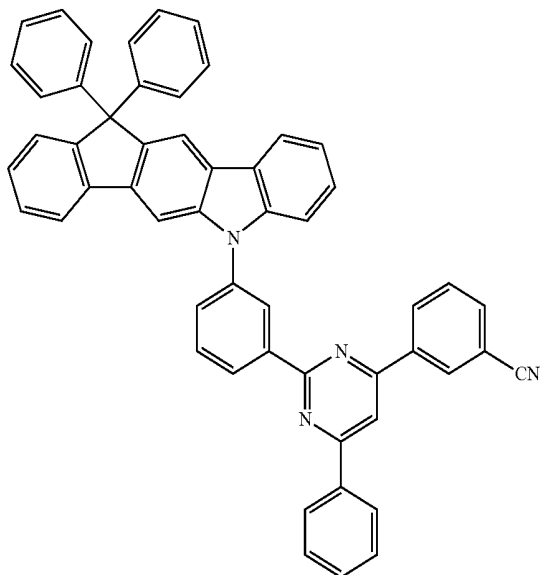


H2-436



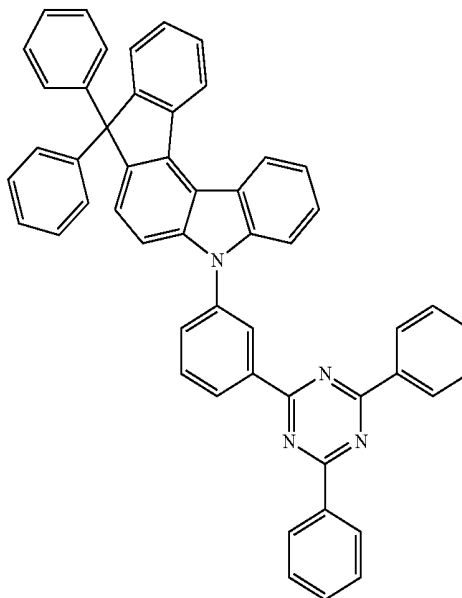
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H2-439



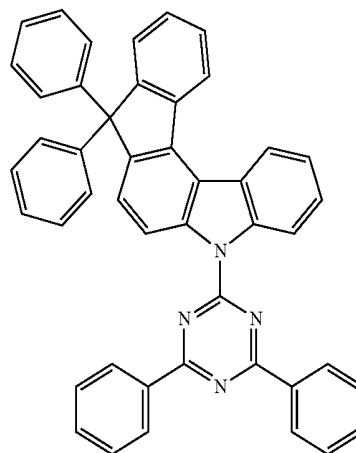
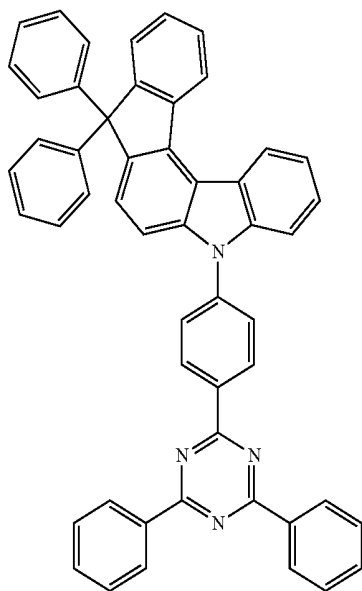
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H2-441

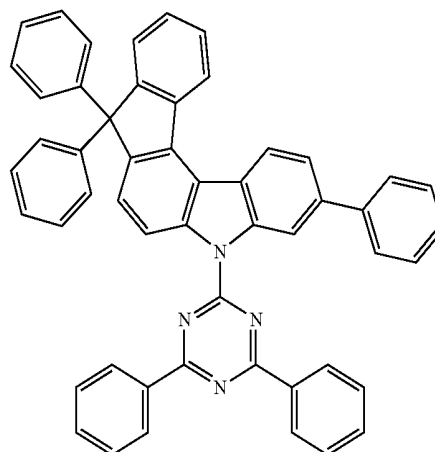


H2-442

H2-440

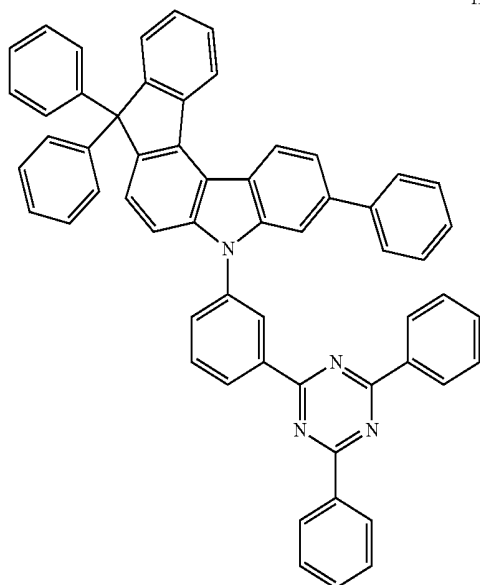


H2-443



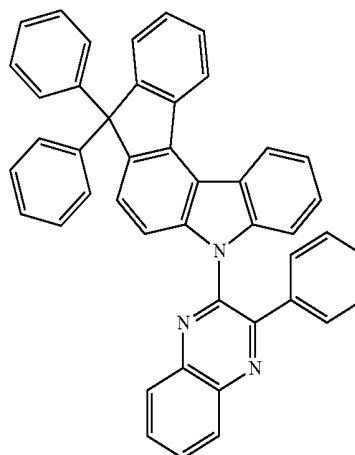
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H2-444

