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(19) **United States**(12) **Patent Application Publication**
Kim et al.(10) **Pub. No.: US 2017/0335181 A1**(43) **Pub. Date: Nov. 23, 2017**(54) **A NOVEL COMBINATION OF A HOST
COMPOUND AND A DOPANT COMPOUND
AND AN ORGANIC
ELECTROLUMINESCENT DEVICE
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(57)

ABSTRACT

Disclosed herein are combinations of a dopant compound and a host compound. The dopant being an Iridium complex and the host being a carbazole derivative. Also made known are electroluminescent devices comprising the same.

**A NOVEL COMBINATION OF A HOST
COMPOUND AND A DOPANT COMPOUND
AND AN ORGANIC
ELECTROLUMINESCENT DEVICE
COMPRISING THE SAME**

TECHNICAL FIELD

[0001] The present invention relates to a novel combination of a host compound and a dopant compound, and an organic electroluminescent 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. The first organic EL device was 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] The most important factor determining luminous efficiency in the organic EL device is light-emitting materials. Depending on its function, the light-emitting materials can be classified as a host material and a dopant material. Generally, devices showing the best electroluminescent characteristics have a structure comprising a light-emitting layer in which a dopant is doped into a host. 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.

[0004] Until now, fluorescent materials have been widely used as a light-emitting material. However, in view of electroluminescent mechanisms, development of phosphorescent materials is one of the best ways to theoretically enhance luminous efficiency by four (4) times. Iridium(III) complexes have been widely known as phosphorescent dopant compounds, including bis(2-(2'-benzothienyl)pyridinato-N,C-3')iridium(acetylacetonate) ((acac)Ir(btp)₂), tris(2-phenylpyridine)iridium (Ir(ppy)₃), and bis(4,6-difluorophenylpyridinato-N,C2)picolinatoiridium (Firpic) as red, green, and blue materials, respectively. At present, 4,4'-N, N'-dicarbazol-biphenyl (CBP) is the most widely known phosphorescent host compound. A high performance organic EL device using a hole blocking layer of bathocuproine (BCP) and aluminum(III)bis(2-methyl-8-quinolinate)(4-phenylphenolate) (BALq) etc., is disclosed. However, when applying a light-emitting material comprising conventional dopant and host compounds, power efficiency is poor and operational lifespan and luminous efficiency are not satisfactory.

[0005] International Publication Nos. WO 2008/109824 A2 and WO 2010/033550 A1, US Application Publication Nos. US 2010/0090591 A1 and US 201 2/01 81 51 1 A1, and Korean Patent Application Laying-Open No. KR 2011-0086021 A disclose iridium complexes having a phenylquinoline ligand as a dopant compound contained in a light-emitting material of an organic EL device. However, they fail to specifically disclose an organic EL device comprising an iridium complex having a phenylquinoline ligand as a

dopant compound, and a carbazole derivative substituted with a 5- to 11-membered nitrogen-containing heteroaryl as a host compound.

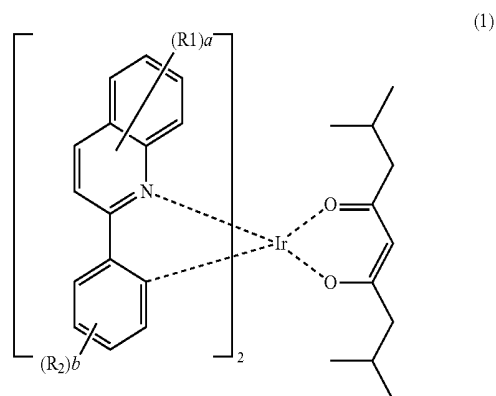
DISCLOSURE OF THE INVENTION

Problems to be Solved

[0006] The objective of the present invention is to provide a novel combination of a host and a dopant having excellent luminous efficiency and lifespan, and an organic electroluminescent device comprising the same.

Solution to Problems

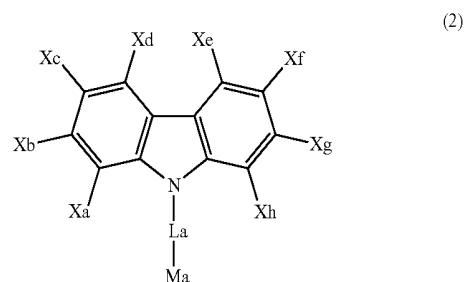
[0007] The present inventors found that the above objective can be achieved by a combination of one or more dopant compound represented by the following formula 1, and one or more host compound represented by the following formula 2, and an organic electroluminescent device comprising the same.



[0008] wherein

[0009] R₁ and R₂ each independently represent hydrogen, deuterium, a halogen, a substituted or unsubstituted (C1-C6)alkyl, or a substituted or unsubstituted (C6-C30)aryl; and

[0010] a and b each independently represent an integer of 1 to 4; where a or b is an integer of 2 or more, each of R₁ and each of R₂ may be the same or different.



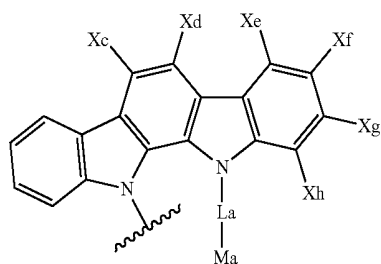
[0011] wherein

[0012] Ma represents a substituted or unsubstituted 5- to 11-membered nitrogen-containing heteroaryl;

[0013] La represents a single bond, a substituted or unsubstituted (C6-C30)arylene, or a substituted or unsubstituted 3- to 30-membered heteroarylene;

[0014] 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, 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 each other 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;

[0015] provided that when any of Xa to Xh are linked to each other to form a ring, the structure of



wherein Xc or Xd is hydrogen, is excluded; and

[0016] the heteroaryl(ene) contains at least one hetero atom selected from B, N, O, S, Si, and P.

EFFECTS OF THE INVENTION

[0017] According to the present invention, an organic electroluminescent device having excellent luminous efficiency and lifespan is provided.

Embodiments of the Invention

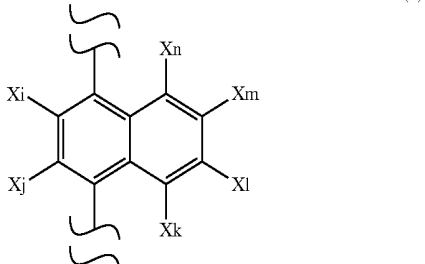
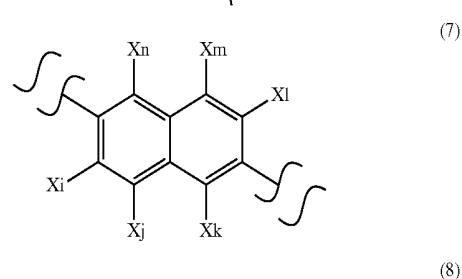
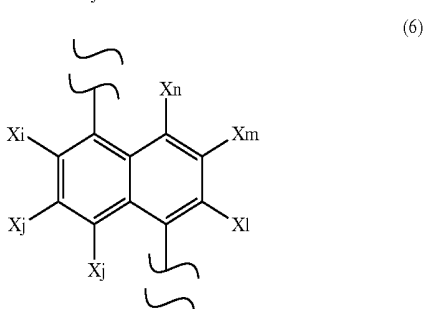
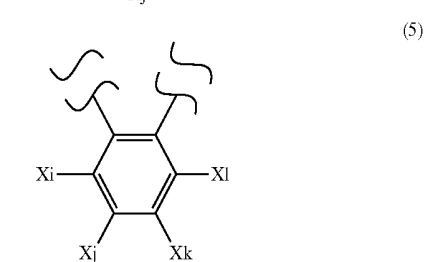
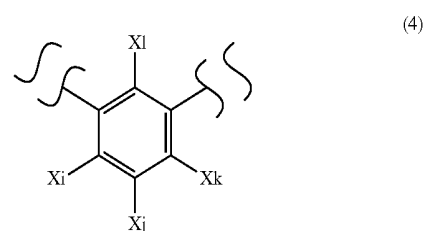
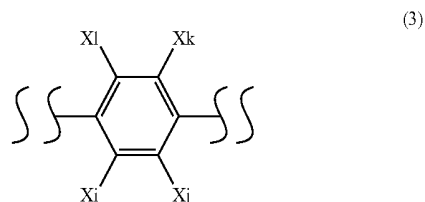
[0018] Hereinafter, the present invention will be described in detail. However, the following description is intended to explain the invention, and is not meant in any way to restrict the scope of the invention.

[0019] The present invention relates to an organic electroluminescent device comprising one or more dopant compounds represented by formula 1, and one or more host compounds represented by formula 2.

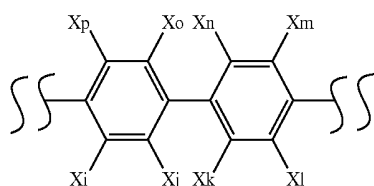
[0020] In formula 1 above, R₁ and R₂ each independently represent hydrogen, deuterium, a halogen, a substituted or unsubstituted (C1-C6)alkyl, or a substituted or unsubstituted (C6-C30)aryl; preferably each independently represent hydrogen, a halogen, a substituted or unsubstituted (C1-C6)alkyl, or a substituted or unsubstituted (C6-C12)aryl; and more preferably each independently represent hydrogen, a halogen, an unsubstituted (C1-C6)alkyl, or a (C6-C12)aryl unsubstituted or substituted with a halogen or a (C1-C6)alkyl.

[0021] In formula 2 above, La represents a single bond, a substituted or unsubstituted (C6-C30)arylene, or a substituted or unsubstituted 3- to 30-membered heteroarylene; preferably represents a single bond, a substituted or unsubstituted (C6-C12)arylene, or a substituted or unsubstituted 5-

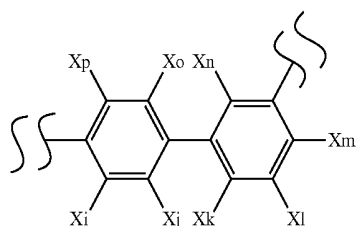
to 15-membered heteroarylene; and more preferably represents a single bond, a (C6-C12)arylene unsubstituted or substituted with a tri(C6-C10)arylsilyl or a (C6-C12)aryl, or an unsubstituted 6- to 15-membered heteroarylene. In addition, La may represent a single bond, a carbazolylene, or one of the following formulas 3 to 15:



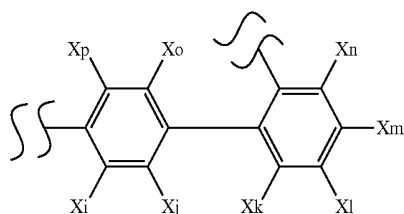
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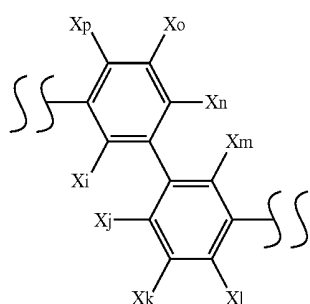
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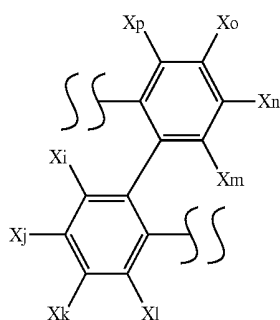
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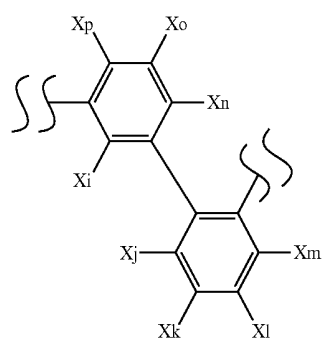
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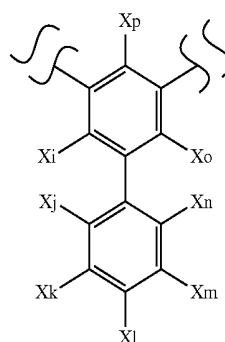
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(14)

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(15)

**[0022]** wherein

[0023] 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 each other 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; and more preferably each independently represent hydrogen, a cyano, a (C6-C15)aryl unsubstituted or substituted with a tri(C6-C10)arylsilyl, or a 10- to 20-membered heteroaryl unsubstituted or substituted with a (C6-C15)aryl.

[0024] In formula 2 above, Ma represents a substituted or unsubstituted 5- to 30-membered nitrogen-containing heteroaryl; preferably represents a substituted or unsubstituted 6- to 10-membered nitrogen-containing heteroaryl; and more preferably represents a 6- to 10-membered nitrogen-containing heteroaryl substituted with a substituent selected from the group consisting of an unsubstituted (C6-C25)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, an unsubstituted 6- to 15-membered heteroaryl, and a 6- to 15-membered heteroaryl substituted with a (C6-C12)aryl.

[0025] In addition, Ma may represent a monocyclic ring-type heteroaryl such as a substituted or unsubstituted pyrrolyl, a substituted or unsubstituted imidazolyl, a substituted or unsubstituted pyrazolyl, a substituted or unsubstituted triazinyl, a substituted or unsubstituted tetrazinyl, a substituted or unsubstituted triazolyl, a substituted or unsubstituted tetrazolyl, a substituted or unsubstituted pyridyl, a substituted or unsubstituted pyrazinyl, a substituted or unsubstituted pyrimidinyl, a substituted or unsubstituted pyridazinyl, etc., or a fused ring-type heteroaryl such as a substituted or unsubstituted benzimidazolyl, a substituted or unsubstituted isoindolyl, a substituted or unsubstituted indo-

lyl, a substituted or unsubstituted indazolyl, a substituted or unsubstituted benzothiadiazolyl, a substituted or unsubstituted quinolyl, a substituted or unsubstituted isoquinolyl, a substituted or unsubstituted cinnolyl, a substituted or unsubstituted quinazolyl, a substituted or unsubstituted naphthyridinyl, a substituted or unsubstituted quinoxalyl, a substituted or unsubstituted carbazolyl, a substituted or unsubstituted phenanthridinyl, etc. Preferably, Ma may represent a substituted or unsubstituted triazinyl, a substituted or unsubstituted pyrimidinyl, a substituted or unsubstituted pyridyl, a substituted or unsubstituted quinolyl, a substituted or unsubstituted isoquinolyl, a substituted or unsubstituted quinazolyl, a substituted or unsubstituted naphthyridinyl, or a substituted or unsubstituted quinoxalyl. In Ma, the substituent of the substituted pyrrolyl, etc., may be a (C6-C25)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, a cyano, a (C1-C6)alkyl, a tri(C6-C12)arylsilyl, a 6- to 15-membered heteroaryl, or a 6- to 15-membered heteroaryl substituted with a (C6-C12)aryl; and specifically, a cyano, a (C1-C6)alkyl, a phenyl, a biphenyl, a terphenyl, a naphthyl, a phenylnaphthyl, a naphthylphenyl, a diphenylfluorene, a phenanthrenyl, an anthracenyl, a dibenzothiophenyl, a dibenzofuranyl, or a phenylcarbazolyl, unsubstituted or substituted with a cyano, a (C1-C6)alkyl, or a triphenylsilyl.

[0026] 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, 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 each other 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 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 each other to form a substituted or unsubstituted mono- or polycyclic, (C6-C20) aromatic ring, whose carbon atom(s) may be replaced with at least one hetero atom selected from nitrogen, oxygen, and sulfur. More preferably, Xa to Xh each independently represent hydrogen; a cyano; a (C6-C15)aryl unsubstituted or substituted with a 10- to 20-membered heteroaryl or 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 each other 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.

[0027] Herein, “(C1-C30)alkyl” is meant to be a linear or branched alkyl having 1 to 30 carbon atoms constituting the chain, 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 constituting the chain, 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 constituting the chain, 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-butyne, 2-butyne, 3-butyne, 1-methylpent-2-ynyl, etc.; “(C3-C30)cycloalkyl” is a mono- or polycyclic hydrocarbon having 3 to 30 ring backbone 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, 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 ring backbone 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, phenylnaphthyl, naphthylphenyl, fluorenyl, phenylfluorenyl, benzofluorenyl, dibenzofluorenyl, phenanthrenyl, phenylphenanthrenyl, 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, preferably 3 to 20 ring backbone atoms, and more preferably 3 to 15 ring backbone atoms, including at least one, preferably 1 to 4 heteroatoms selected from the group consisting of B, N, O, S, 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, benzimidazolyl, benzothiazolyl, benzoisothiazolyl, benzoisoxazolyl, benzoxazolyl, isoindolyl, indolyl, benzindolyl, indazolyl, benzothiadiazolyl, quinolyl, isoquinolyl, cinnolyl, quinazolyl, quinoxalyl, carbazolyl, phenoxazinyl, phenanthridinyl, benzodioxolyl, etc.;

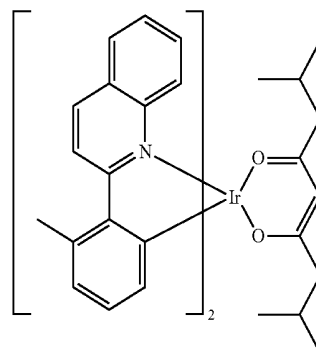
[0028] “nitrogen-containing 5- to 30-membered heteroaryl” is an aryl having 5 to 30 ring backbone atoms, preferably 5 to 20, and more preferably 5 to 15, including at least one heteroatom, N; is a monocyclic ring, or a fused ring condensed with at least one benzene ring; may be partially saturated; may 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 benzimidazolyl, isoindolyl, indolyl, indazolyl, benzothiadi-

azolyl, quinolyl, isoquinolyl, cinnolyl, quinazolyl, quinoxalyl, carbazolyl, phenanthridinyl, etc. Further, “halogen” includes F, Cl, Br, and I.

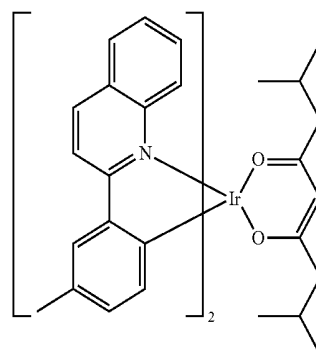
[0029] Herein, “substituted” in the expression “substituted or unsubstituted” means that a hydrogen atom in a certain functional group is replaced with another atom or group, i.e. a substituent. The substituents of the substituted alkyl, the substituted alkenyl, the substituted alkynyl, the substituted cycloalkyl, the substituted aryl(ene), the substituted heteroaryl(ene), the substituted trialkylsilyl, the substituted triarylsilyl, the substituted dialkylarylsilyl, the substituted alkylarylsilyl, the substituted mono- or di- arylamino, or the substituted mono- or polycyclic, (C3-C30) alicyclic or aromatic ring in the formulas 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)alkyldi(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 halogen, a cyano, a (C1-C6)alkyl, a 5- to 15-membered heteroaryl unsubstituted or substituted with a (C6-C12)aryl, a (C6-C25)aryl unsubstituted or substituted with a cyano, a (C6-C12)aryl, or a tri(C6-C12)arylsilyl, a tri(C6-C12)arylsilyl, and a (C1-C6)alkyl(C6-C12)aryl.

[0030] The compound represented by formula 1 includes the following compounds, but is not limited thereto:

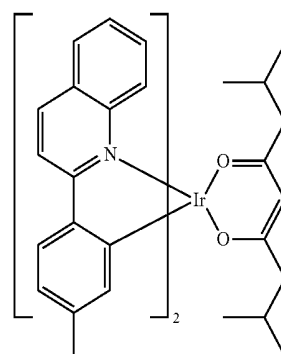
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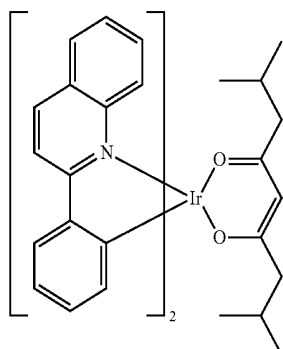
D-2



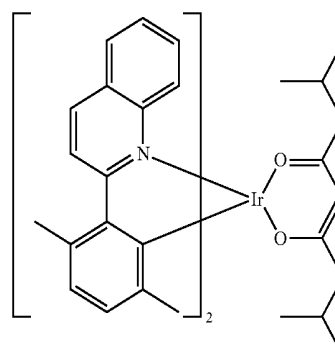
D-3



D-4

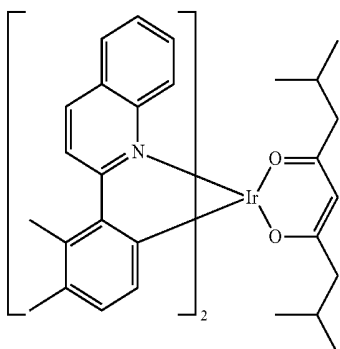


D-1



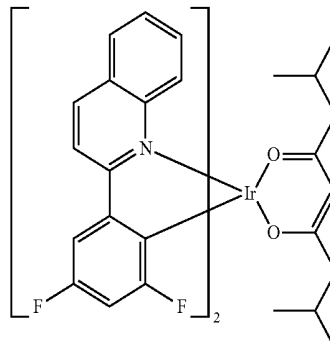
D-5

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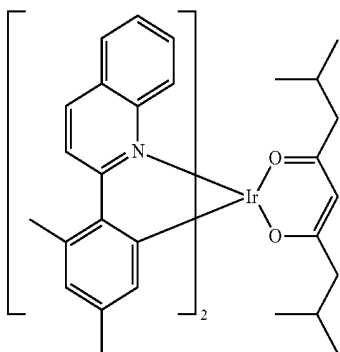


D-6

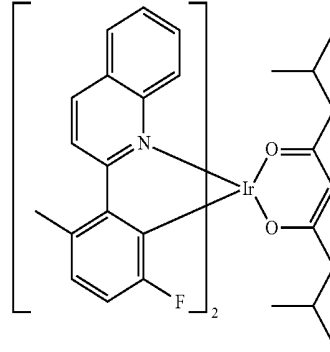
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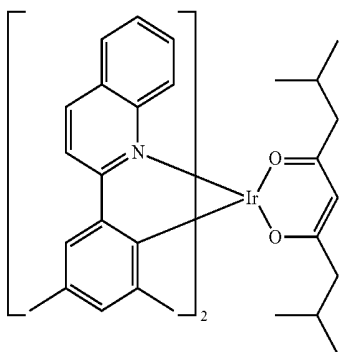
D-10



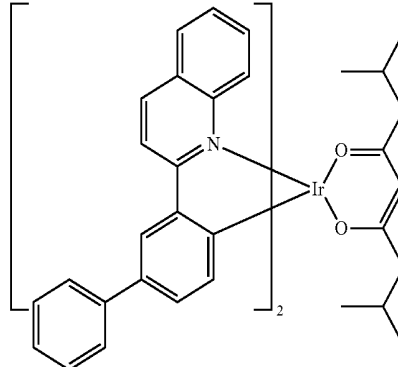
D-7



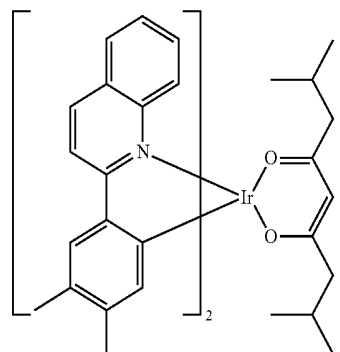
D-11



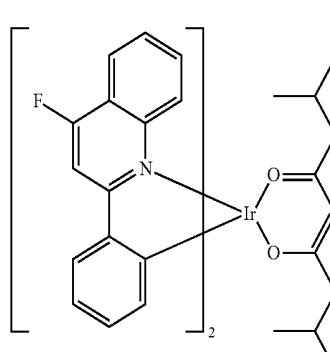
D-8



D-12

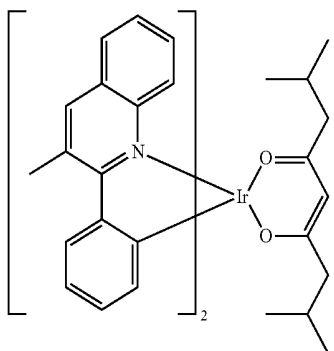


D-9



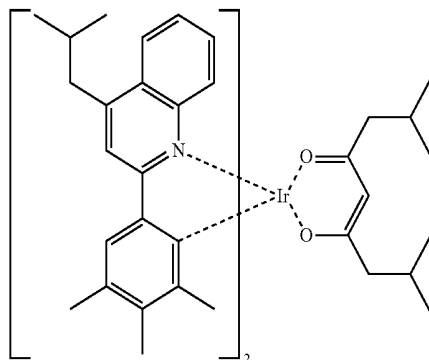
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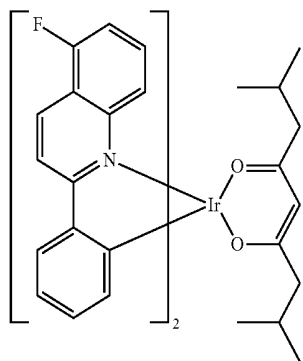


D-14

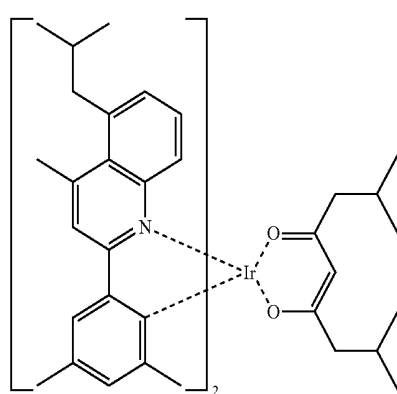
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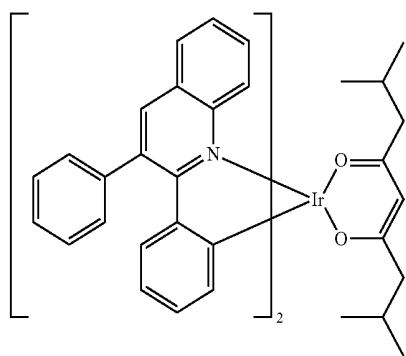
D-18



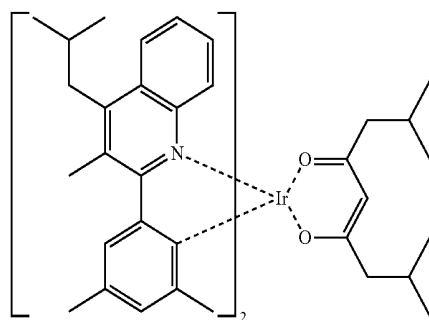
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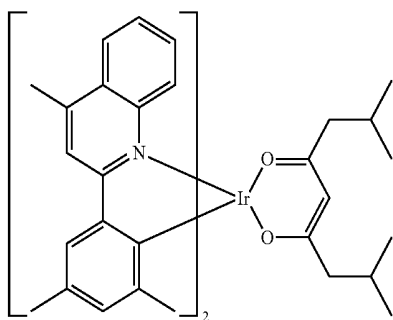
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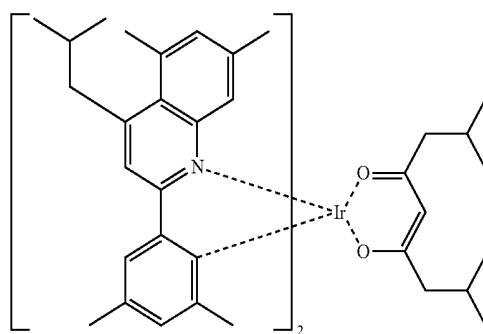
D-16



D-20

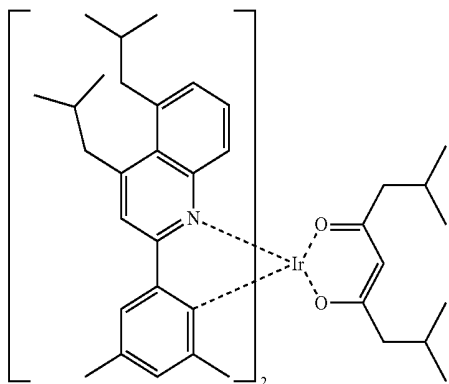


D-17



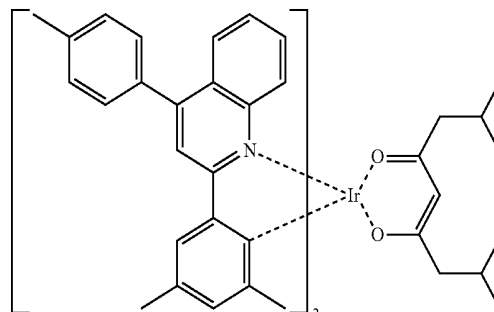
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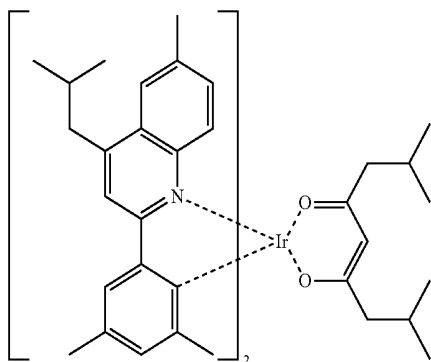


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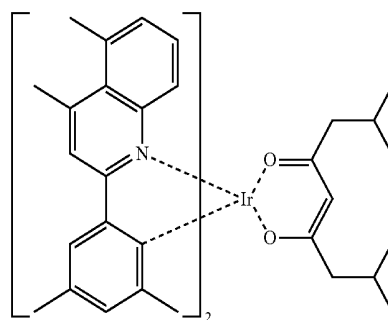
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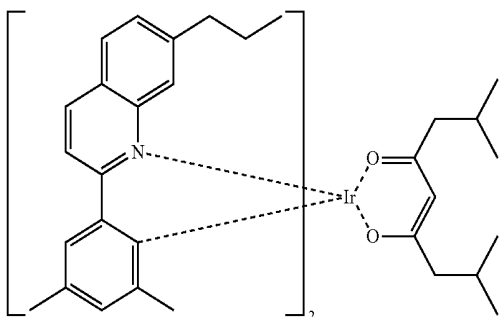
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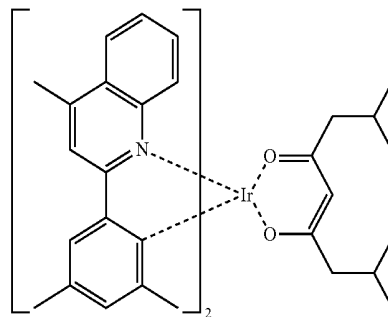
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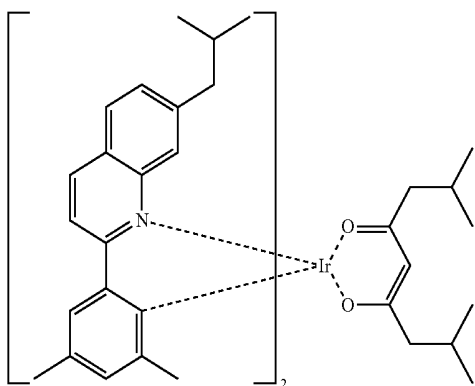
D-27



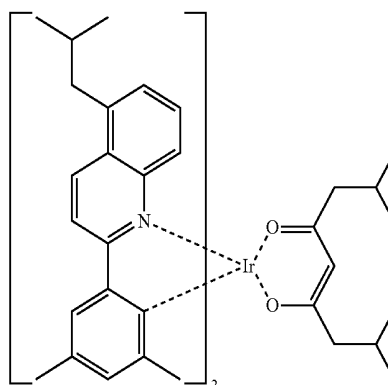
D-24



D-28

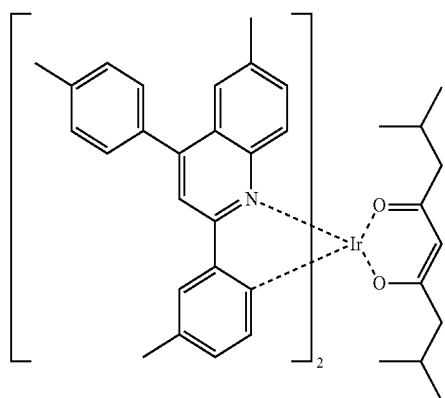


D-25



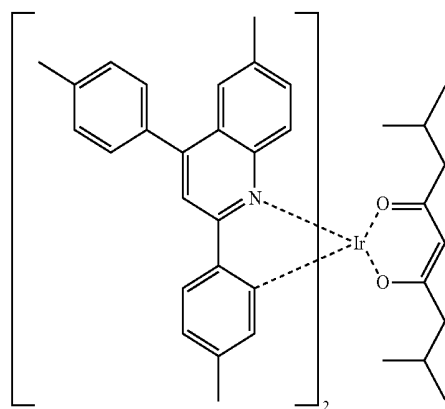
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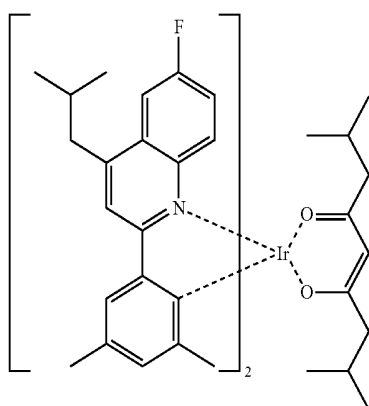