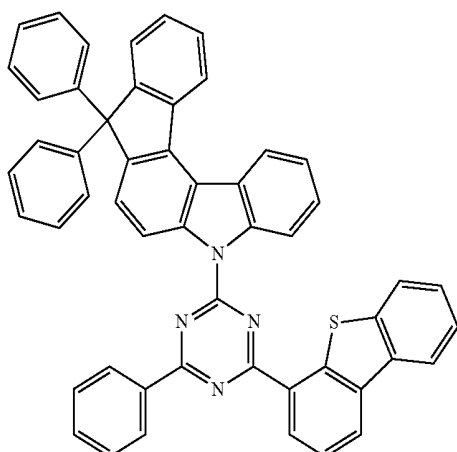


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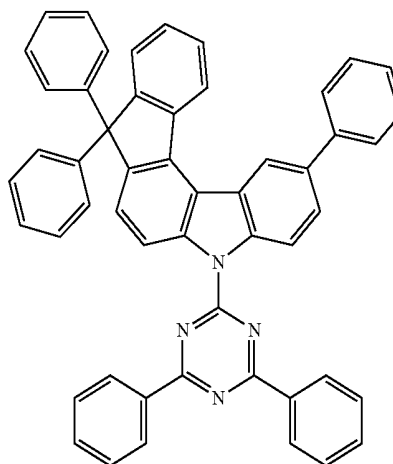
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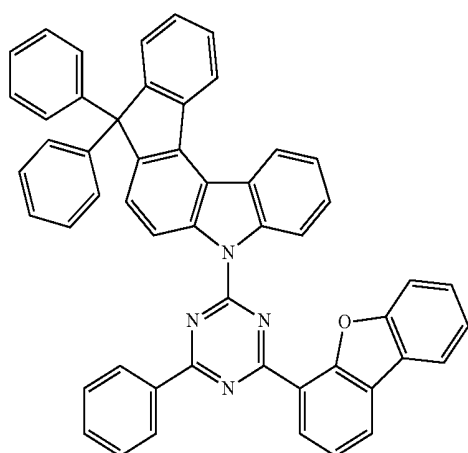
H2-445



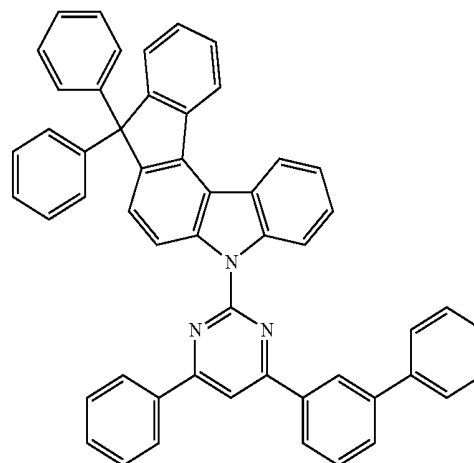
H2-448



H2-446

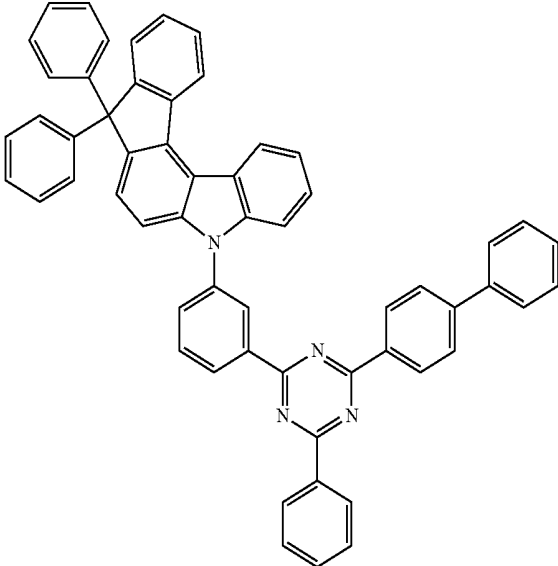


H2-449



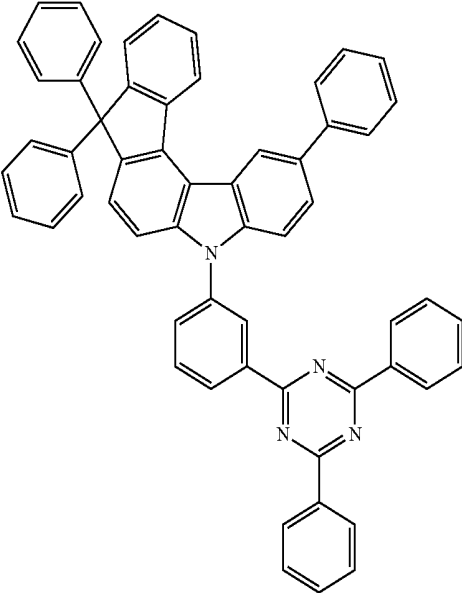
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H2-450

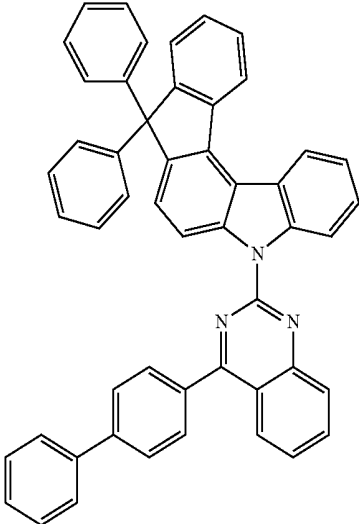


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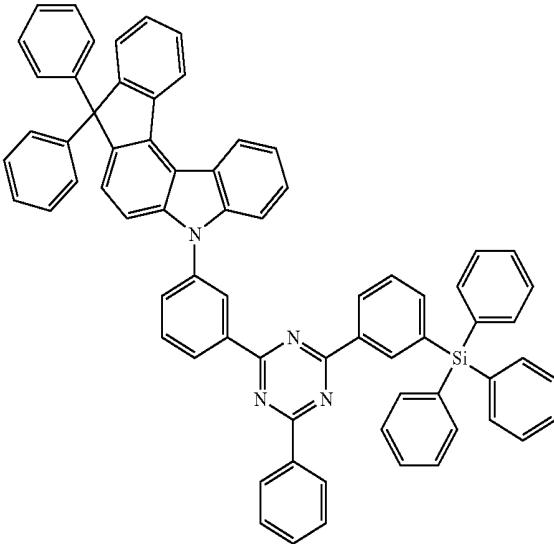
H2-452



H2-451

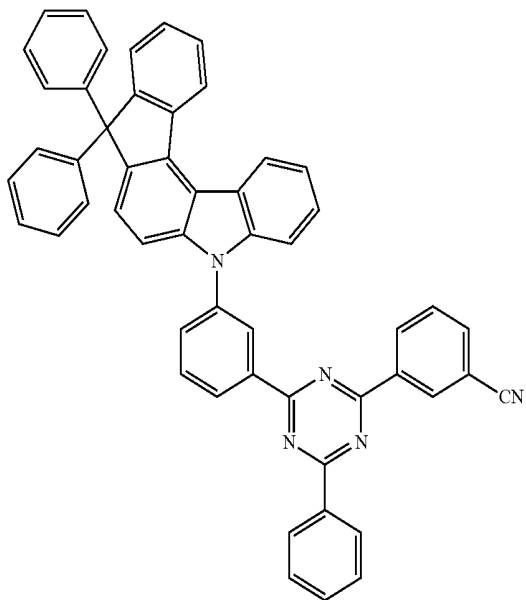


H2-453



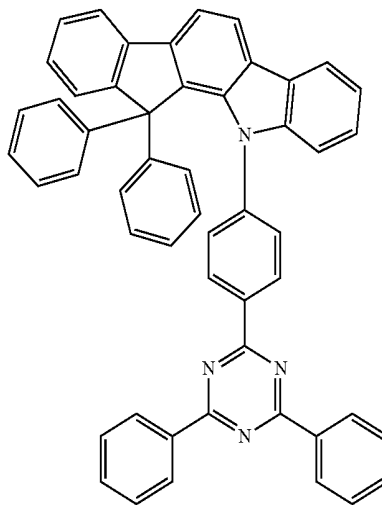
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H2-454



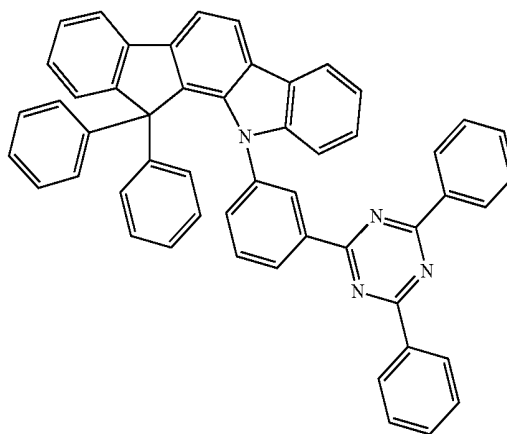
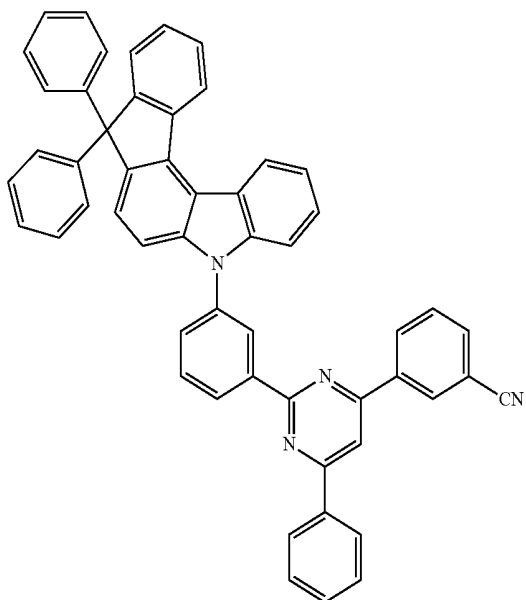
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H2-456