D-30

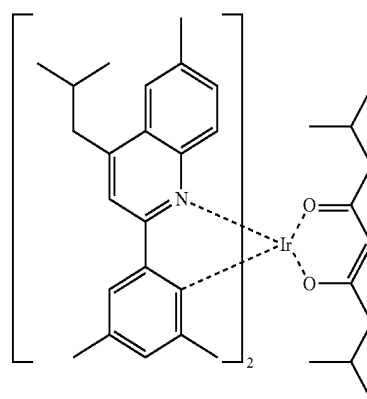
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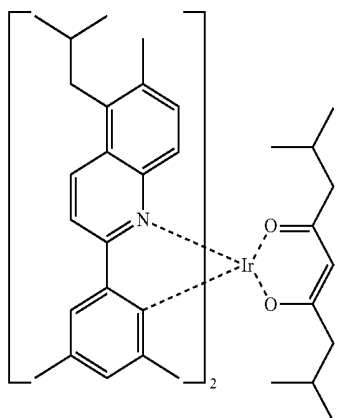
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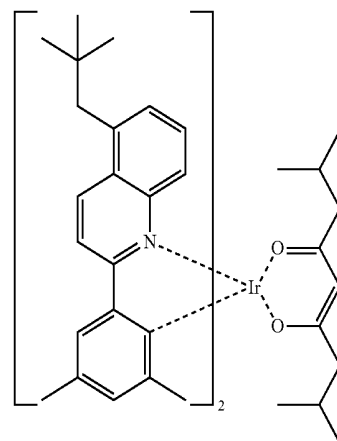
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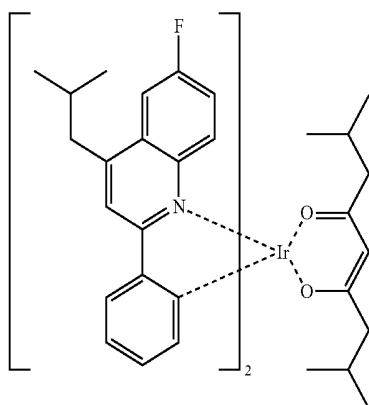
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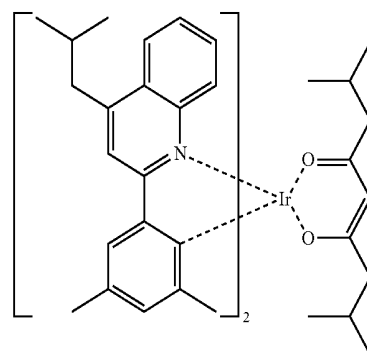
D-32



D-36

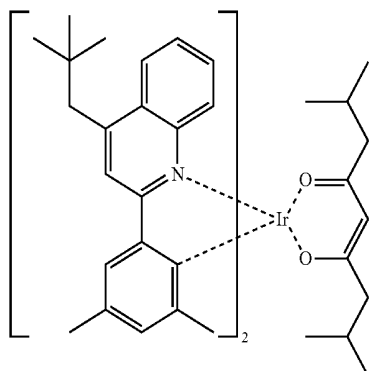


D-33



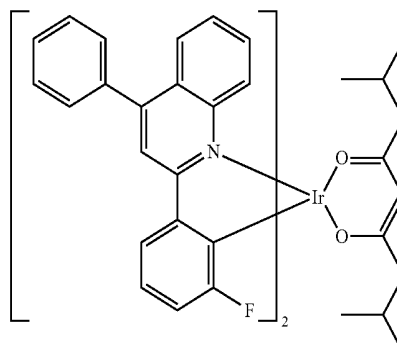
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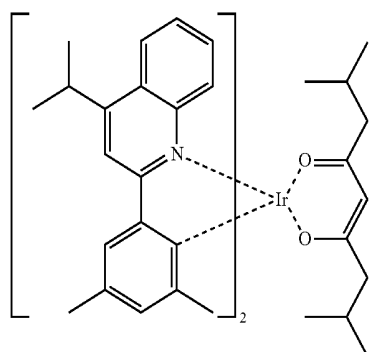


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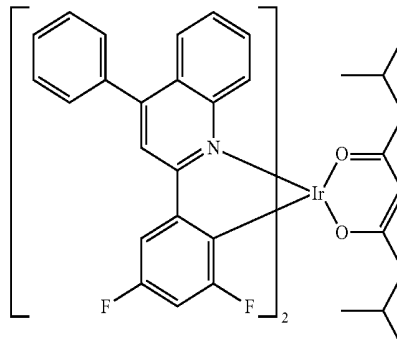
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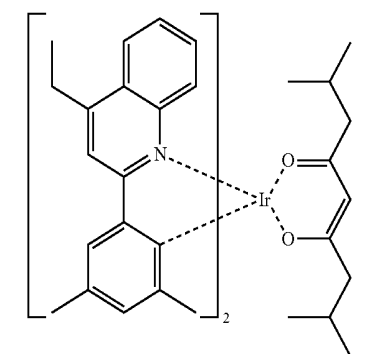
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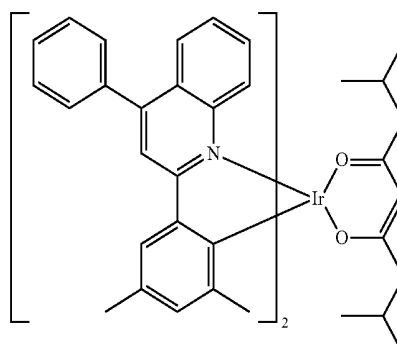
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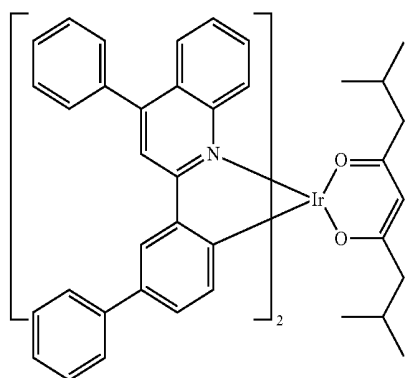
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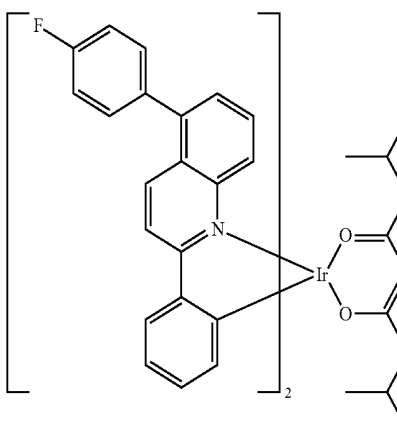
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D-44

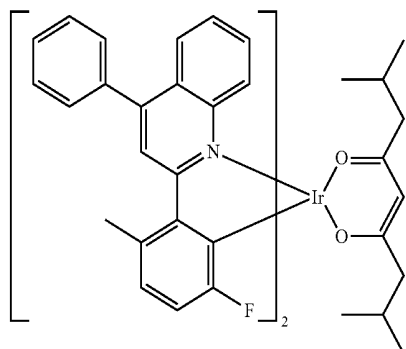


D-41



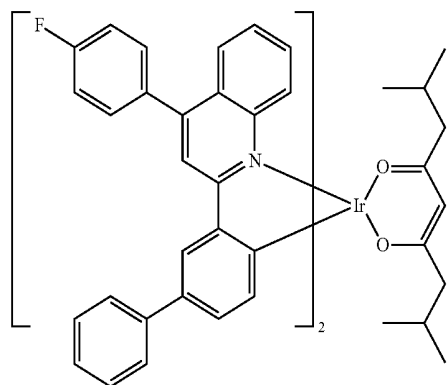
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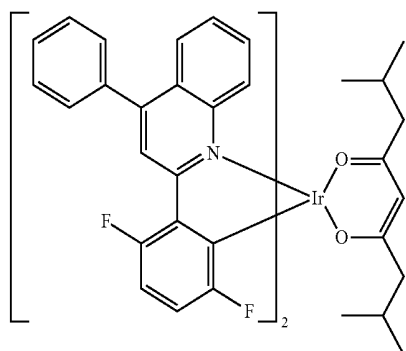


D-46

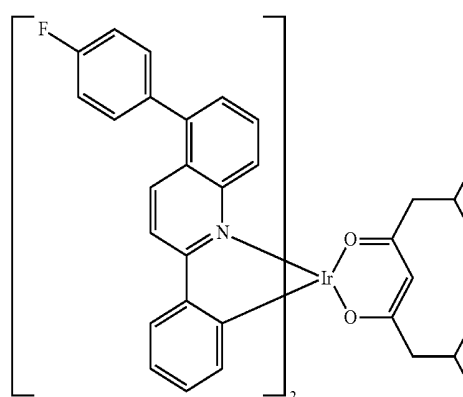
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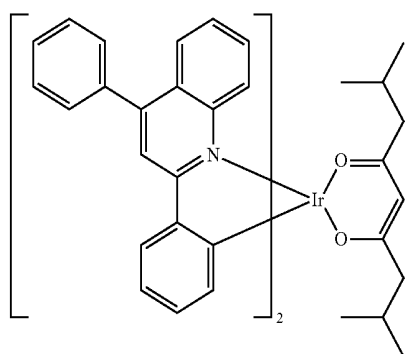
D-50



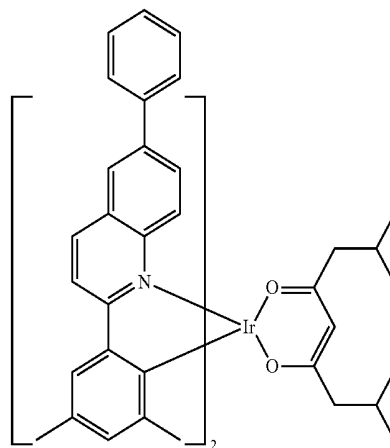
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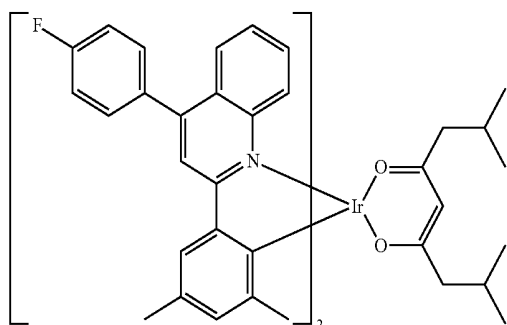
D-51



D-48

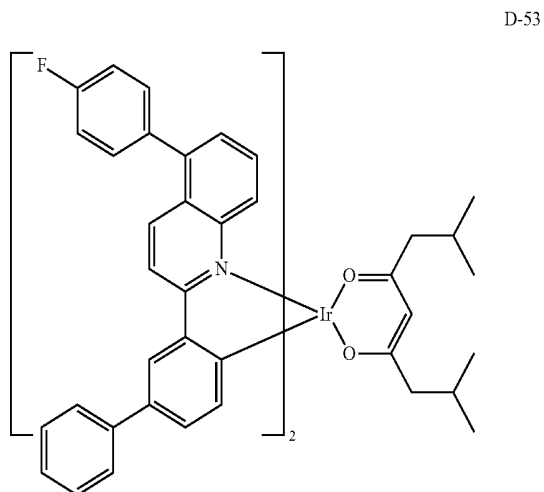


D-52

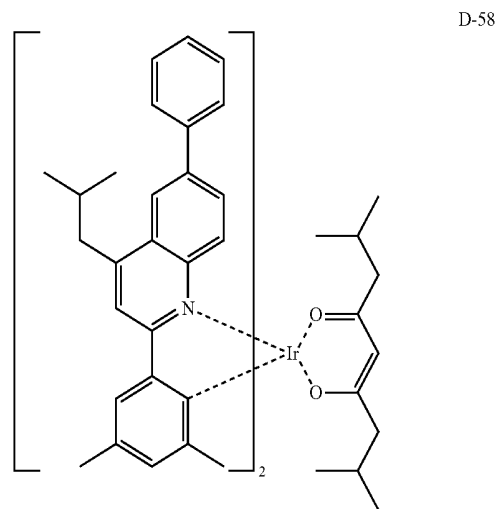
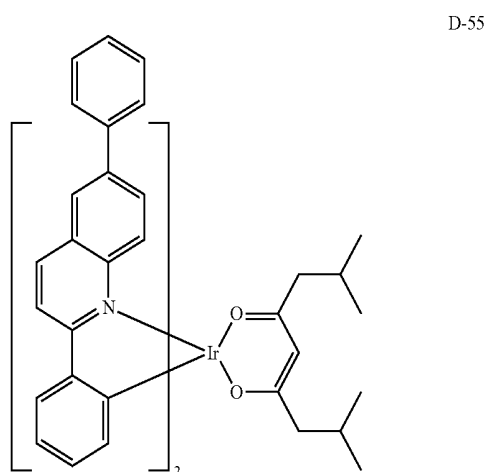
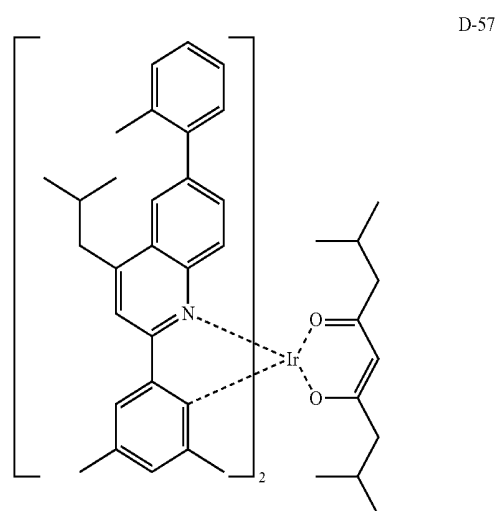
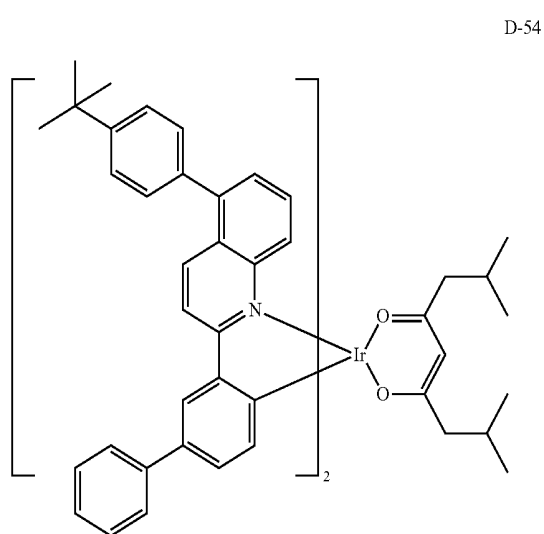
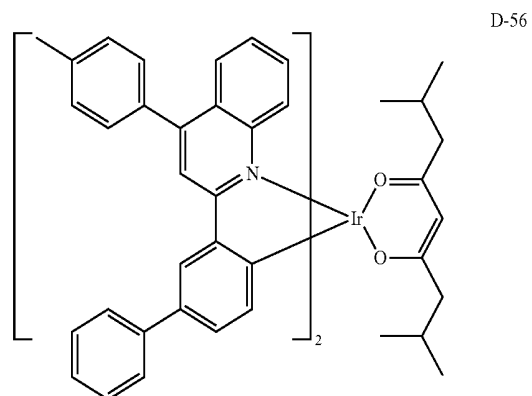


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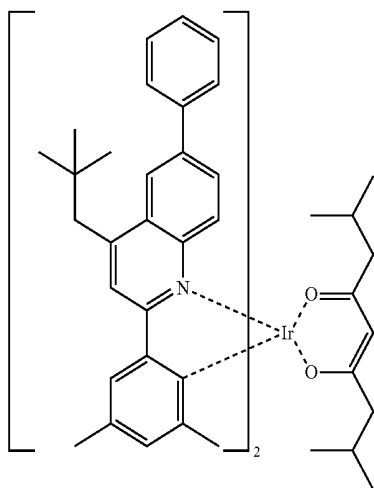
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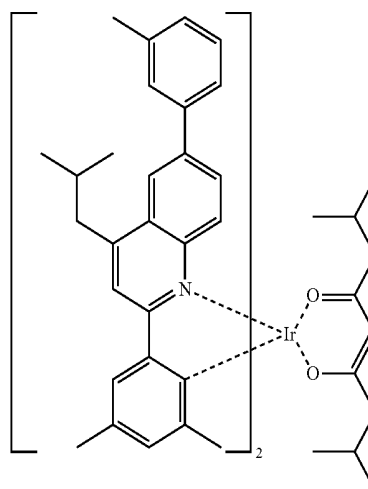


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D-59

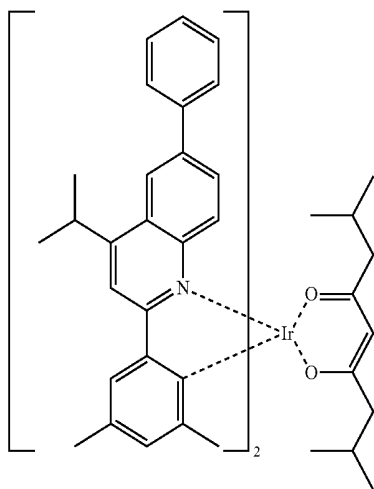
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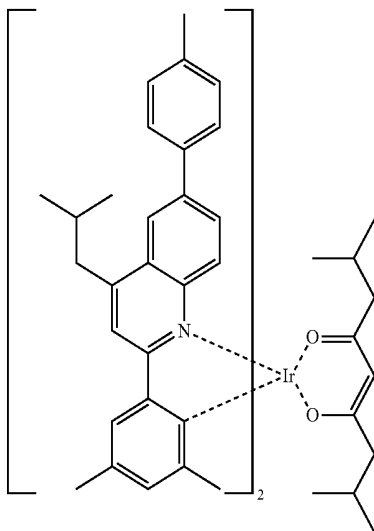
D-62

[0031] The compound represented by formula 2 includes the following compounds, but is not limited thereto:

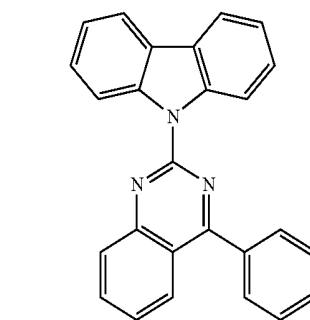
D-60



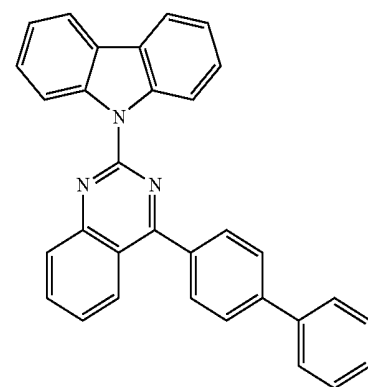
D-61



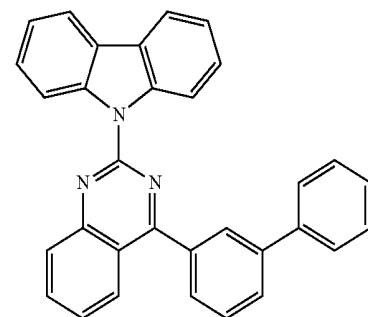
H2-1



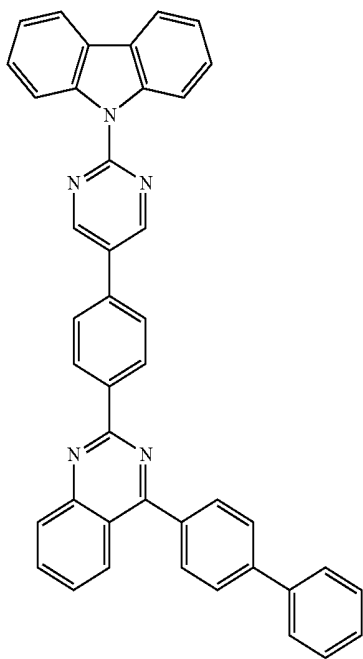
H2-2



H2-3

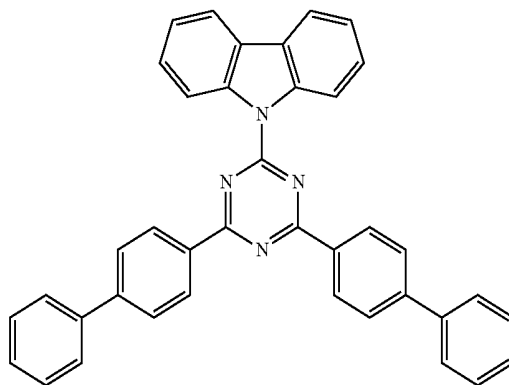


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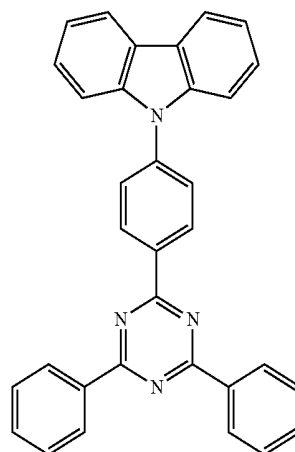
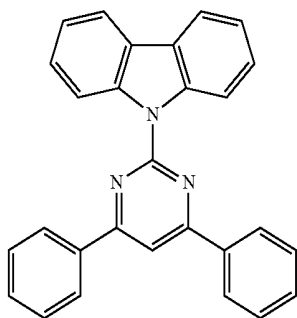
H2-4

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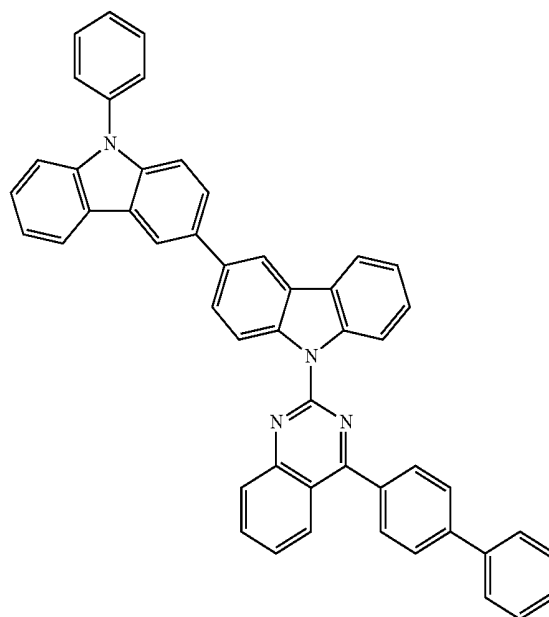
H2-7

H2-5

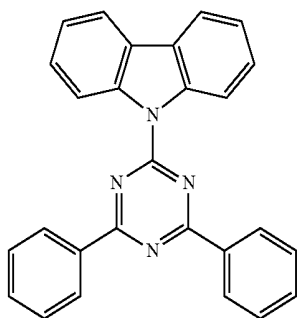


H2-8

H2-9



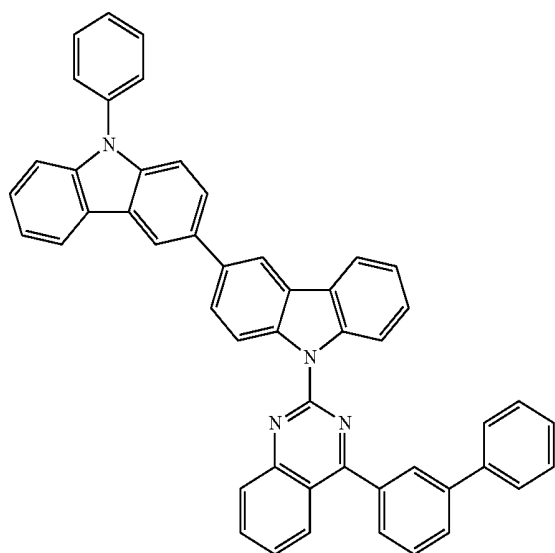
H2-6



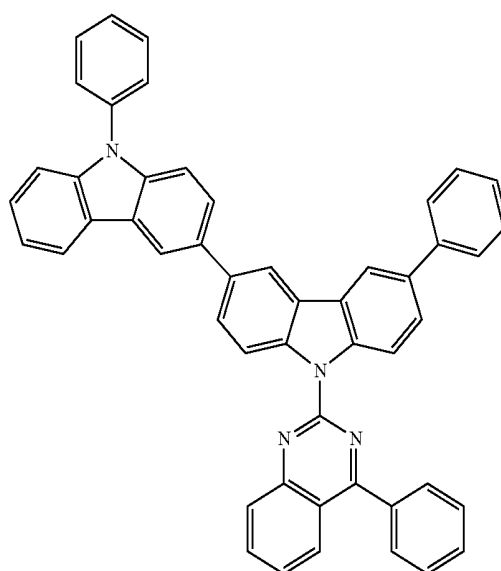
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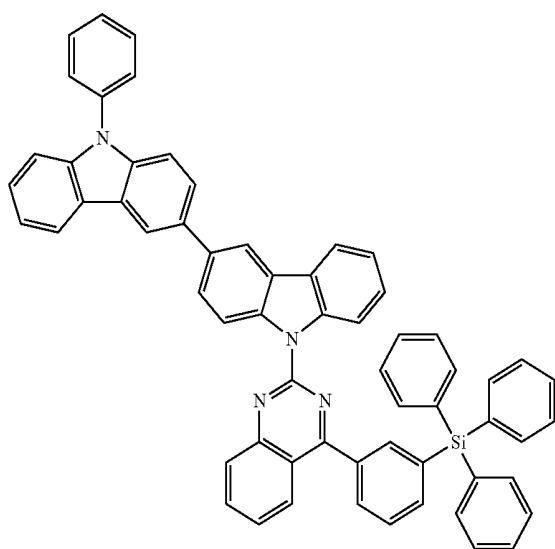
H2-10



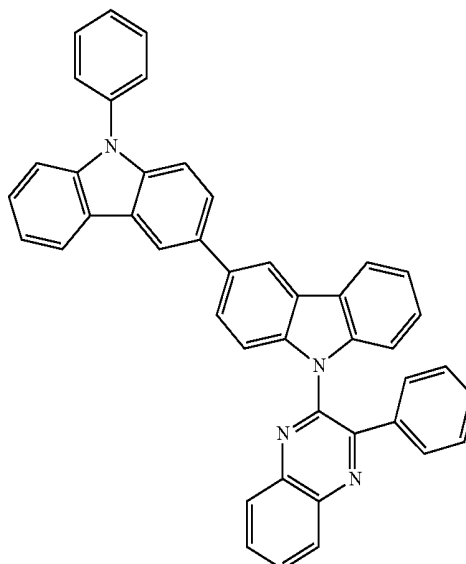
H2-12



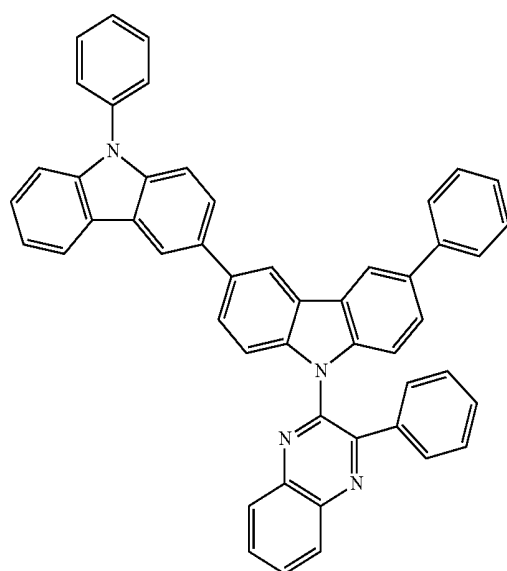
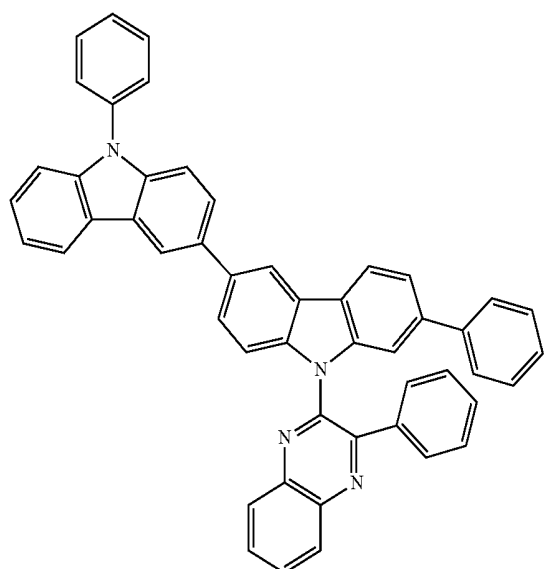
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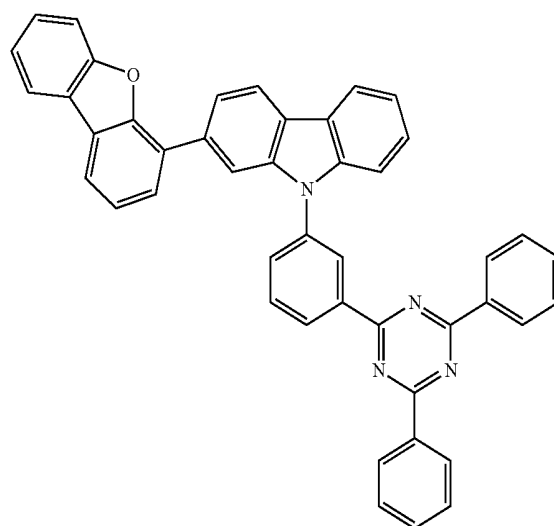
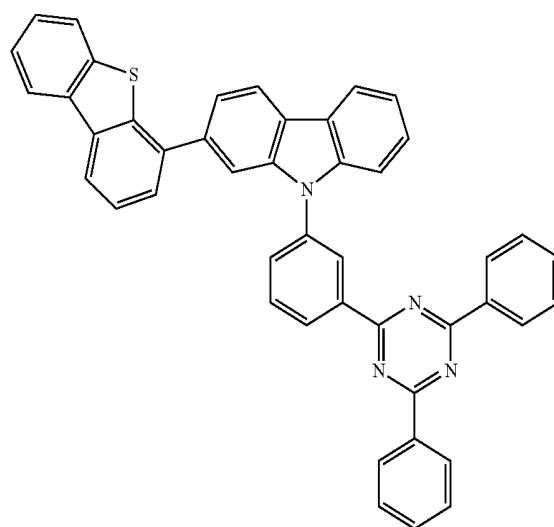
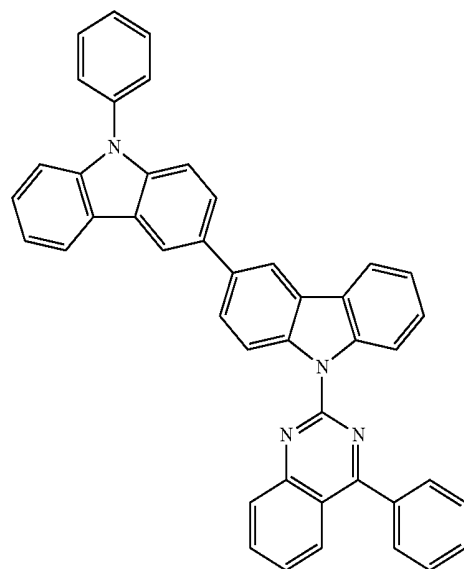
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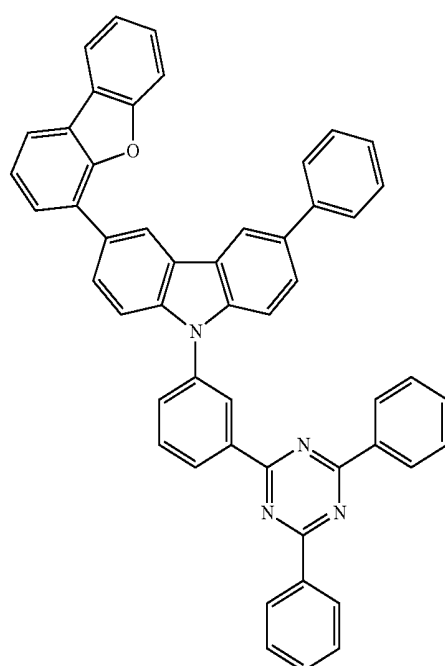
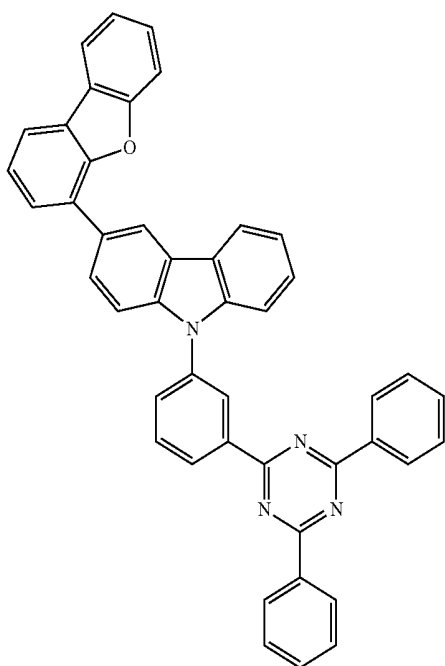
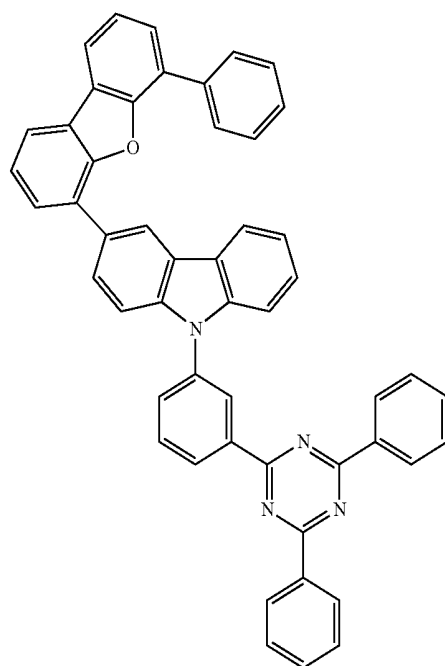
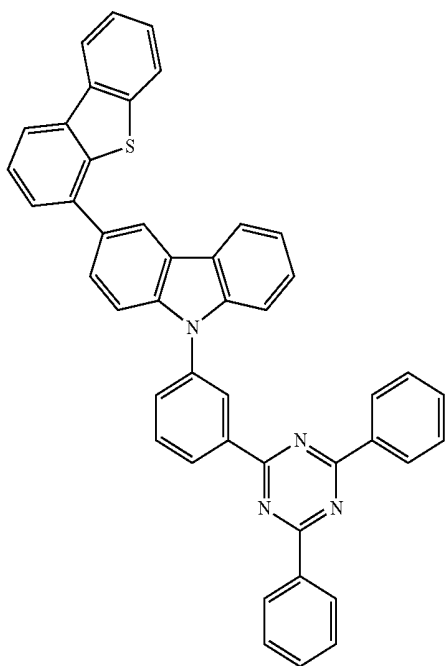


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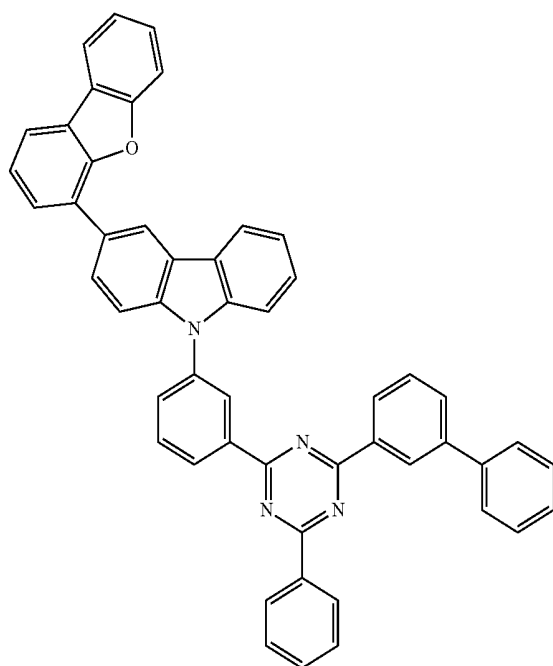
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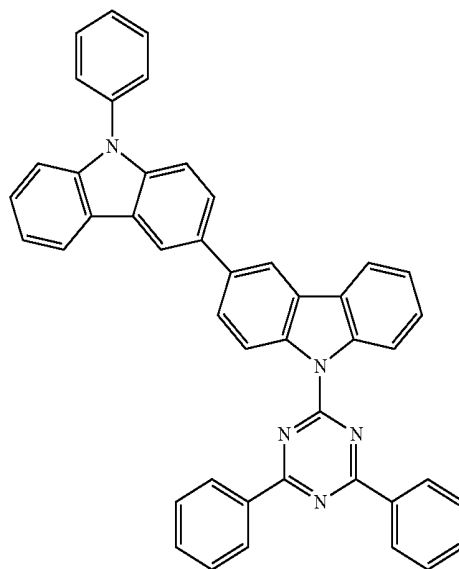
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H2-23

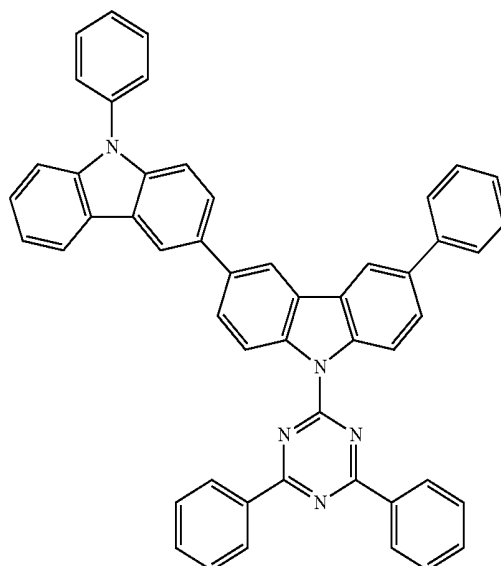
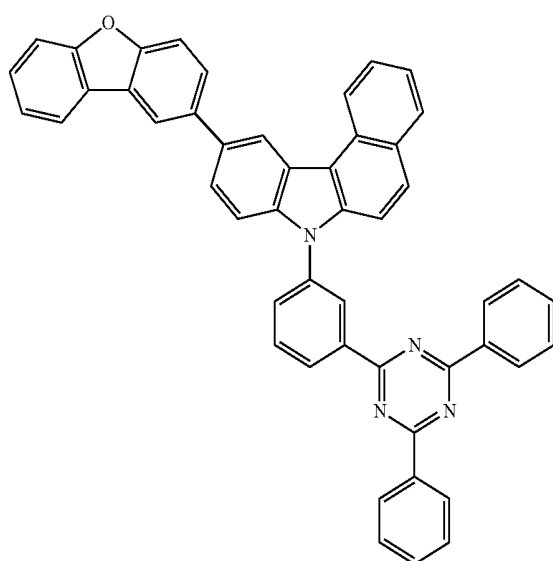


H2-25



H2-26

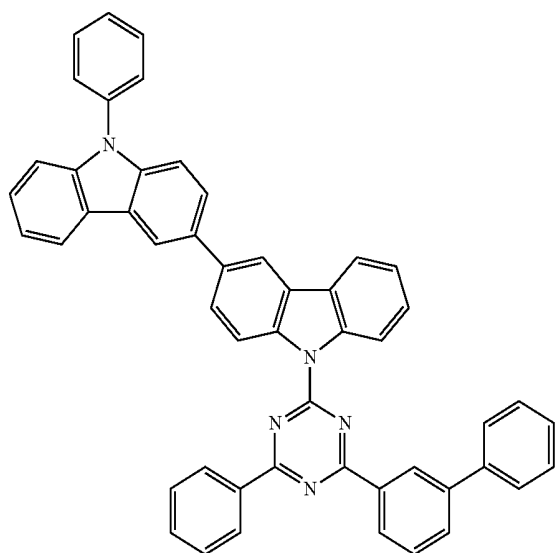
H2-24



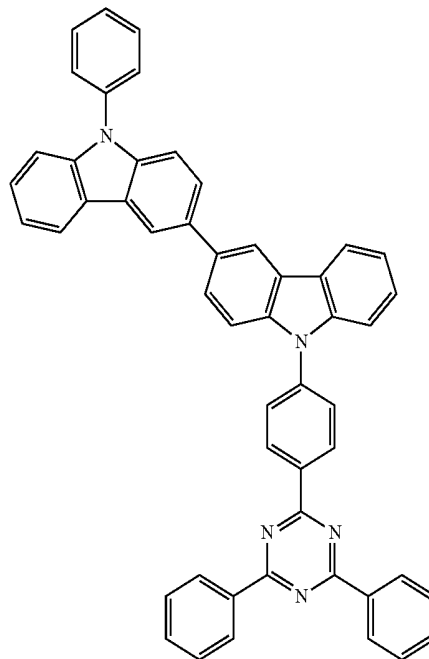
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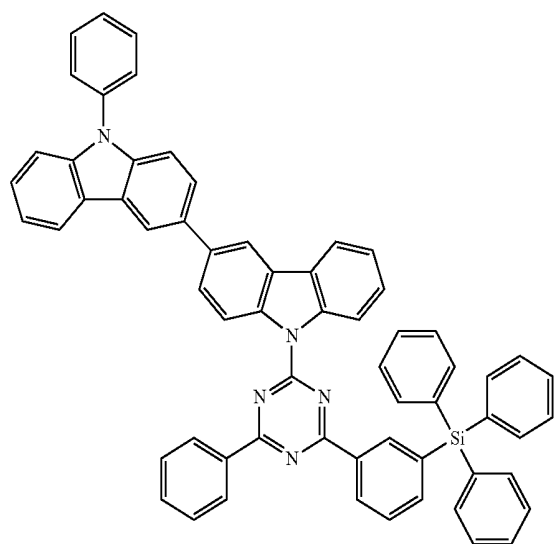
H2-27



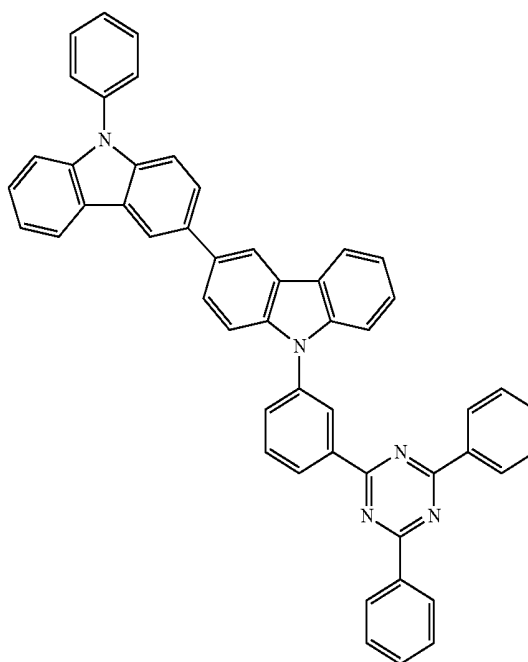
H2-29



H2-28



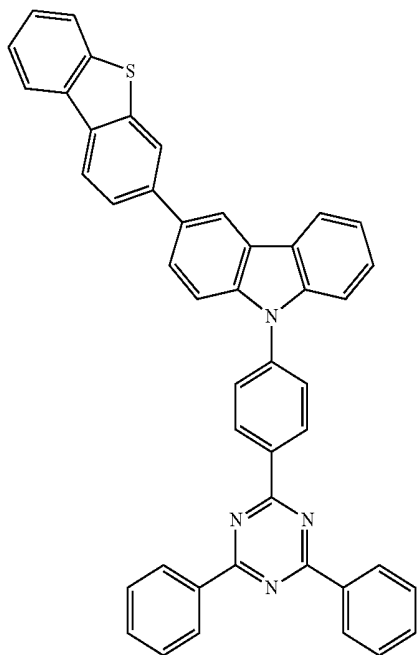
H2-30



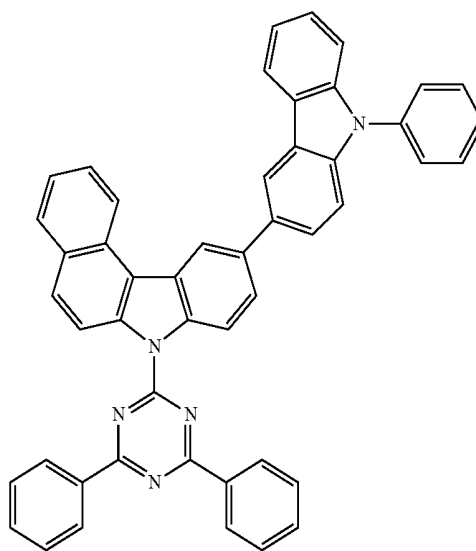
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H2-31

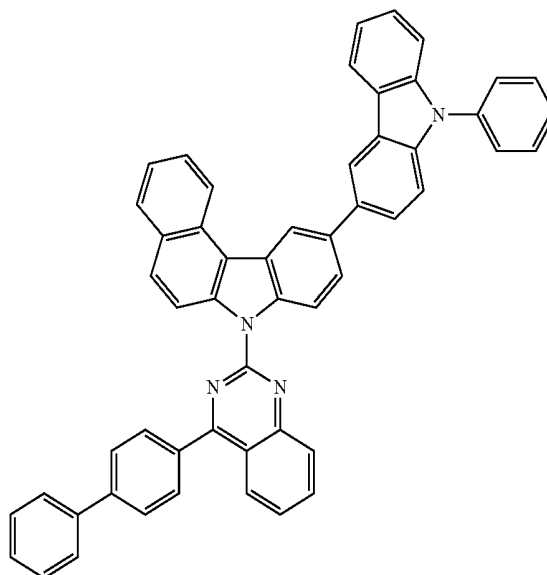
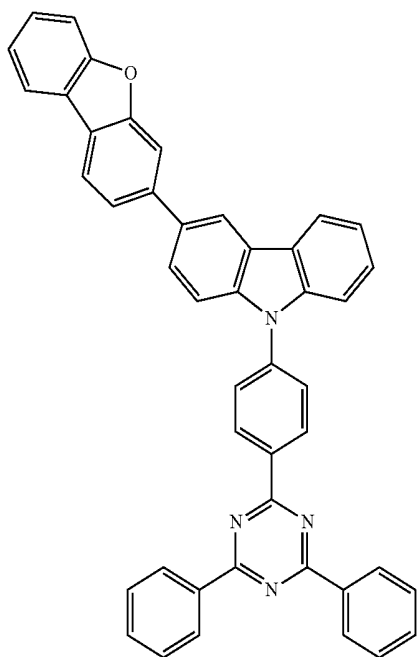


H2-33



H2-34

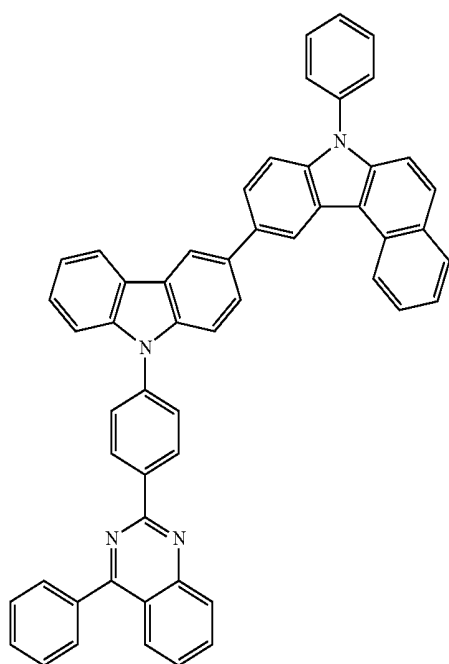
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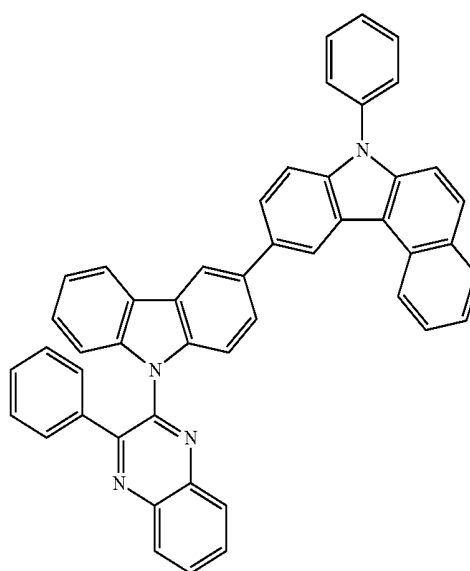
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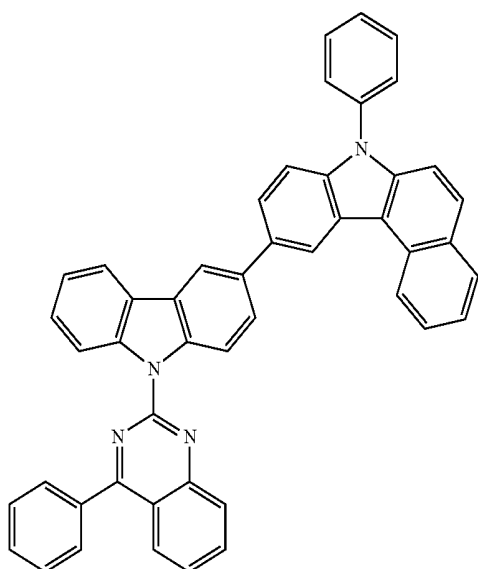
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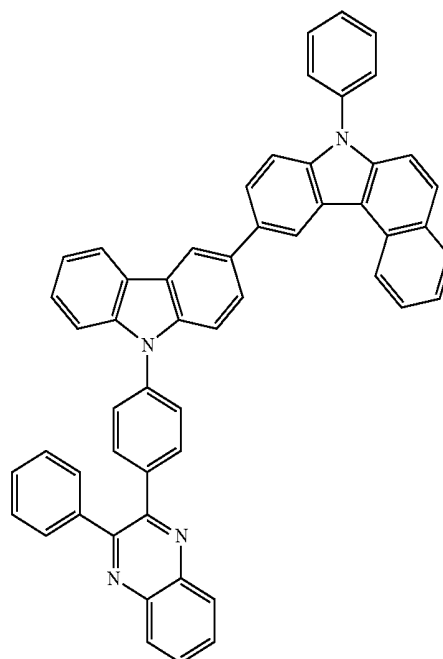
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H2-36

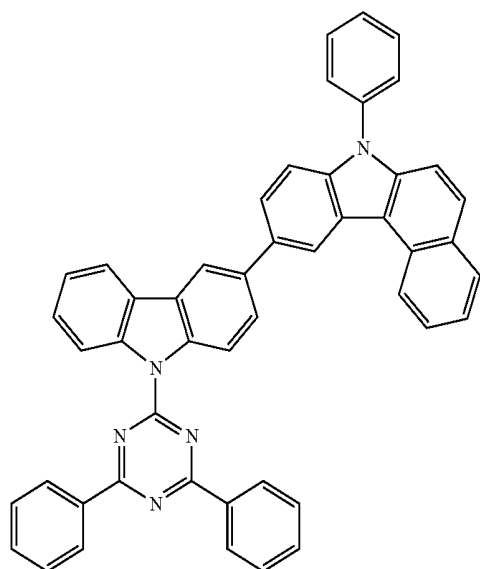


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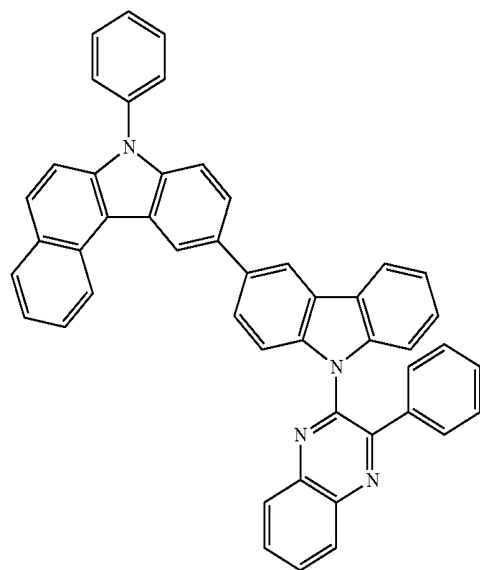


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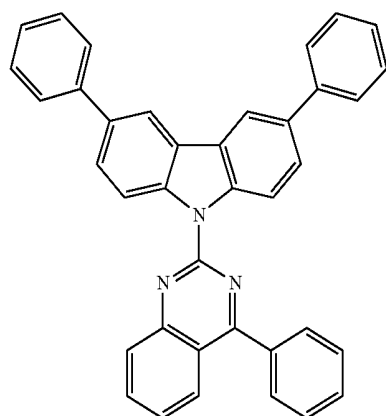
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H2-40

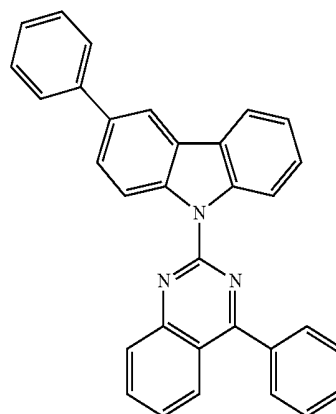


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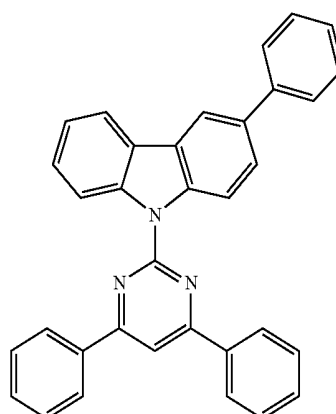


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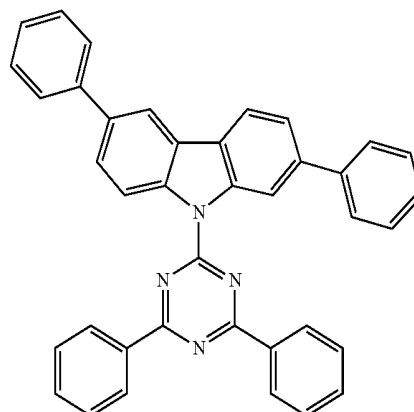
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H2-43



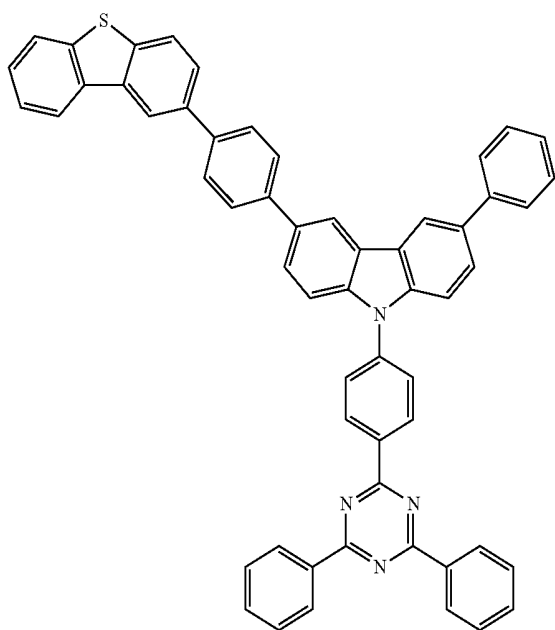
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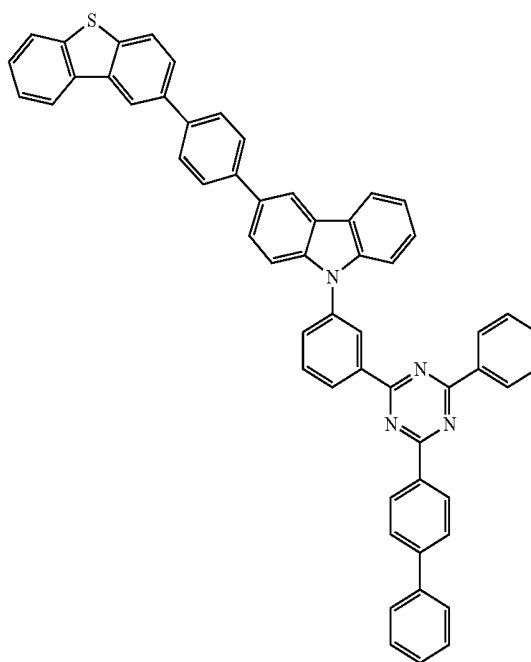
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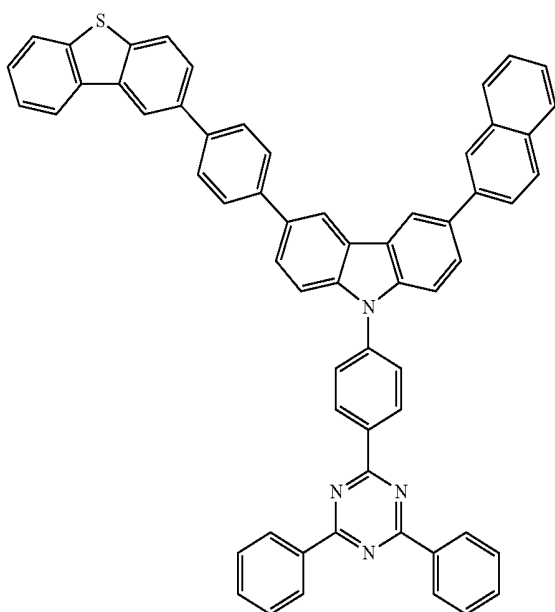
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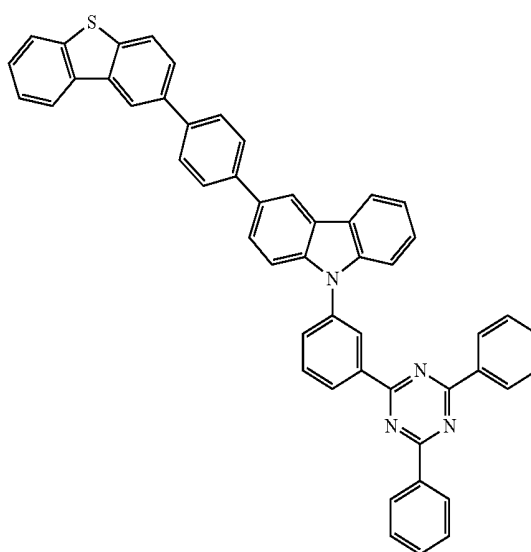
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H2-46



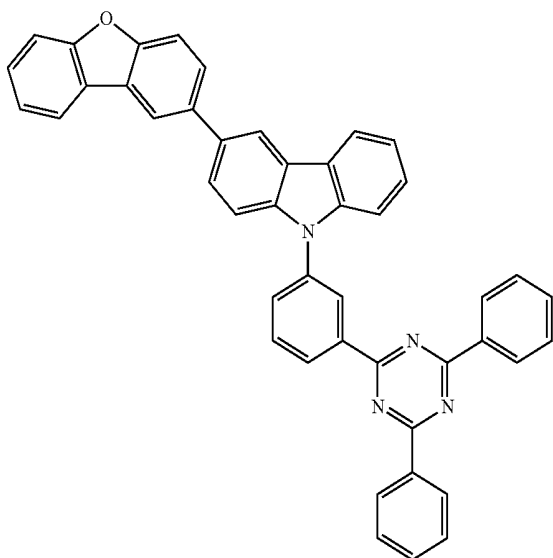
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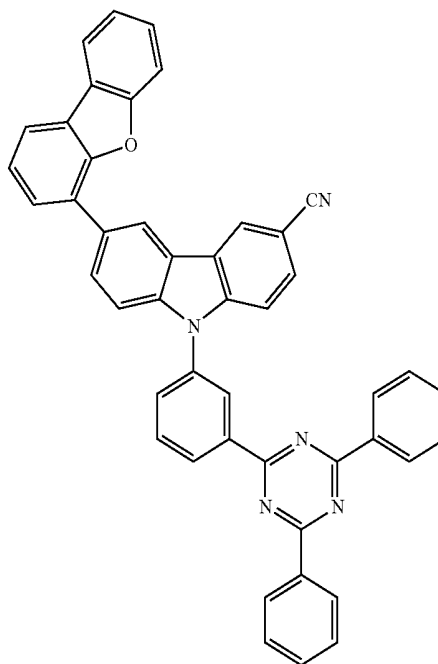
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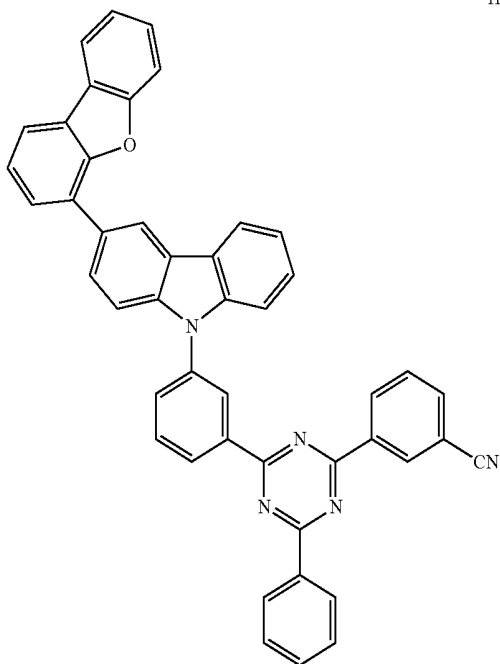
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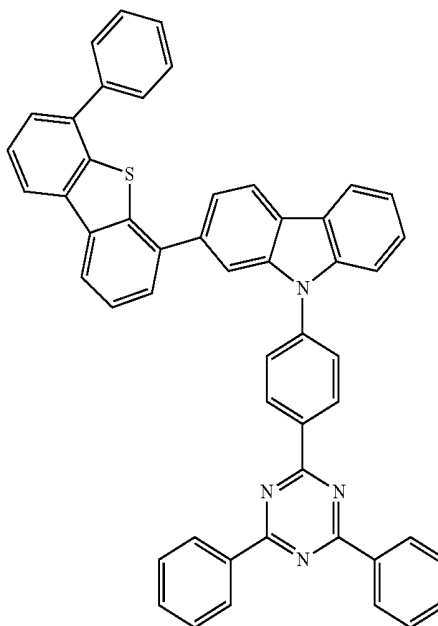
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H2-50

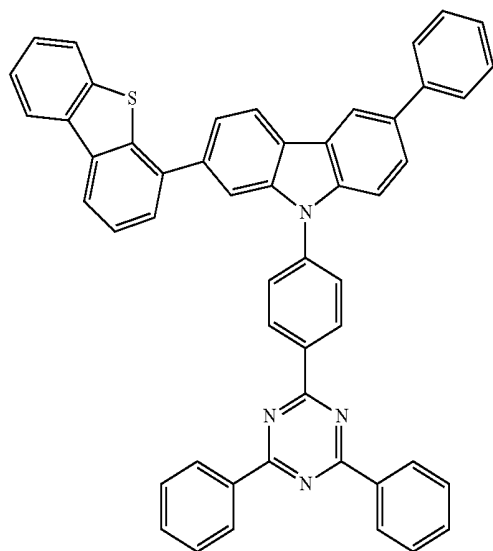


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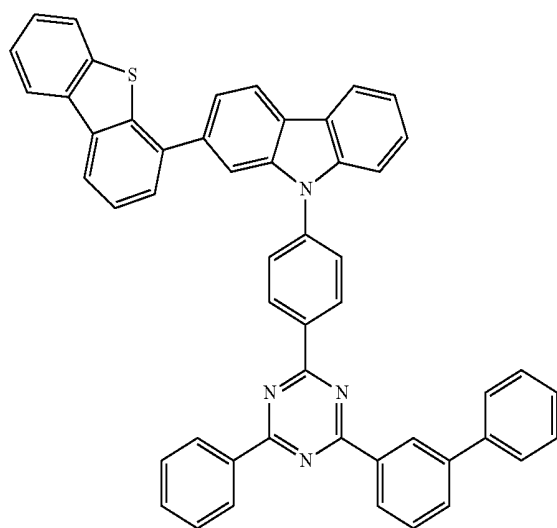