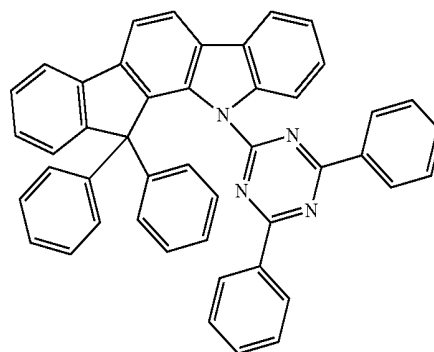


H2-457

H2-455

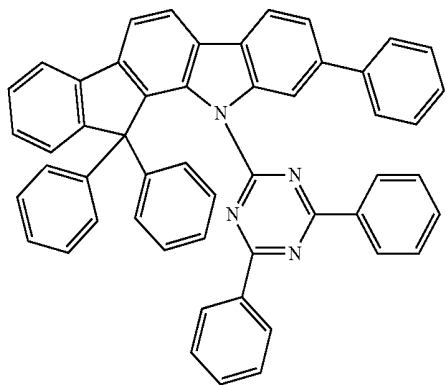


H2-458



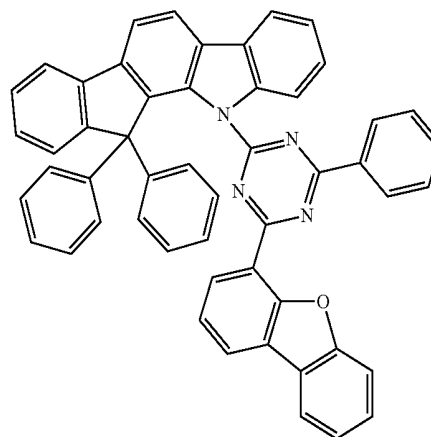
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H2-459

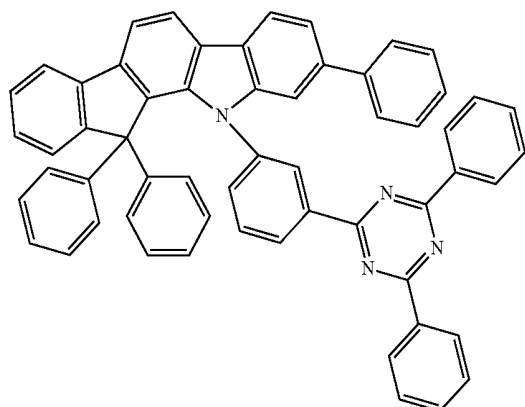


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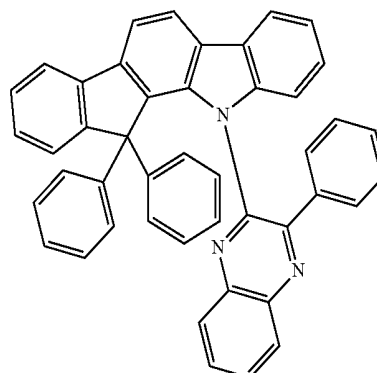
H2-262



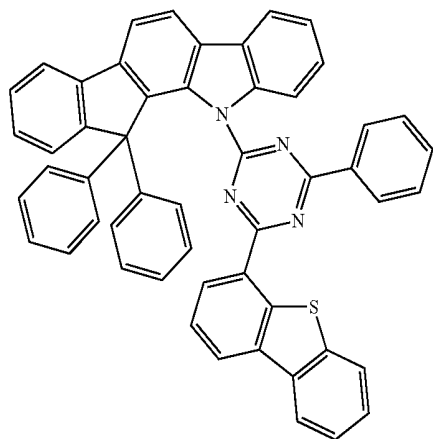
H2-460



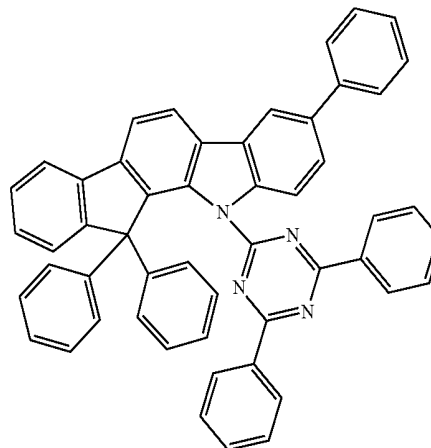
H2-263



H2-461

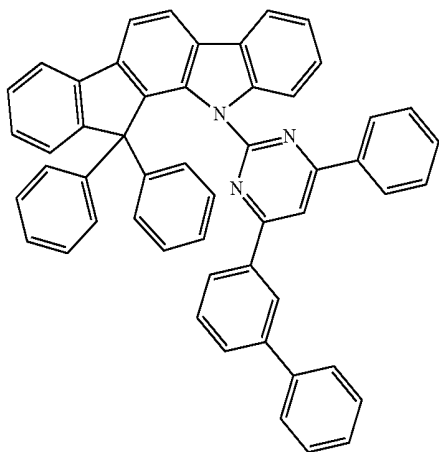


H2-264



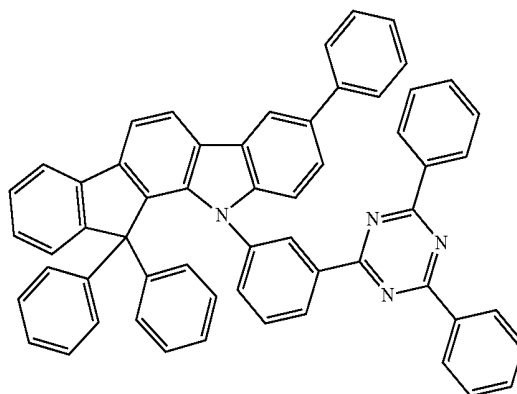
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H2-465