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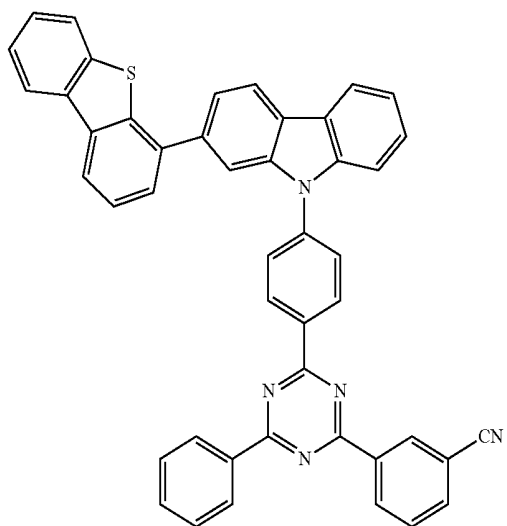
H2-53



H2-54

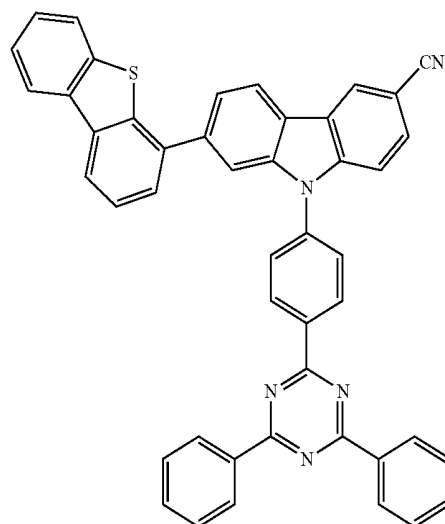


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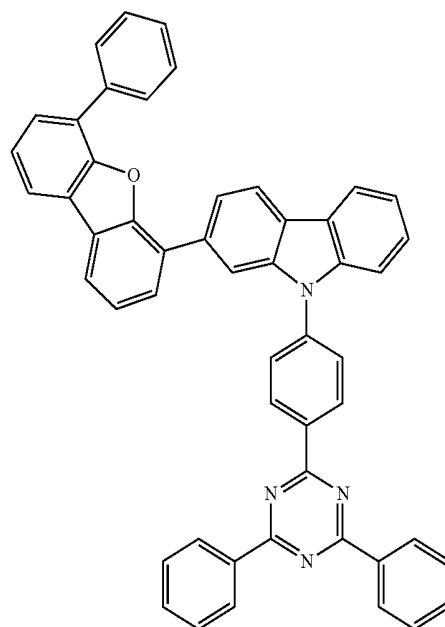


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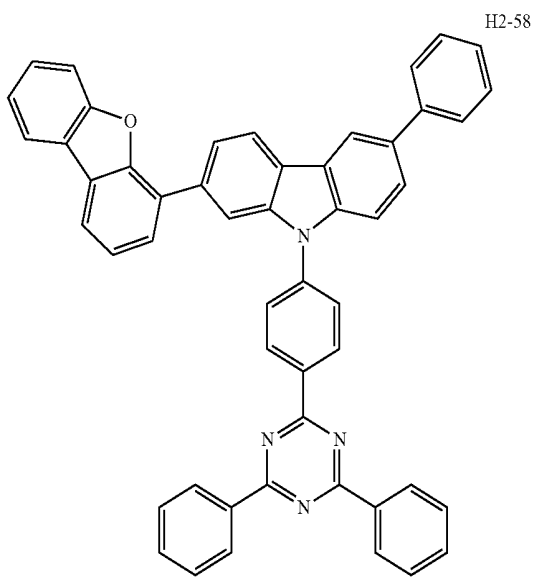
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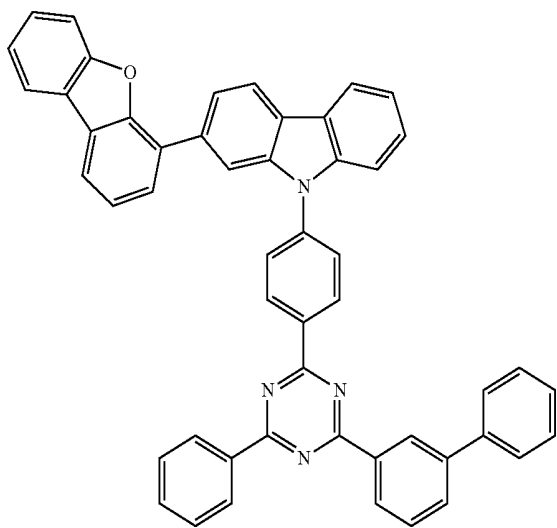
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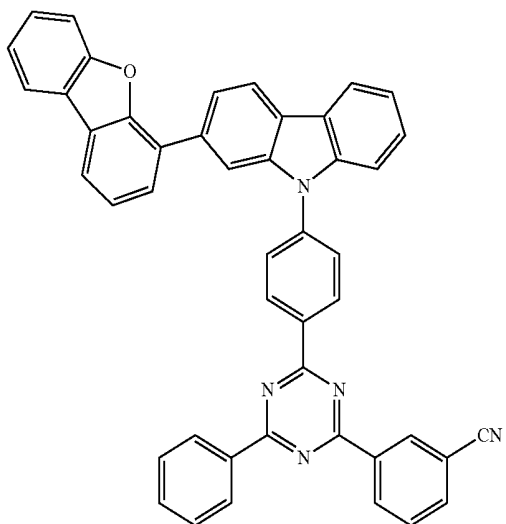
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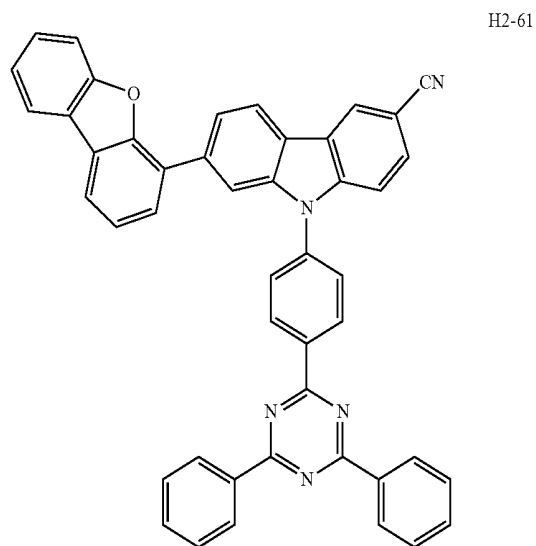
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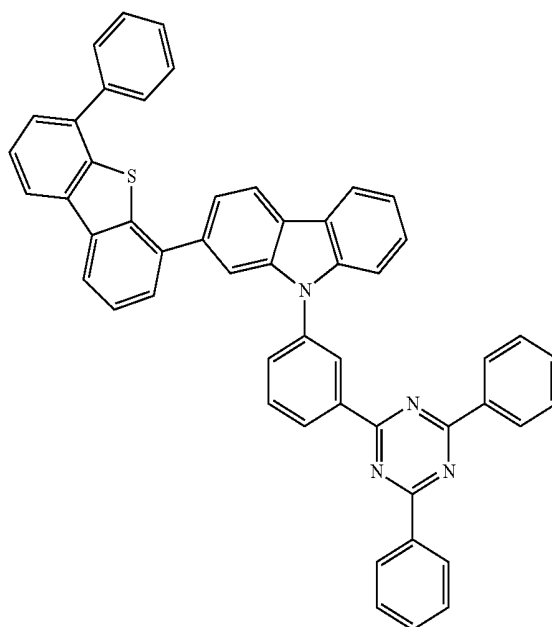
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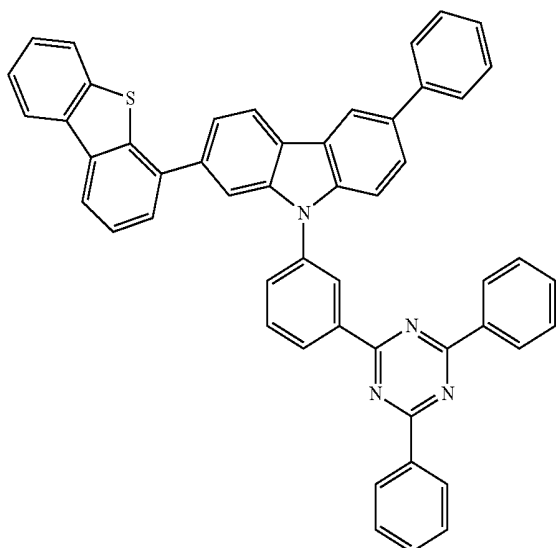


H2-62

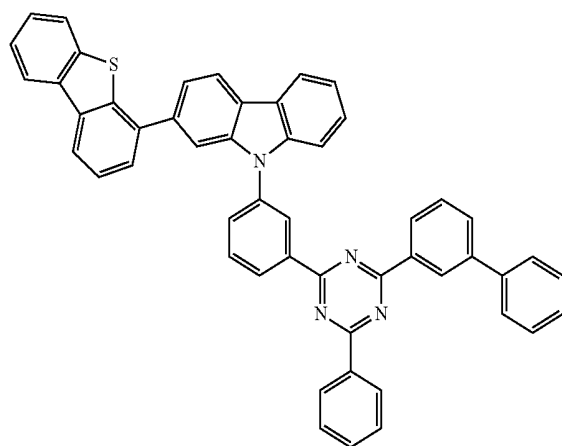


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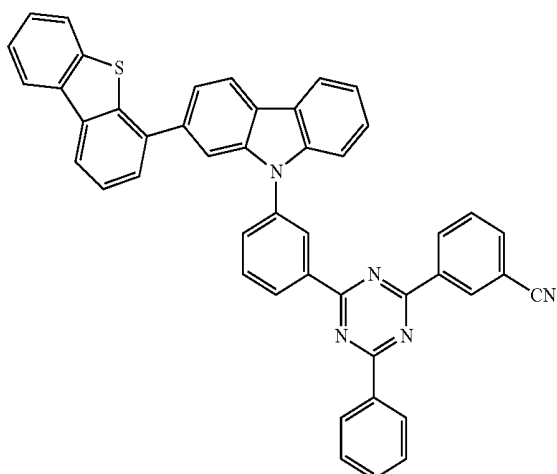
H2-63



H2-64

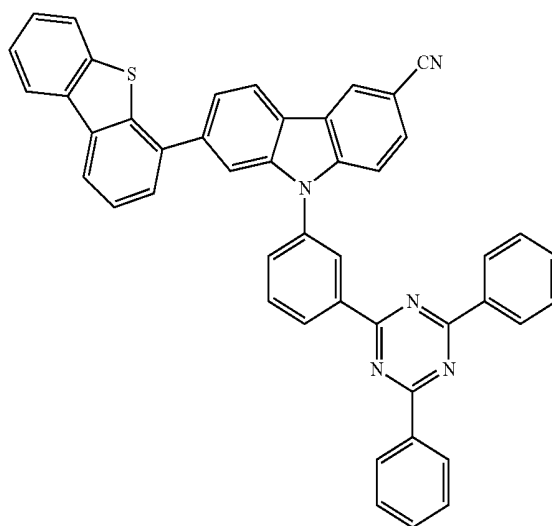


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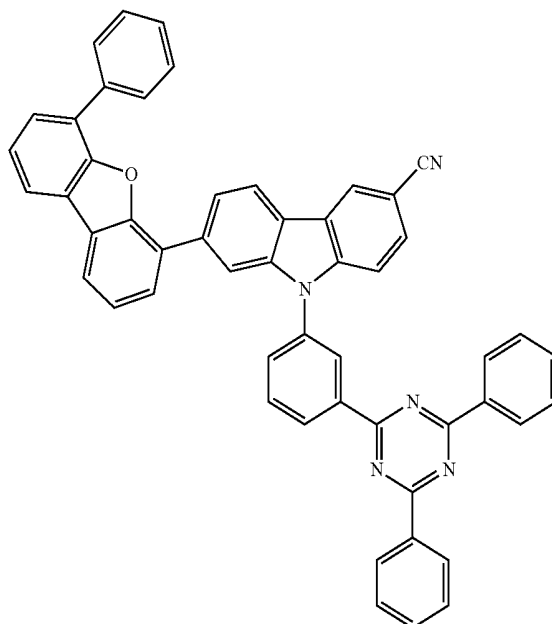


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H2-66

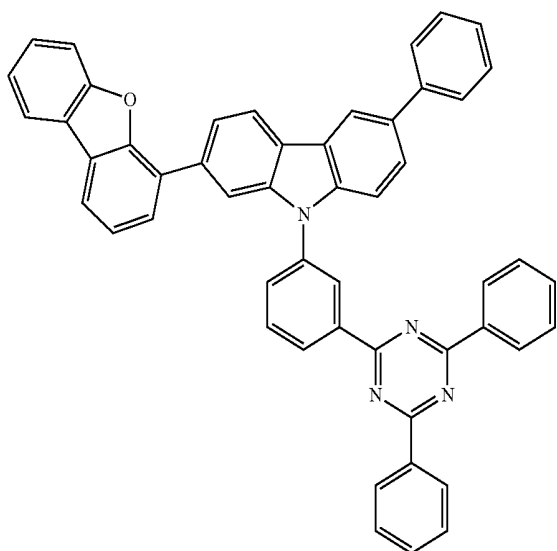


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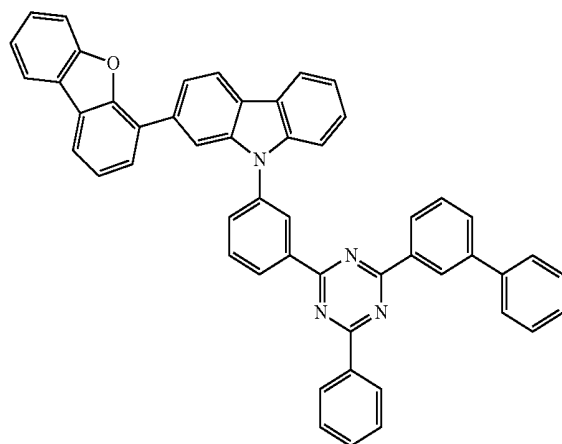


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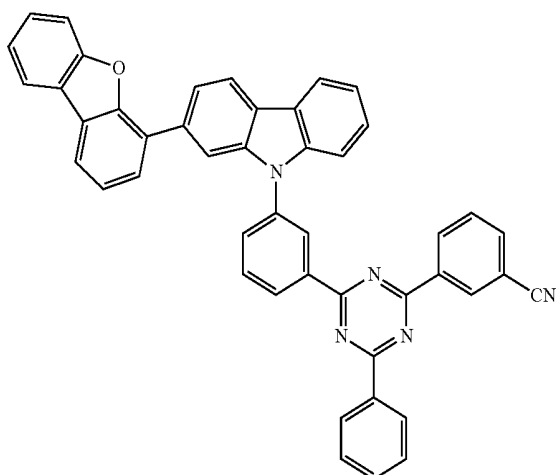
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H2-69

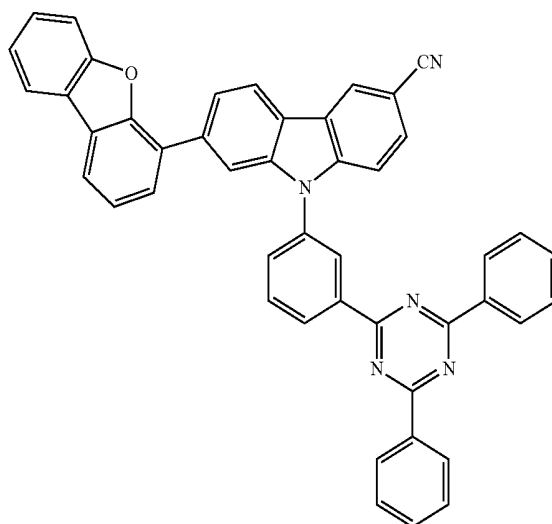


H2-70

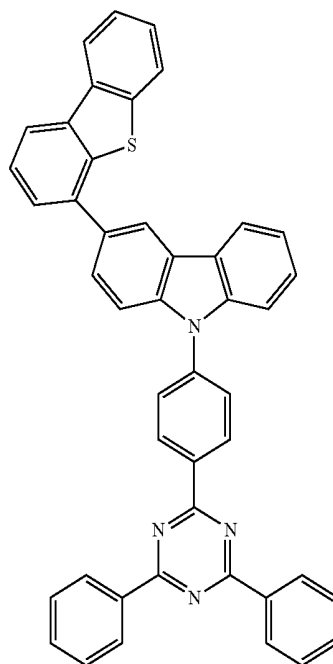


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H2-71



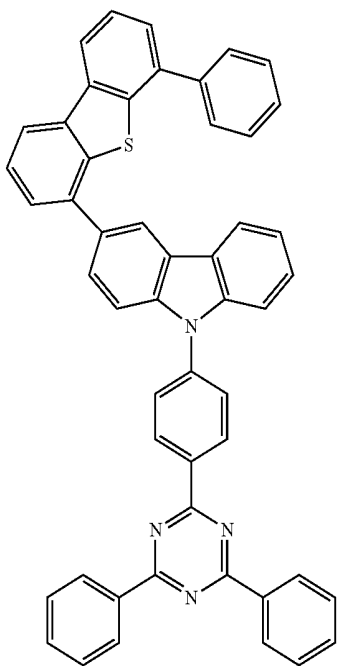
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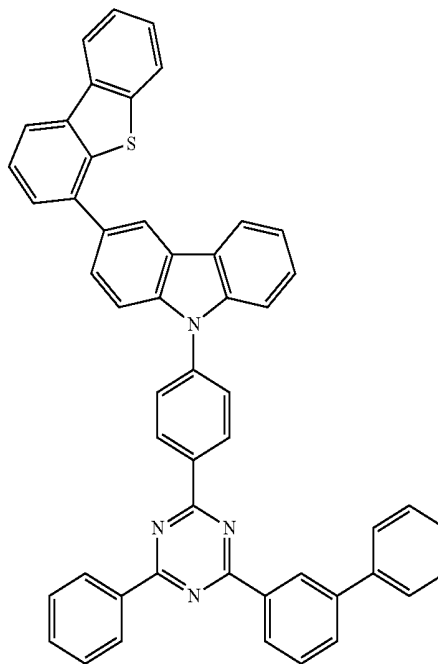
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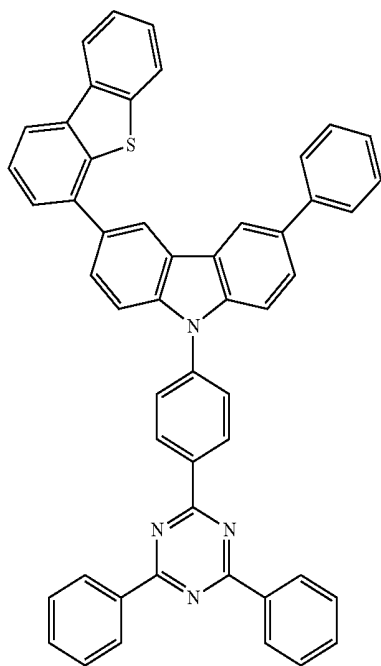
H2-73



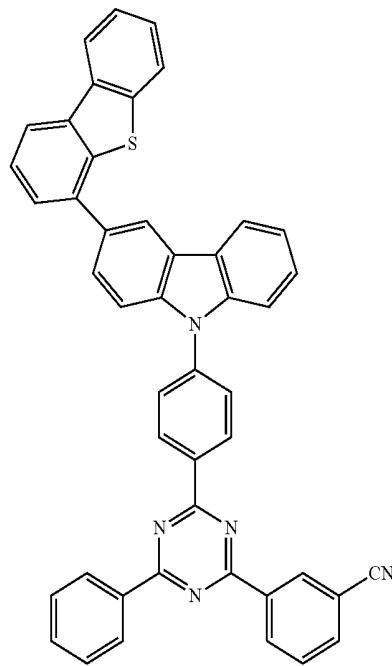
H2-75



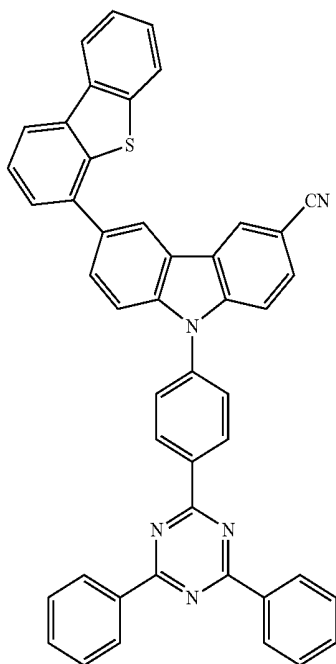
H2-74



H2-76

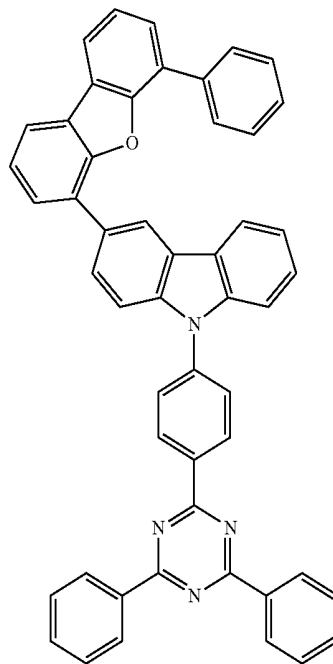


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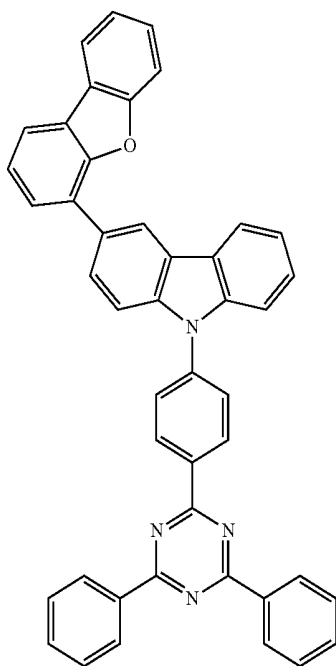


H2-77

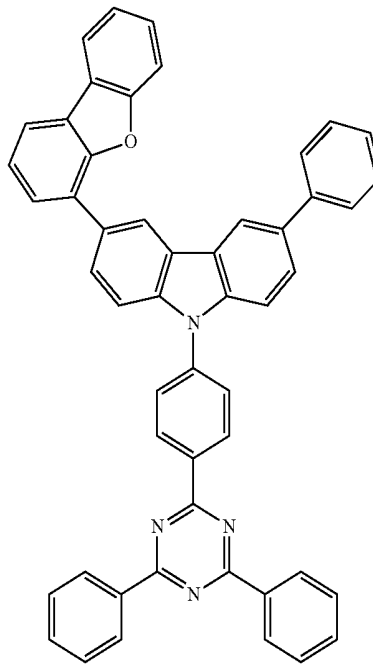
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H2-79



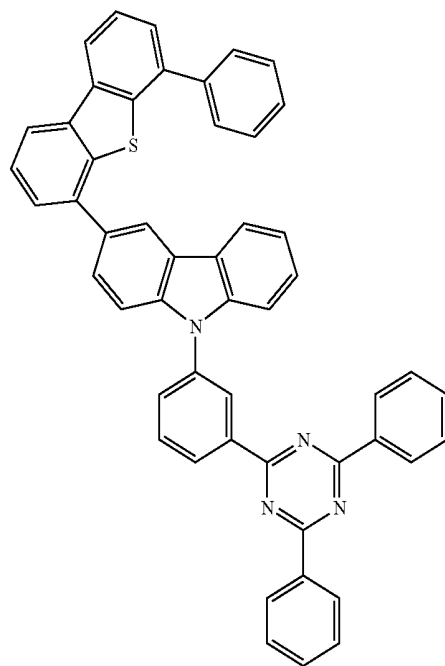
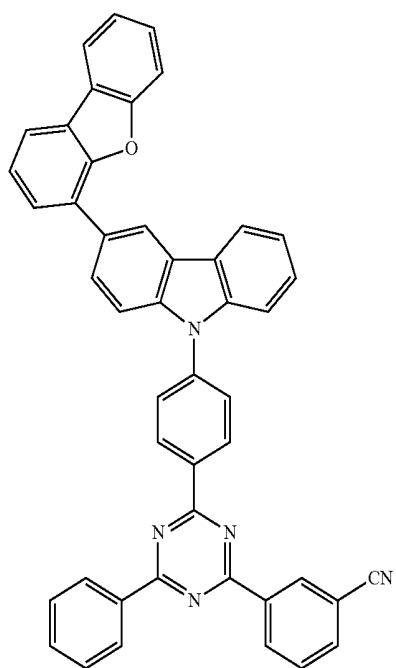
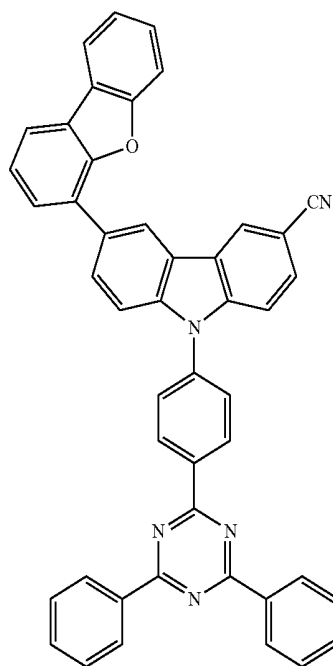
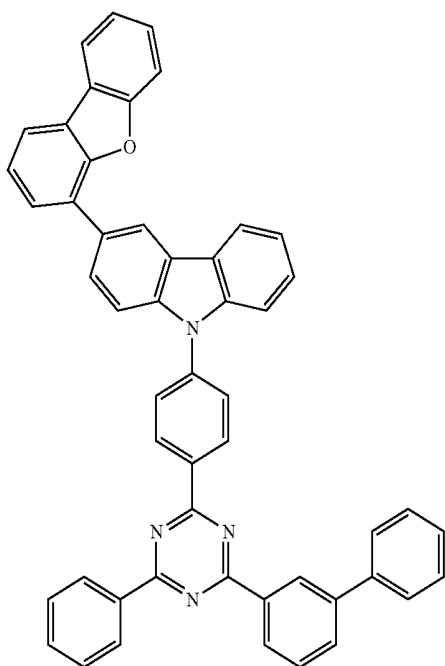
H2-78



H2-80

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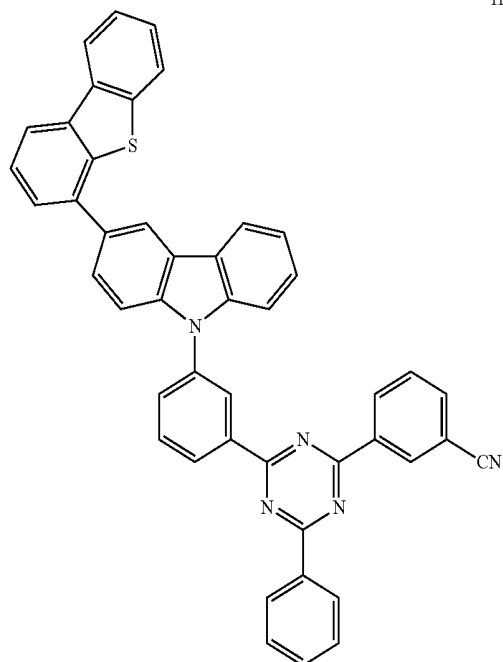
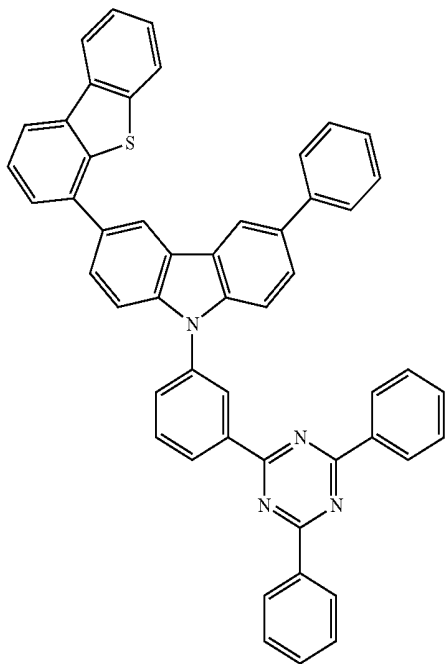


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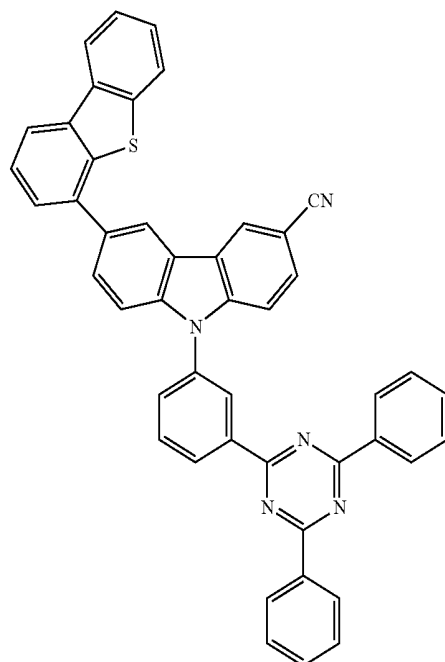
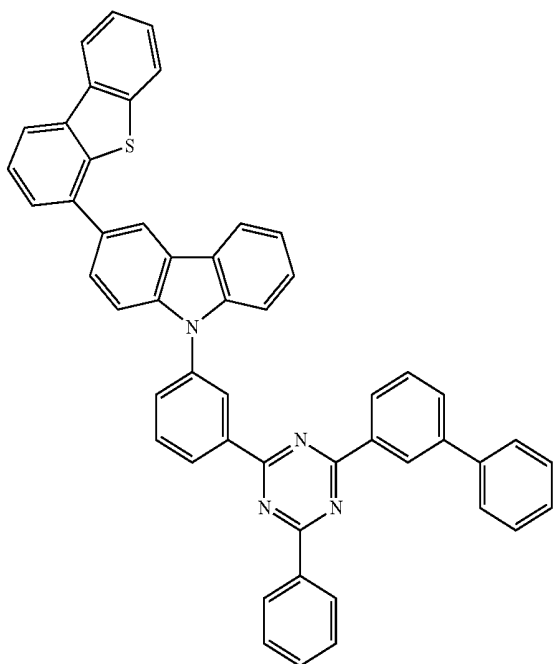
H2-87

H2-85

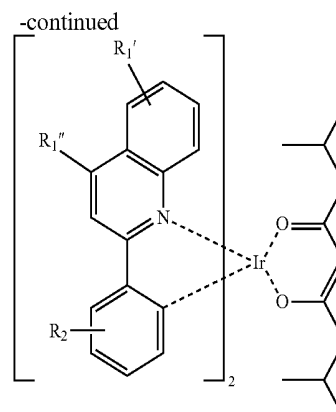
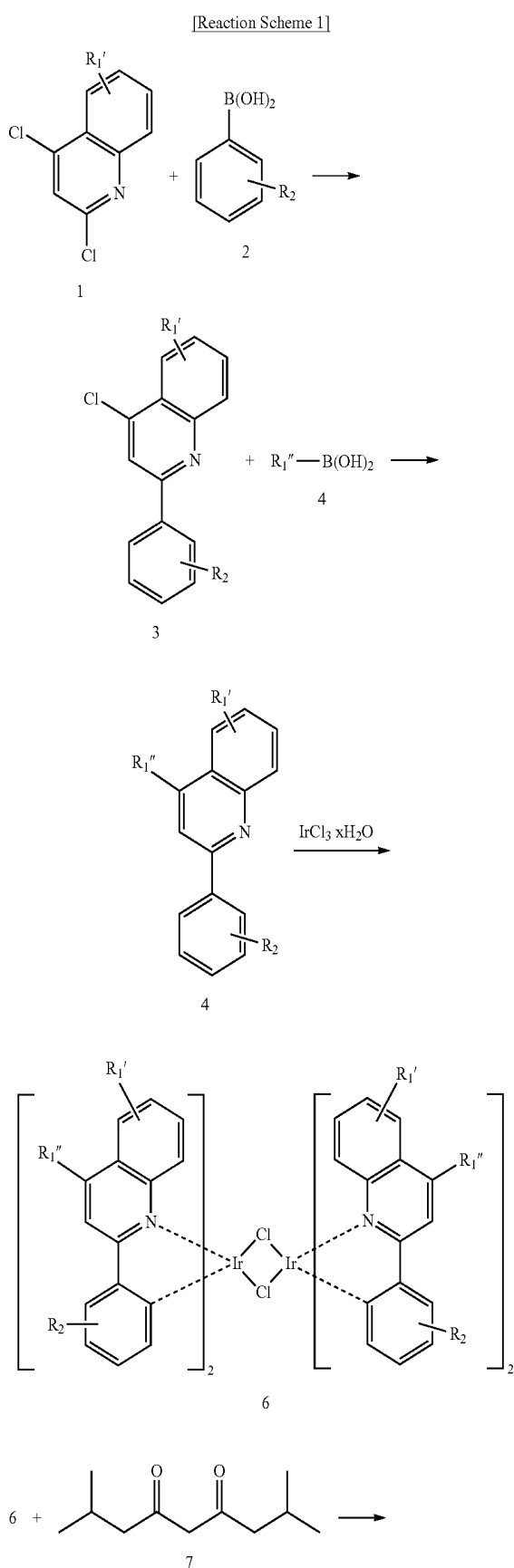


H2-88

H2-86



[0032] The compounds represented by formulas 1 and 2 can be prepared by a synthetic method known to a person skilled in the art. For example, the compound of formula 1 can be prepared according to the following reaction scheme.



[0033] wherein R_1 and R_2 are as defined in formula 1 above.

[0034] Specifically, said organic electroluminescent device comprises a first electrode; a second electrode; and at least one organic layer between said first and second electrodes. Said organic layer comprises a light-emitting layer, and said light-emitting layer comprises a combination of one or more dopant compounds represented by formula 1, and one or more host compounds represented by formula 2.

[0035] One of the first and second electrodes can be an anode, and the other can be a cathode. The organic layer 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 inter-layer, and a hole blocking layer.

[0036] Said light-emitting layer is a layer which emits light, and it may be a single layer, or it may be a multi layer of which two or more layers are laminated. The light-emitting layer can also inject/transfer electrons/holes besides emitting light. The dopant is preferably doped in an amount of less than 25 wt %, based on the total amount of the dopant and host of the light-emitting layer.

[0037] Another embodiment of the present invention provides a dopant and host combination of one or more dopant compounds represented by formula 1, and one or more host compounds represented by formula 2, and an organic EL device comprising the dopant and host combination.

[0038] Still another embodiment of the present invention provides an organic electroluminescent material comprising the combination of one or more dopant compounds represented by formula 1, and one or more host compounds represented by formula 2, and an organic EL device comprising the material. Said material can be comprised of the combination of a compound represented by formula 1 and a compound represented by formula 2 alone, or can further include conventional materials generally used in organic electroluminescent materials.

[0039] Still another embodiment of the present invention provides an organic electroluminescent layer containing the combination of one or more dopant compounds represented by formula 1, and one or more host compounds represented by formula 2. Said organic layer comprises plural layers. Said dopant compound and host compound can be comprised in the same layer, or can be comprised in different layers. In addition, the present invention provides an organic EL device comprising the organic layer.

[0040] The organic electroluminescent device of the present invention comprises compounds of formulas 1 and 2, and

may further comprise at least one compound selected from the group consisting of arylamine-based compounds and styrylarylamine-based compounds.

[0041] In addition, in the organic electroluminescent device according to the present invention, the organic layer 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 4th period, transition metals of the 5th period, lanthanides and organic metals of d-transition elements of the Periodic Table, or at least one complex compound comprising said metal. Further, said organic layer may further comprise a light-emitting layer and a charge generating layer.

[0042] In addition, the organic electroluminescent device of the present invention may emit white light by further comprising at least one light-emitting layer which comprises a blue electroluminescent compound, a red electroluminescent compound or a green electroluminescent compound known in the field. Also, if necessary, a yellow or orange light-emitting layer can be comprised in the device.

[0043] 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 electrodes; 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 SiO_x (1 ≤ x ≤ 2), AlO_x (1 ≤ x ≤ 1.5), SiON, SiAlON, etc.; said metal halide includes LiF, MgF₂, CaF₂, a rare earth metal fluoride, etc.; and said metal oxide includes Cs₂O, Li₂O, MgO, SrO, BaO, CaO, etc.

[0044] 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.

[0045] 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 dopant and host compounds of the present invention may be co-evaporated or mixture-evaporated.

[0046] 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.

[0047] 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.

[0048] By using the organic electroluminescent device of the present invention, a display system or a lighting system can be produced.

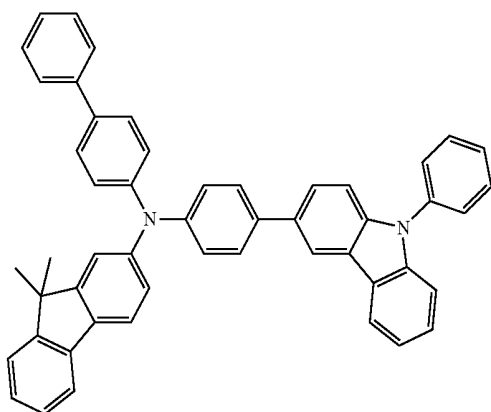
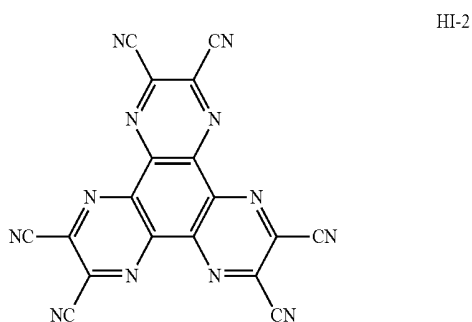
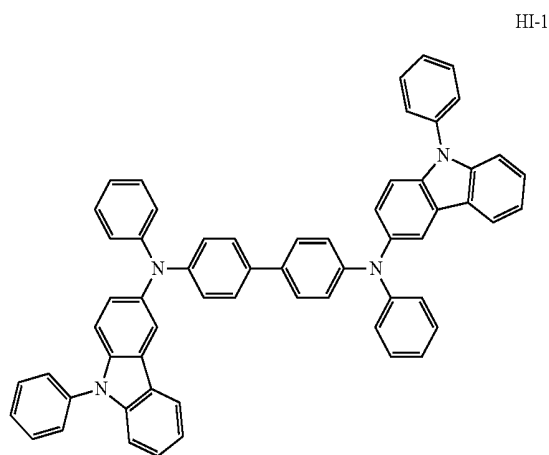
[0049] Hereinafter, the luminescent properties of the device comprising the dopant compound and the host compound of the present invention will be explained in detail with reference to the following examples.

DEVICE EXAMPLE 1

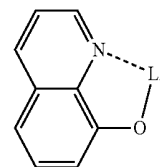
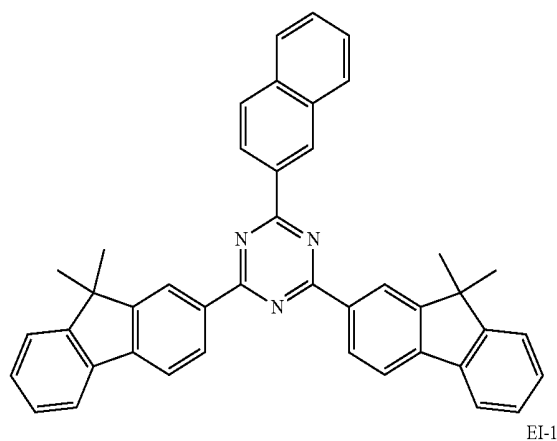
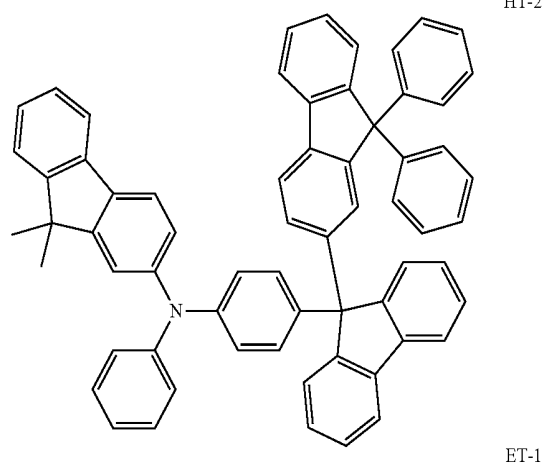
Preparation of an OLED Device Comprising the Dopant and the Host of the Present Invention

[0050] An OLED device was produced using the dopant and host compounds according to the present invention. A transparent electrode indium tin oxide (ITO) thin film (10 Ω/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. N⁴,N^{4'}-diphenyl-N⁴,N^{4'}-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. N-(4-(9,9-diphenyl-9H,9'H-[2,9'-bifluorene-9'-yl)phenyl)-9,9-dimethyl-N-phenyl-9H-fluorene-2-amine (compound HT-2) 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 second hole transport layer having a thickness of 60 nm on the first hole transport layer. A host compound listed in Table 1 was introduced into one cell of said vacuum vapor depositing apparatus as a host, and a

dopant compound was introduced into another cell. The host material was evaporated while the dopant was evaporated at a different rate from the host material, 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 second hole transport layer. 2,4-bis(9,9-dimethyl-9H-fluorenyl)-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.



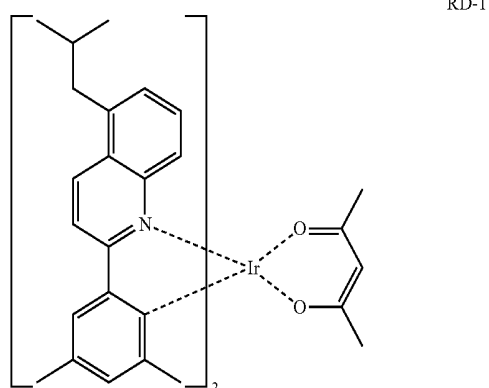
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COMPARATIVE EXAMPLE 1

Preparation of an OLED Device Comprising the Host Compound of the Present Invention and a Conventional Dopant Compound

[0051] An OLED device was produced in the same manner as in Device Examples 1, except for using compound RD-1 as a dopant of the light-emitting layer.



[0052] The evaluation results of the OLED device produced in Device Example 1 and

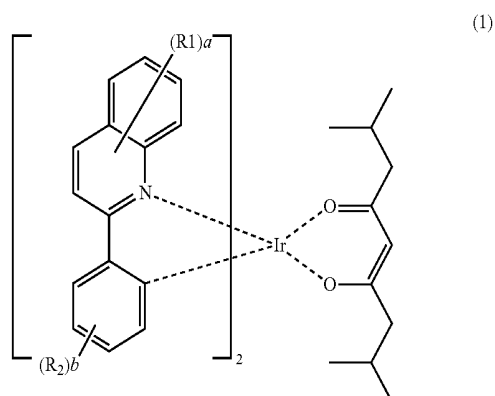
[0053] Comparative Example 1 are shown in Table 1 below.

TABLE 1

	Host	Dopant	Voltage (V)	Efficiency (cd/A)	Color Coordinates (x, y)		Lifespan T95 (hr)
Device Example 1	H2-16	D-29	4.1	32.2	660	339	583
Comparative Example 1	H2-16	RD-1	4.1	29.9	661	338	502

[0054] When the dopant and host compounds according to the present invention are used, an organic EL device having higher luminous efficiency and longer lifespan than the conventional devices is provided.

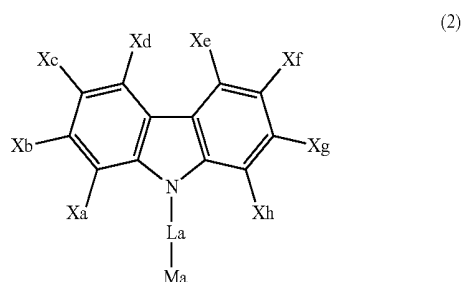
1. A combination of one or more dopant compound represented by the following formula 1, and one or more host compound represented by the following formula 2:



wherein

R_1 and R_2 each independently represent hydrogen, deuterium, a halogen, a substituted or unsubstituted (C1-C6)alkyl, or a substituted or unsubstituted (C6-C30)aryl; and

a and b each independently represent an integer of 1 to 4; where a or b is an integer of 2 or more, each of R_1 and each of R_2 may be the same or different.



wherein

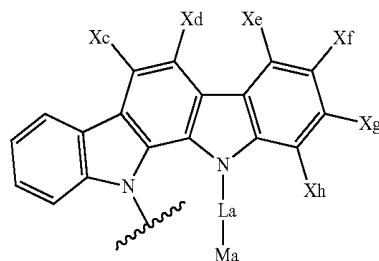
Ma represents a substituted or unsubstituted 5- to 11-membered nitrogen-containing heteroaryl;

La represents a single bond, a substituted or unsubstituted (C6-C30)arylene, or a substituted or unsubstituted 3- to 30-membered heteroarylene;

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 substi-

tuted 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 each other 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;

provided that when any of Xa to Xh are linked to each other to form a ring, the structure of

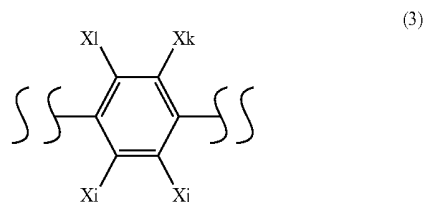


where Xc or Xd is hydrogen, is excluded; and

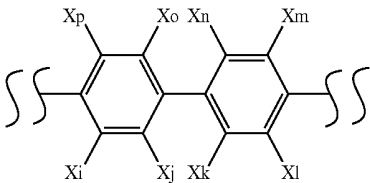
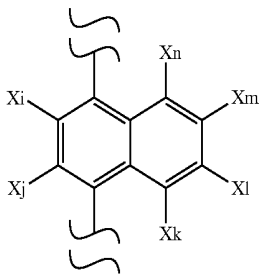
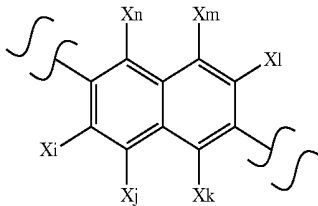
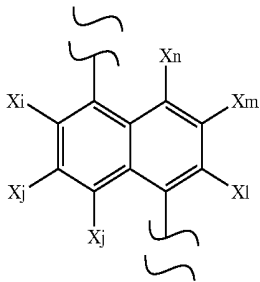
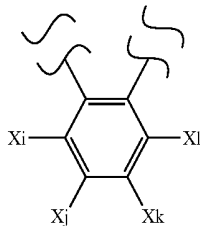
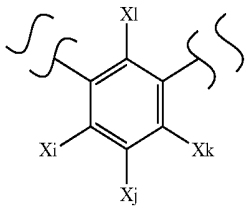
the heteroaryl(ene) contains at least one hetero atom selected from B, N, O, S, Si, and P.

2. The combination according to claim 1, wherein in formula 1, R_1 and R_2 each independently represent hydrogen, a halogen, a substituted or unsubstituted (C1-C6)alkyl, or a substituted or unsubstituted (C6-C12)aryl.

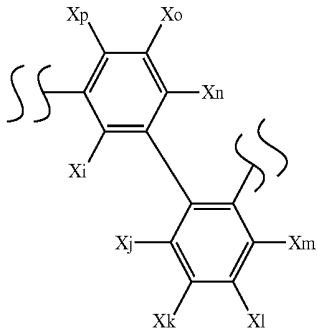
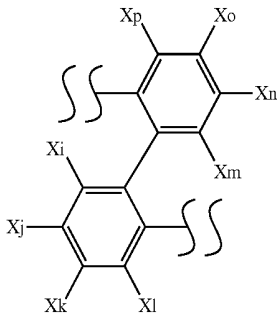
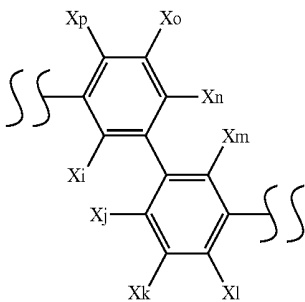
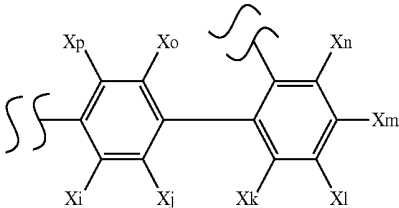
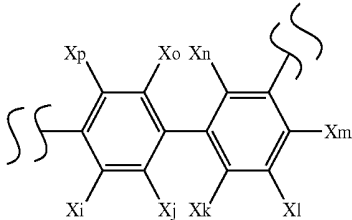
3. The combination according to claim 1, wherein in formula 2, La is represented by a single bond, a carbazylene, or one of the following formulas 3 to 15:



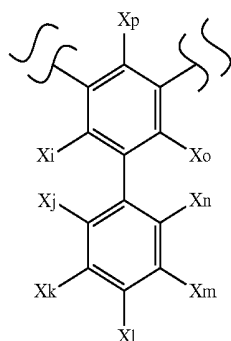
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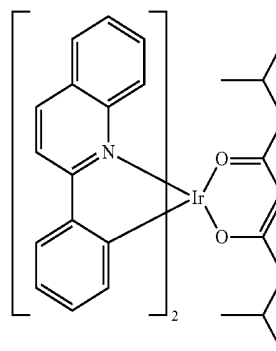
wherein

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 each other 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.

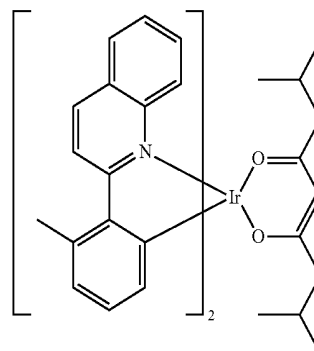
4. The combination according to claim 1, wherein in formula 2, Ma represents a monocyclic ring-type heteroaryl selected from a group consisting of a substituted or unsubstituted pyrrolyl, a substituted or unsubstituted imidazolyl, a substituted or unsubstituted pyrazolyl, a substituted or unsubstituted triazinyl, a substituted or unsubstituted tetrazinyl, a substituted or unsubstituted triazolyl, a substituted or unsubstituted tetrazolyl, a substituted or unsubstituted pyridyl, a substituted or unsubstituted pyrazinyl, a substituted or unsubstituted pyrimidinyl, and a substituted or unsubstituted pyridazinyl, or a fused ring-type heteroaryl selected from a group consisting of a substituted or unsubstituted benzimidazolyl, a substituted or unsubstituted isoindolyl, a substituted or unsubstituted indolyl, a substituted or unsubstituted indazolyl, a substituted or unsubstituted benzothiadiazolyl, a substituted or unsubstituted quinolyl, a substituted or unsubstituted isoquinolyl, a substituted or unsubstituted cinnolyl, a substituted or unsubstituted quinazolinyl, a substituted or unsubstituted naphthyridinyl, a substituted or unsubstituted quinoxalinyl, a substituted or unsubstituted carbazolyl, and a substituted or unsubstituted phenanthridinyl.

5. The combination according to claim 1, wherein in formula 2, Xa to Xh 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 each other to form a substituted or unsubstituted mono- or polycyclic, (C6-C20) aromatic ring.

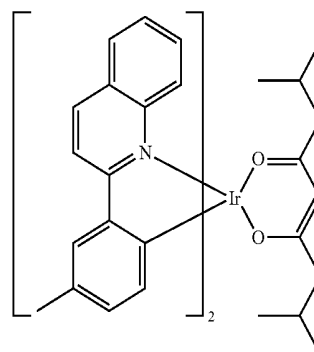
6. The combination according to claim 1, wherein the compound represented by formula 1 is selected from the group consisting of:



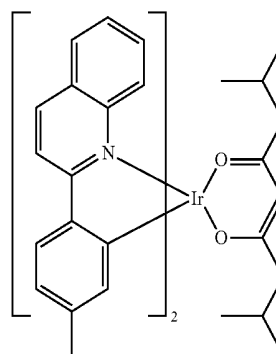
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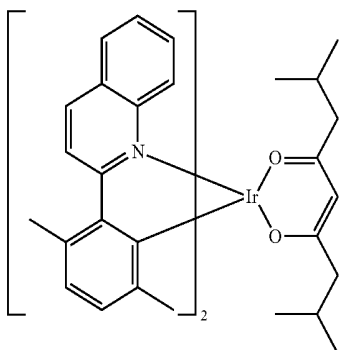


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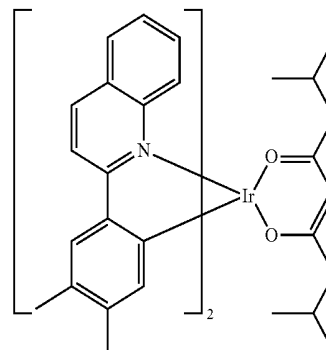
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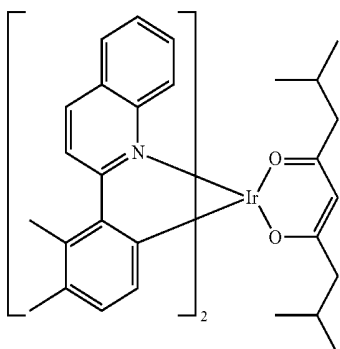


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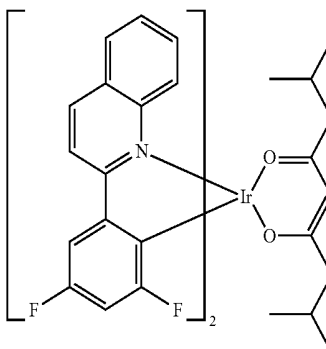
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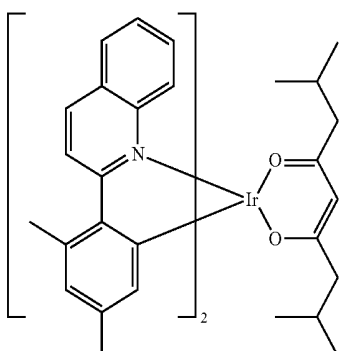
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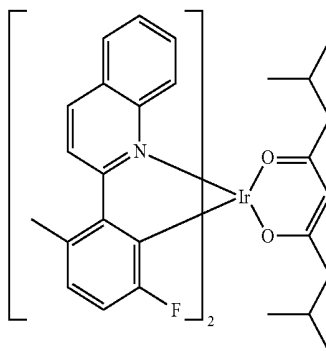
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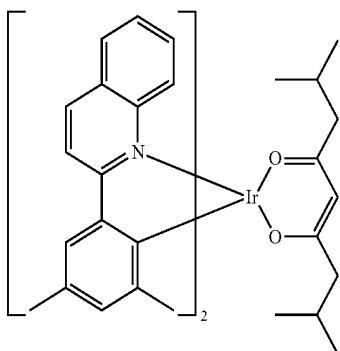
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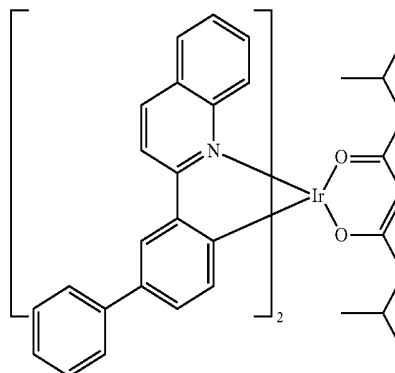
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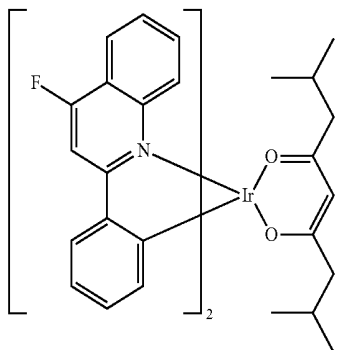


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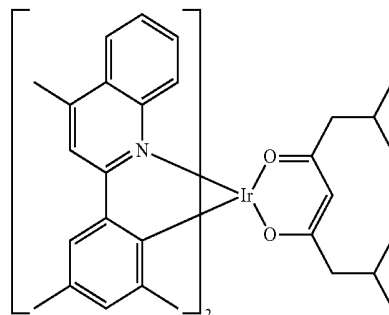
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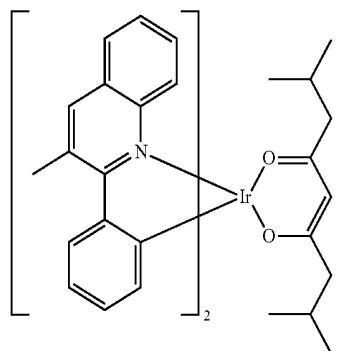


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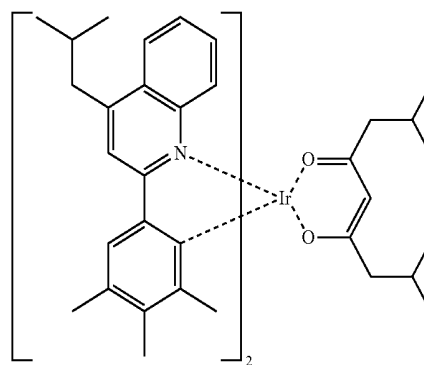
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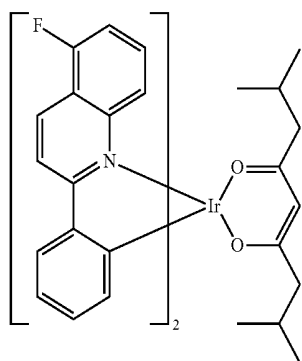
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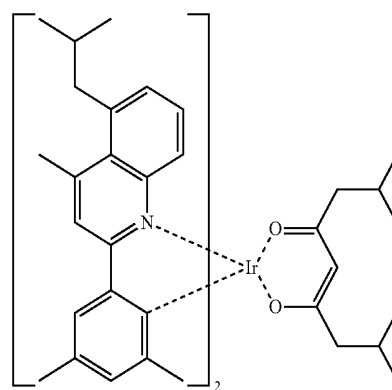
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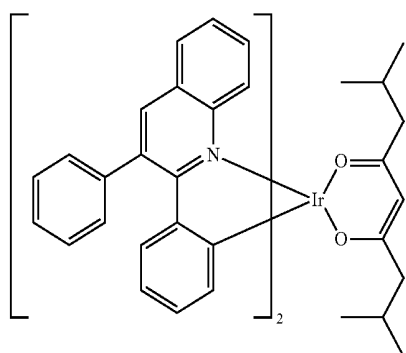
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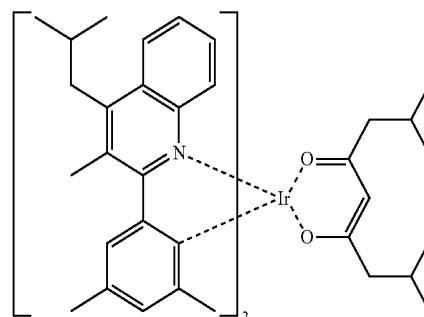
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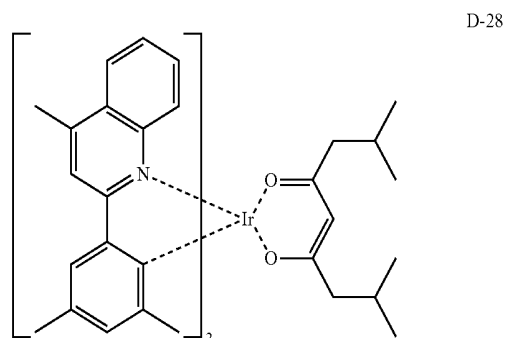
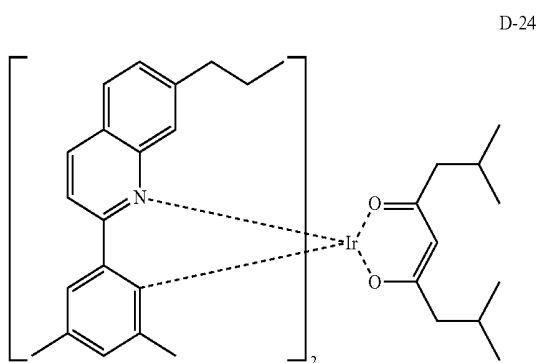
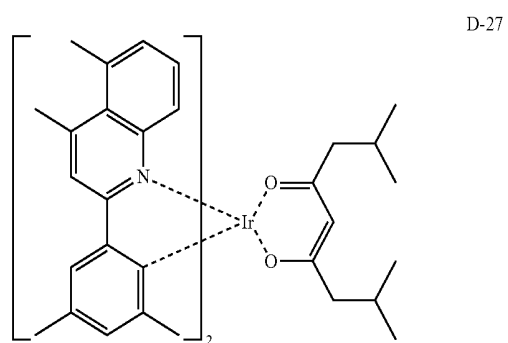
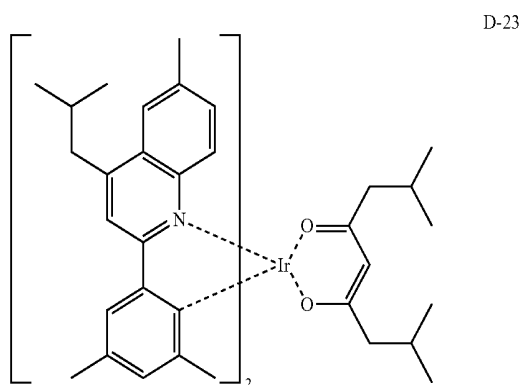
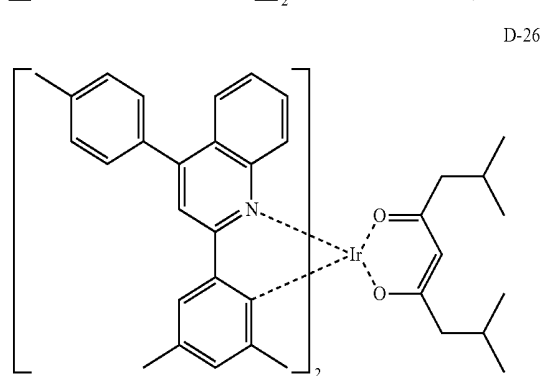
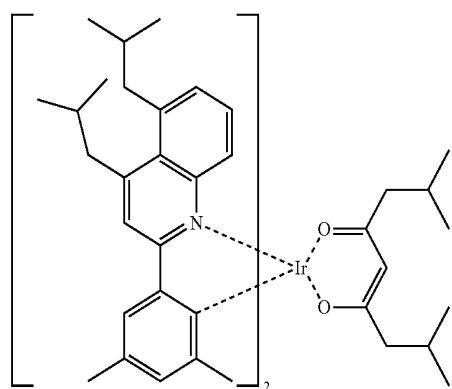
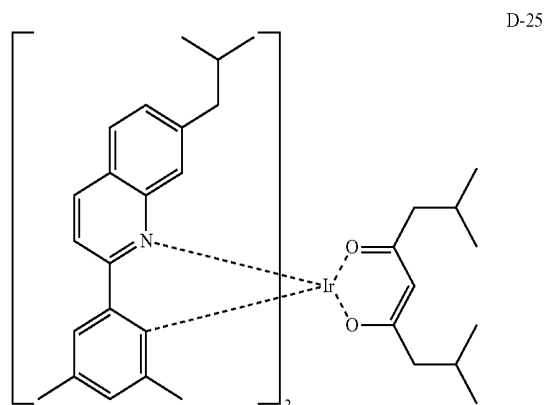
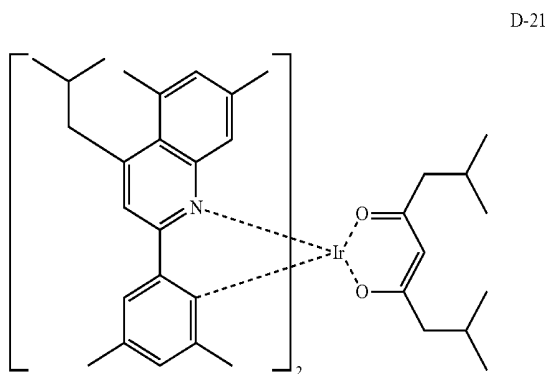
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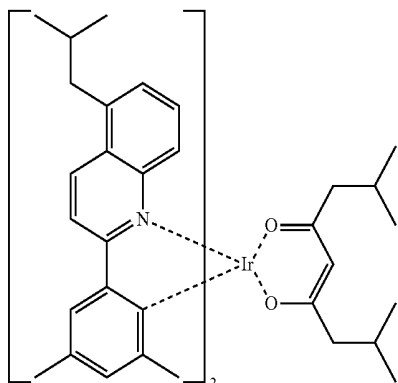
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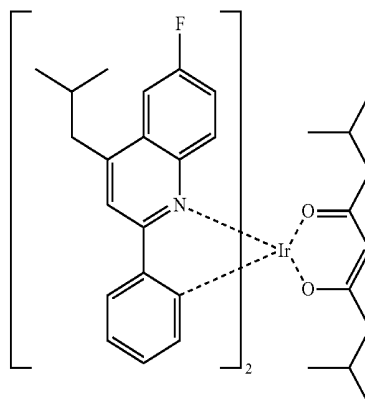