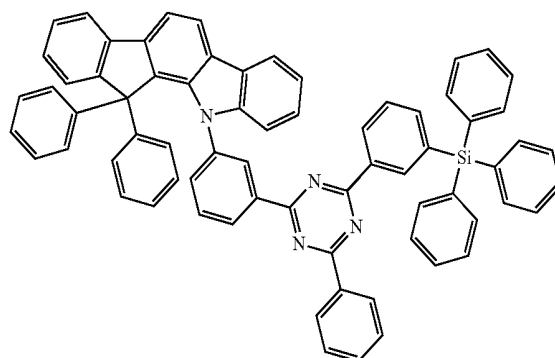
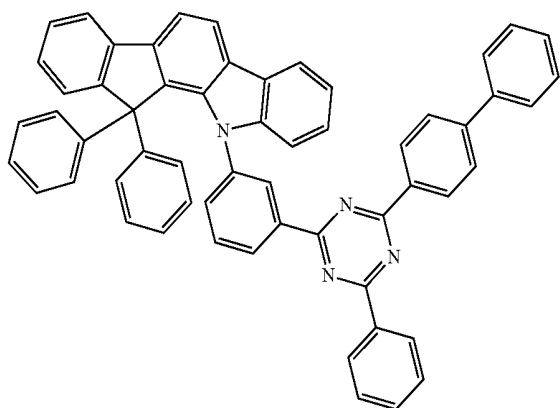
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H2-468



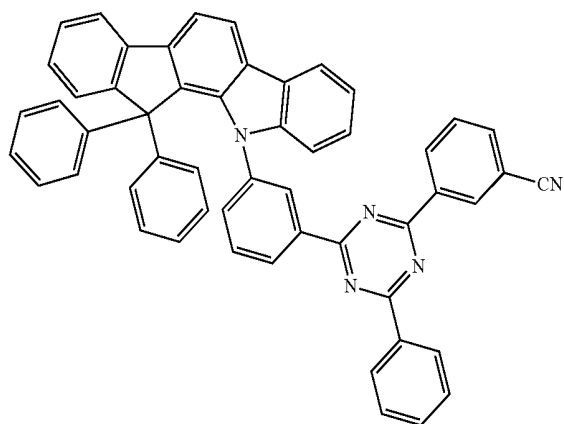
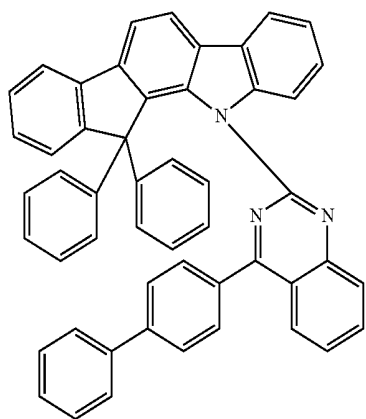
H2-469

H2-466



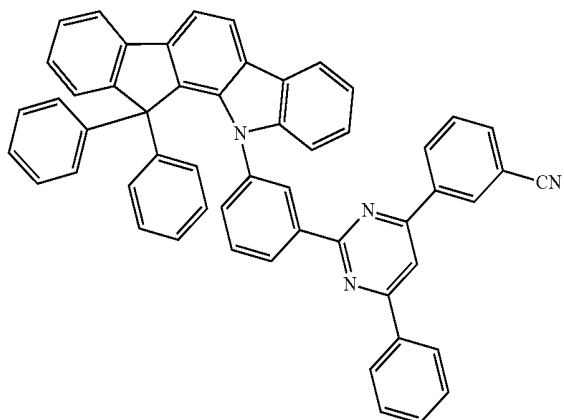
H2-470

H2-467



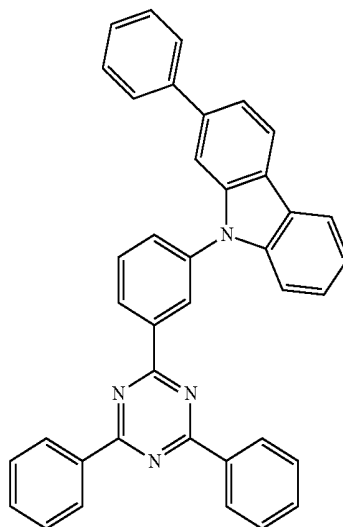
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H2-471

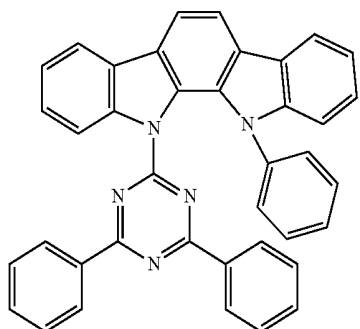


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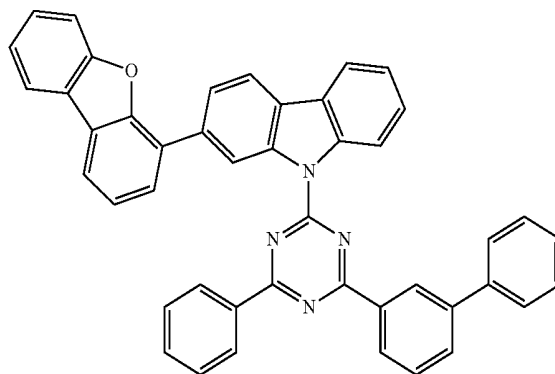
H2-474



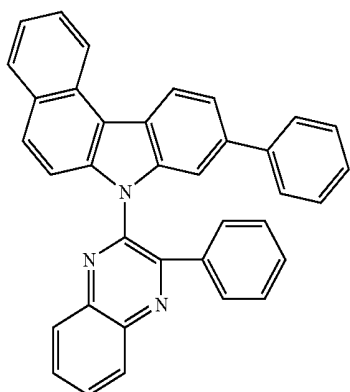
H2-472



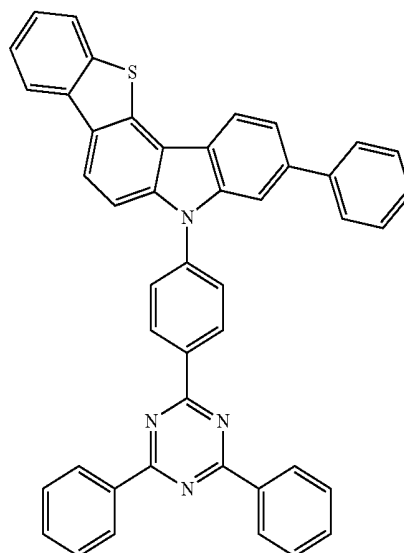
H2-475



H2-473

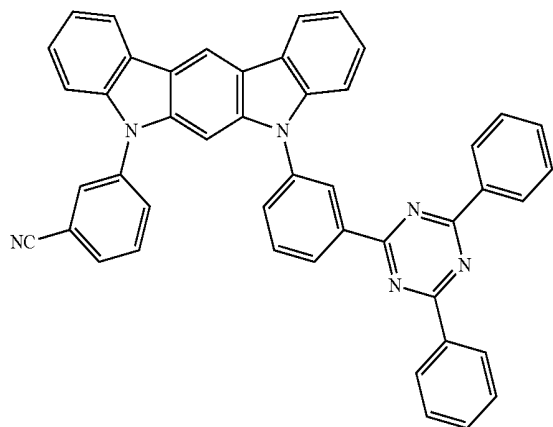


H2-476



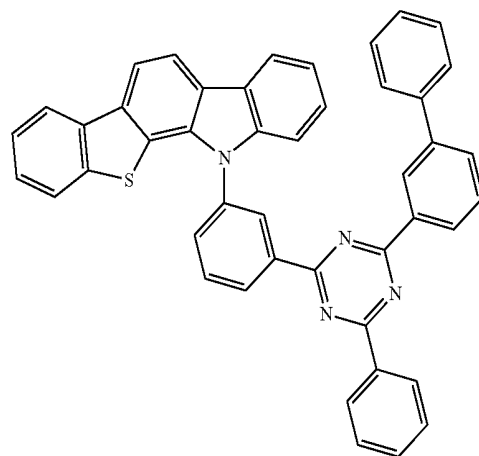
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H2-477

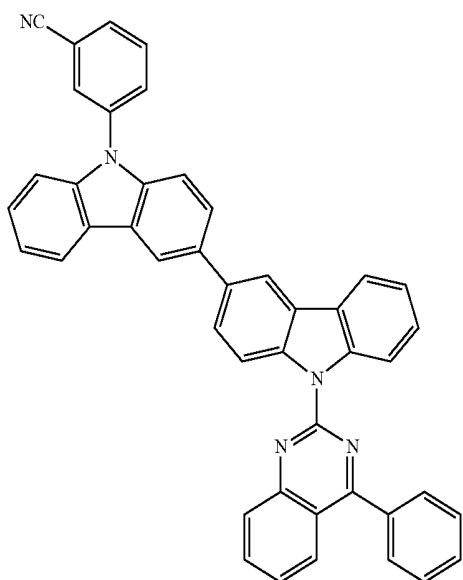


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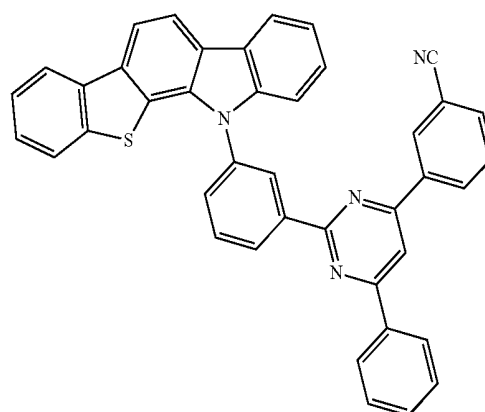
H2-480