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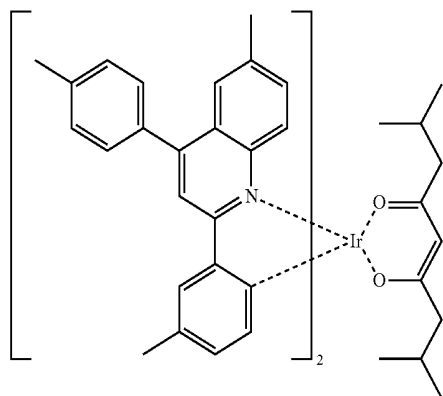


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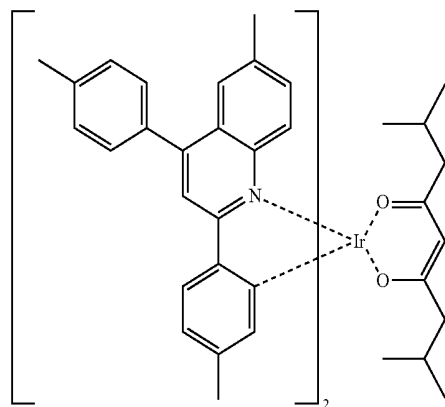
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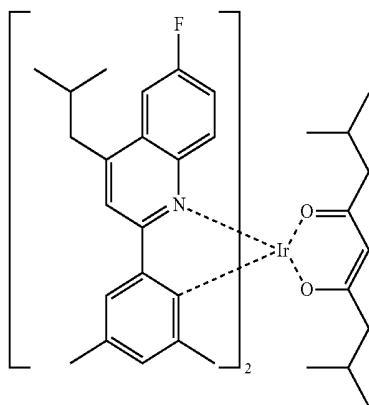
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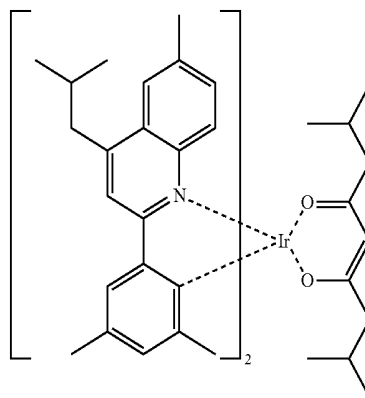
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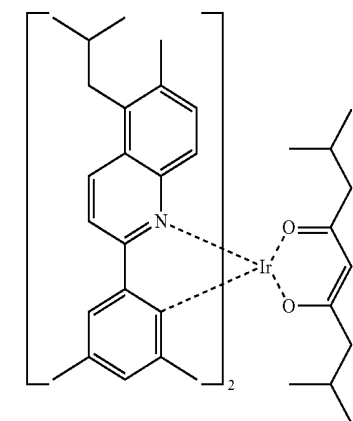
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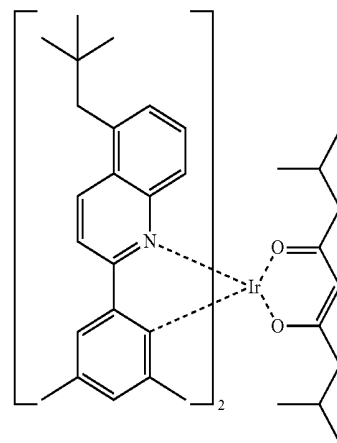
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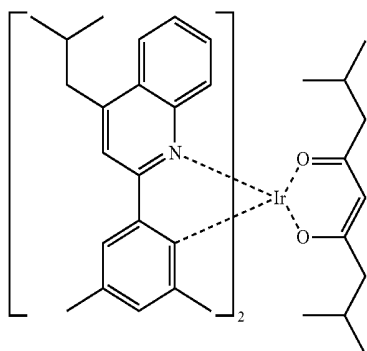


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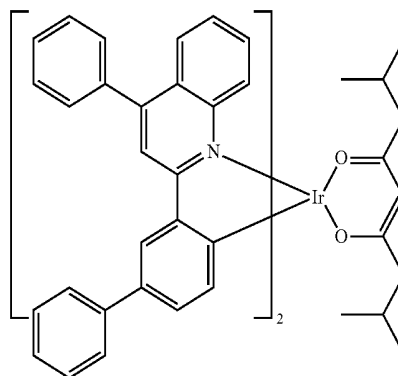
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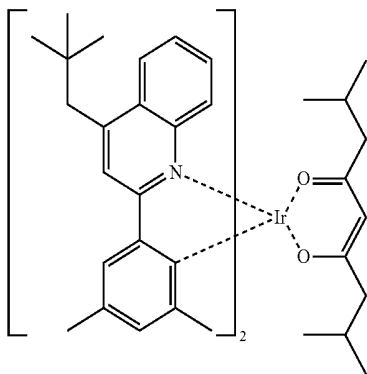


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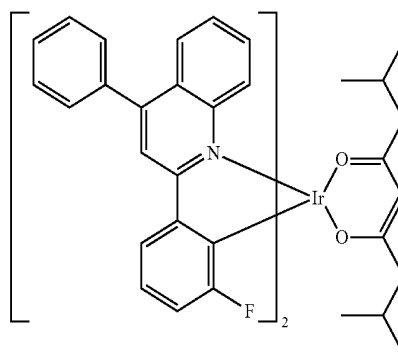
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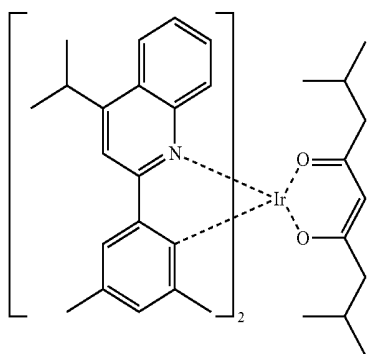
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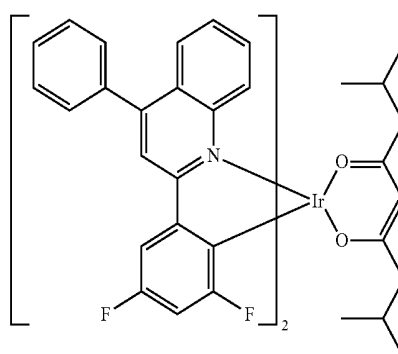
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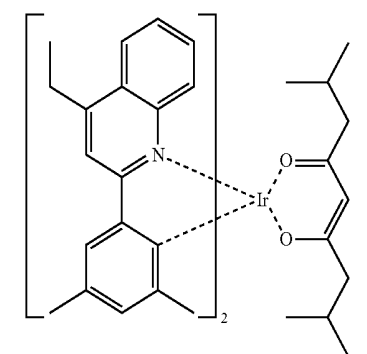
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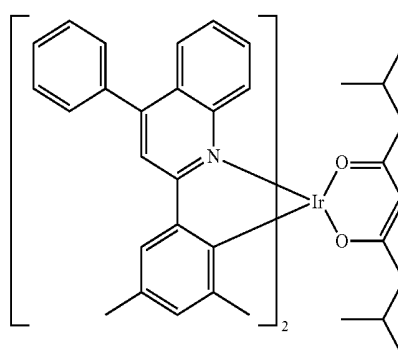
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D-43

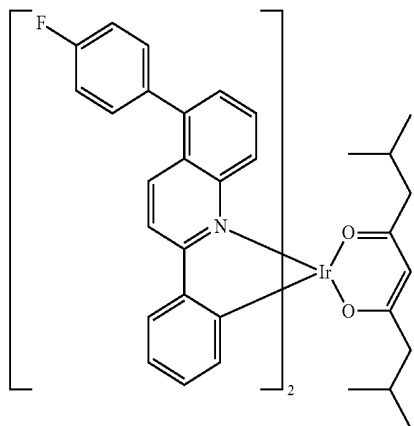


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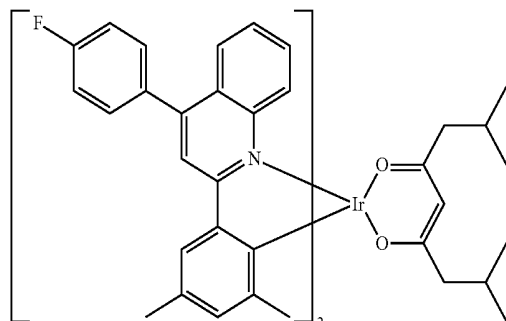
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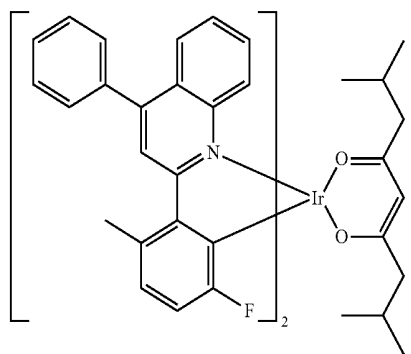


D-45

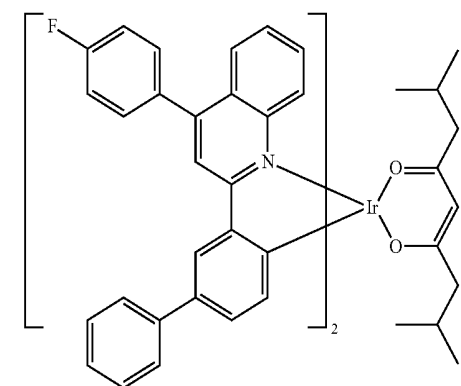
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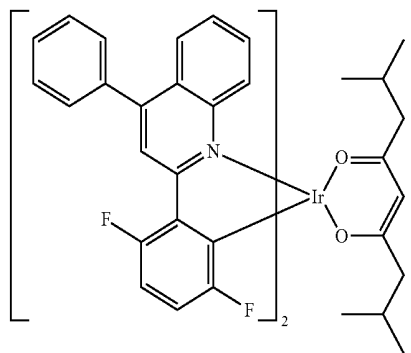
D-49



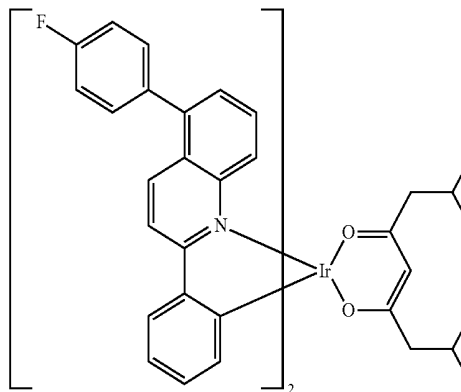
D-46



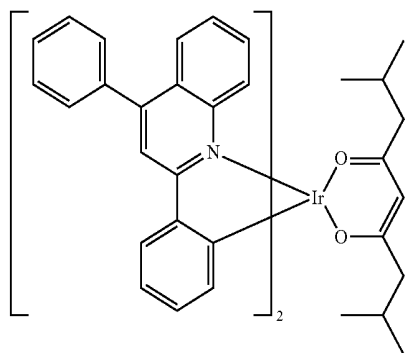
D-50



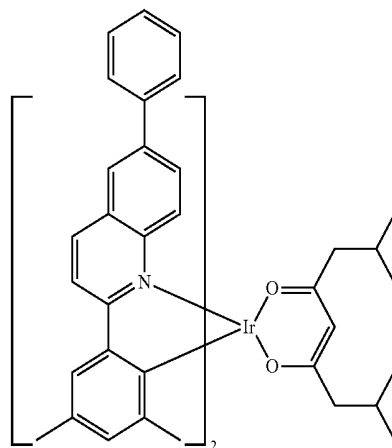
D-47



D-51

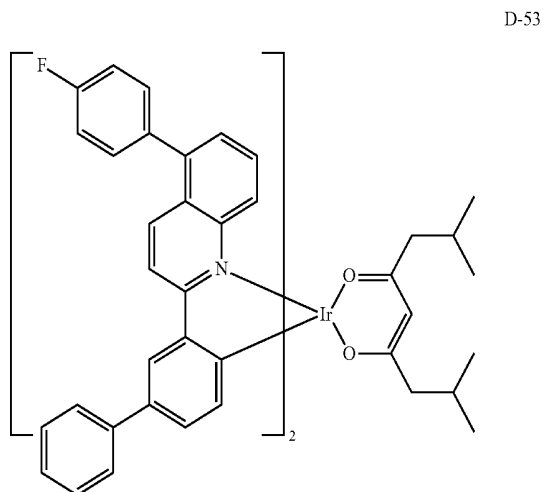


D-48

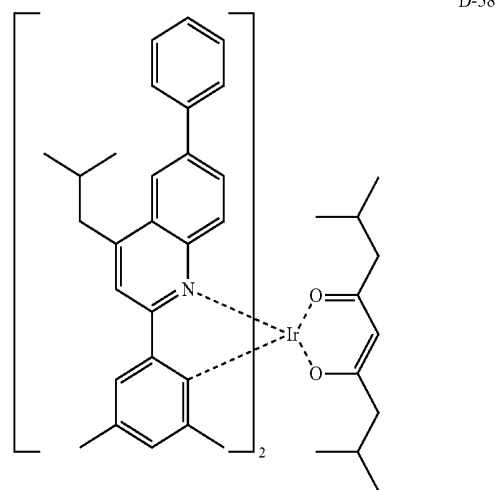
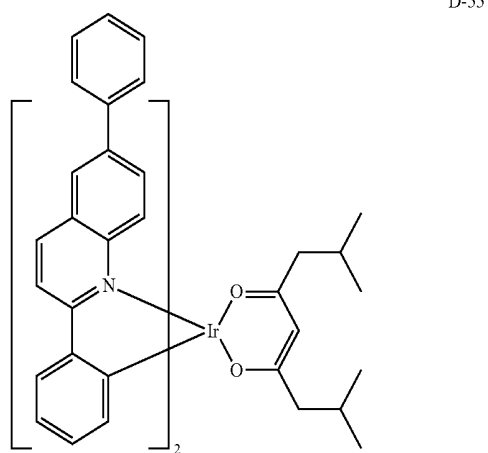
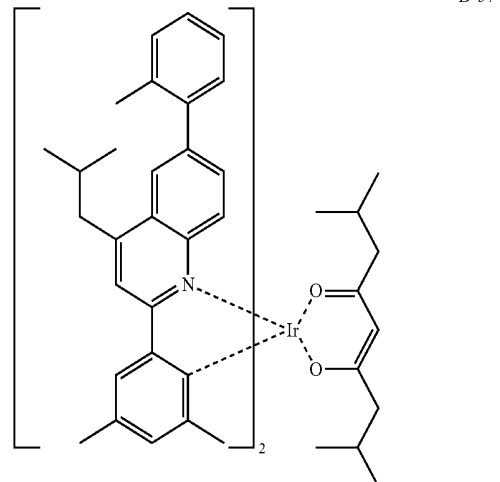
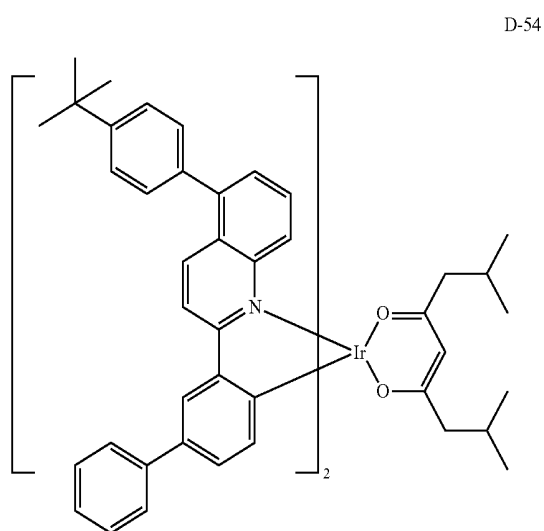
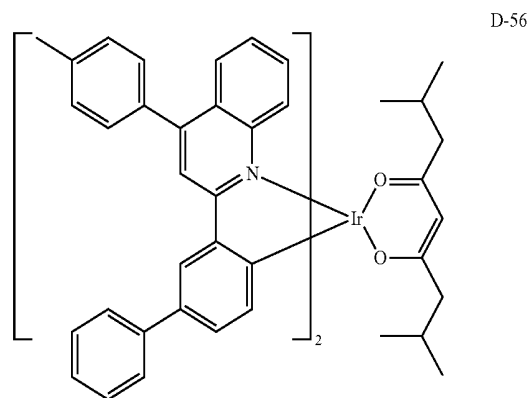


D-52

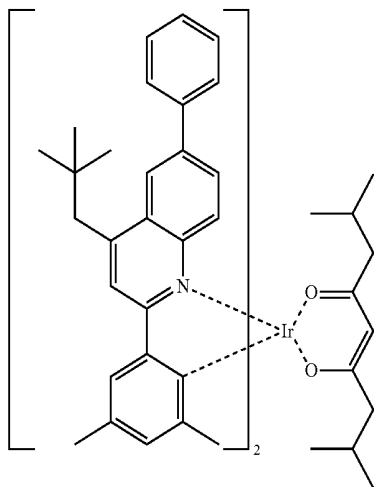
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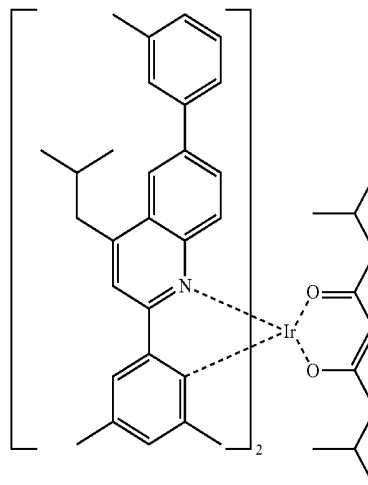


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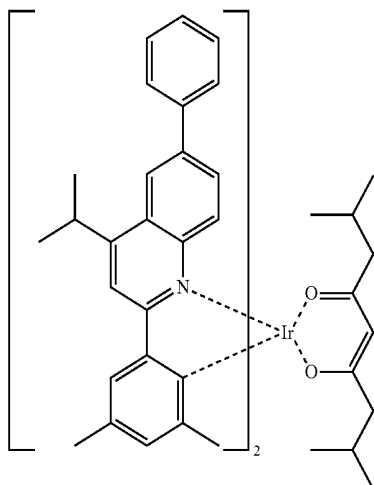


D-59

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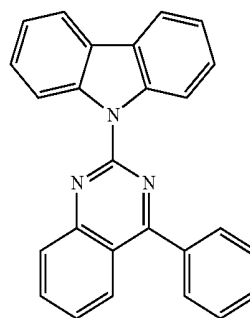


D-62



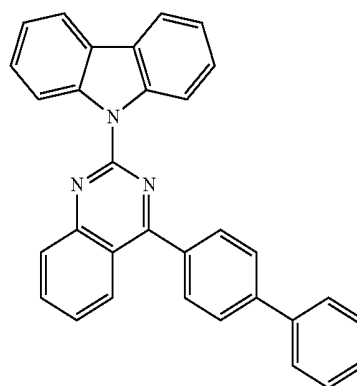
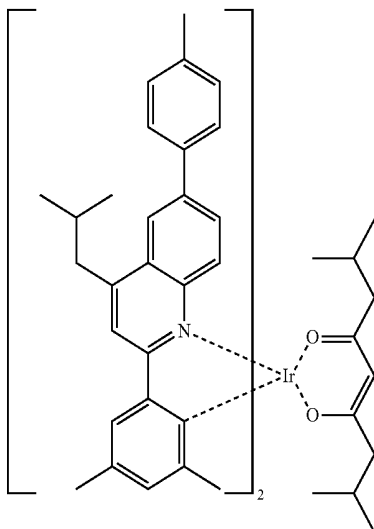
D-60

7. The combination according to claim 1, wherein the compound represented by formula 2 is selected from the group consisting of:



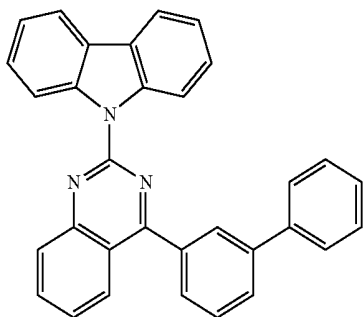
H2-1

D-61

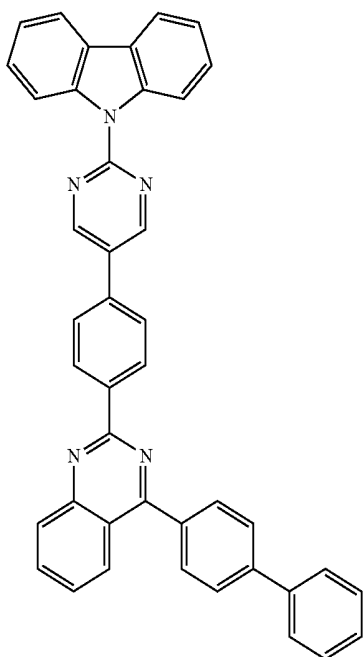


H2-2

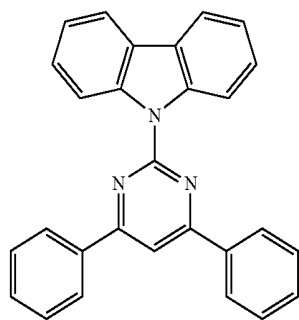
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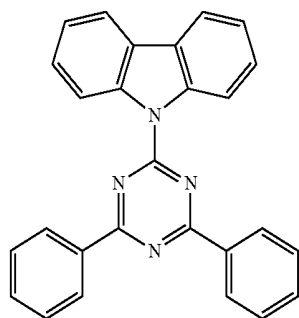
H2-3



H2-4

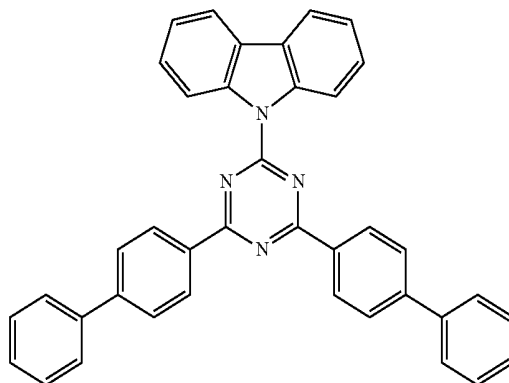


H2-5

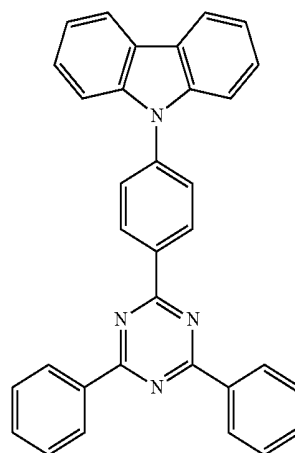


H2-6

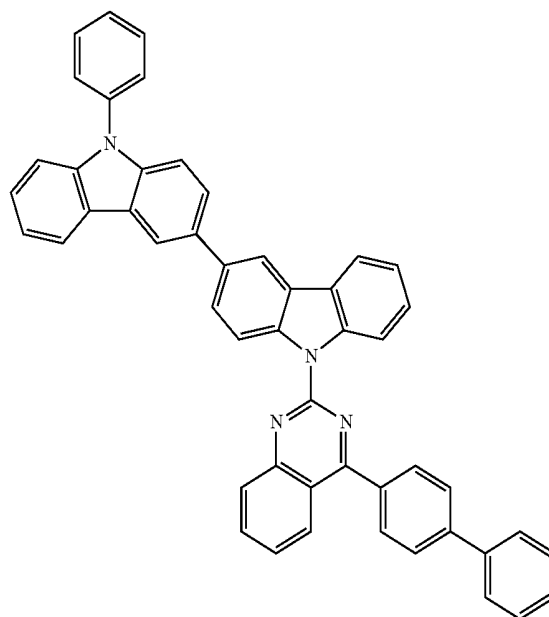
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H2-7



H2-8

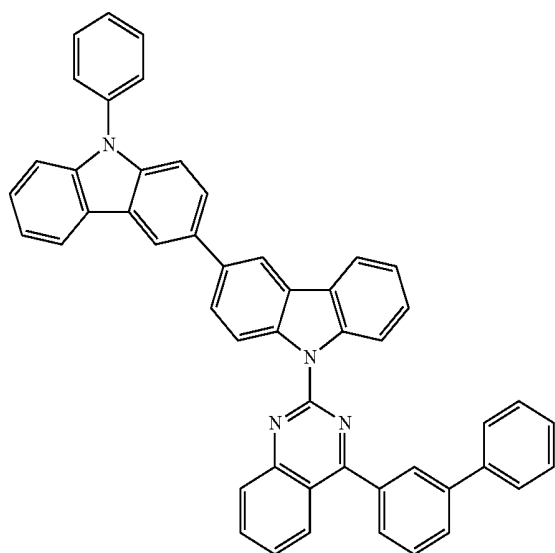


H2-9

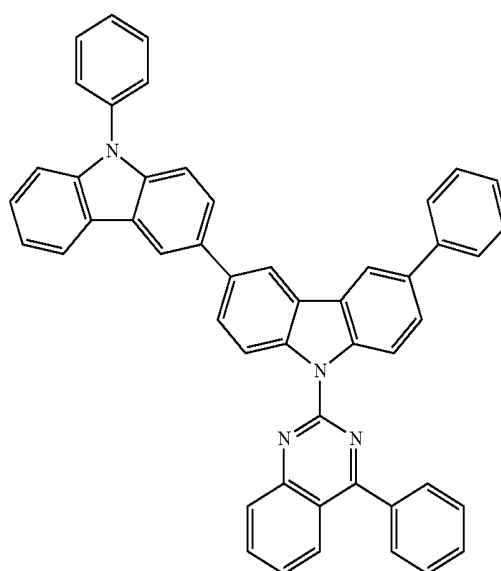
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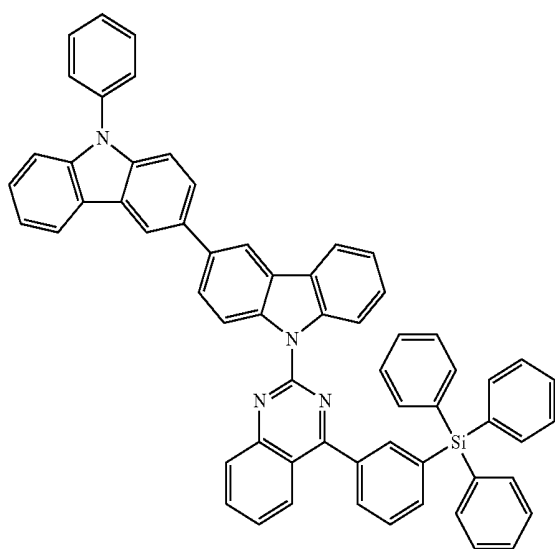
H2-10



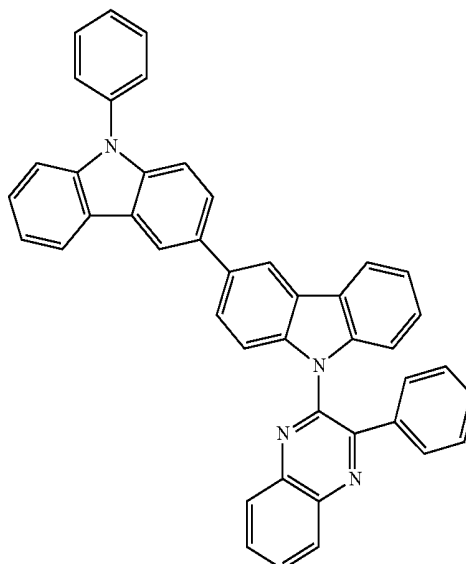
H2-12



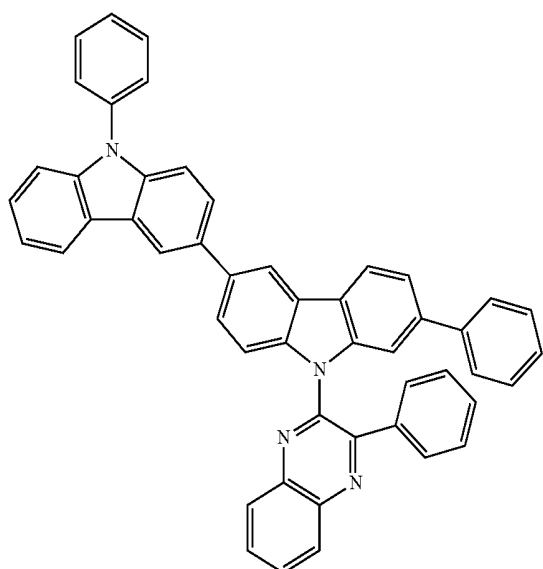
H2-11



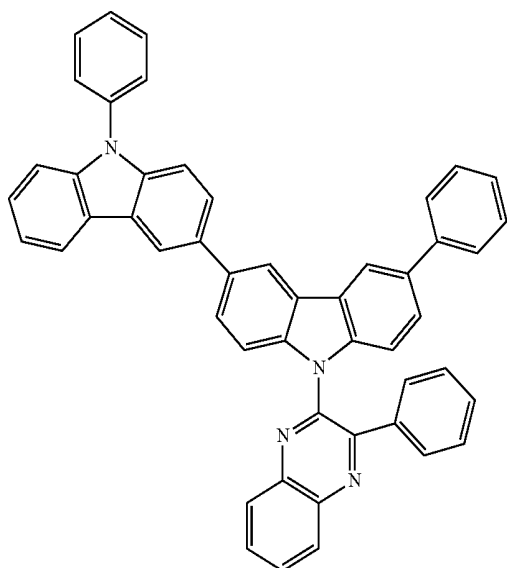
H2-13



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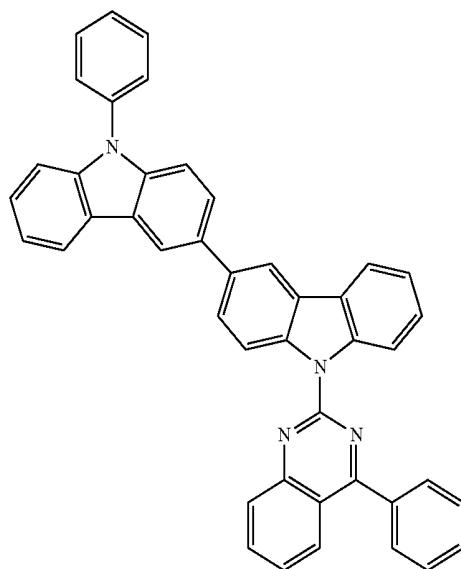


H2-15

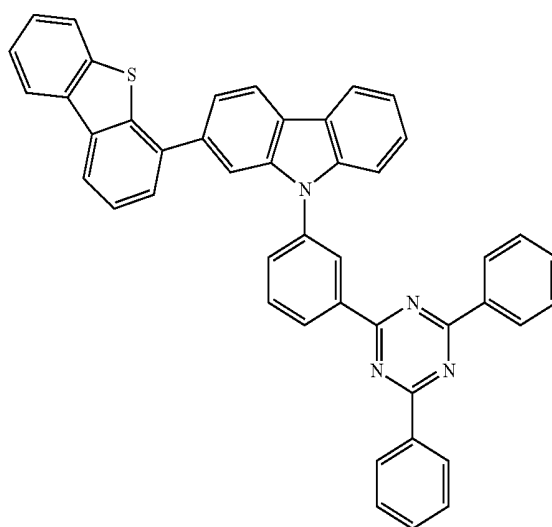


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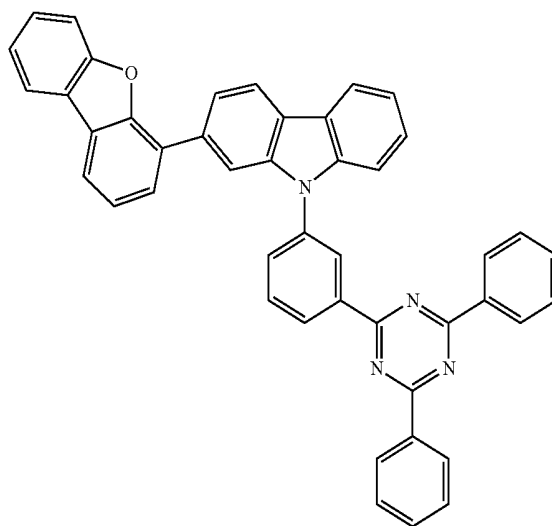
H2-16