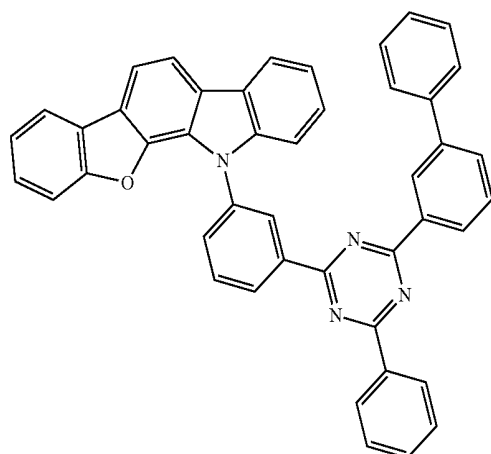
H2-478



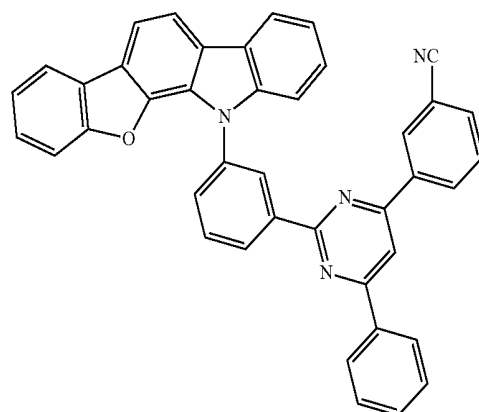
H2-481



H2-479

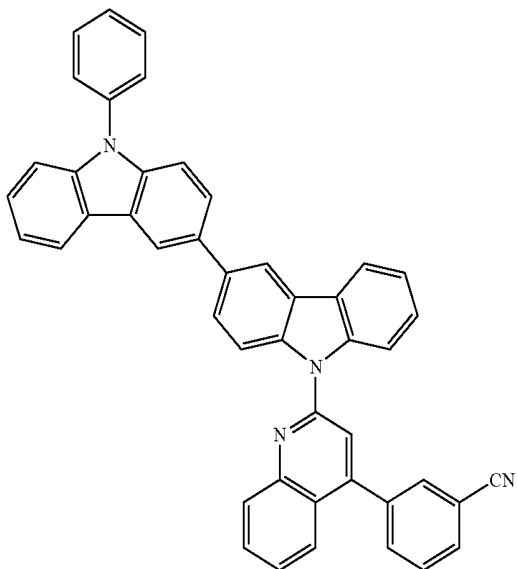


H2-482

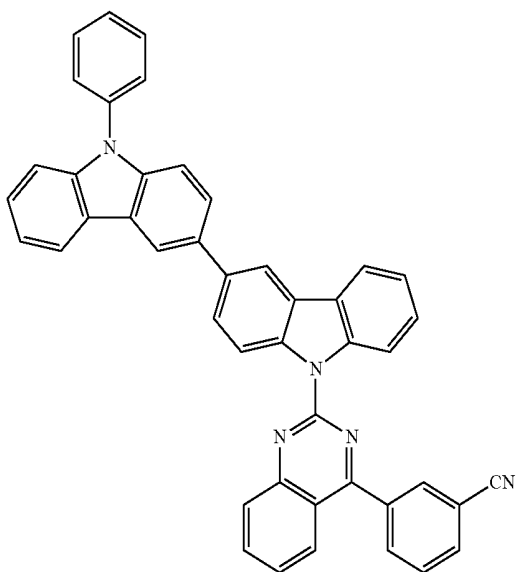


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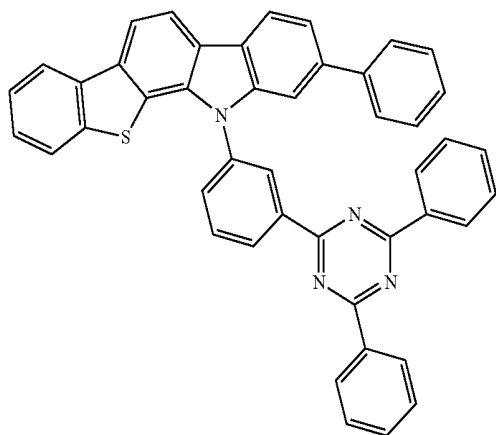
H2-483



H2-484

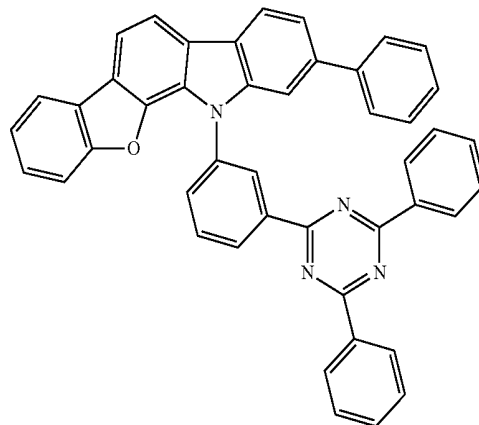


H2-485

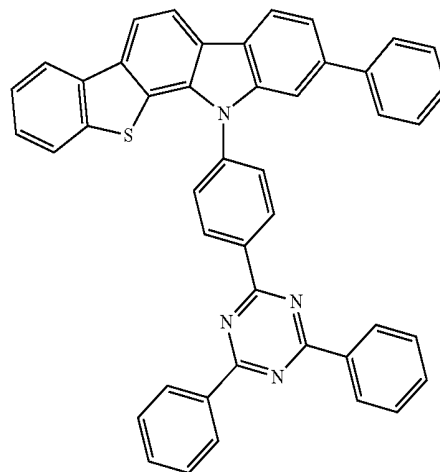


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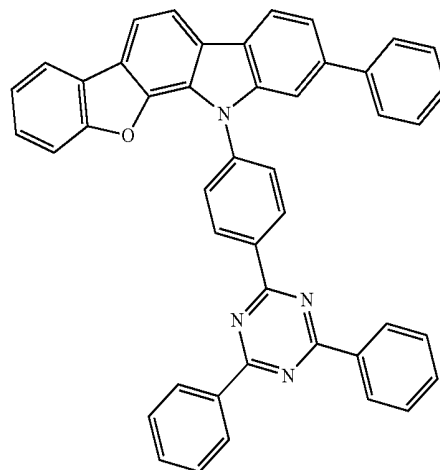
H2-486