H2-17

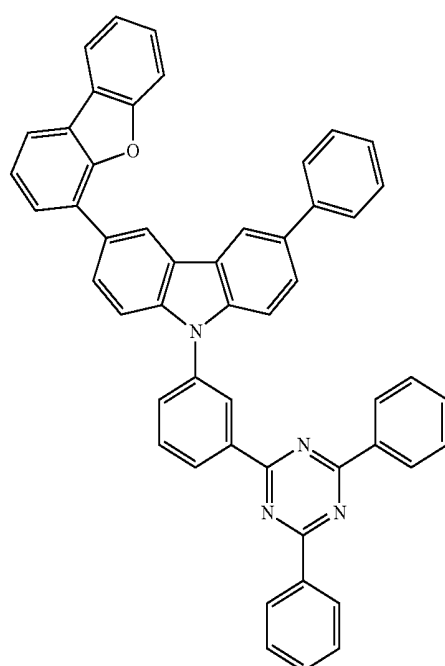
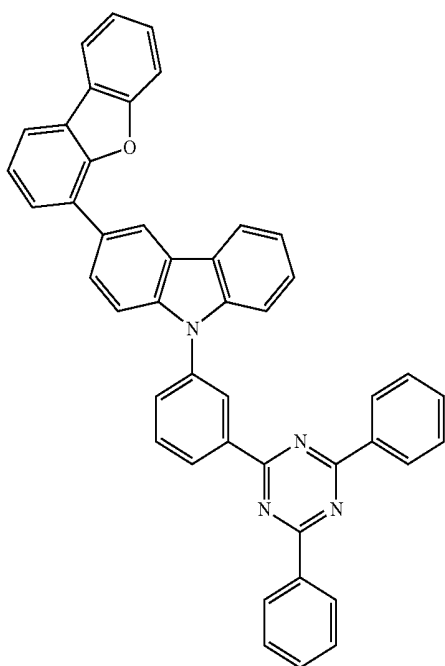
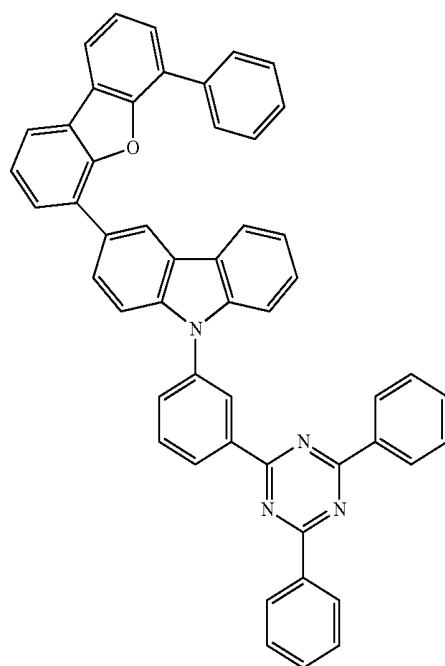
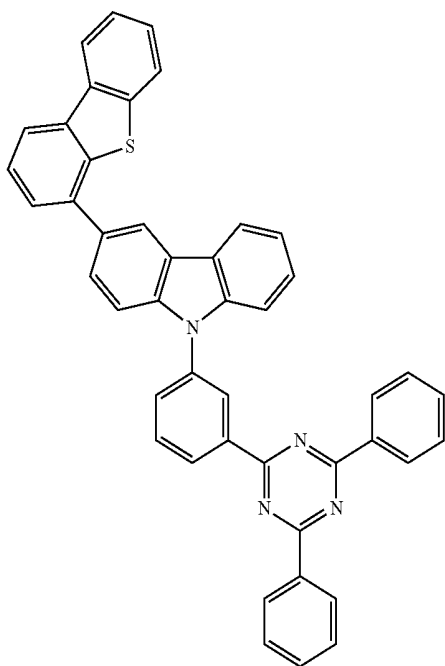


H2-18



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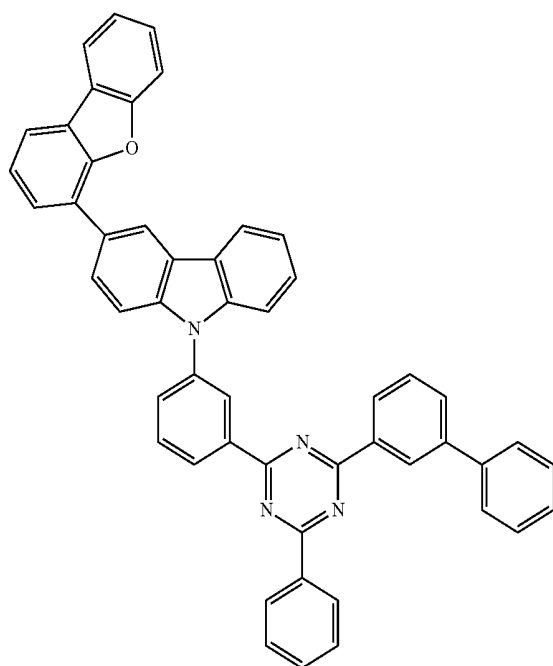
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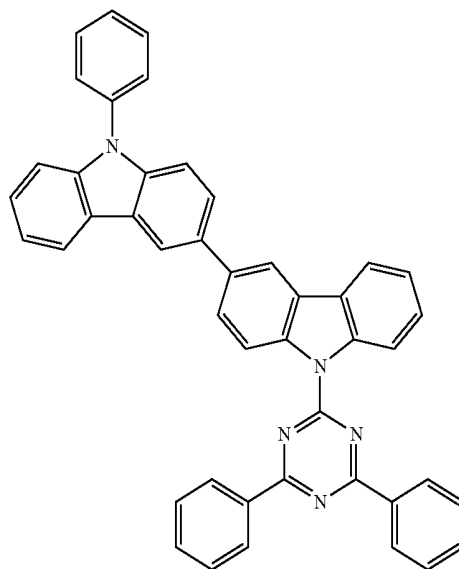
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H2-23

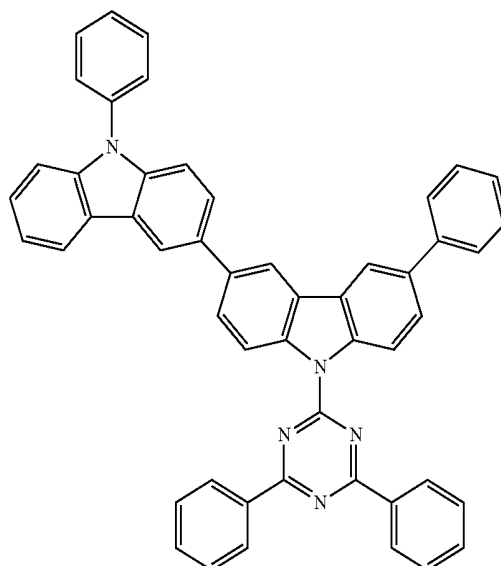
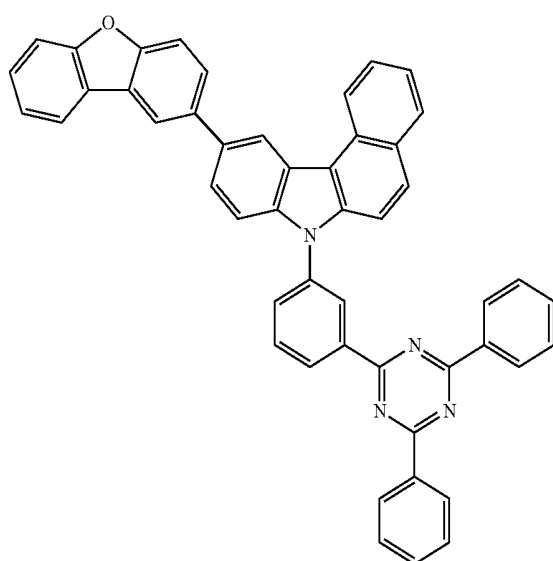


H2-25



H2-26

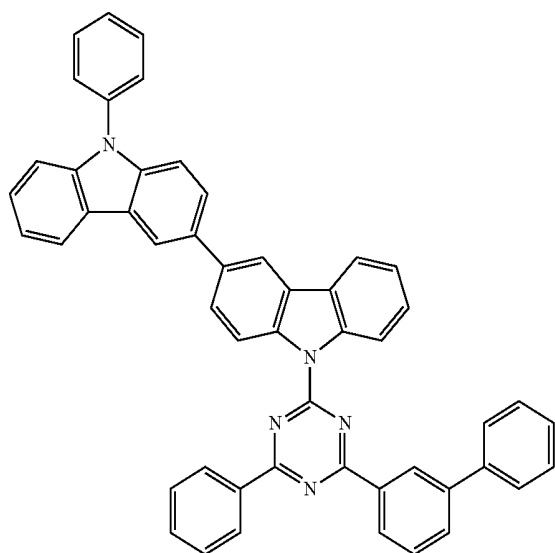
H2-24



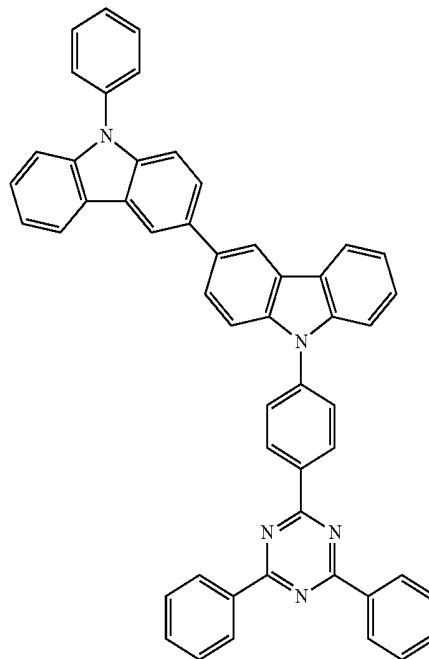
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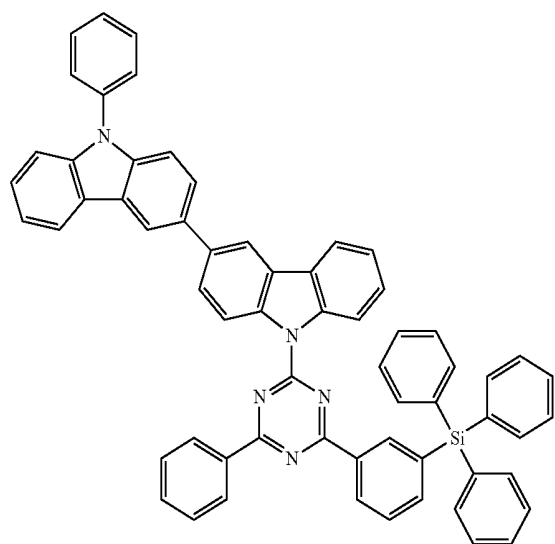
H2-27



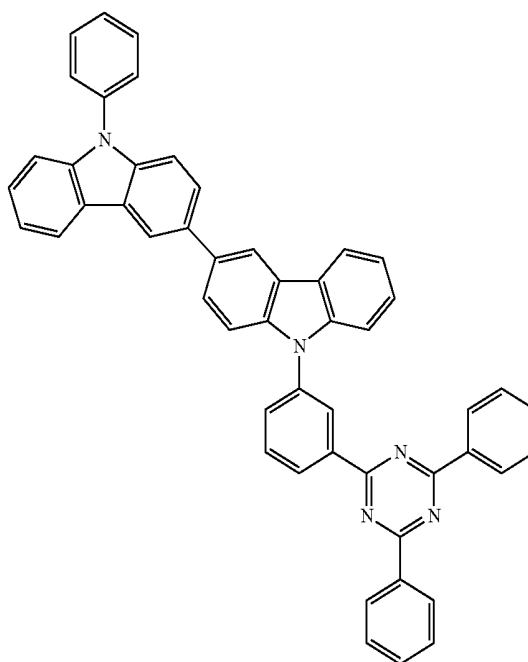
H2-29



H2-28



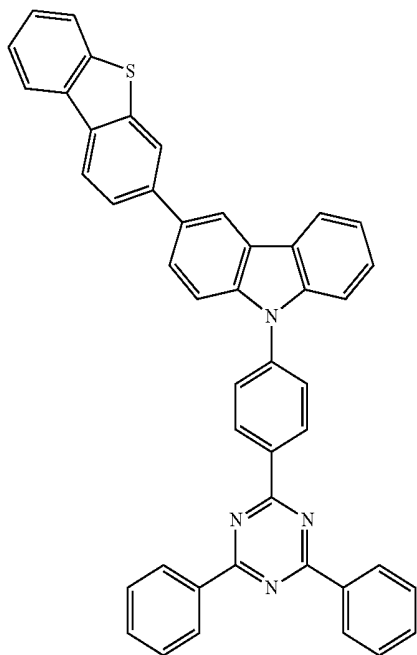
H2-30



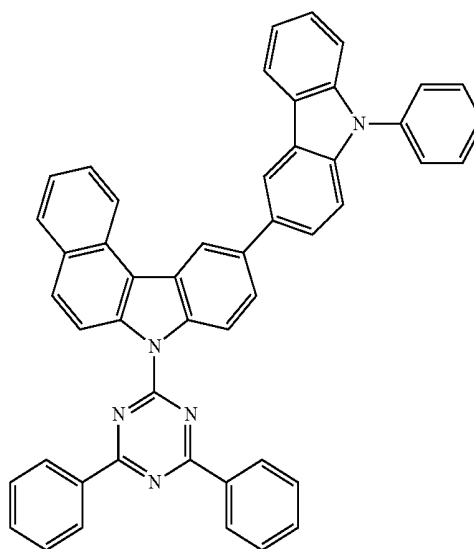
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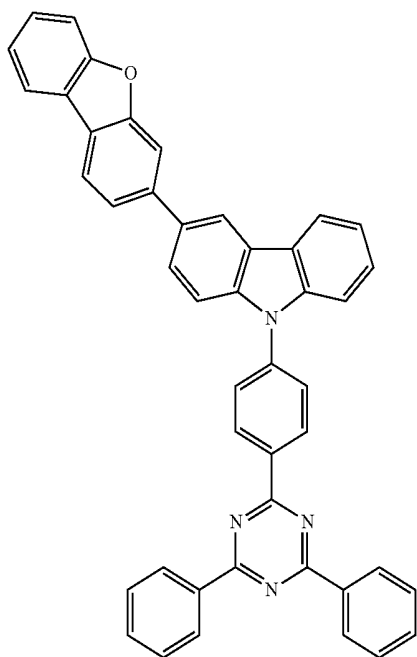
H2-31



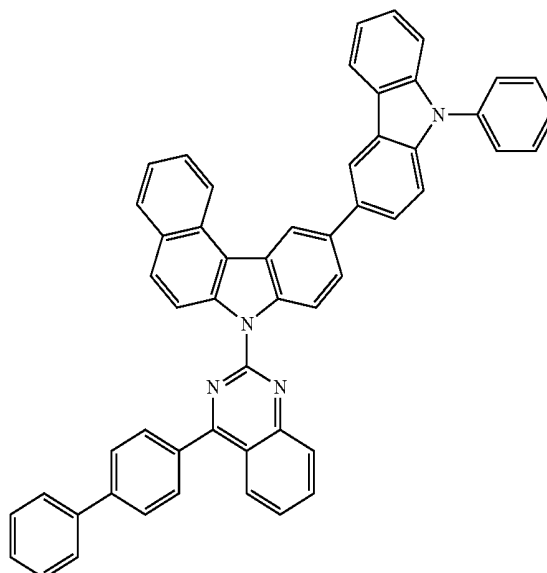
H2-33



H2-32



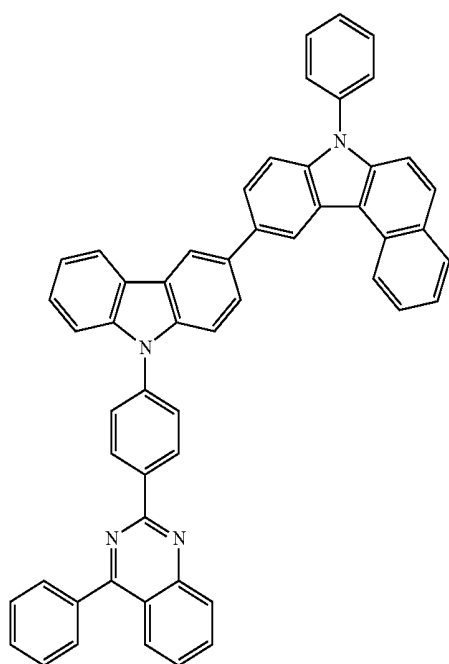
H2-34



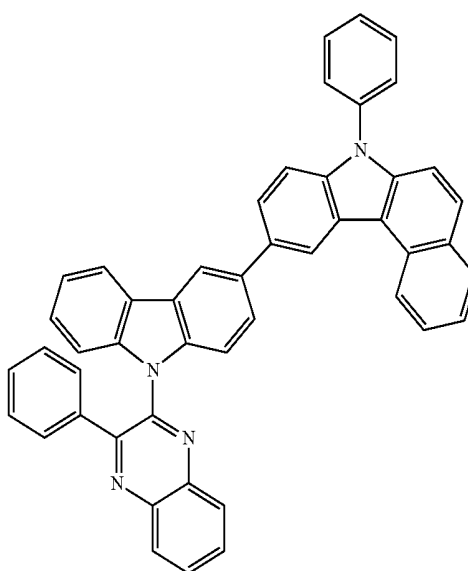
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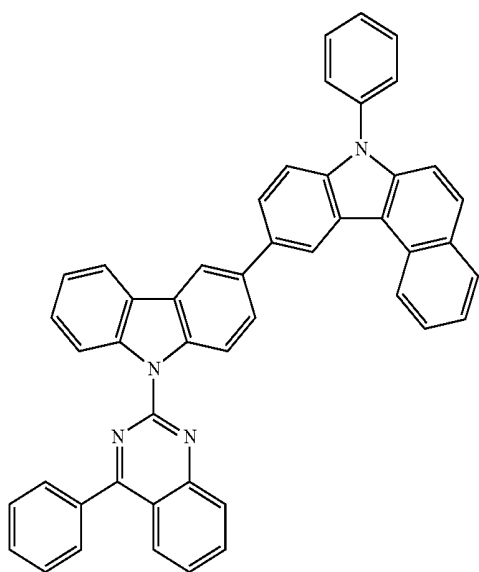
H2-35



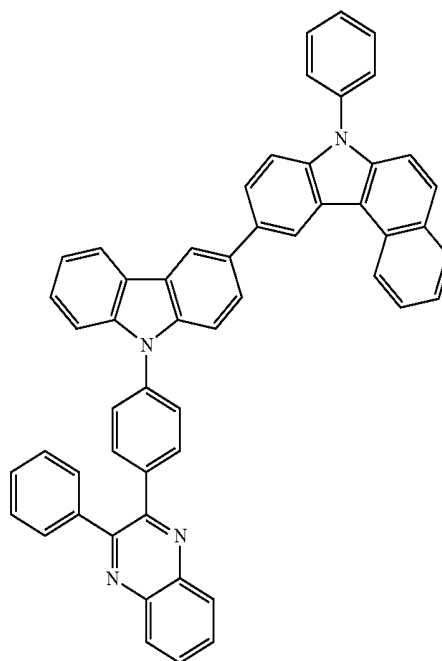
H2-37



H2-36

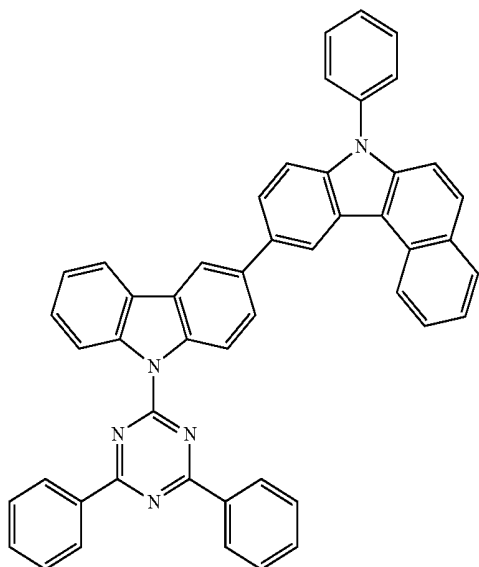


H2-38

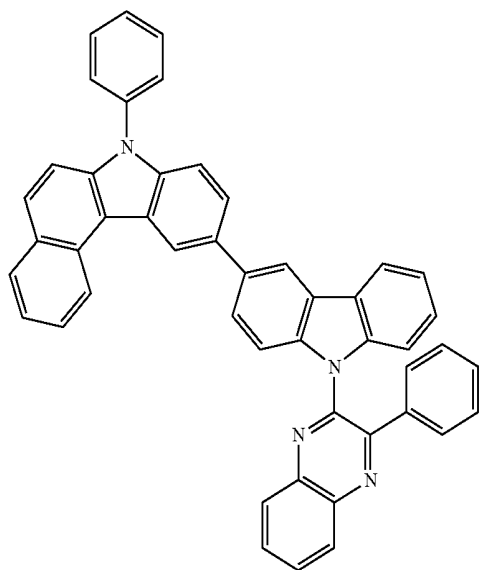


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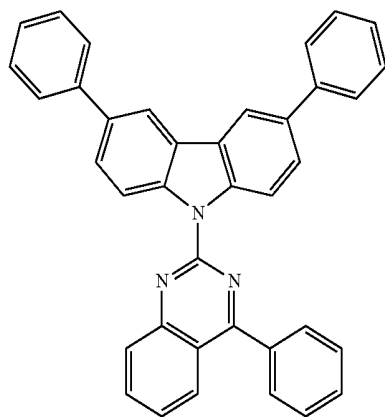
H2-39



H2-40

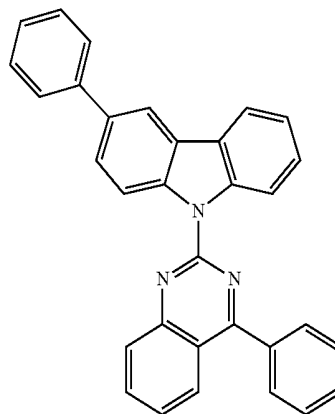


H2-41

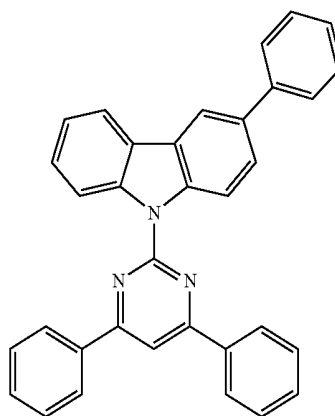


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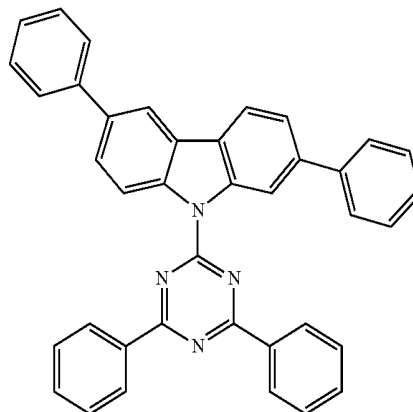
H2-42



H2-43



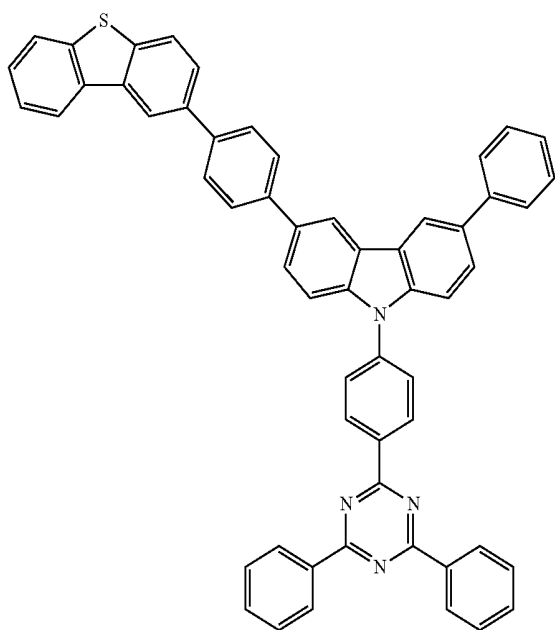
H2-44



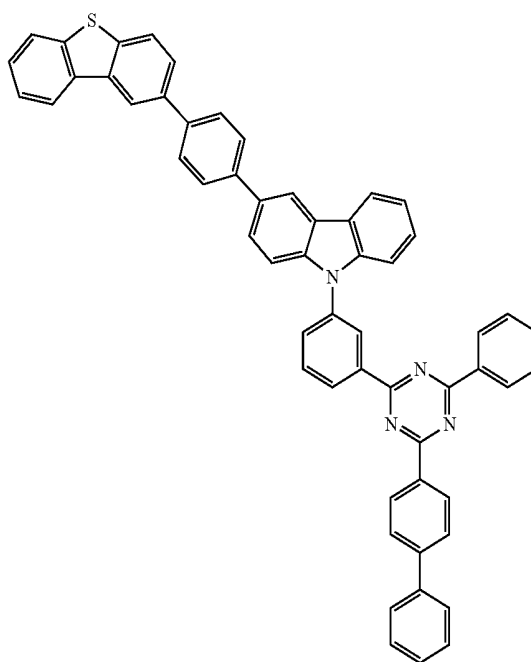
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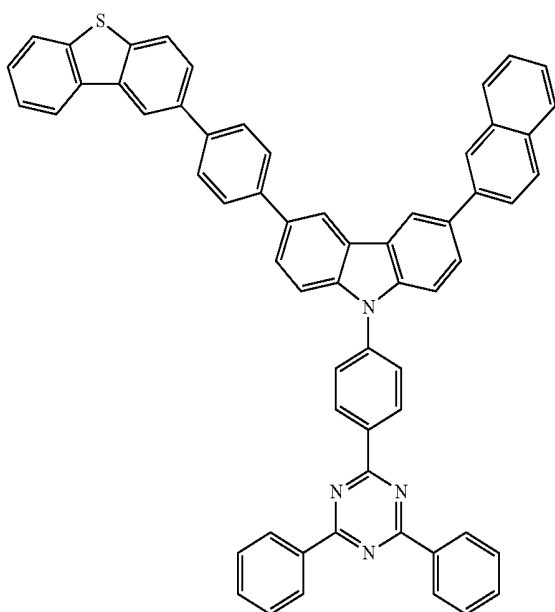
H2-45



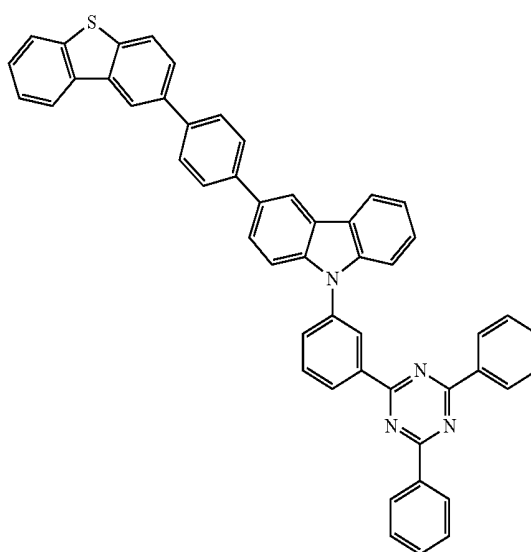
H2-47



H2-46



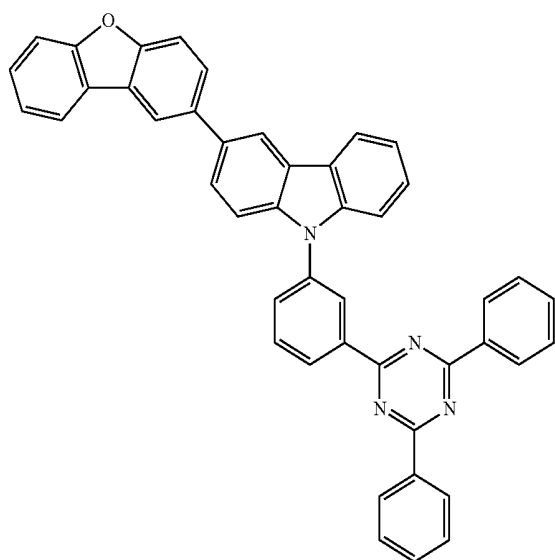
H2-48



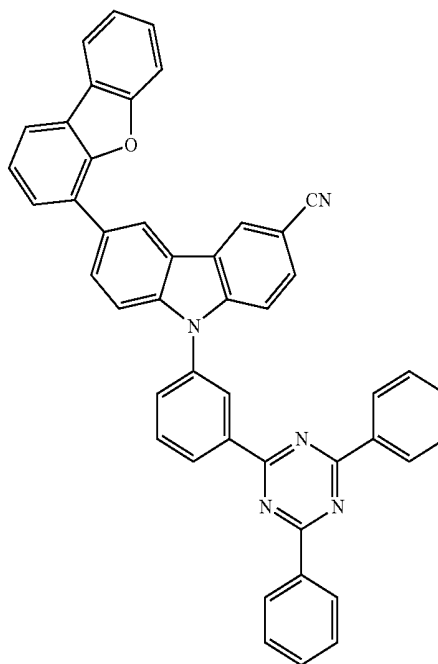
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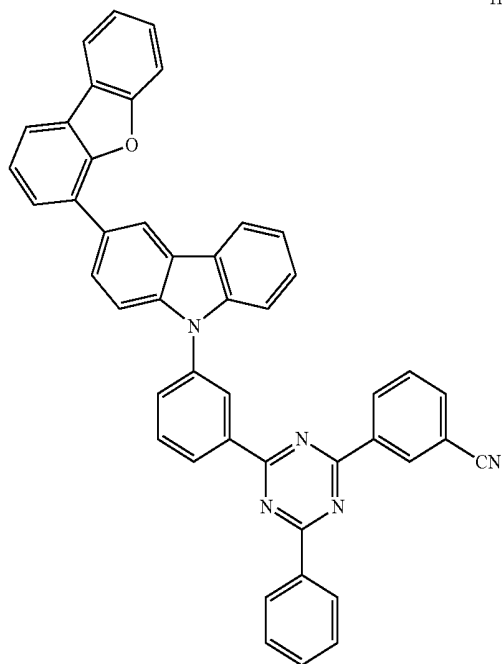
H2-49



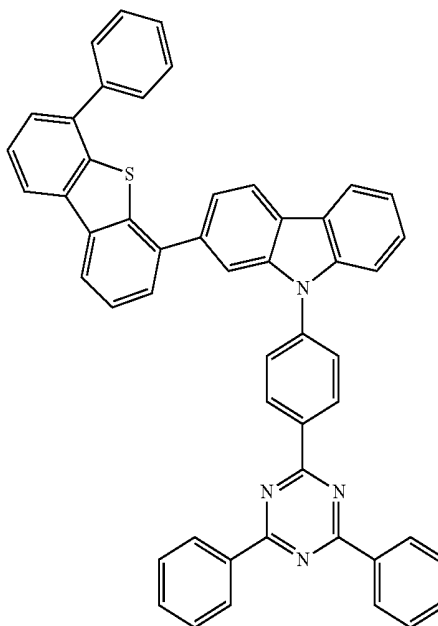
H2-51



H2-50

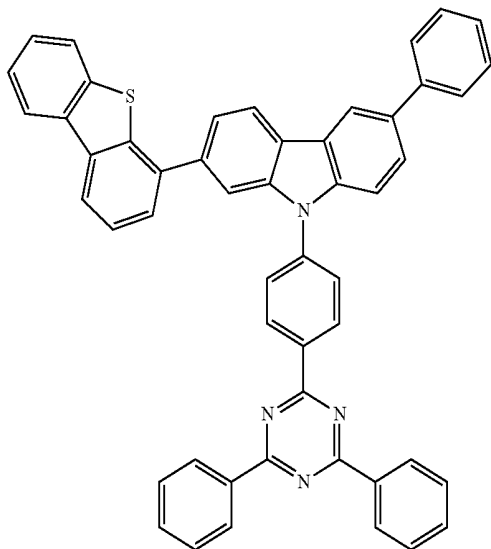


H2-52

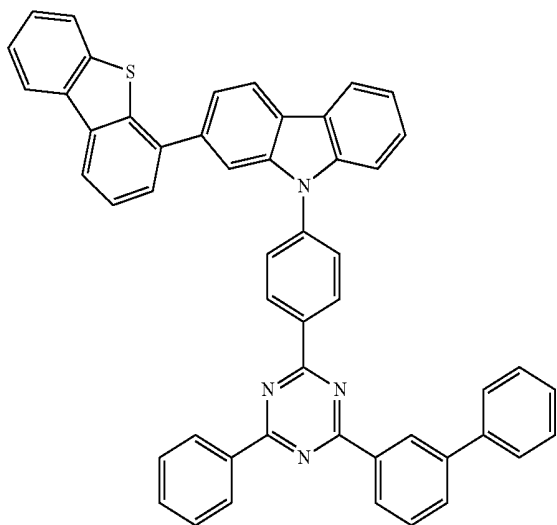


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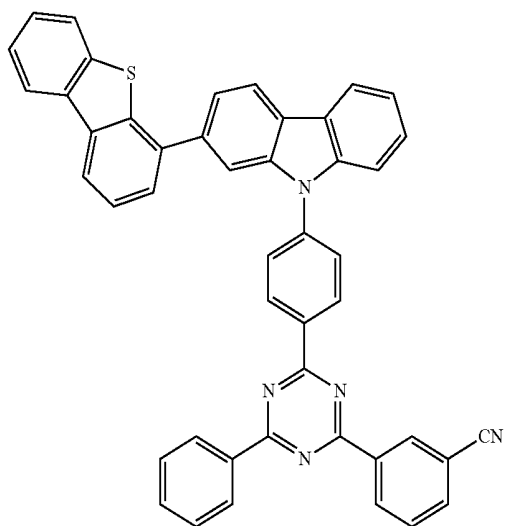
H2-53