H2-487

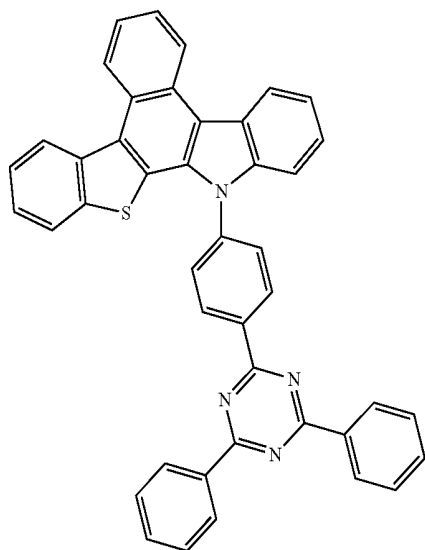


H2-488



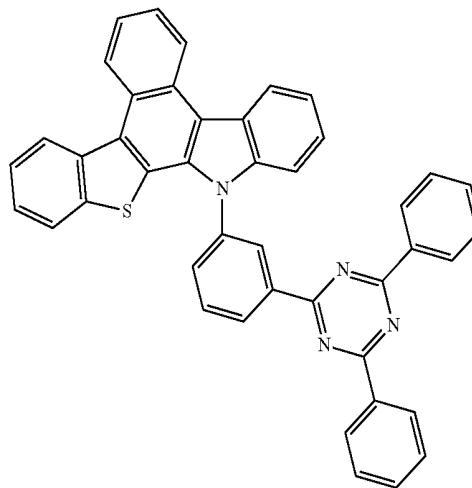
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H2-489

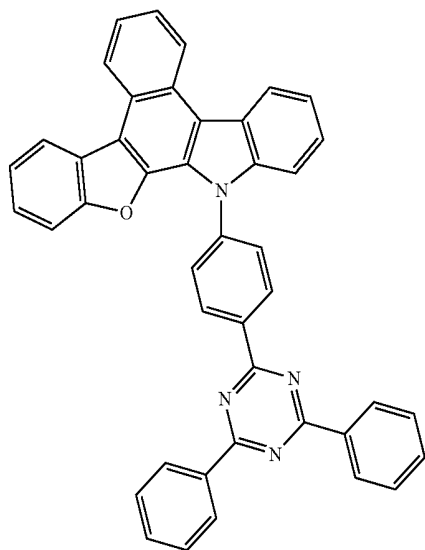


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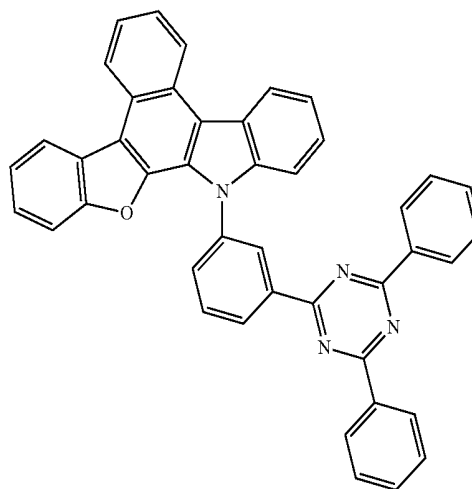
H2-491



H2-490



H2-492



\* \* \* \* \*

专利名称(译)	多组分主体材料和包含其的有机电致发光器件		
公开(公告)号	<a href="#">US20170125699A1</a>	公开(公告)日	2017-05-04
申请号	US15/301975	申请日	2015-04-17
[标]申请(专利权)人(译)	罗门哈斯电子材料有限公司		
申请(专利权)人(译)	罗门哈斯电子材料KOREA LTD.		
当前申请(专利权)人(译)	罗门哈斯电子材料KOREA LTD.		
[标]发明人	AHN HEE CHOON KIM YOUNG KWANG LEE SU HYUN JUN JI SONG LEE SEON WOO KIM CHI SIK PARK KYOUNG JIN KIM NAM KYUN CHOI KYUNG HOON SHIM JAE HOON CHO YOUNG JUN LEE KYUNG JOO		
发明人	AHN, HEE-CHOON KIM, YOUNG-KWANG LEE, SU-HYUN JUN, JI-SONG LEE, SEON-WOO KIM, CHI-SIK PARK, KYOUNG-JIN KIM, NAM-KYUN CHOI, KYUNG-HOON SHIM, JAE-HOON CHO, YOUNG-JUN LEE, KYUNG-JOO		
IPC分类号	H01L51/00 C09K11/06 C09K11/02		
CPC分类号	H01L51/0072 C09K2211/1088 C09K11/06 H01L51/0085 H01L51/0052 H01L51/0094 H01L51/0067 H01L51/0071 H01L51/0074 H01L51/0073 H01L2251/5384 H01L51/5016 C09K2211/1007 C09K2211 /1029 C09K2211/185 C09K11/025 C07D209/86 C07D209/88 C07D401/04 C07D401/10 C07D401/14 C07D405/14 C07D409/14 C07D487/04 C07D491/04 C07D495/04 C07F15/0033 H01L51/0061 H01L51 /5064		
优先权	1020140046857 2014-04-18 KR 1020140087769 2014-07-11 KR		
外部链接	<a href="#">Espacenet</a> <a href="#">USPTO</a>		

#### 摘要(译)

本发明涉及多组分主体材料和包含该主体材料的有机电致发光器件。通过包含多组分主体化合物的特定组合，根据本发明的有机电致发光器件可以提供高发光效率和优异的使用寿命特性。

(1)