H2-54

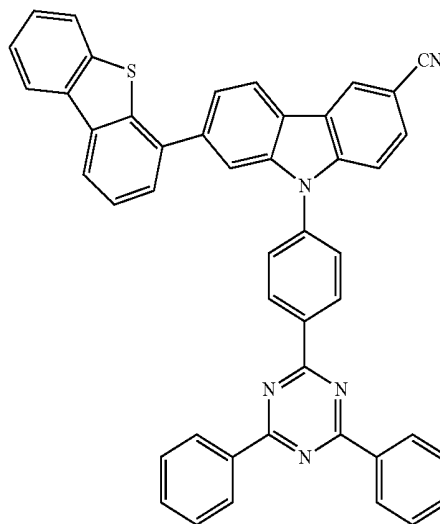


H2-55

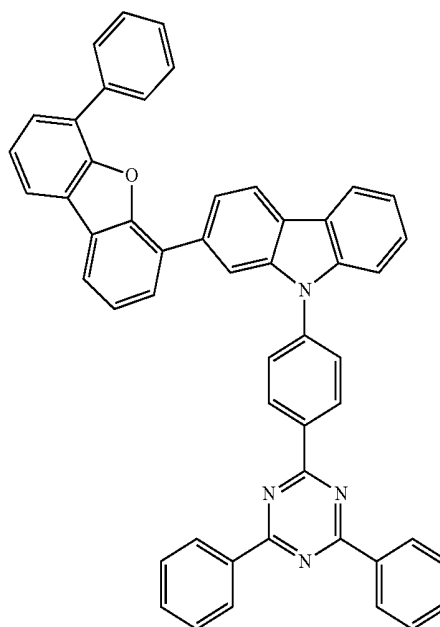


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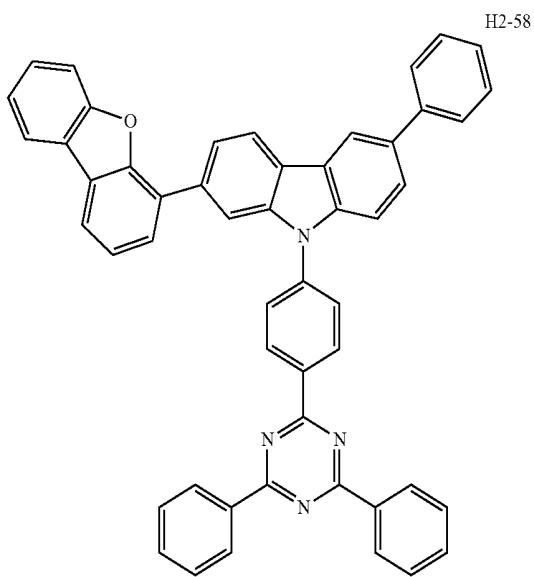
H2-56



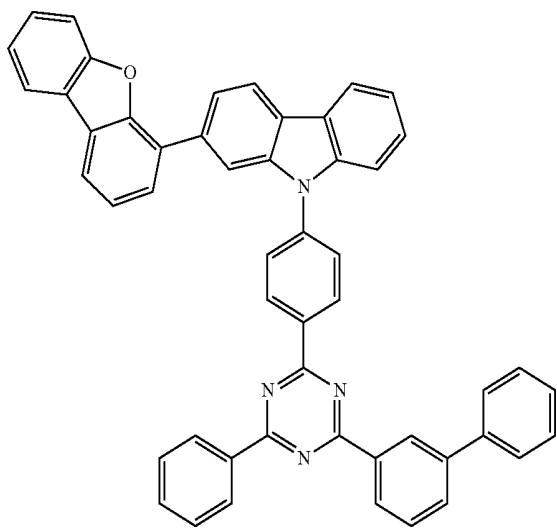
H2-57



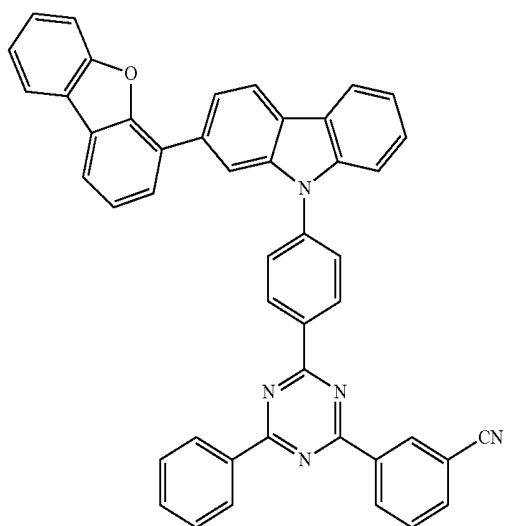
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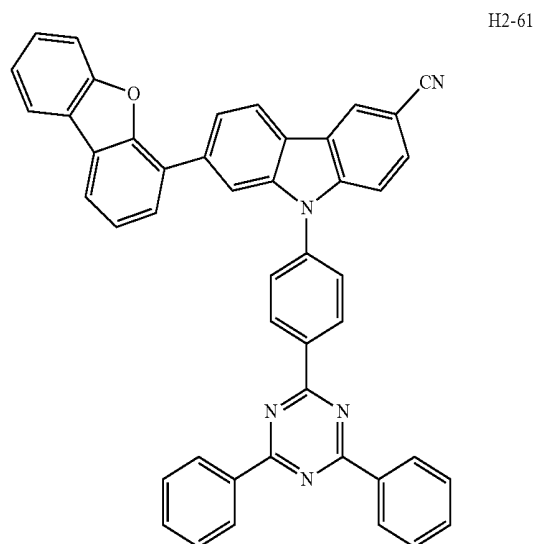
H2-59



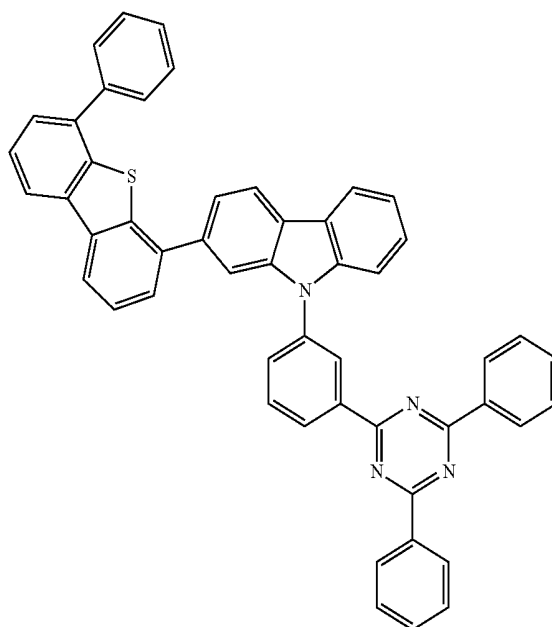
H2-60



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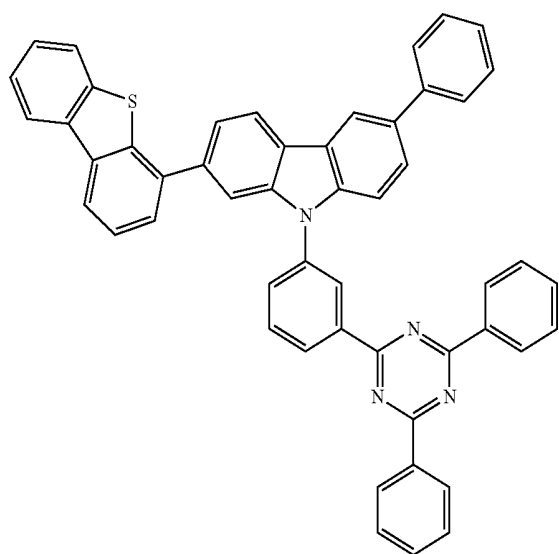
H2-62



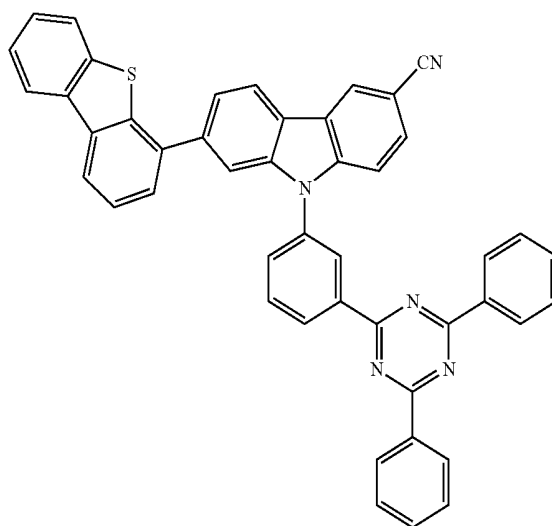
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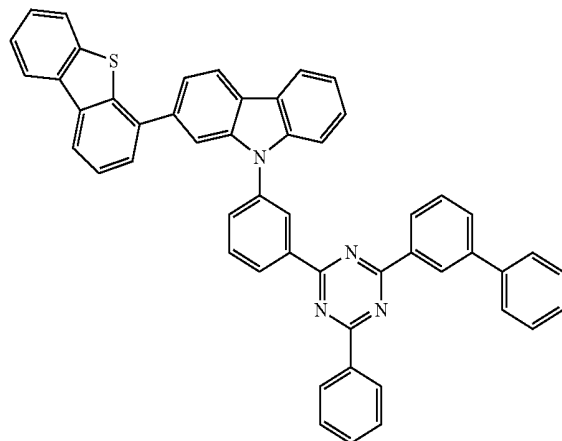
H2-63



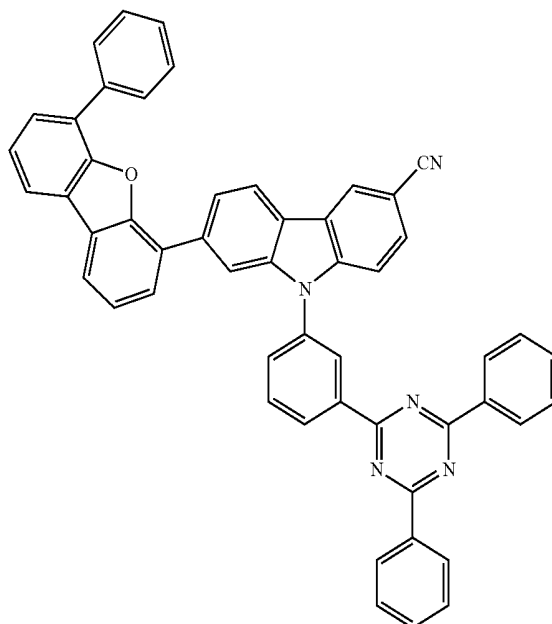
H2-66



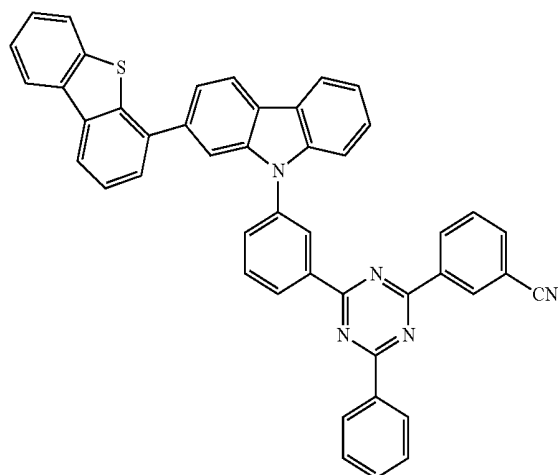
H2-64



H2-67

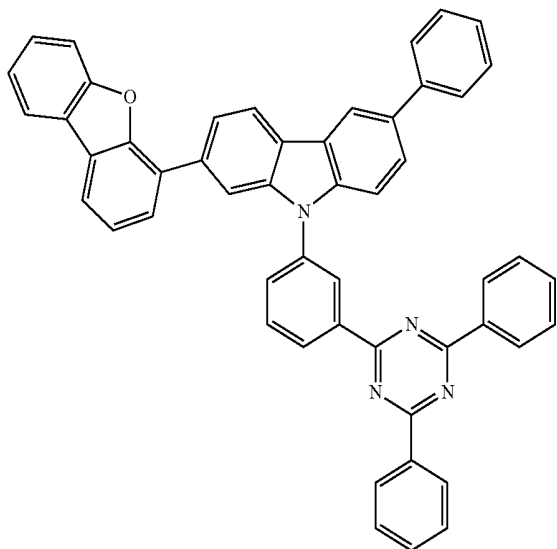


H2-65

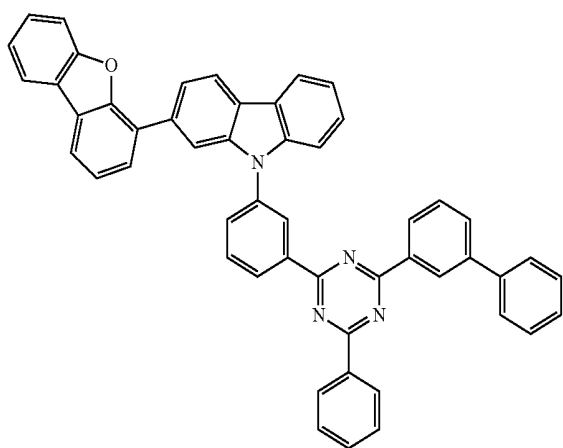


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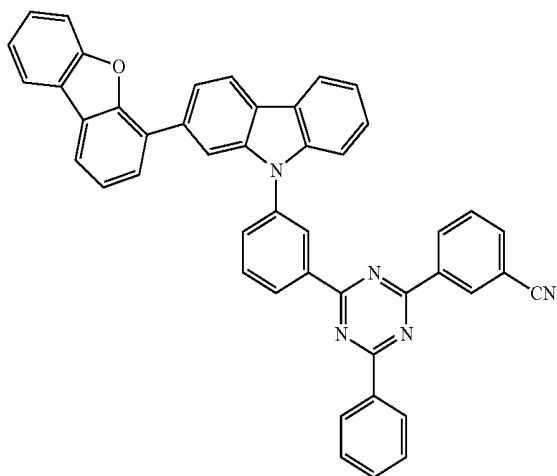
H2-68



H2-69

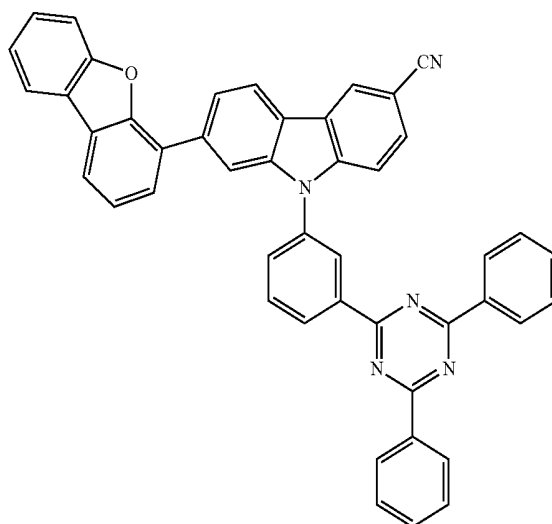


H2-70

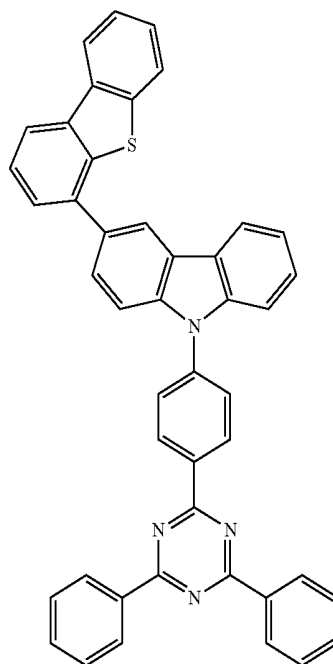


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H2-71



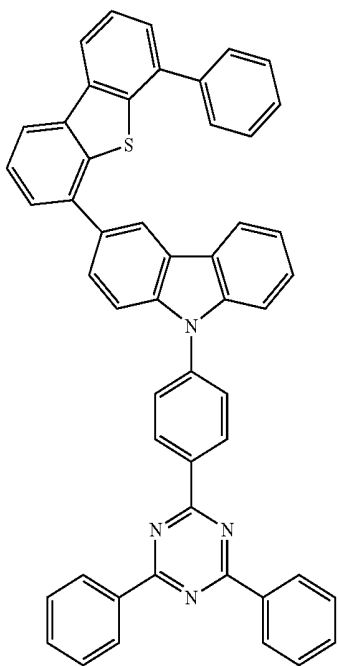
H2-72



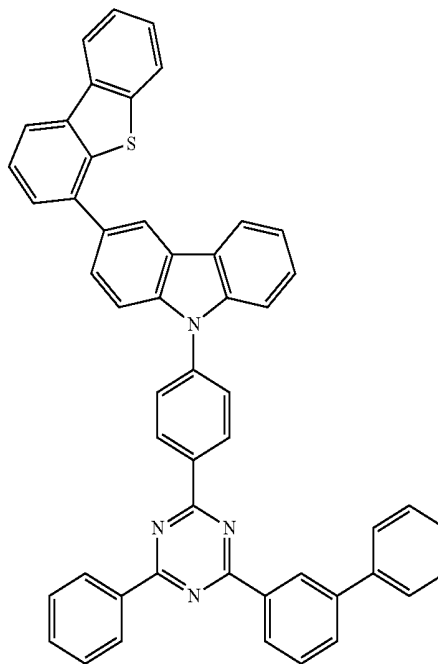
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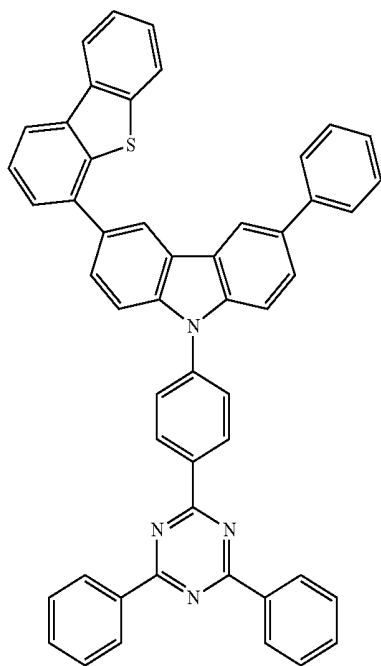
H2-73



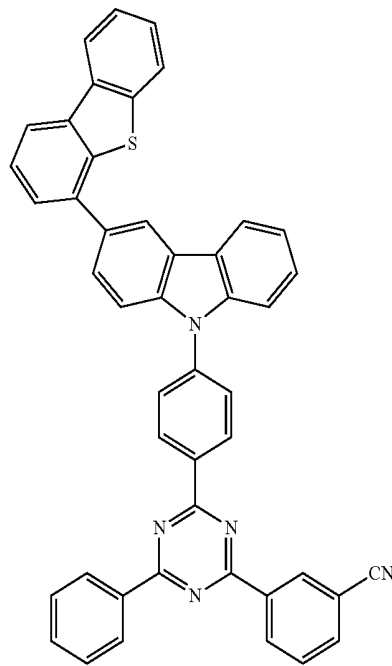
H2-75



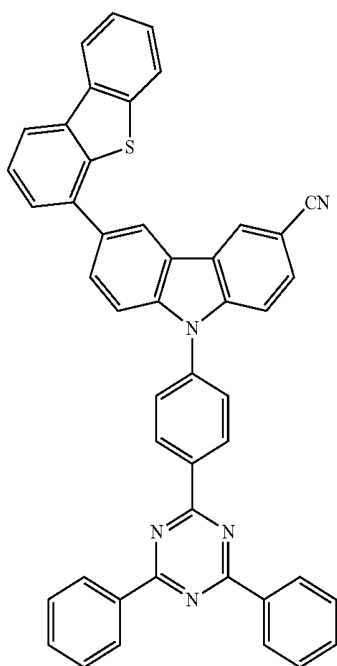
H2-74



H2-76

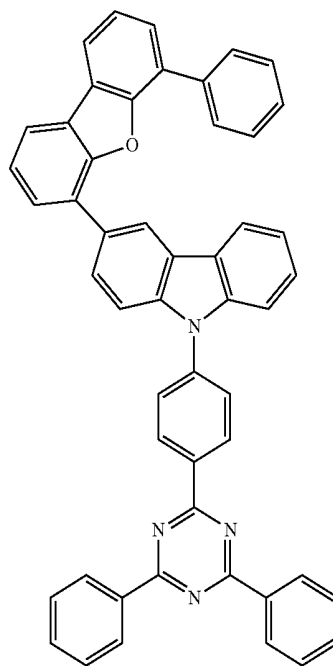


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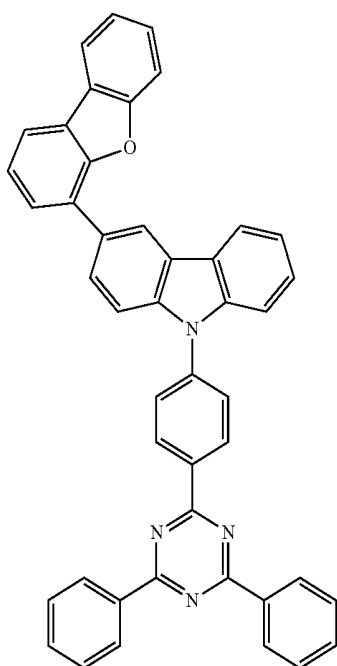


H2-77

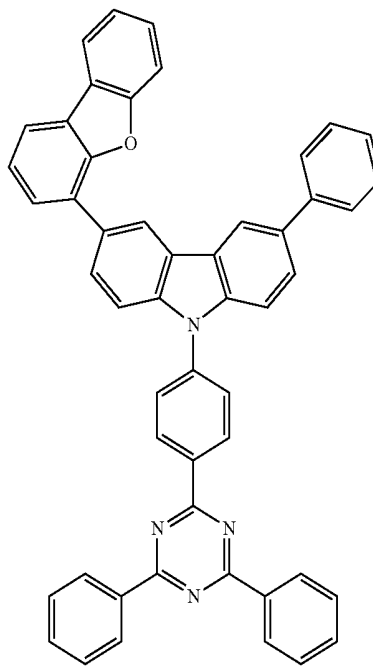
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H2-79



H2-78

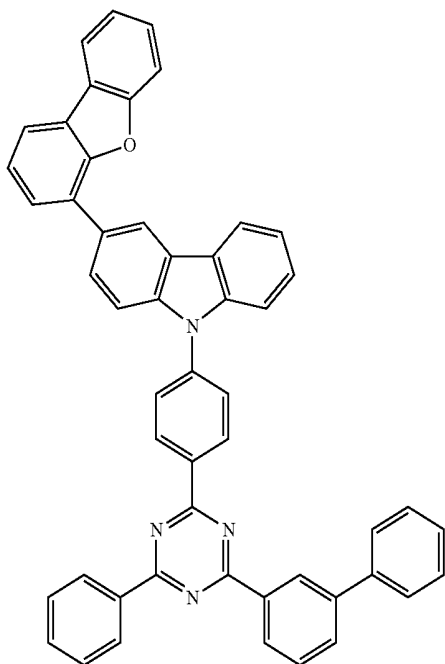


H2-80

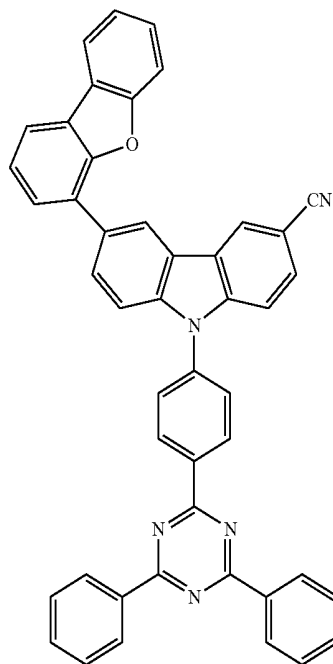
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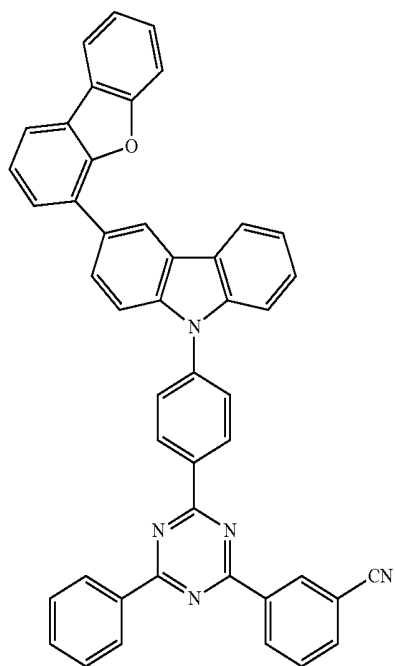
H2-81



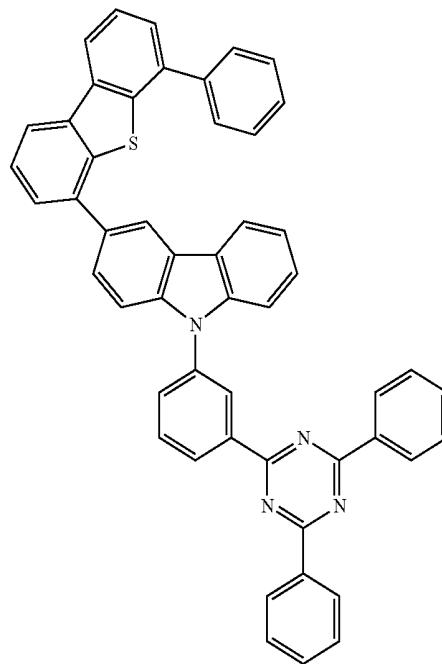
H2-83



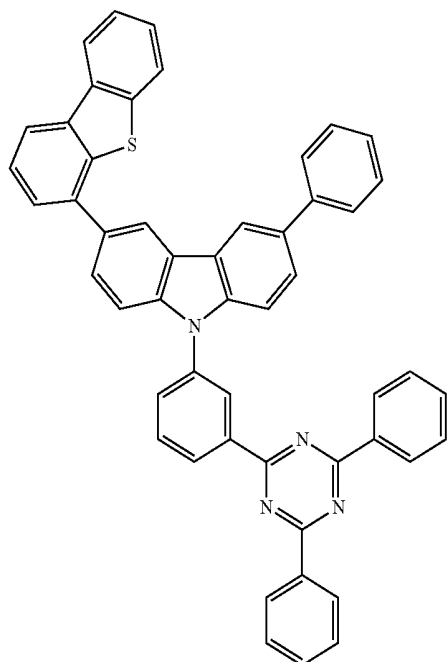
H2-82



H2-84

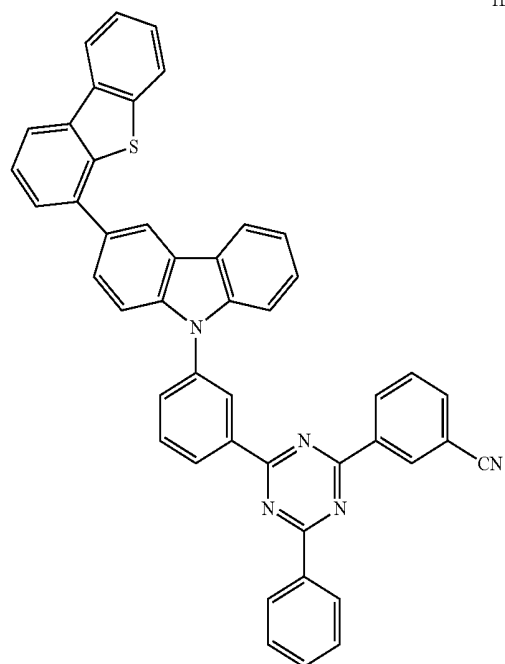


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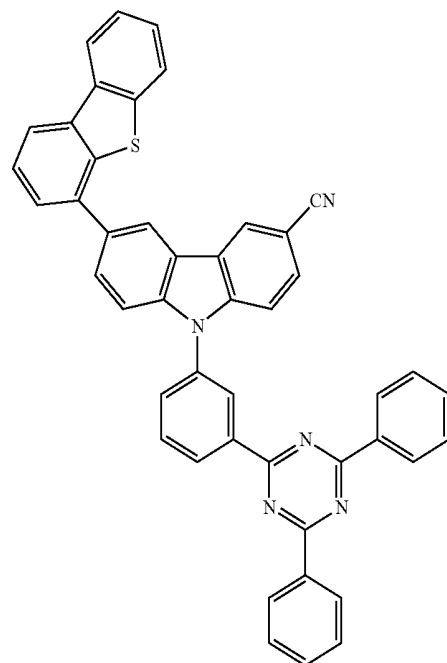
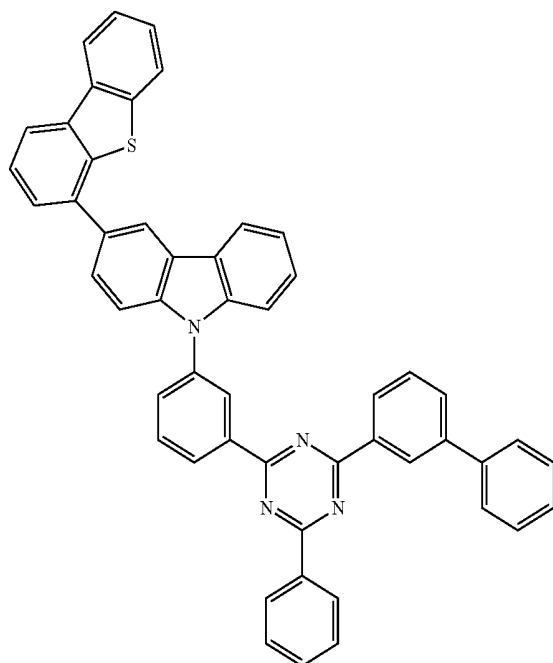
H2-85

-continued



H2-87

H2-86



H2-88

8. An organic electroluminescent device which comprises the combination according to claim 1.

* * * * *

专利名称(译)	主体化合物和掺杂剂化合物的新型组合和包含其的有机电致发光器件		
公开(公告)号	US20170335181A1	公开(公告)日	2017-11-23
申请号	US15/521903	申请日	2015-11-04
[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	KIM HYUN KANG HEE RYONG JANG SUNG WOO KIM BITNARI		
发明人	KIM, HYUN KANG, HEE-RYONG JANG, SUNG-WOO KIM, BITNARI		
IPC分类号	C09K11/06 H01L51/00 H01L51/50		
CPC分类号	C09K11/06 H01L51/0085 C09K2211/1007 C09K2211/1029 C09K2211/1044 C09K2211/1059 H01L51/5064 C09K2211/185 H01L51/0067 H01L51/0072 H01L51/0074 H01L51/5016 C09K2211/1088 C07D209/86 C09K2211/1011 C09K2211/1014 C09K2211/1033 C09K2211/1037 C09K2211/1092 H01L51/0052 H01L51/0058 H01L2251/5384		
外部链接	Espacenet USPTO		

摘要(译)

本文公开了掺杂剂化合物和主体化合物的组合。掺杂剂是铱络合物，主体是唑啉衍生物。还已知的是包含其的电致发光器件。

